FCC TEST REPORT

Test report No.:	EMC- FCC- R0129
FCC ID:	2AAHK-IEXR100
Type of equipment:	WIFI REMOCON
Model Name:	iEXR100
Applicant:	AMON
Max.RF Output Power:	23.69 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.247
Frequency Range:	2 412 MHz ~ 2 462 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: 2013. 12. 22 ~ 24

Issued date: 2014. 01. 20

Tested by: AHN, BYUNG WOO

Approved by: YU, SANG HOON

[Contents]

1. Client information

Applicant:	AMON
Address:	4F, Hanjun Bldg,110-4,Singil-dong,Yeongdeungpo-gu, Seoul, Korea
Telephone number:	+82-2-368-2020
Facsimile number:	+82-2-368-2029
Contact person:	Myung ok Lim / mickey@siv.co.kr / Manager

Manufacturer:	Seyeong NDC., Ltd.
Address :	2~4F, Hanjun Bldg,110-4,Singil-dong,Yeongdeungpo-gu, Seoul, Korea

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

CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 508785
VCCI Registration No.: R-3327, G-198, C-3706, T-1849
IC Recognition No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant	AMON
Address of Applicant	4F, Hanjun Bldg,110-4, Singil-dong, Yeongdeungpo-gu, Seoul, Korea
Manufacturer	Seyeong NDC., Ltd.
Address of Manufacturer	2~4F, Hanjun Bldg,110-4,Singil-dong,Yeongdeungpo-gu, Seoul, Korea
Type of equipment	WIFI REMOCON
Basic Model	iEXR100
Variant Model	RX100, X7R100
Serial number	Proto Type

* Variant model names are different only for the marketing area, and all model names are electrically identical in construction, radio characteristics, and features.

3.2 General description

Frequency Range	2 412 ~ 2 462 MHz(802.11b/g/n_HT20)
Communication	IEEE 802.11b/g/n_HT20
Type of Modulation	CCK, OFDM
Number of Channels	11 ch
Type of Antenna	Integral type
Antenna Gain	1.4 dBi
Power supply	DC 3.7 V
Operating temperature	- 20 ~ 55 °C *
Dimension	52 mm x 37 mm x 19 mm (W x D x H)

*Declared by the applicant.

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.

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

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 3.7 V

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	C
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	Expanded Uncertainty U = KUc (K = 2)	
Conducted RF power	± 0.58 dB	
Conducted Emissions	9 kHz ~ 150 kHz:	± 3.82 dB
	150 kHz ~ 30 MHz:	± 3.43 dB
Radiated disturbance	30 MHz ~ 300 MHz :	+ 4.86 dB, - 4.88 dB
	300 MHz ~ 1 000 MHz:	+ 4.98 dB, - 4.99 dB
	1 GHz ~ 6 GHz :	+ 6.19 dB, - 6.20 dB
	6 GHz ~ 18 GHz :	+ 6.41 dB, - 6.53 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 an integral type of antenna. The directional peak gain of the antenna is 1.4 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 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 9.0 of 558074 D01 DTS Meas Guidance.

5.2.2.1 PKPM1 Peak power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

5.2.3 Test Result

- Complied

*** 802.11b**

Channel	Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2412	13.72	30.00	16.28
Middle	2437	13.37	30.00	16.63
High	2462	13.29	30.00	16.71

*** 802.11g**

Channel	Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.69	30.00	6.31
Middle	2437	23.07	30.00	6.93
High	2462	22.45	30.00	7.55

*** 802.11n HT20**

Channel	Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
Low	2412	21.30	30.00	8.70
Middle	2437	20.84	30.00	9.16
High	2462	20.74	30.00	9.26

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer (G_{ANT} = 1.4 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 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 10.0 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 kHz ≤ RBW ≤ 100 kHz.
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 kHz) and repeat.

