FCC TEST REPORT

Test report No.:	EMC- FCC- R0168
FCC ID:	NLMSNHE6110BN
Type of equipment:	Smart Camera
Model Name:	SNH-E6110BN
Applicant:	Samsung Techwin Co., Ltd.
Max.RF Output Power:	25.12 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.247
Frequency Range:	2 412 ㎒ ~ 2 462 ㎒ 2 422 ㎒ ~ 2 452 ㎒
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 receipt: 2014. 03. 06

Date of test: 2014. 05. 30 ~ 06. 09

Issued date: 2014. 06. 09

Tested by: KIM, SUNG SIN

Approved by: YU, SANG HOON

65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea
82-31-336-9919 (Main) 82-505-299-8311 (Fax)

[Contents]

1. Client information

Applicant:	Samsung Techwin Co., Ltd.
Address:	84, Jeongdong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea
Telephone number:	+82-70-7147-8361
Facsimile number:	+82-31-277-2784
Contact person:	Kang, Jei Soon / js2002.kang@samsung.com

Manufacturer#1:	Samsung Techwin Co., Ltd.
Address:	84, Jeongdong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea

Manufacturer#2:	TIANJIN SAMSUNG TECHWIN OPTO-ELECTRONIC CO., LTD
Address:	No.11 Weiliu Road. Micro-Electronic Industrial Park Jingang Road Tianjin 300385, China

2. Laboratory information

Address

EMC compliance Ltd.
65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea
Telephone Number: 82-31-336-9919 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231
FCC Site Registration No.: 687132
VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849
IC Site Registration No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant:	Samsung Techwin Co., Ltd.
Address of Applicant	84, Jeongdong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea
Manufacturer#1	Samsung Techwin Co., Ltd.
Address of Manufacturer	84, Jeongdong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea
Manufacturer#2	TIANJIN SAMSUNG TECHWIN OPTO-ELECTRONIC CO., LTD
Address of Manufacturer	No.11 Weiliu Road. Micro-Electronic Industrial Park Jingang Road Tianjin 300385, China
Type of equipment	Smart Camera
Basic Model	SNH-E6110BN
Serial number	Proto Type

3.2 General description

Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (802.11n_HT40)
Communication	IEEE 802.11b/g/n_HT20, HT40
Type of Modulation	CCK, OFDM
Number of Channels	11 ch (802.11b/g/n_HT20), 9 ch(802.11n_HT40)
Type of Antenna	PCB Antenna
Antenna Gain	1.70 dBi
Transmit Power	25.12 dBm
Power supply	DC 5 V

3.3 Test frequency

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

802.11b/g/n_HT20

	Frequency
Low frequency	2 412 ㎒
Middle frequency	2 437 ㎒
High frequency	2 462 ㎒

802.11n_HT40

	Frequency
Low frequency	2 422 ㎒
Middle frequency	2 437 ㎒
High frequency	2 452 ㎒

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 5 Ⅴ

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	RSS-GEN, 7.1.2	Antenna Requirement	5.1	C
15.247(b)(3)	RSS-210, A8.4(2)	Maximum Peak Output Power	5.2	C
15.247(e)	-	Peak Power Spectral Density	5.3	C
15.247(a)(2)	RSS-GEN,4.6.2	6 dB Channel Bandwidth	5.4	C
-	RSS-210, A1.1	Occupied Bandwidth	5.4	C
15.247(d), 15.205(a), 15.209(a)	RSS-210, A8.5 RSS-210, A2.9 RSS-GEN, 7.2.3	Spurious Emission, Band Edge, and Restricted bands	5.5	C
15.207(a)	RSS-GEN, 7.2.4	Conducted Emissions	5.6	C

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

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = KUc (K = 2)	
Conducted RF power	± 1.36 dB	
Conducted Spurious Emissions	± 1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.86 dB, - 4.88 dB
	300 MHz ~ 1 000 MHz:	+ 4.98dB, - 4.99 dB
	1 GHz ~ 6 GHz:	+ 6.19 dB, - 6.20 dB
	6 GHz ~ 18 GHz:	+ 6.41 dB, - 6.53 dB
	18 GHz ~ 25 GHz:	+ 6.41 dB, - 6.53 dB
Conducted Emissions	9 kHz ~ 150 kHz:	± 3.82 dB
	150 kHz ~ 30 MHz:	± 3.43 dB

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 a wire type of antenna. The directional peak gain of the antenna is 1.70 dBi.

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 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ 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 ㏈i. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 ㏈i 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 ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

5.2.2 Measurement Procedure

These test measurement settings are specified in section 9.0 of 558074 D01 DTS Meas Guidance.

5.2.2.1 Integrated band power method

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

5.2.3 Test Result

- Complied

*** 802.11b**

Channel	Frequency (㎒)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	19.55	30.00	10.45
Middle	2 437	18.97	30.00	11.03
High	2 462	18.66	30.00	11.34

*** 802.11g**

Channel	Frequency (㎒)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	25.12	30.00	4.88
Middle	2 437	24.46	30.00	5.54
High	2 462	22.56	30.00	7.44

*** 802.11n HT20**

Channel	Frequency (㎒)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	24.16	30.00	5.84
Middle	2 437	24.41	30.00	5.59
High	2 462	22.40	30.00	7.60

*** 802.11n HT40**

Channel	Frequency (㎒)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2 422	19.67	30.00	10.33
Middle	2 437	19.74	30.00	10.26
High	2 452	19.85	30.00	10.15

-NOTE:

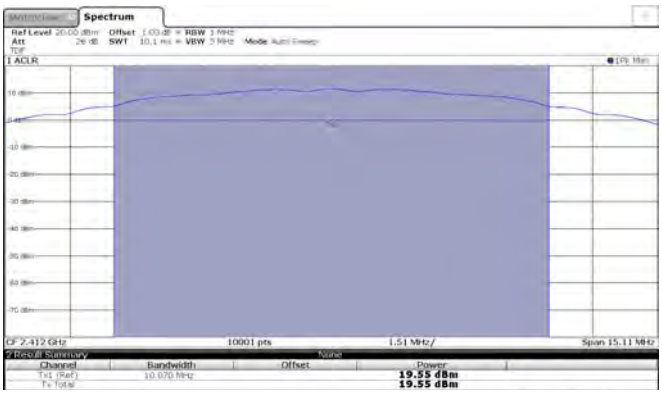
1. Since the directional gain of the integral antenna declared by the manufacturer (G_{ANT} = 1.7 dBi), does not exceed 6.0 dBi , there was no need to reduce the output power.
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.2.4 Test Plot

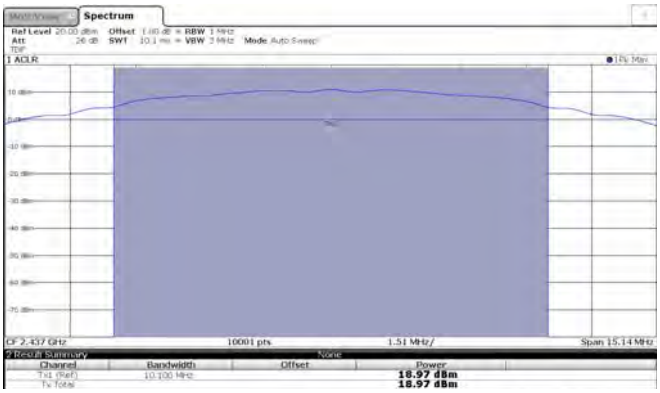
Figure 1. Plot of the Maximum Peak Output Power

*** 802.11b**

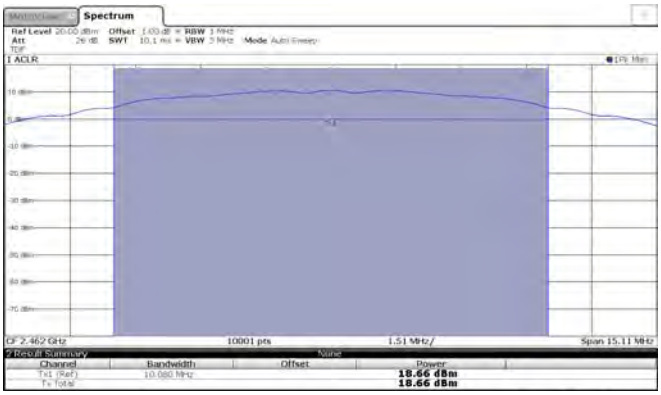
Lowest Channel
(2 412 ㎒)



Middle Channel
(2 437 ㎒)

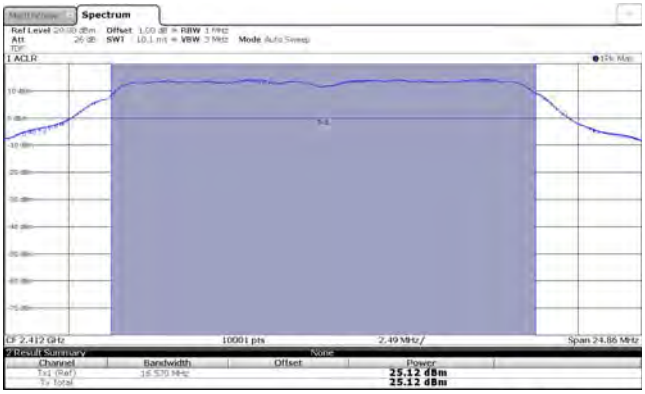


Highest Channel
(2 462 ㎒)

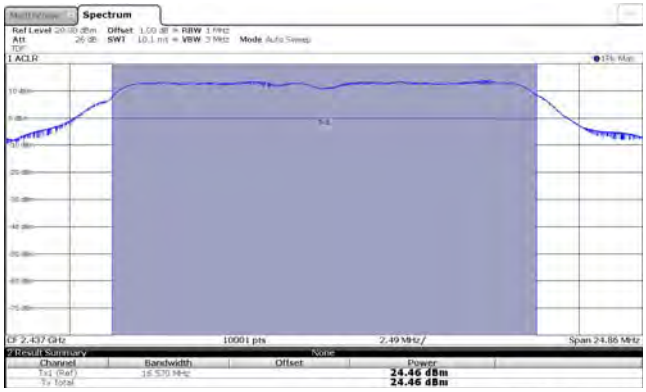


***802.11g**

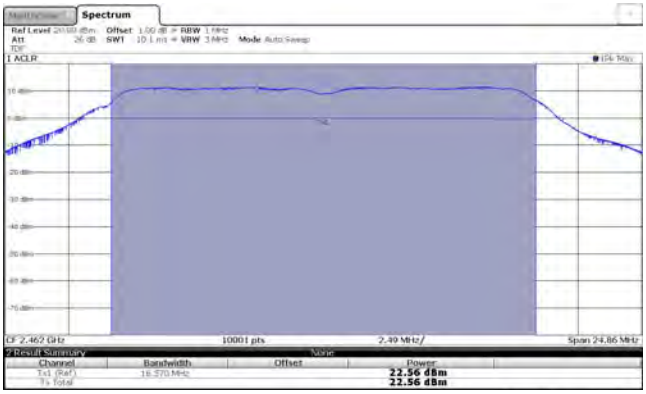
Lowest Channel
(2 412 ㎒)



Middle Channel
(2 437 ㎒)

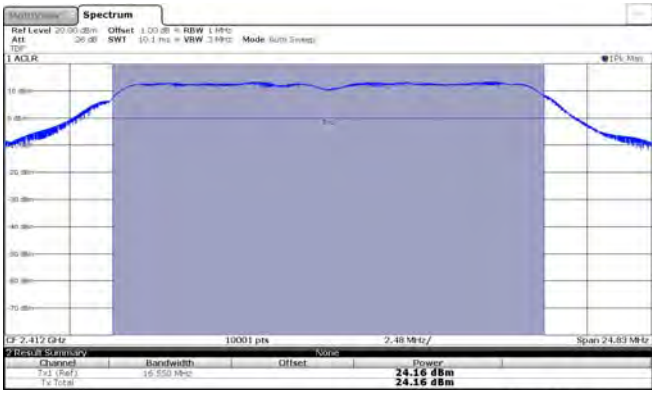


Highest Channel
(2 462 ㎒)

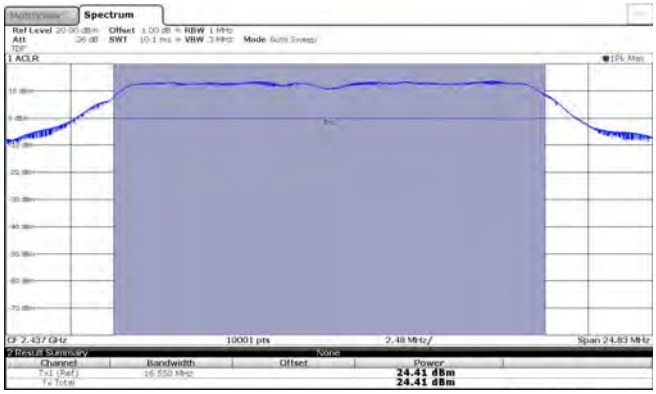


***802.11n HT20**

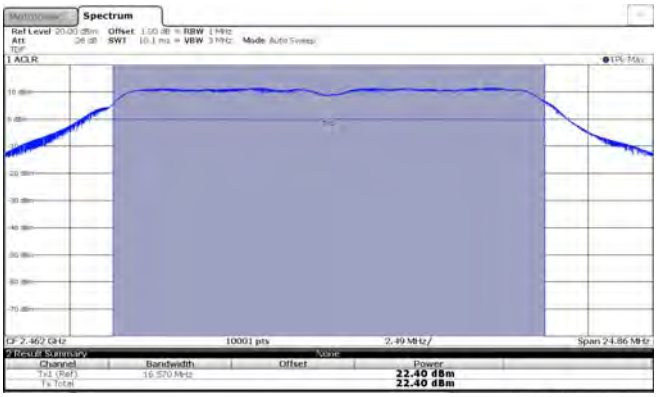
Lowest Channel
(2 412 ㎒)