5.3.3 Test Result

- Complied

*** 802.11b**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	-6.11	8.00	14.11
Middle	-6.48	8.00	14.48
High	-6.54	8.00	14.54

*** 802.11g**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	-14.66	8.00	22.66
Middle	-14.79	8.00	22.79
High	-15.07	8.00	23.07

*** 802.11n HT20**

Channel	Result [dBm]	Limit [dBm]	Margin [dBm]
Low	-14.60	8.00	22.60
Middle	-14.31	8.00	22.31
High	-14.48	8.00	22.48

-NOTE:

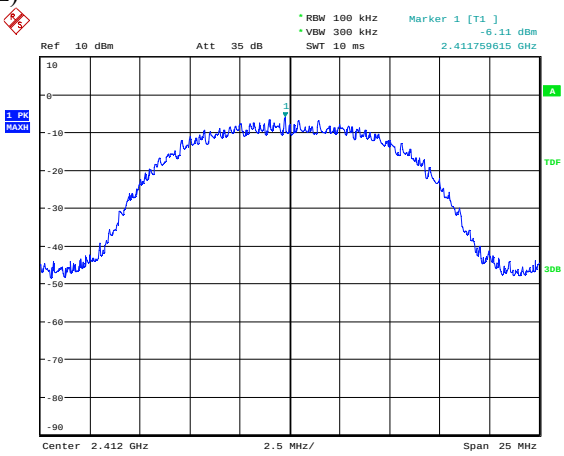
1. Since the directional gain of the integral antenna declared by the manufacturer (G_{ANT} = 1.4 dBi), does not exceed 6.0 dBi, there was no need to reduce the output power.
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.3.4 Test Plot

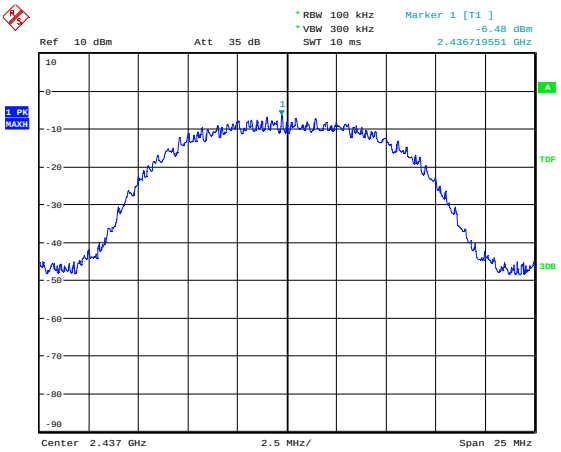
Figure 3. Plot of the Power Density (Conducted)

*** 802.11b**

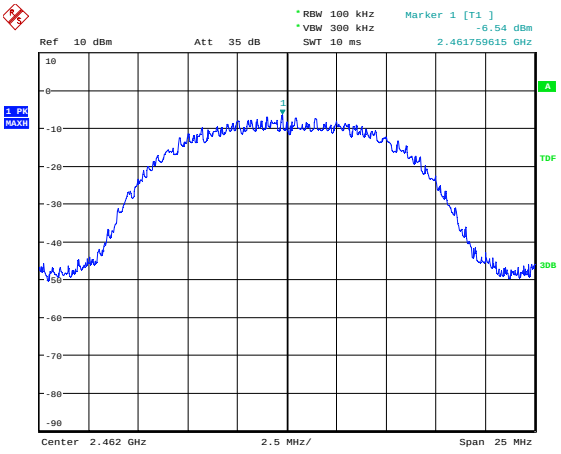
Lowest Channel(2 412 MHz)



Middle Chnnel (2 437 MHz)

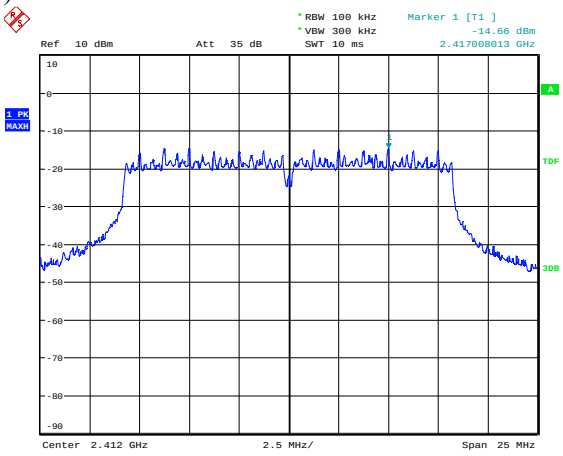


Highest Chnnel (2 462 MHz)