Middle Channel
(2 437 ㎒)

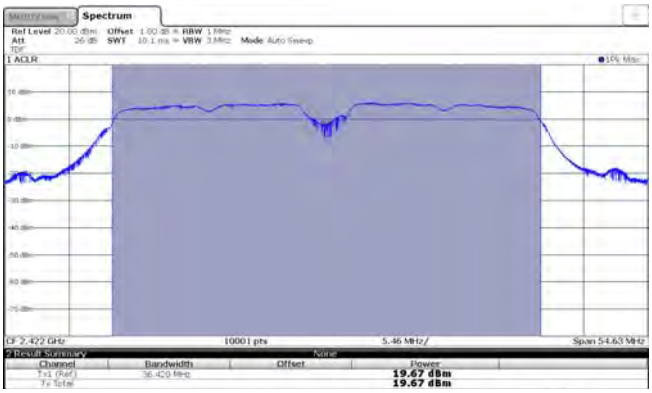


Highest Channel
(2 462 ㎒)

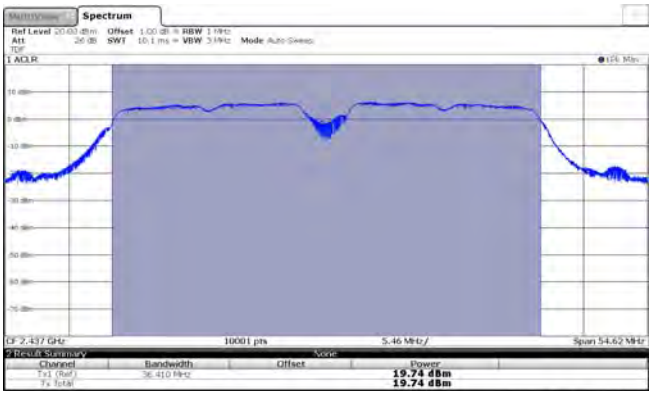


***802.11n HT40**

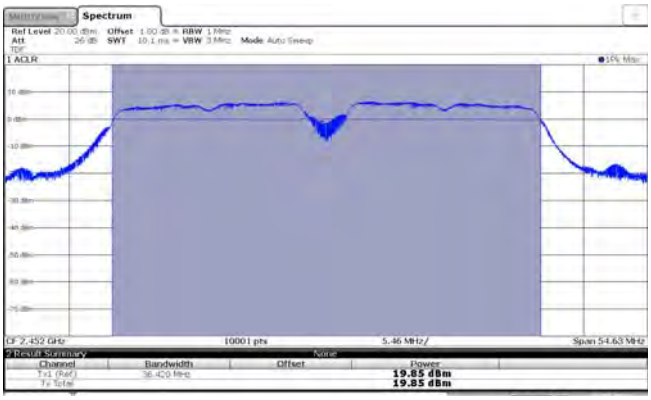
Lowest Channel
(2 422 ㎒)



Middle Channel
(2 437 ㎒)



Highest Channel
(2 452 ㎒)



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 ㎑ 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 10.0 of 558074 D01 DTS Meas Guidance.

5.3.2.1 Method PKPSD (peak PSD)

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.

1) Set analyzer center frequency to DTS channel center frequency.

2) Set the span to 1.5 times the DTS bandwidth.

3) Set the RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.

4) Set the VBW ≥ 3 x RBW.

5) Detector = peak.

6) Sweep time = auto couple.

7) Trace mode = max hold.

8) Allow trace to fully stabilize.

9) Use the peak marker function to determine the maximum amplitude level within the RBW.

10) If measured value exceeds limit, reduce RBW (no less than 3 ㎑) and repeat.

5.3.3 Test Result

- Complied

*** 802.11b**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	5.65	8.00	2.35
Middle	5.33	8.00	2.67
High	4.80	8.00	3.20

*** 802.11g**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	2.44	8.00	5.56
Middle	2.56	8.00	5.44
High	2.79	8.00	5.21

*** 802.11n HT20**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	2.47	8.00	5.53
Middle	2.51	8.00	5.49
High	0.24	8.00	7.76

*** 802.11n HT40**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	-5.11	8.00	13.11
Middle	-4.74	8.00	12.74
High	-4.43	8.00	12.43

-NOTE:

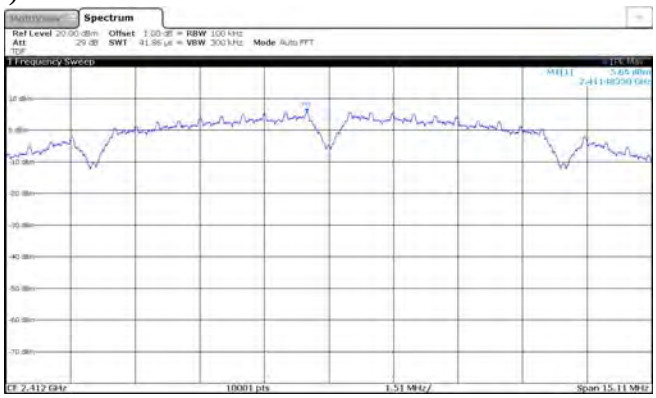
1. Since the directional gain of the integral antenna declared by the manufacturer (G_{ANT} = 1.7 dBi), does not exceed 6.0 dBi, there was no need to reduce the output power.
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.3.4 Test Plot

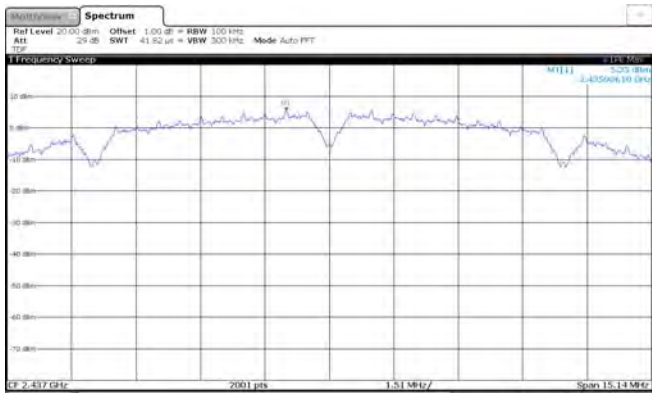
Figure 3. Plot of the Power Density

*** 802.11b**

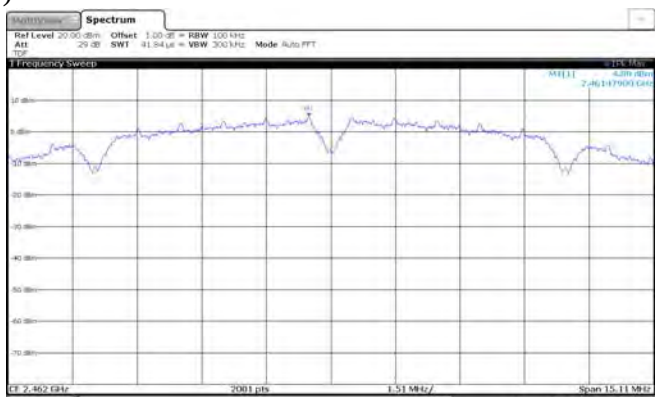
Lowest Channel(2 412 ㎒)



Middle Chnnel (2 437 ㎒)

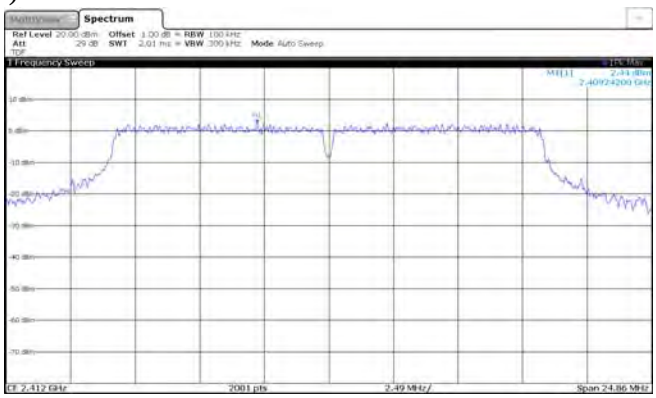


Highest Chnnel (2 462 ㎒)

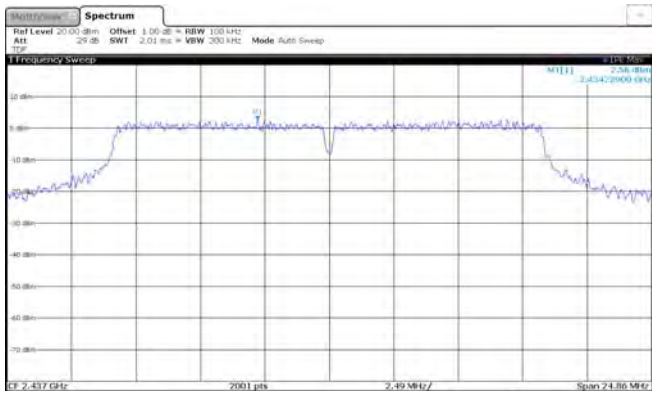


*** 802.11g**

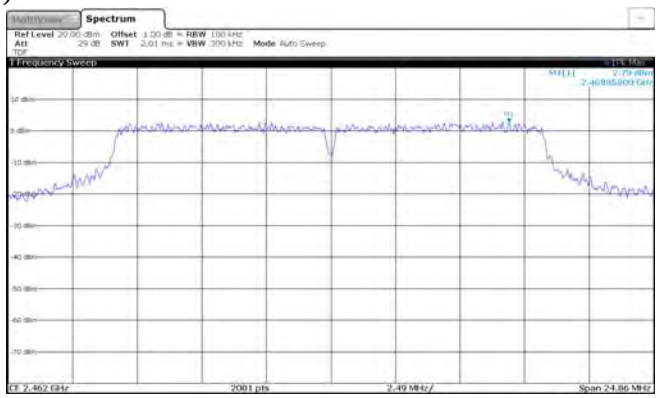
Lowest Channel(2 412 ㎒)



Middle Chnnel (2 437 ㎒)

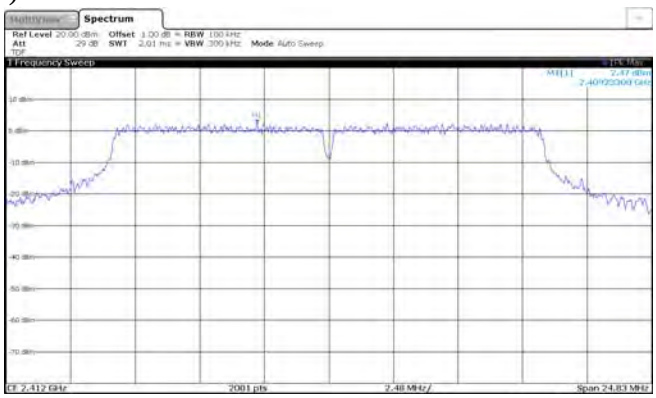


Highest Chnnel (2 462 ㎒)

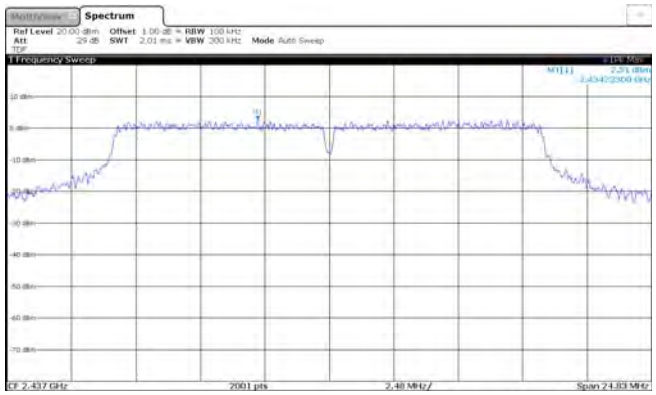


*** 802.11n HT20**

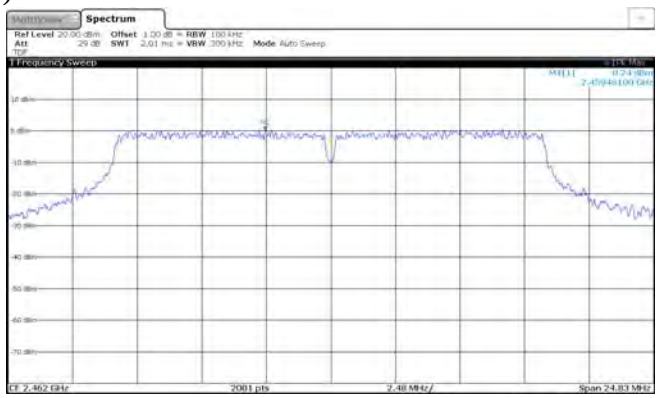
Lowest Channel(2 412 ㎒)



Middle Chnnel (2 437 ㎒)