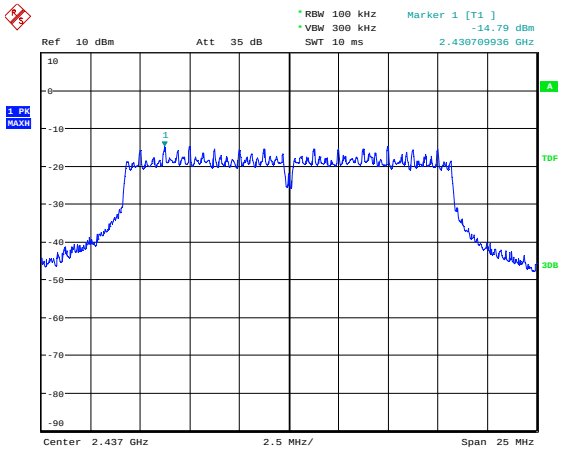


*** 802.11g**

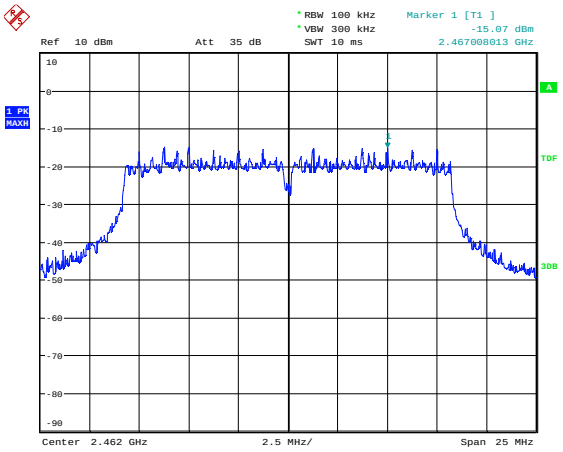
Lowest Channel(2 412 MHz)



Middle Chnnel (2 437 MHz)

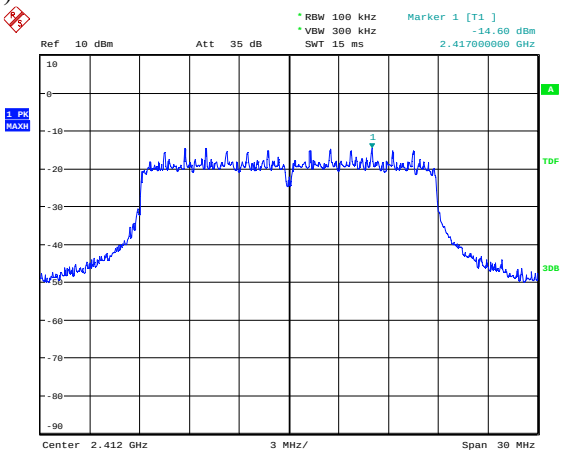


Highest Chnnel (2 462 MHz)

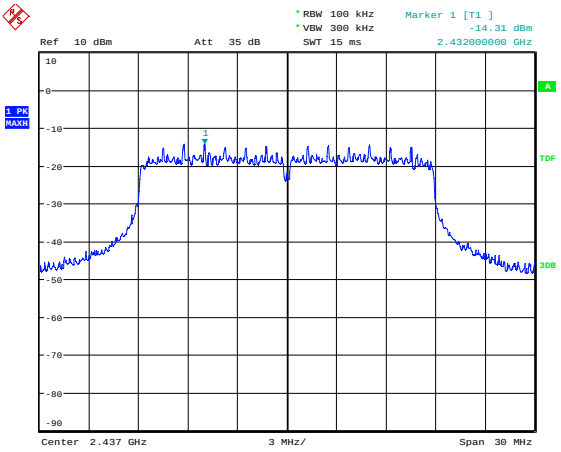


*** 802.11n HT20**

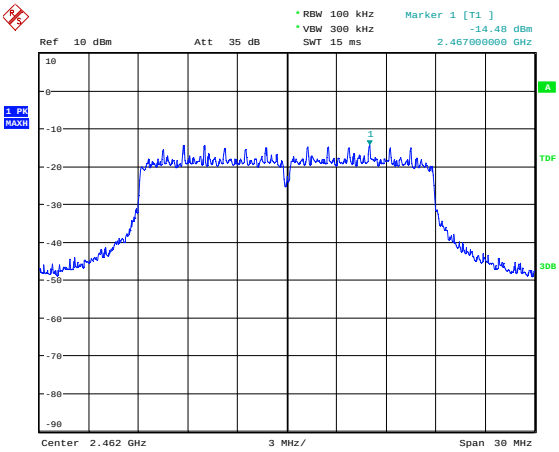
Lowest Channel(2 412 MHz)



Middle Chnnel (2 437 MHz)



Highest Chnnel (2 462 MHz)



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 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 8.0 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 frequencies) 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 an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, 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 dB.