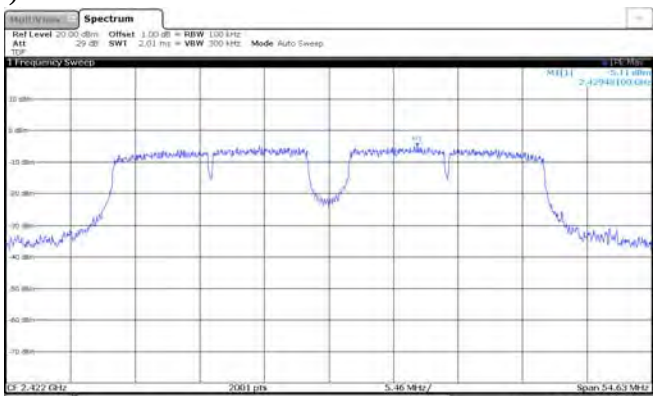


Highest Chnnel (2 462 ㎒)

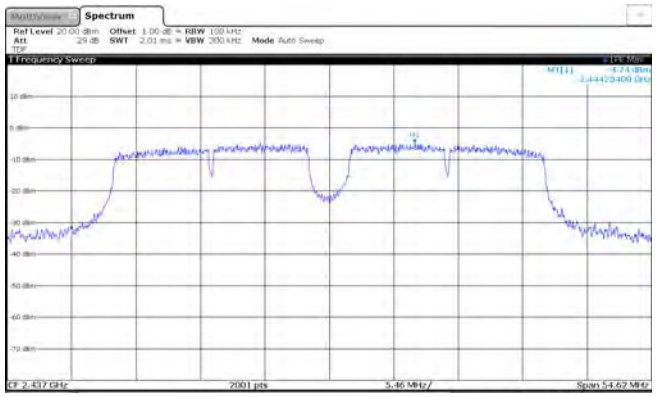


*** 802.11n HT40**

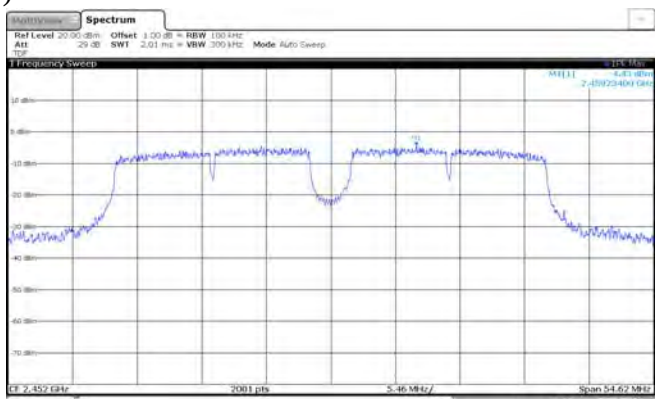
Lowest Channel(2 422 ㎒)



Middle Chnnel (2 437 ㎒)



Highest Chnnel (2 452 ㎒)



5.4 6 dB Bandwidth(DTS Channel Bandwidth)

5.4.1 Regulation

According to §15.247(a)(2) Systems using digital modulation techniques may operate in the 902–928 ㎒, 2 400–2 483.5 ㎒, and 5 725–5 850 ㎒ bands. The minimum 6 ㏈ bandwidth shall be at least 500 ㎑.

5.4.2 Measurement Procedure

These test measurement settings are specified in section 8.0 of 558074 D01 DTS Meas Guidance.

5.4.2.1 DTS Channel Bandwidth-Option 1

1) Set RBW = 100 ㎑.
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 frequencies) that are attenuated by 6 ㏈ 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 an instrument may be employed using the X ㏈ bandwidth mode with X set to 6 ㏈, if the functionality described above (i.e., RBW = 100 ㎑, VBW ≥ 3 x RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 ㏈.

5.4.3 Test Result

- Complied

*** 802.11b**

Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	Min. Limit (㎑)	Occupied Bandwidth (99 % BW) (㎒)
Low	2 412	10.07	500 ㎑	14.99
Middle	2 437	10.10	500 ㎑	14.97
High	2 462	10.08	500 ㎑	14.99

*** 802.11g**

Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	Min. Limit (㎑)	Occupied Bandwidth (99 % BW) (㎒)
Low	2 412	16.57	500 ㎑	16.81
Middle	2 437	16.57	500 ㎑	17.05
High	2 462	16.57	500 ㎑	16.57

*** 802.11n HT20**

Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	Min. Limit (㎑)	Occupied Bandwidth (99 % BW) (㎒)
Low	2 412	16.55	500 ㎑	17.39
Middle	2 437	16.55	500 ㎑	18.23
High	2 462	16.57	500 ㎑	16.59

*** 802.11n HT40**

Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	Min. Limit (㎑)	Occupied Bandwidth (99 % BW) (㎒)
Low	2 422	36.42	500 ㎑	36.18
Middle	2 437	36.41	500 ㎑	36.18
High	2 452	36.42	500 ㎑	36.18

-NOTE:

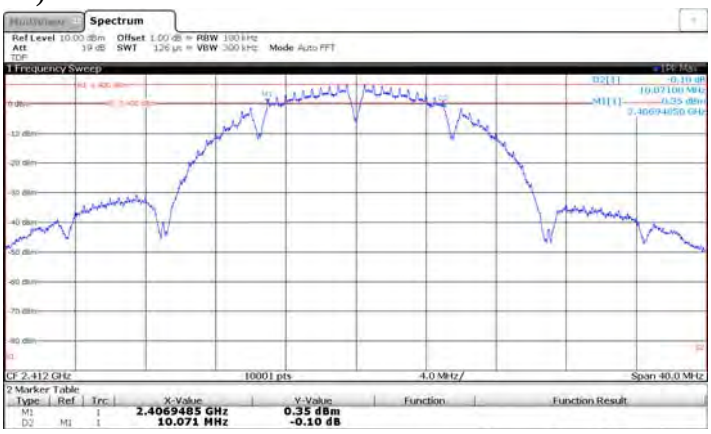
1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.4.4 Test Plot

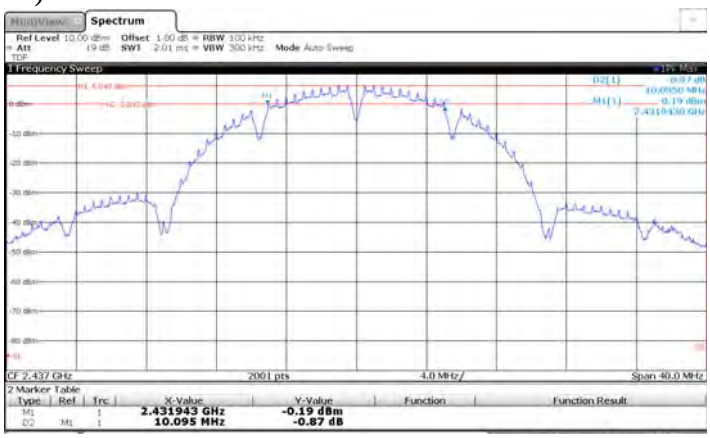
Figure 4. Plot of the 6dB Bandwidth & Occupied Bandwidth

*** 802.11b (6 dB Bandwidth)**

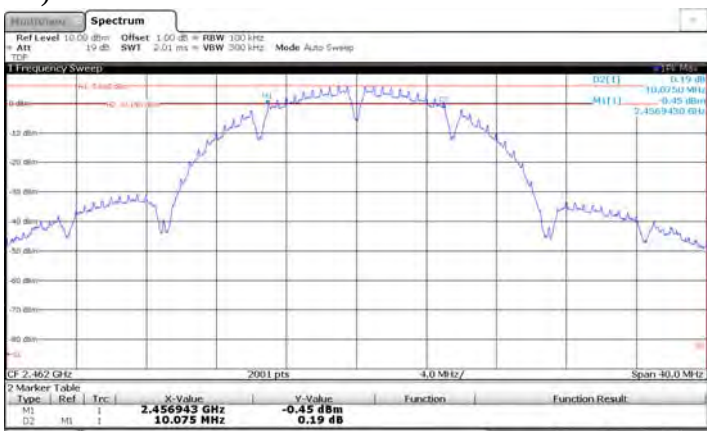
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

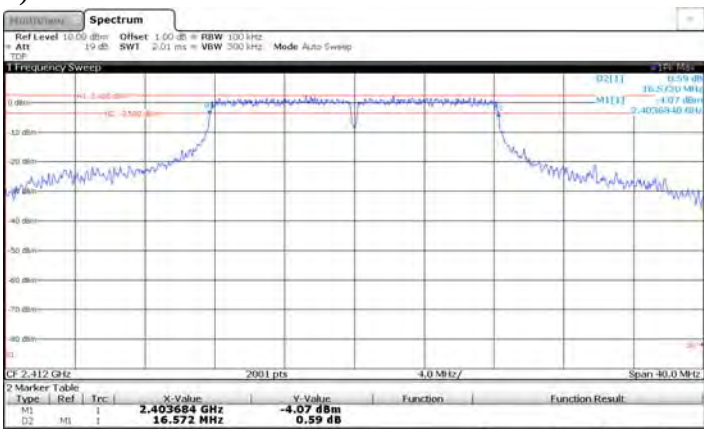


Highest Channel (2 462 ㎒)

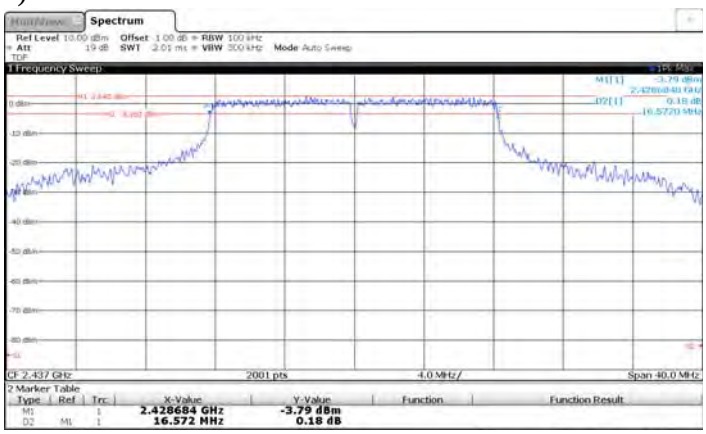


*** 802.11g (6 dB Bandwidth)**

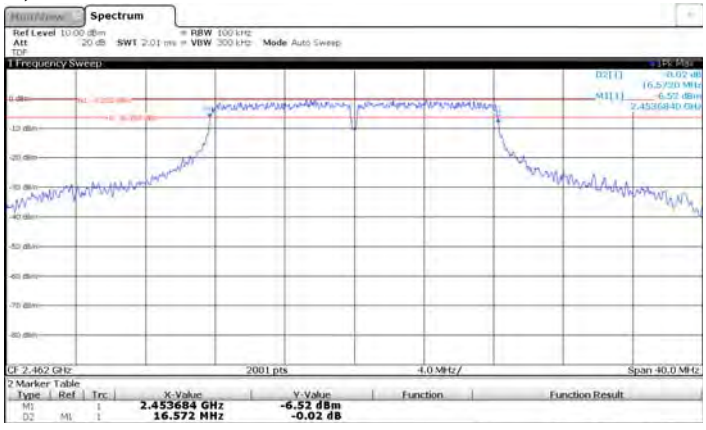
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

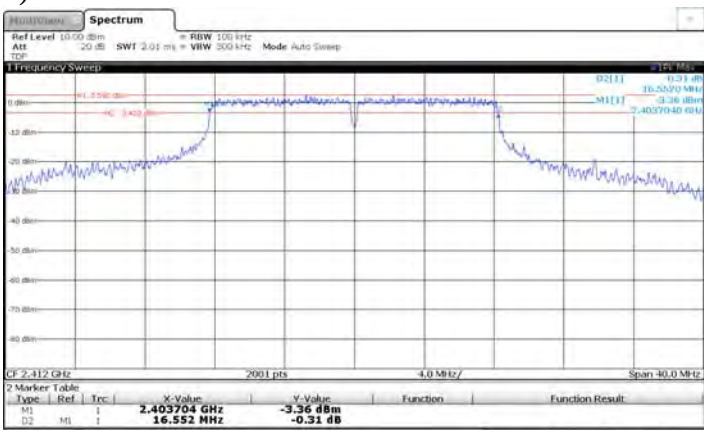


Highest Channel (2 462 ㎒)