5.4.3 Test Result

- Complied

*** 802.11b**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Min. Limit (kHz)
Low	2 412	10.449	500
Middle	2 437	10.449	500
High	2 462	10.449	500

*** 802.11g**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Min. Limit (kHz)
Low	2 412	16.510	500
Middle	2 437	16.510	500
High	2 462	16.510	500

*** 802.11n HT20**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Min. Limit (kHz)
Low	2 412	17.630	500
Middle	2 437	17.720	500
High	2 462	17.692	500

-NOTE:

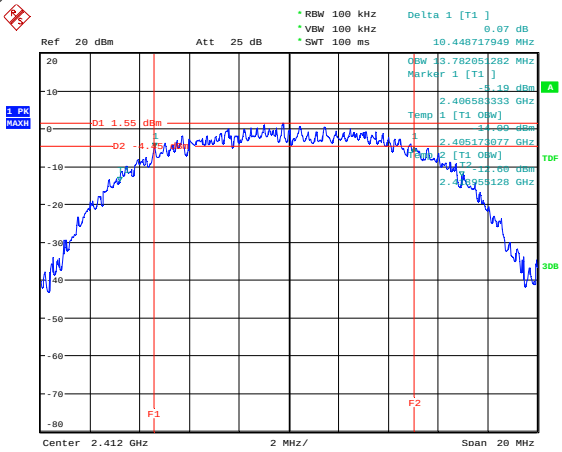
1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.4.4 Test Plot

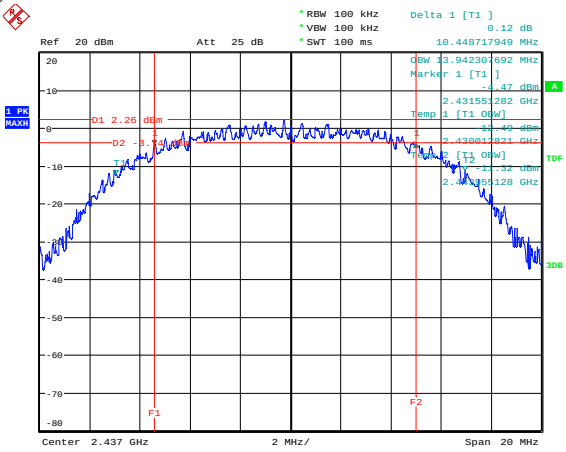
Figure 4. Plot of the 6dB Bandwidth (Conducted)

*** 802.11b**

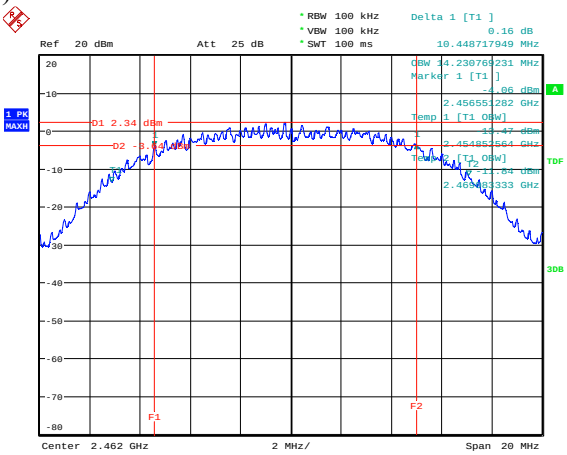
Lowest Channel (2 412 MHz)



Middle Channel (2 437 MHz)

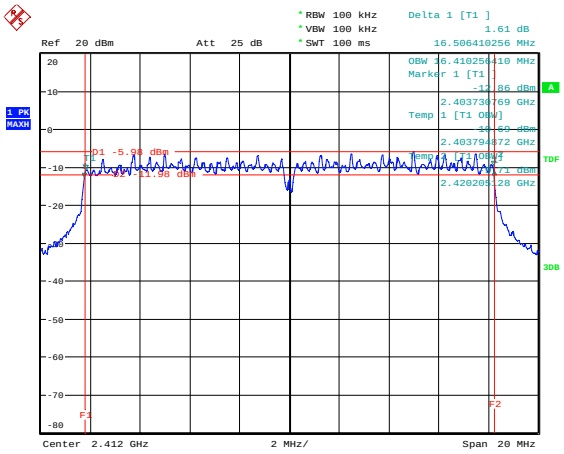


Highest Channel (2 462 MHz)

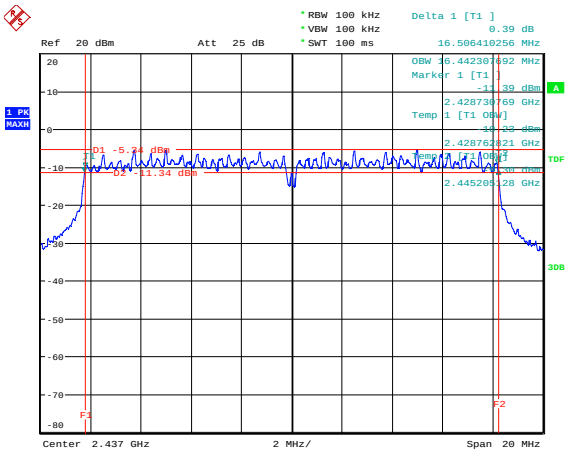


*** 802.11g**

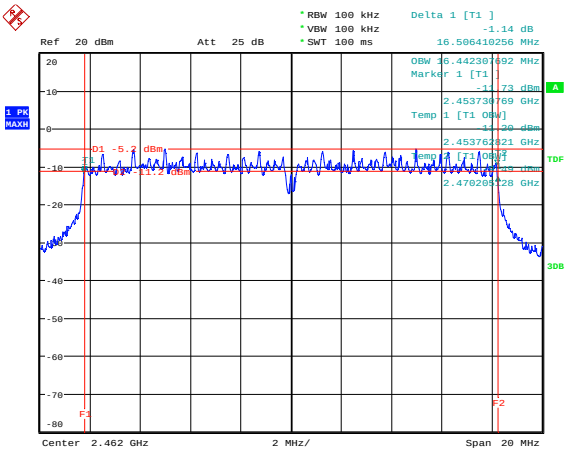
Lowest Channel (2 412 MHz)



Middle Channel (2 437 MHz)

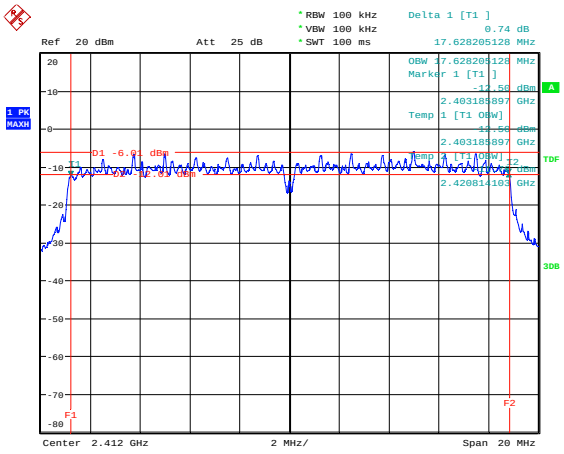


Highest Channel (2 462 MHz)

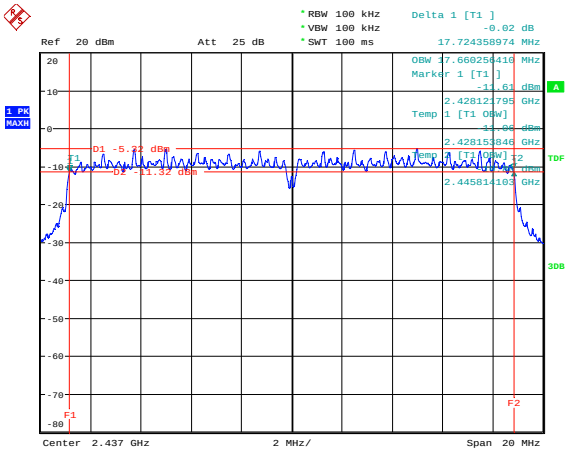


*** 802.11n HT20**

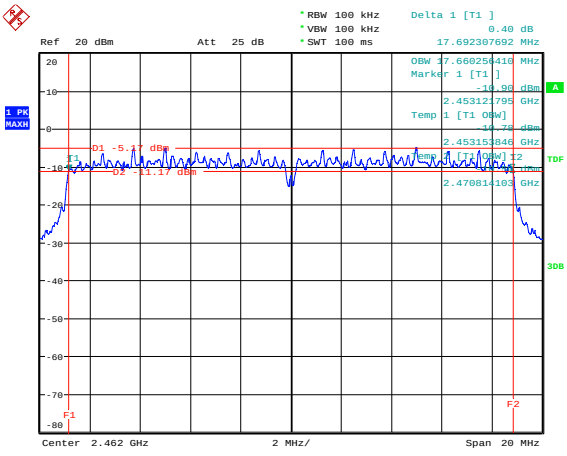
Lowest Channel (2 412 MHz)



Middle Channel (2 437 MHz)



Highest Channel (2 462 MHz)



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), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** 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.