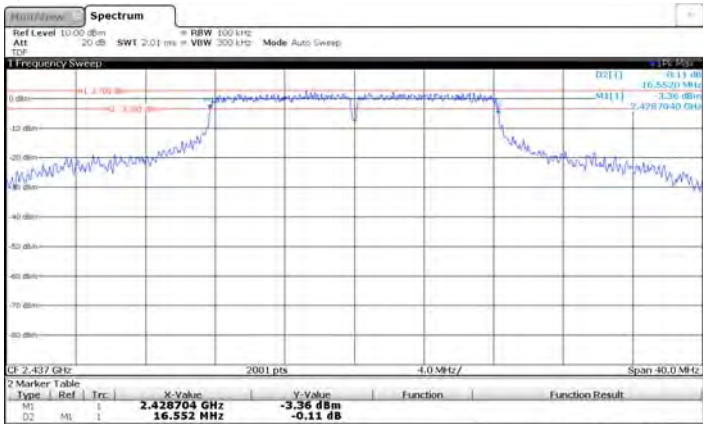


*** 802.11n HT20 (6 dB Bandwidth)**

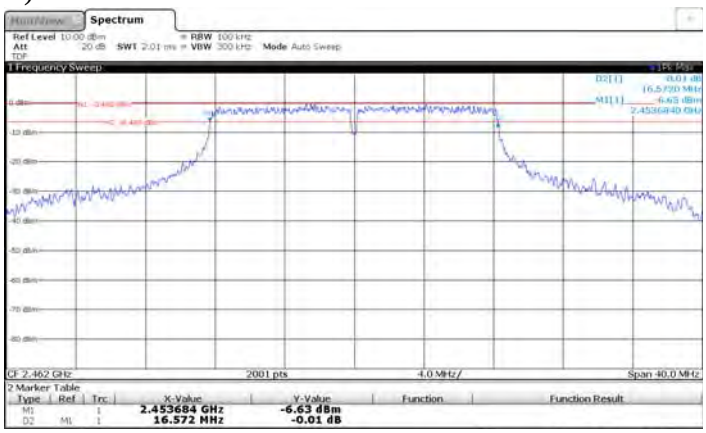
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

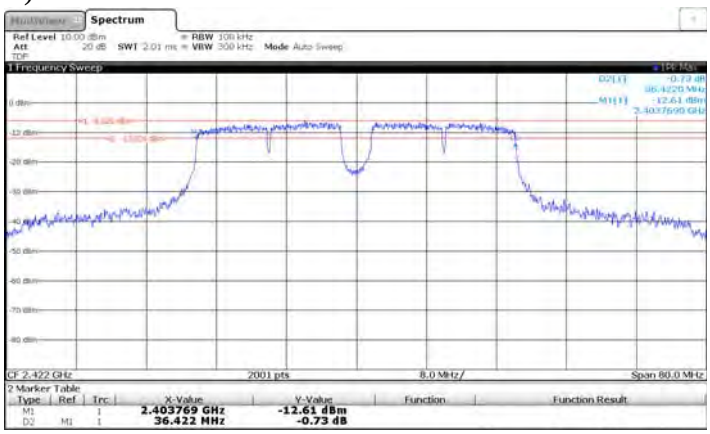


Highest Channel (2 462 ㎒)

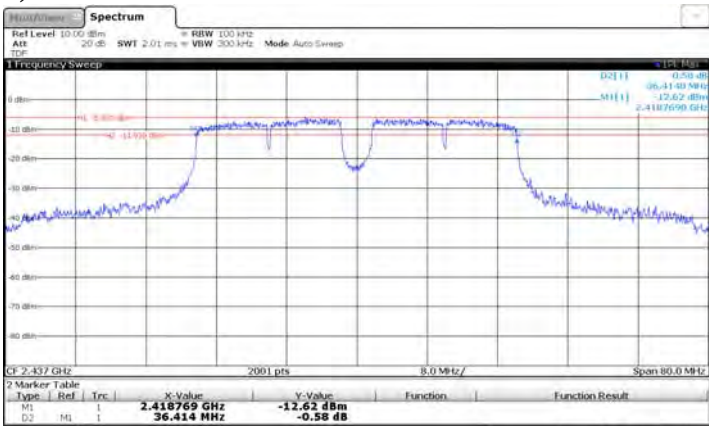


*** 802.11n HT40 (6 dB Bandwidth)**

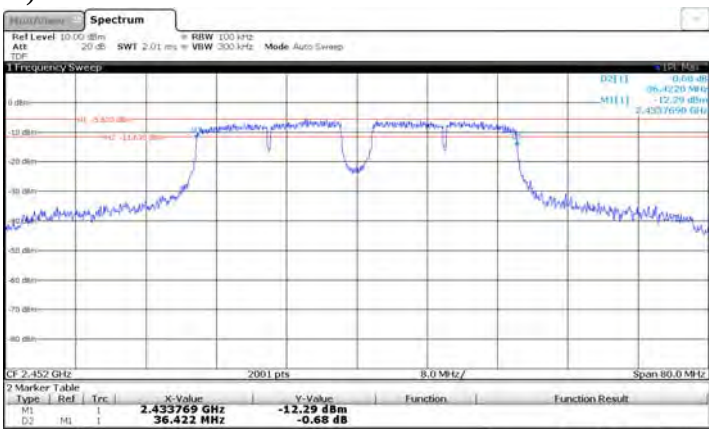
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)

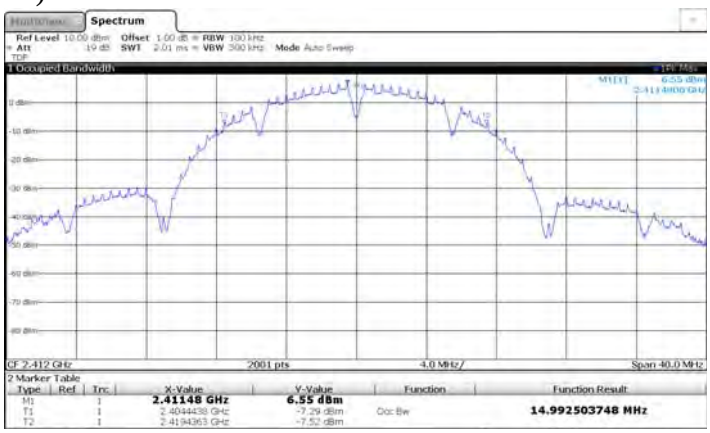


Highest Channel (2 452 ㎒)

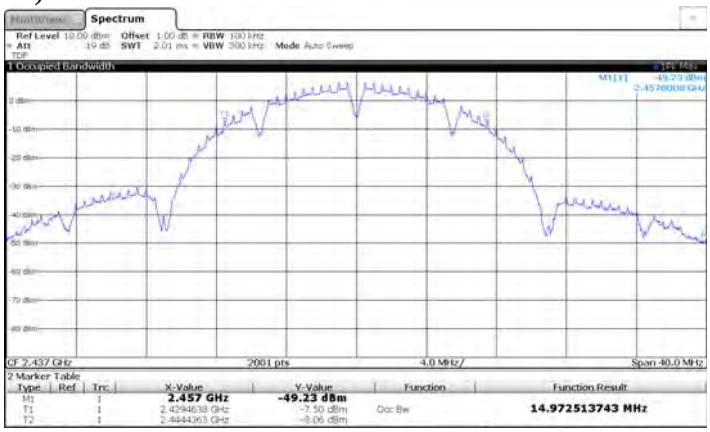


*** 802.11b (Occupied Bandwidth)**

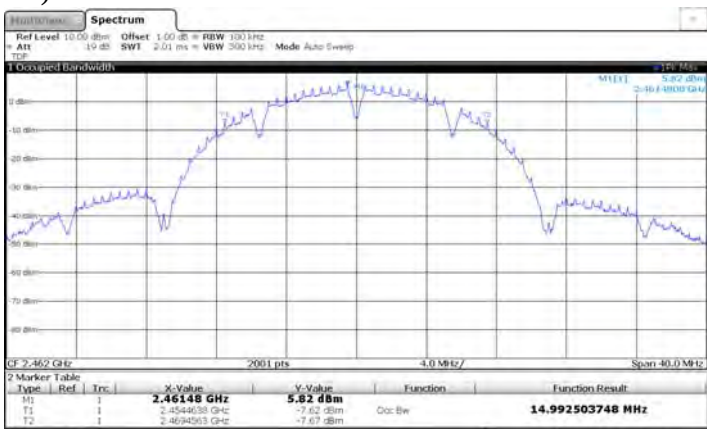
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

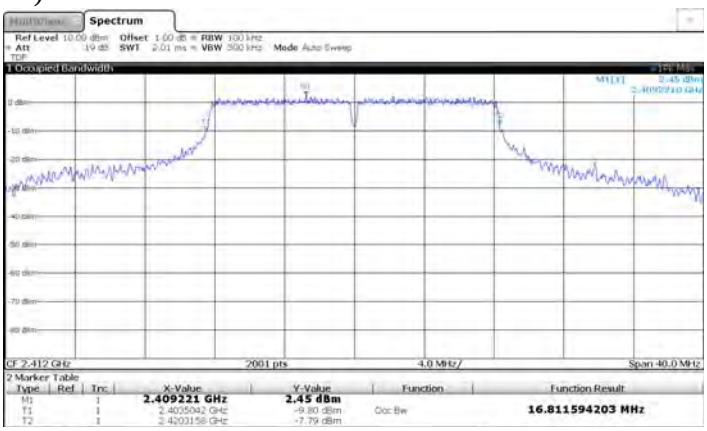


Highest Channel (2 462 ㎒)

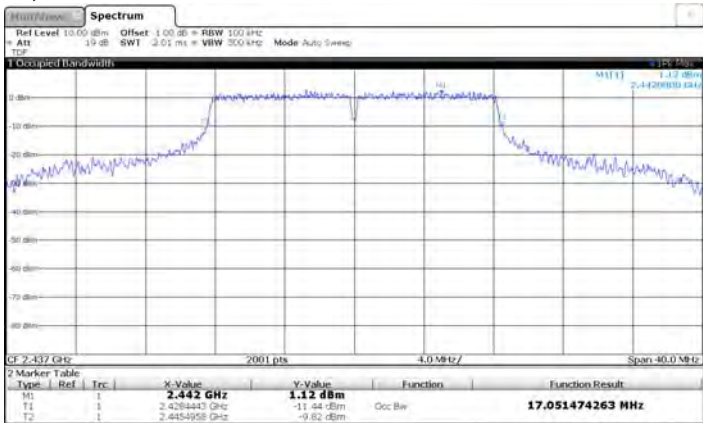


*** 802.11g (Occupied Bandwidth)**

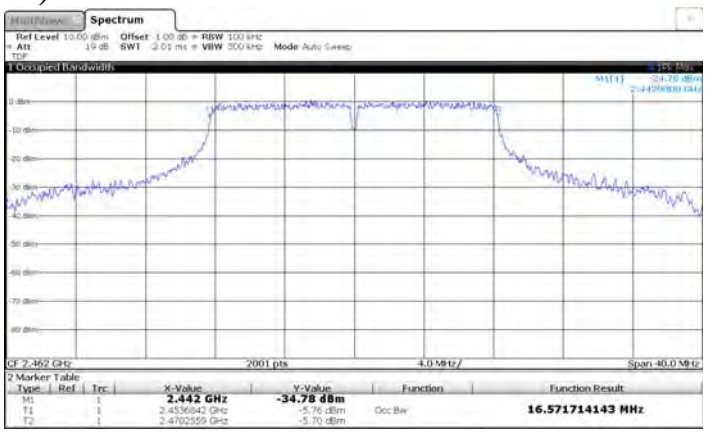
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

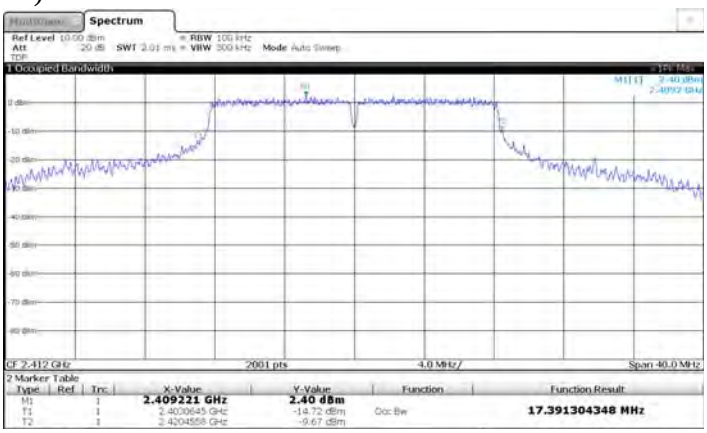


Highest Channel (2 462 ㎒)

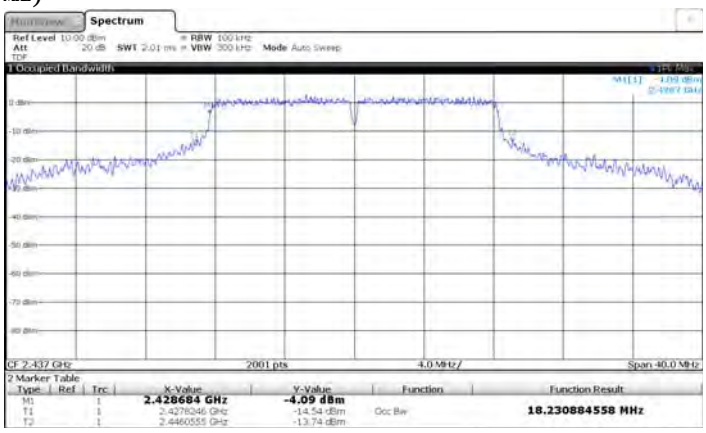


*** 802.11n HT20 (Occupied Bandwidth)**

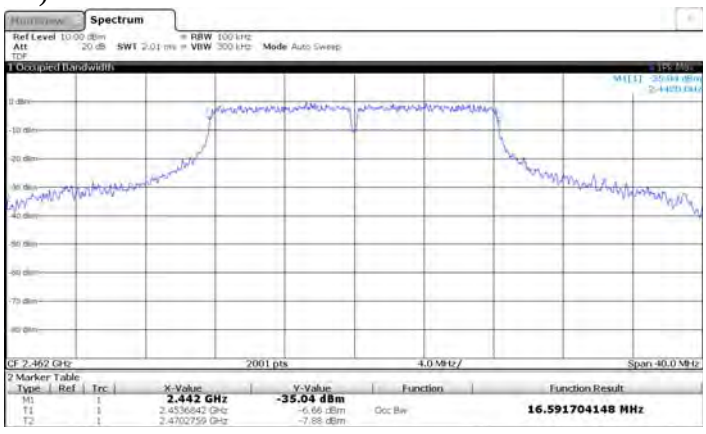
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

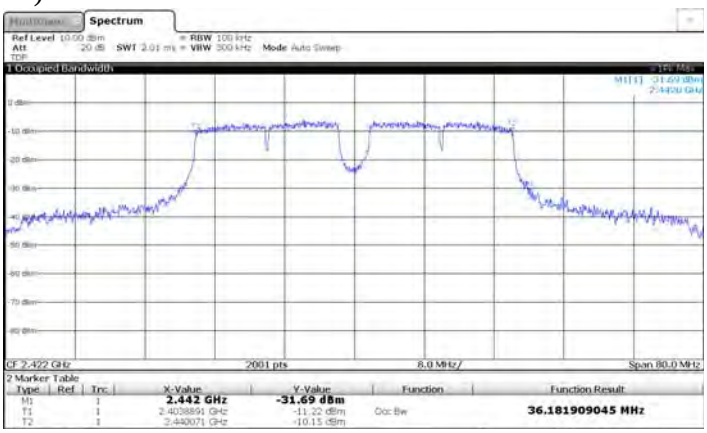


Highest Channel (2 462 ㎒)

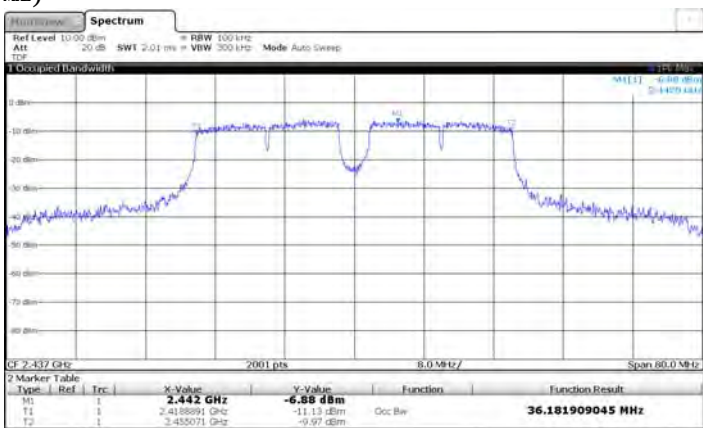


*** 802.11n HT40 (Occupied Bandwidth)**

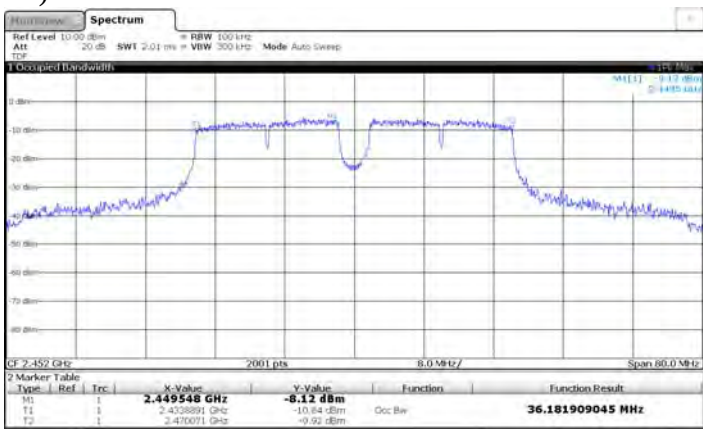
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



Highest Channel (2 452 ㎒)



5.5 Spurious Emission, Band Edge, and Restricted bands

5.5.1 Regulation

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈ instead of 20 ㏈. 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 (㎒)	Field strength (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

5.5.2 Measurement Procedure

5.5.2.1 Band-edge Compliance of RF Conducted Emissions

5.5.2.1.1 Reference Level Measurement

Establish a reference level by using the following procedure:

1) Set instrument center frequency to DTS channel center frequency.
2) Set the span to ≥ 1.5 times the DTS bandwidth.
3) Set the RBW = 100 ㎑.
4) Set the VBW ≥ 3 x RBW.
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum PSD level.

5.5.2.1.2 Emissions Level Measurement

1) Set the center frequency and span to encompass frequency range to be measured.
2) Set the RBW = 100 ㎑.
3) Set the VBW ≥ 3 x RBW.
4) Detector = peak.
5) Ensure that the number of measurement points ≥ span/RBW
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

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 ㎑
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.

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 ㎑ to 30 ㎒ using the loop antenna, and from 30 to 1 000 ㎒ using the TRILOG broadband antenna, and from 1 000 ㎒ to 26 500 ㎒ 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 ㏈ Att – A.G)

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

5.5.3 Test Result

- Complied

1. Conducted Spurious Emissions was shown in figure 5.
   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 6.
3. Measured value of the Field strength of spurious Emissions (Radiated)

*** Below 1 ㎓ data (worst-case: 802. 11n HT40)**

Low channel (2 412 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒ (3 m Distance)							
Below 30.00	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 ㎓							
252.19	120	H	51.2	-13.6	37.6	46.0	8.4
300.145	120	V	47.5	-11.9	35.6	54.0	18.4
601.238	120	H	42.3	-4.9	37.4	54.0	16.6
651.847	120	H	44.1	-4.0	40.1	54.0	13.9
675.98	120	H	40.2	-3.9	36.3	54.0	17.7
775.203	120	H	40.6	-2.3	38.3	54.0	15.7
825.158	120	H	40.4	-1.4	39.0	54.0	15.0
880.205	120	H	37.3	-0.3	37.0	54.0	17.0
Above 900.00	Not Detected	-					

*** Above 1 ㎓ data**

802.11b_Low channel (2 412 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 823.25	1 000	V	49.6	6.8	56.4	74.0	17.6
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 823.25	1 000	V	44.2	6.8	51.0	54.0	3.0
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11b_ Middle channel (2 437 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 874.00	1 000	V	48.6	7.0	55.6	74.0	18.4
Above 4 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 874.00	1 000	V	43.1	7.0	50.1	54.0	3.9
Above 4 000.00	Not Detected	-	-	-	-	-	-

802.11b_High channel (2 462 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB (㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 923.99	1 000	V	46.7	7.2	53.9	74.0	20.1
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 923.99	1 000	V	42.1	7.2	49.3	54.0	4.7
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11g_Low channel (2 412 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 823.95	1 000	V	48.9	6.8	55.7	74.0	18.3
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 823.95	1 000	V	43.7	6.8	50.5	54.0	3.5
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11g_ Middle channel (2 437 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 874.40	1 000	V	52.8	7.0	59.8	74.0	14.2
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 874.40	1 000	V	42.1	7.0	49.1	54.0	4.9
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11g_High channel (2 462 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 924.78	1 000	V	48.2	7.2	55.4	74.0	18.6
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 924.78	1 000	V	35.8	7.2	43.0	54.0	11.0
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11n HT20_Low channel (2 412 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 824.01	1 000	V	45.1	6.8	51.9	74.0	22.1
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 824.01	1 000	V	32.9	6.8	39.7	54.0	14.3
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11n HT20_ Middle channel (2 437 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 875.03	1 000	V	51.0	7.0	58.0	74.0	16.0
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 875.03	1 000	V	40.5	7.0	47.5	54.0	6.5
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11n HT20_ High channel (2 462 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 924.10	1 000	V	48.1	7.2	55.3	74.0	18.7
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 924.10	1 000	V	36.7	7.2	43.9	54.0	10.1
Above 5 000.00	Not Detected	-	-	-	-	-	-

802.11n HT40_Low channel (2 422 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
Above 1 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
Above 1 000.00	Not Detected	-	-	-	-	-	-

802.11n HT40_ Middle channel (2 437 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
Above 1 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
Above 1 000.00	Not Detected	-	-	-	-	-	-

802.11n HT40_ High channel (2 452 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
4 903.95	1 000	V	43.0	7.1	50.1	74.0	23.9
Above 5 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
4 903.95	1 000	V	33.7	7.1	40.8	54.0	13.2
Above 5 000.00	Not Detected	-	-	-	-	-	-

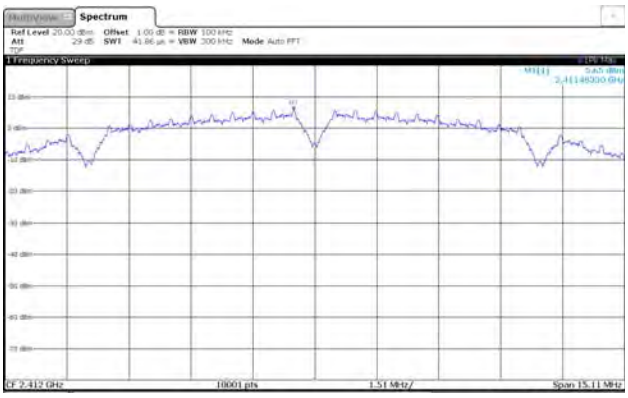
5.5.4 Test Plot

Figure 5. Plot of the Band-edge & Conducted Spurious Emissions

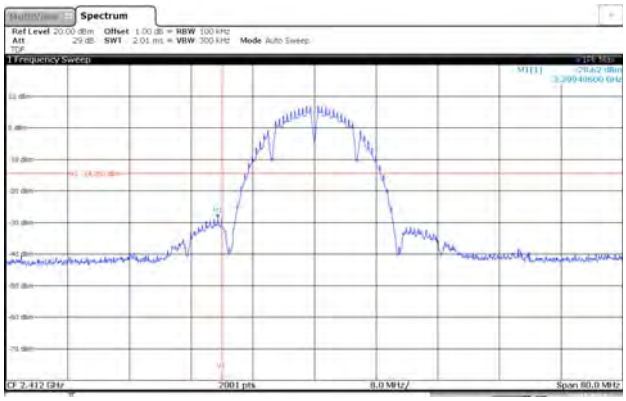
*** 802.11b**

Lowest Channel (2 412 ㎒)

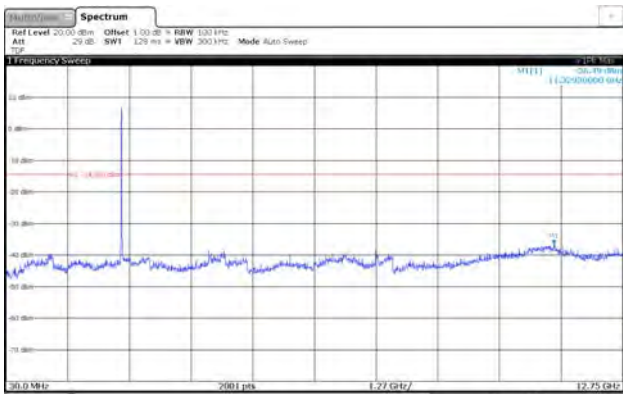
Reference



Band-edge

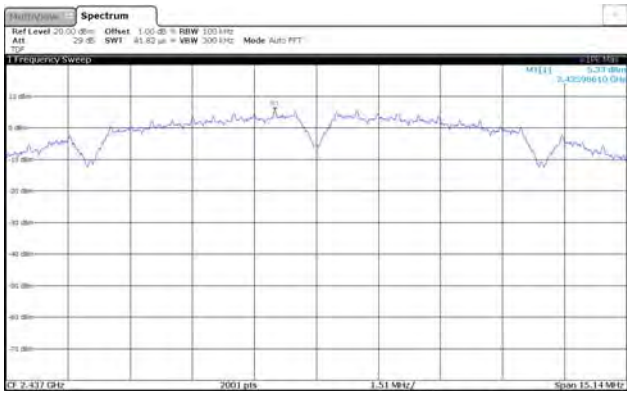


Conducted Spurious Emissions

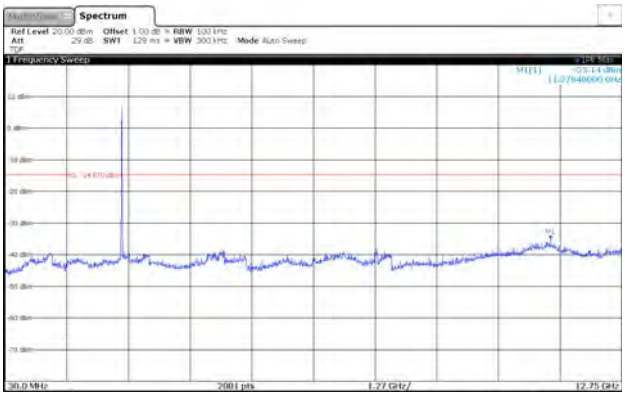


Middle Channel (2 437 ㎒)

Reference

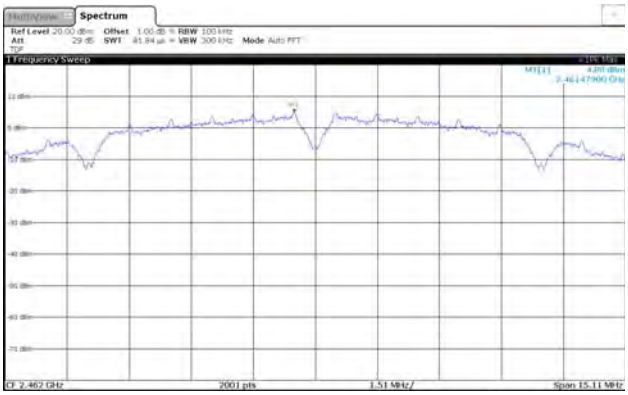


Conducted Spurious Emissions

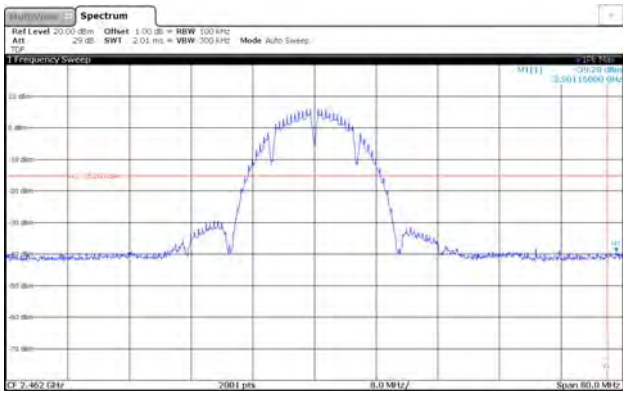


Highest Channel (2 462 ㎒)

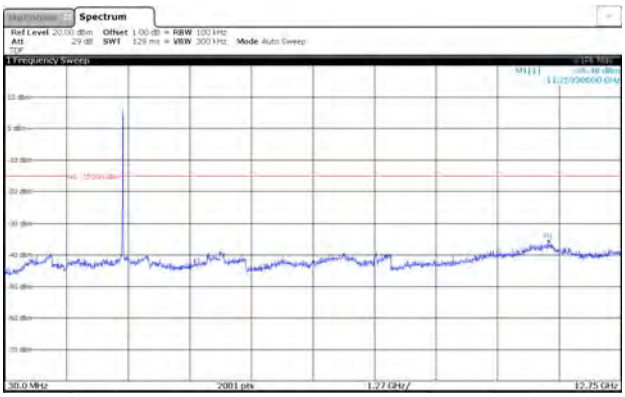
Reference



Band-edge



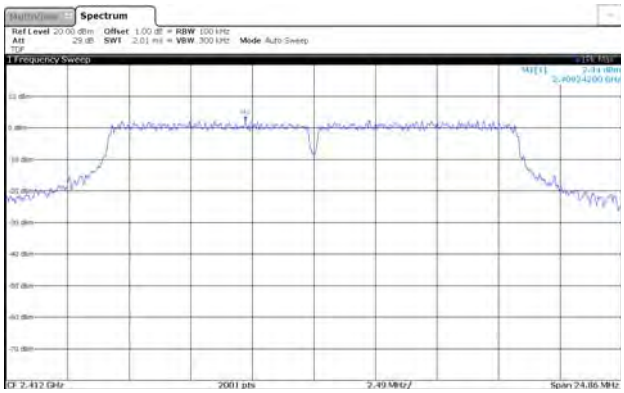
Conducted Spurious Emissions



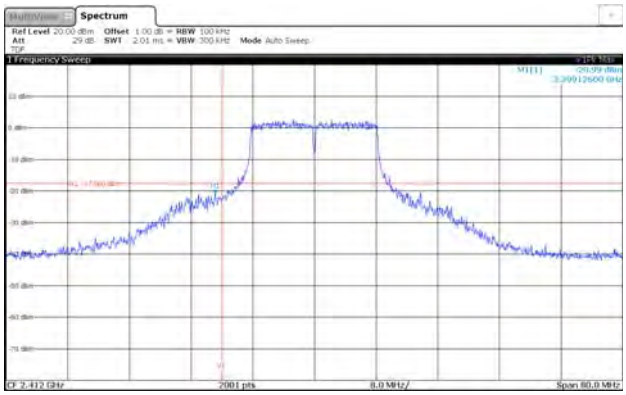
*** 802.11g**

Lowest Channel (2 412 ㎒)

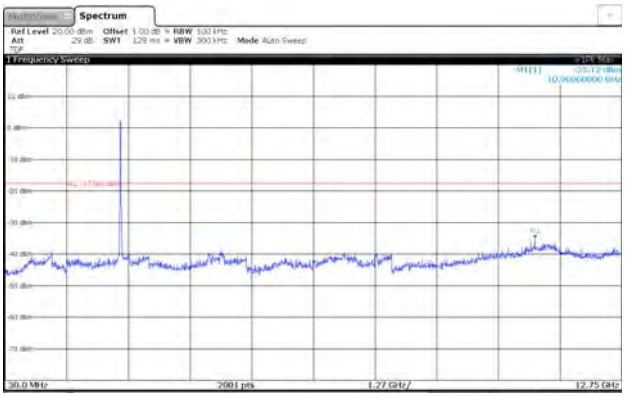
Reference



Band-edge

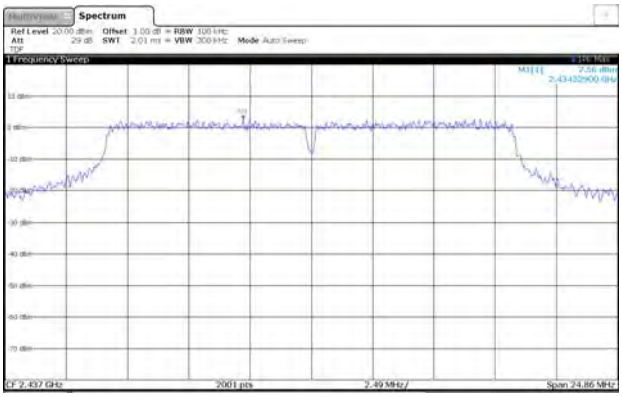


Conducted Spurious Emissions

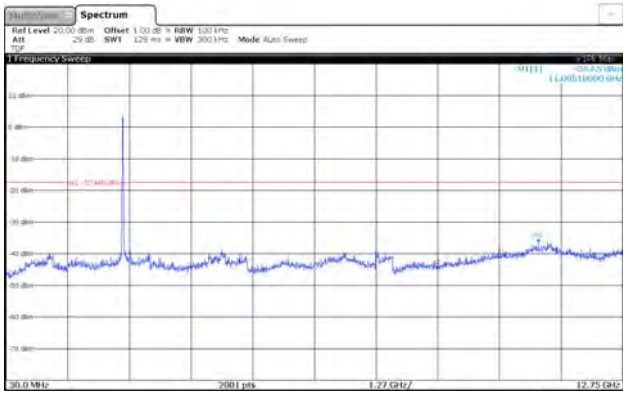


Middle Channel (2 437 ㎒)

Reference

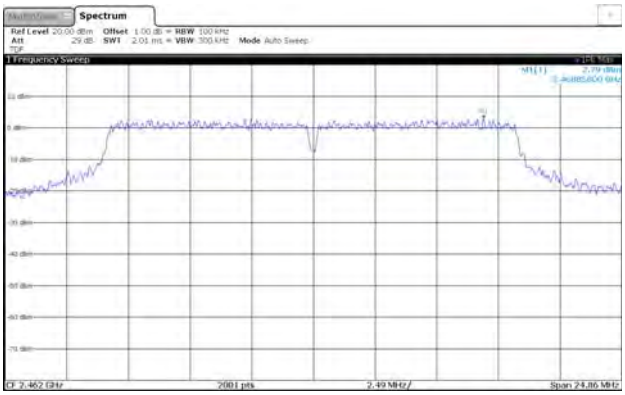


Conducted Spurious Emissions

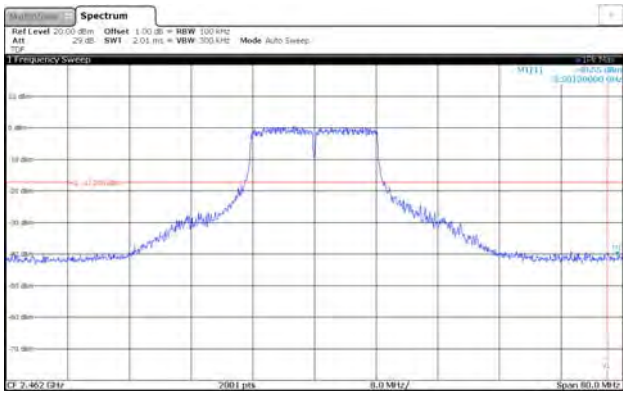


Highest Channel (2 462 ㎒)

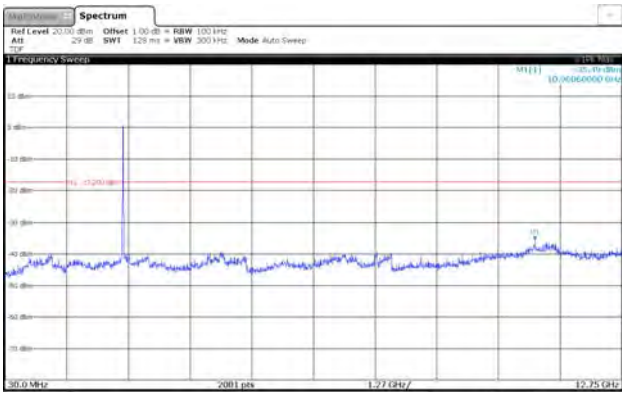
Reference



Band-edge



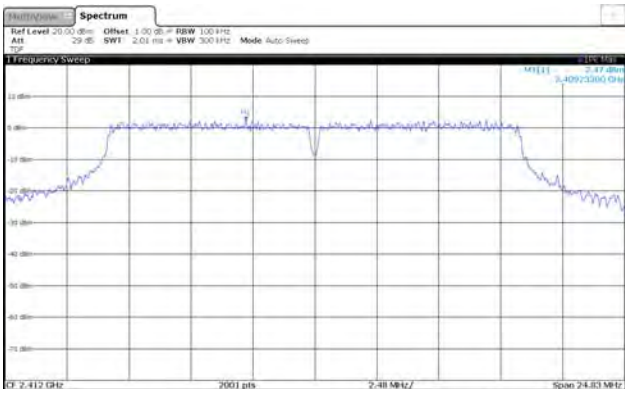
Conducted Spurious Emissions



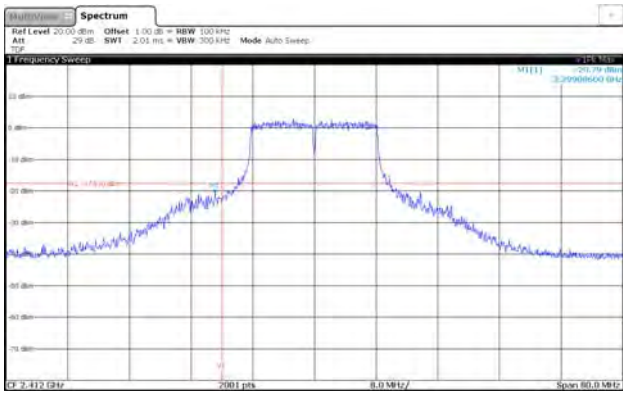
*** 802.11n HT20**

Lowest Channel (2 412 ㎒)

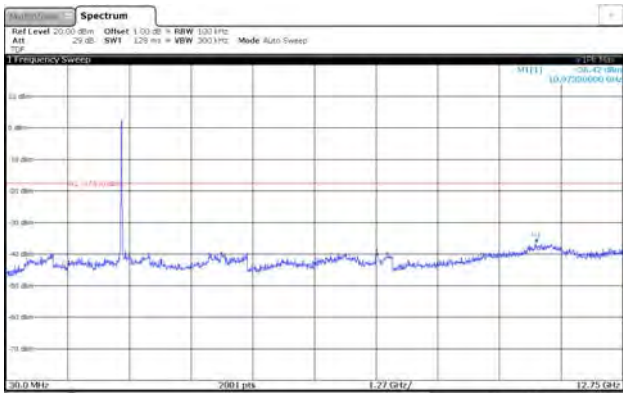
Reference



Band-edge

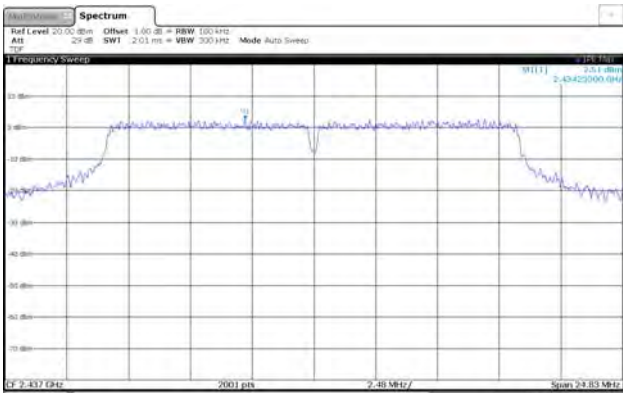


Conducted Spurious Emissions

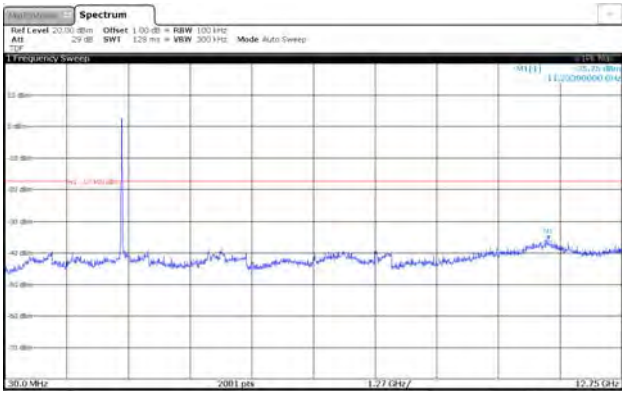


Middle Channel (2 437 ㎒)

Reference

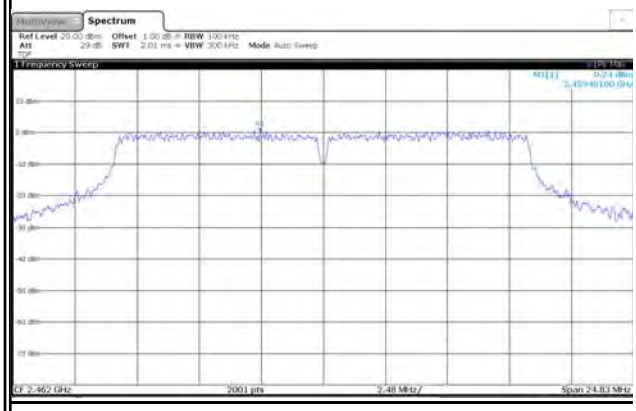


Conducted Spurious Emissions

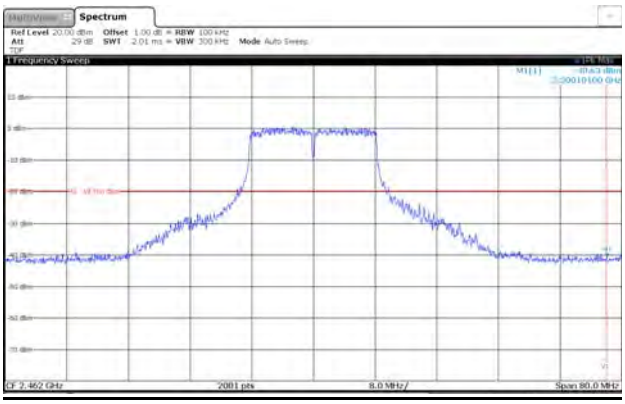


Highest Channel (2 462 ㎒)

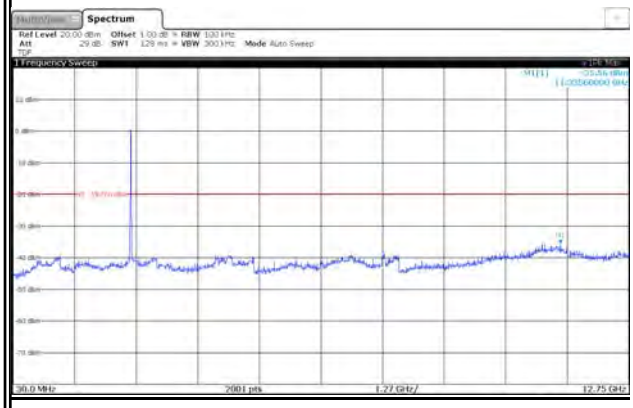
Reference



Band-edge



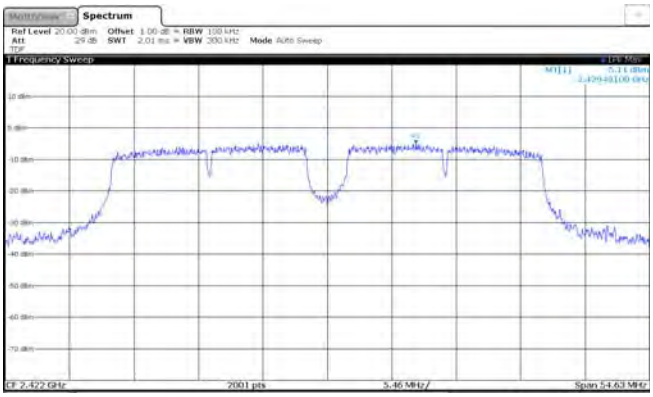
Conducted Spurious Emissions



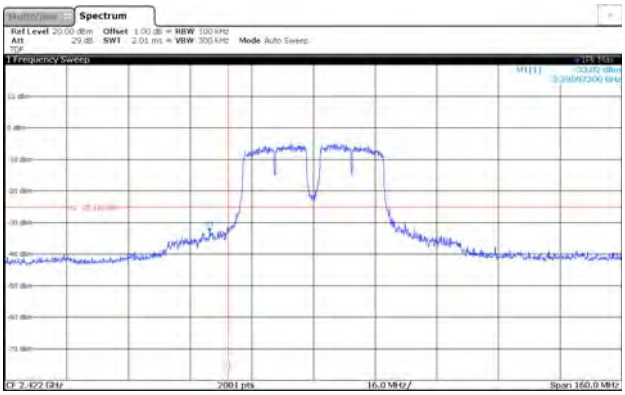
*** 802.11n HT40**

Lowest Channel (2 422 ㎒)

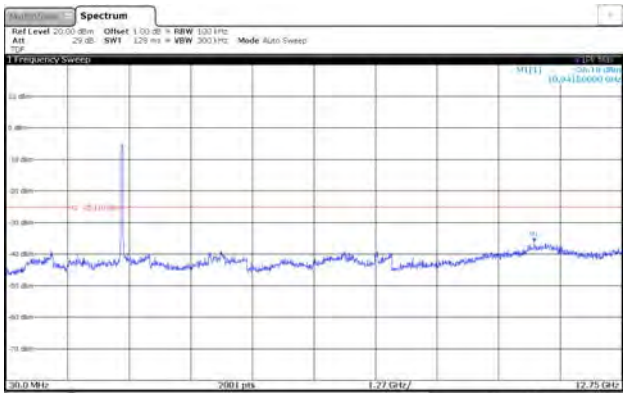
Reference



Band-edge

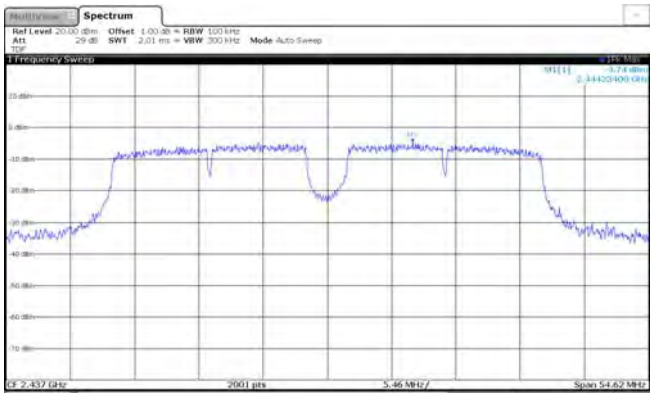


Conducted Spurious Emissions

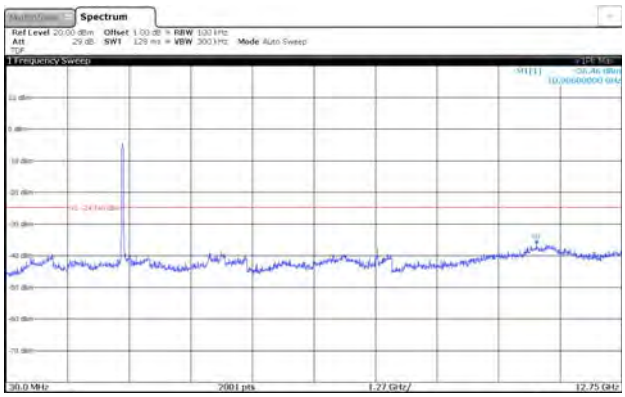


Middle Channel (2 437 ㎒)

Reference

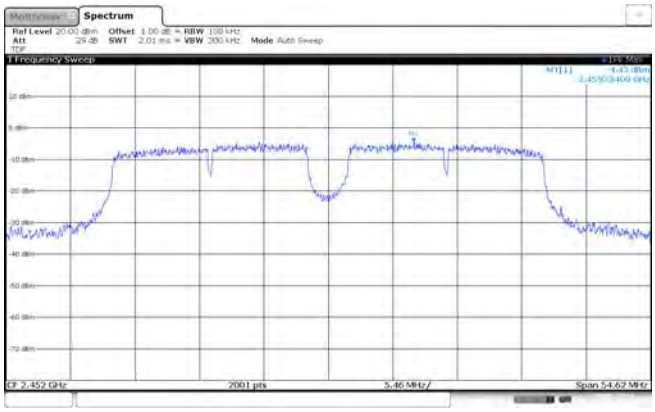


Conducted Spurious Emissions

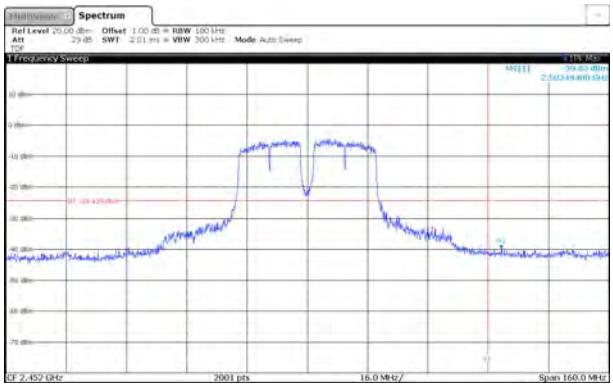


Highest Channel (2 452 ㎒)

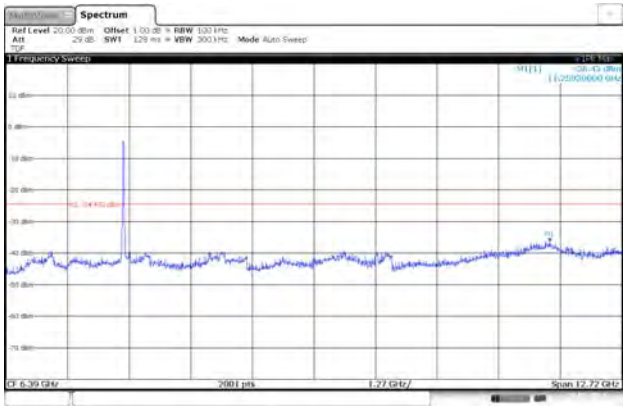
Reference



Band-edge



Conducted Spurious Emissions

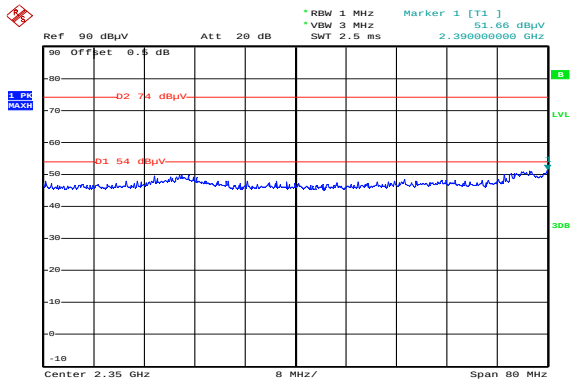


5.5.5 Test Plot (Continue)

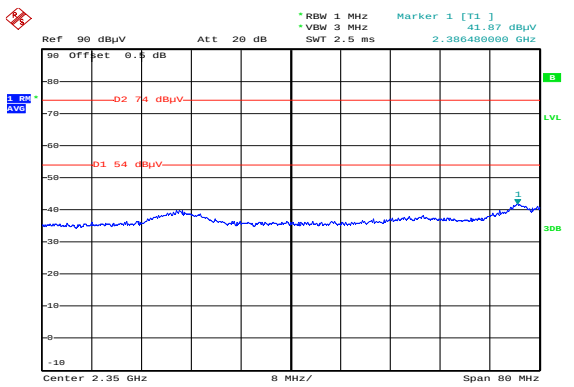
Figure 6. Plot of the Band Edge (Radiated Restricted Bands)

*** 802.11b**

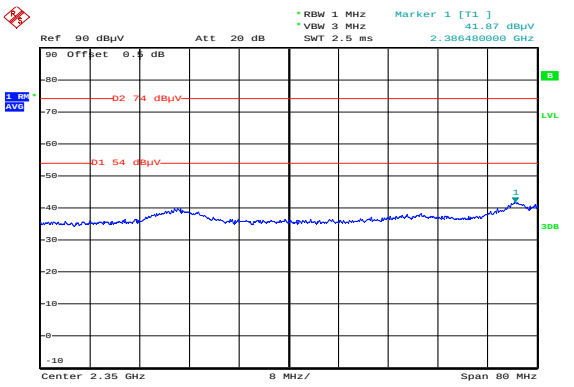
Lowest Channel(2 412 ㎒): Peak



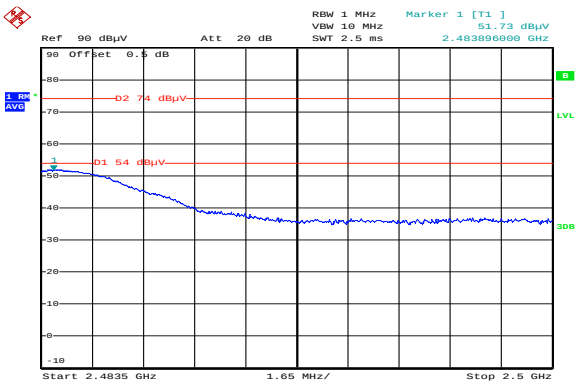
Lowest Channel(2 412 ㎒): Average



Highest Channel(2 462 ㎒): Peak



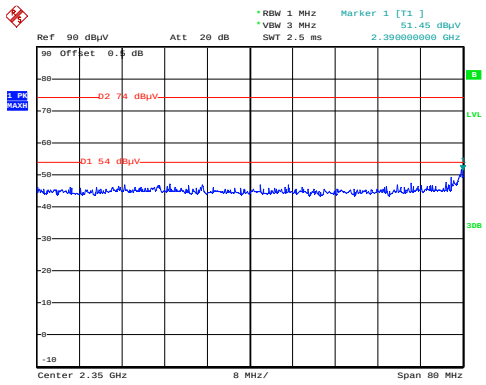
Highest Channel(2 462 ㎒): Average



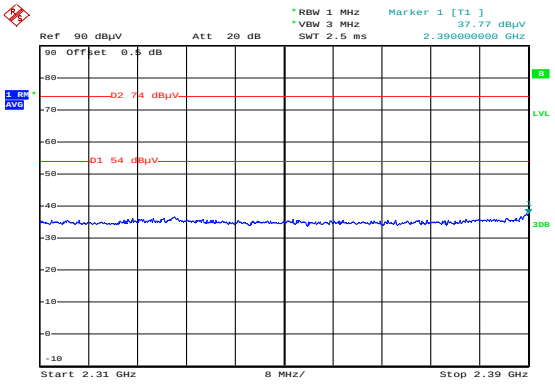
* **offset** = **Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= 0.5 ㏈ (2 412 ㎒)
= 0.5 ㏈ (2 462 ㎒)

*** 802.11g**

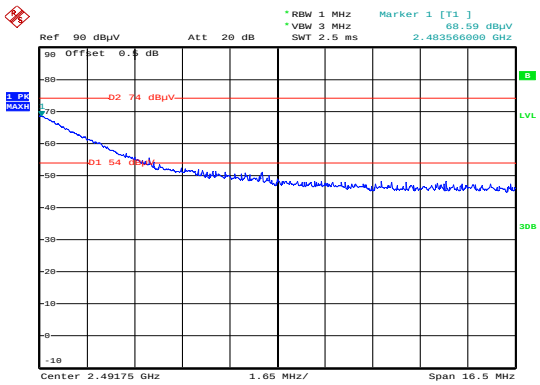
Lowest Channel(2 412 ㎒): Peak



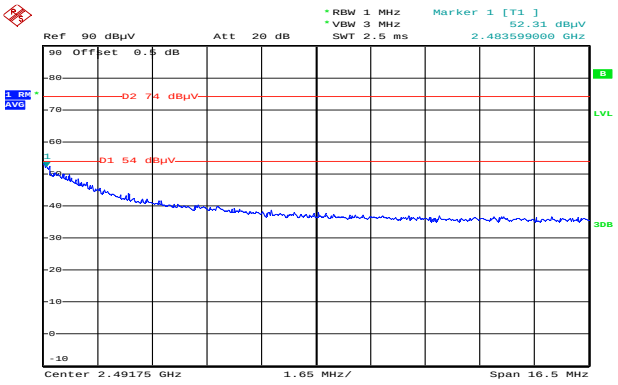
Lowest Channel(2 412 ㎒): Average



Highest Channel(2 462 ㎒): Peak



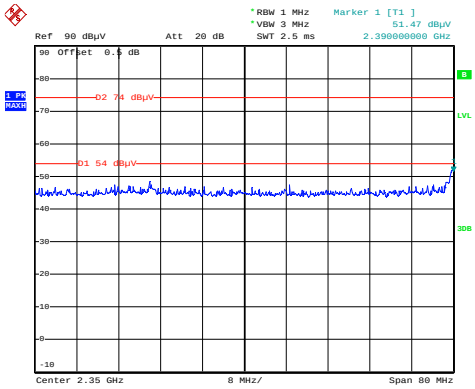
Highest Channel(2 462 ㎒): Average



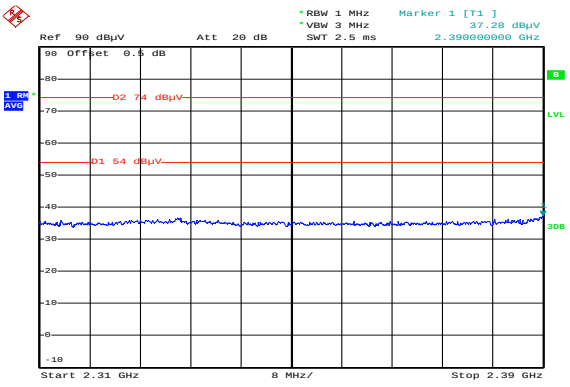
*** offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= 0.5 ㏈ (2 412 ㎒)
= 0.5 ㏈ (2 462 ㎒)

*** 802.11n HT20**

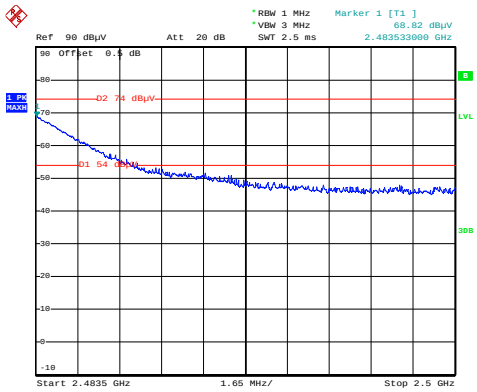
Lowest Channel(2 412 ㎒): Peak



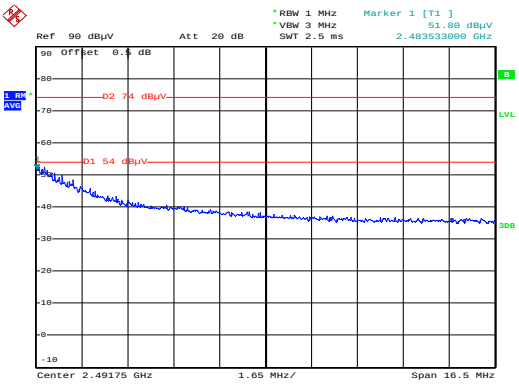
Lowest Channel(2 412 ㎒): Average



Highest Channel(2 462 ㎒): Peak



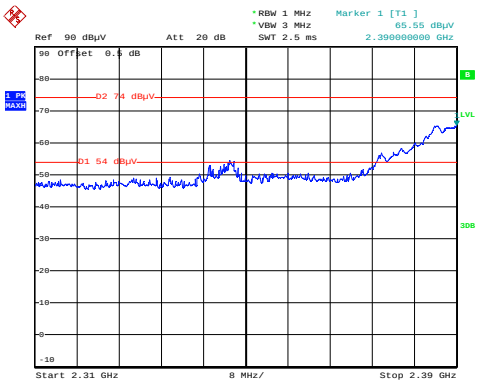
Highest Channel(2 462 ㎒): Average



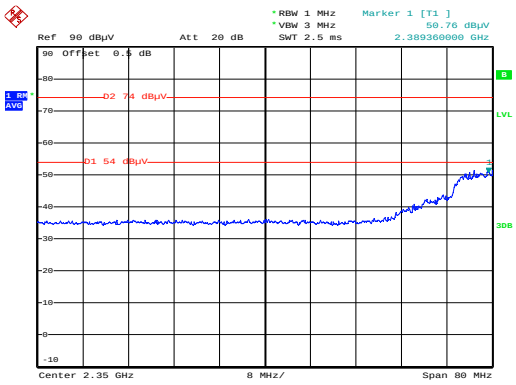
*** offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= 0.5 ㏈ (2 412 ㎒)
= 0.5 ㏈ (2 462 ㎒)

*** 802.11n HT40**

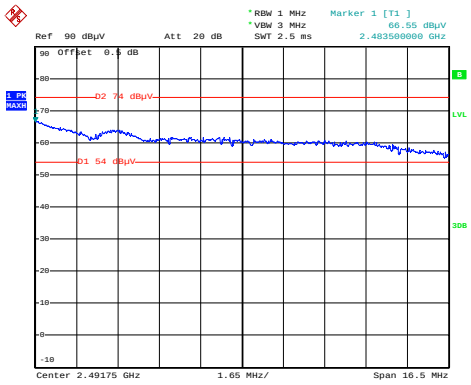
Lowest Channel(2 422 ㎒): Peak



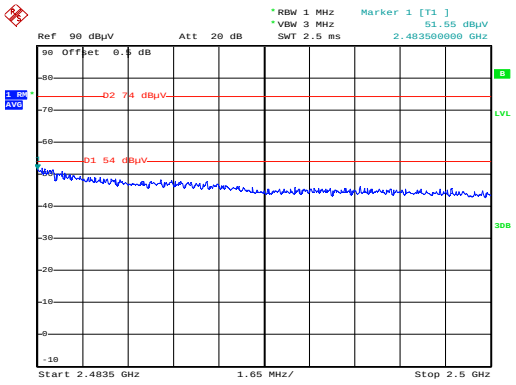
Lowest Channel(2 422 ㎒): Average



Highest Channel(2 452 ㎒): Peak



Highest Channel(2 452 ㎒): Average



*** offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= 0.5 ㏈ (2 422 ㎒)
= 0.5 ㏈ (2 452 ㎒)

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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω 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 (㎒)	Conducted limit (㏈㎶)	
	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 ㎝ in which is located 40 ㎝ 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.

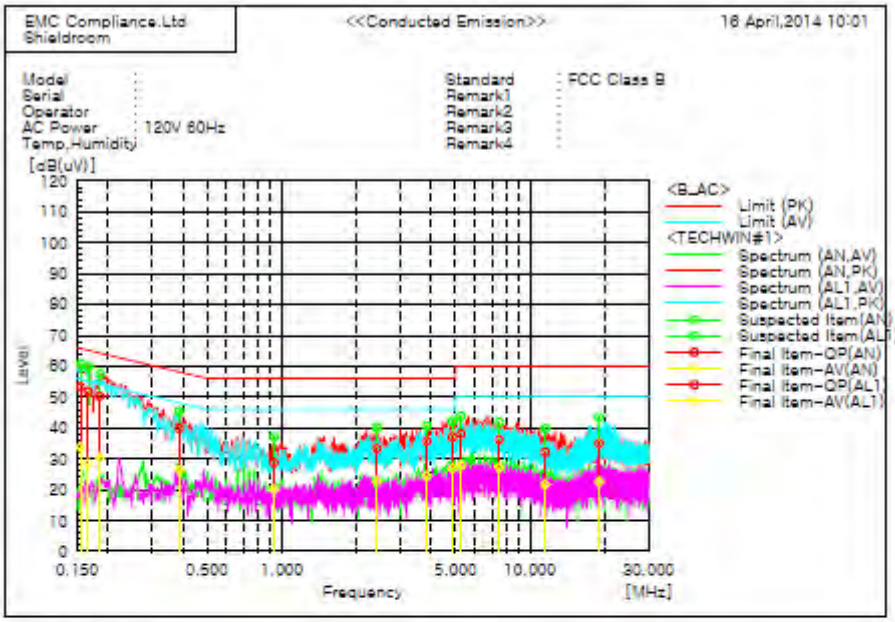
4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.

5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 ㎑ or to QUASI-PEAK and AVERAGE within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

- Complied

***Conducted worst-case data : 802.11g_Lowest Channel (2 412 ㎒)**



Final Result

L2 Phase

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	o.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16489	43.1	29.4	10.6	53.4	39.7	65.7	55.7	12.3	22.0
2	0.16683	41.4	18.1	10.4	51.8	28.5	65.1	55.1	13.3	26.6
3	0.98182	18.4	9.7	10.4	28.8	20.1	56.0	46.0	27.2	25.9
4	3.88541	25.3	14.1	10.4	35.7	24.5	56.0	46.0	20.3	21.5
5	7.50615	25.2	16.2	11.0	36.2	27.2	60.0	50.0	23.8	22.8
6	5.27563	27.4	17.8	10.6	38.0	27.9	60.0	50.0	22.0	22.1
7	0.18487	39.8	20.0	10.5	50.3	30.5	64.3	54.3	14.0	23.8
8	2.41966	23.0	12.4	10.3	33.3	22.7	56.0	46.0	22.7	23.3
9	4.86968	28.6	16.4	10.5	37.1	26.9	56.0	46.0	18.9	19.1
10	11.49605	20.1	9.7	12.0	32.1	21.7	60.0	50.0	27.9	28.3

L8 Phase

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	o.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.98652	29.4	15.9	10.4	39.8	26.3	56.1	46.1	16.3	21.8
2	18.84485	30.8	8.5	14.2	45.0	22.7	60.0	50.0	25.0	27.3

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
■	EMI Test Receiver	R&S	RSCI	100001	14.07.25
■	LISN	R&S	ENV216	101352	14.10.04
■	Amplifier	Sonoma Instrument	310N	293004	14.10.31
■	Spectrum Analyzer	R&S	FSV40	100989	15.01.29
■	Spectrum Analyzer	R&S	FSP40	100209	14.10.21
■	Broadband Preamplifier	Schwarzbeck	BBV9718	216	14.06.10
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	14.07.18
■	Horn Antenna	ETS - Lindgren	3115	62589	14.11.11
■	Attenuator	HP	8491A	16861	14.07.08
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0/ 18G-12SS	44	15.02.05
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Signal Generator	R&S	SMR40	100007	14.06.11
■	Horn antenna	ETS.lindgren	3116	00086635	15.02.26
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	15.05.09