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 kHz.
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 kHz.
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 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.

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 26 500 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

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)

*** 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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
31.213	120	V	35.4	-15.8	19.6	40.0	20.4
160.223	120	H	30.0	-13.4	16.6	43.5	26.9
831.826	120	V	29.9	-1.0	28.9	46.0	17.1
838.253	120	V	28.5	-0.9	27.6	46.0	18.4
Above 900.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 300.000	1 000	H	58.7	1.8	60.5	74.0	13.5
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 300.000	1 000	H	43.5	1.8	45.3	54.0	8.7
Above 3 000.000	Not Detected	-	-	-	-	-	-

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
30.121	120	V	31.2	-15.9	15.3	40.0	24.7
31.334	120	V	32.5	-15.8	16.7	40.0	23.3
61.161	120	V	25.9	-14.9	11.0	40.0	29.0
165.800	120	V	27.9	-13.5	14.4	43.5	29.1
Above 200.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 300.000	1 000	H	56.3	1.8	58.1	74.0	15.9
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 300.000	1 000	H	42.2	1.8	44.0	54.0	10.0
Above 3 000.000	Not Detected	-	-	-	-	-	-

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
43.338	120	H	26.4	-14.7	11.7	40.0	28.3
143.975	120	H	29.4	-13.6	15.8	43.5	27.7
209.086	120	V	27.9	-15.8	12.1	43.5	31.4
Above 300.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 304.000	1 000	H	63.7	1.8	65.5	74.0	8.5
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 304.000	1 000	H	46.8	1.8	48.6	54.0	5.4
Above 3 000.000	Not Detected	-	-	-	-	-	-

*** 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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
43.338	120	H	26.4	-14.7	11.7	40.0	28.3
45.520	120	H	23.8	-14.5	9.3	40.0	30.7
59.585	120	V	31.2	-14.7	16.5	40.0	23.5
Above 100.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 299.750	1 000	H	58.2	-8.0	50.2	74.0	23.8
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 299.750	1 000	H	38.6	-8.0	30.6	54.0	23.4
Above 3 000.000	Not Detected	-	-	-	-	-	-

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
30.728	120	V	25.7	-15.9	9.8	40.0	30.2
46.611	120	V	27.1	-14.4	12.7	40.0	27.3
146.279	120	V	23.2	-13.5	9.7	43.5	33.8
Above 200.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 306.750	1 000	H	60.6	-7.9	52.7	74.0	21.3
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 306.750	1 000	H	41.7	-7.9	33.8	54.0	20.2
Above 3 000.000	Not Detected	-	-	-	-	-	-

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
46.005	120	V	27.7	-14.5	13.2	40.0	26.8
43.338	120	V	26.3	-14.7	11.6	40.0	28.4
Above 100.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 302.000	1 000	H	61.5	-8.0	53.5	74.0	20.5
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 302.000	1 000	H	42.9	-8.0	34.9	54.0	19.1
Above 3 000.000	Not Detected	-	-	-	-	-	-

*** 802.11n HT20**

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
31.091	120	V	29.1	-15.8	13.3	40.0	26.7
43.338	120	V	27.4	-14.7	12.7	40.0	27.3
77.894	120	V	24.6	-18.2	6.4	40.0	33.6
249.947	120	V	23.8	-13.5	10.3	46.0	35.7
Above 300.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 304.000	1 000	H	62.7	-8.0	54.7	74.0	19.3
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 304.000	1 000	H	46.4	-8.0	38.4	54.0	15.6
Above 3 000.000	Not Detected	-	-	-	-	-	-

Middle channel (2 437MHz)

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
30.728	120	V	36.8	-15.9	20.9	40.0	19.1
40.913	120	V	36.2	-15.0	21.2	40.0	18.8
43.095	120	V	29.1	-14.7	14.4	40.0	25.6
159.980	120	V	27.4	-13.4	14.0	43.5	29.5
Above 200.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 304.000	1 000	H	64.0	-8.0	56.0	74.0	18.0
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 304.000	1 000	H	45.3	-8.0	37.3	54.0	16.7
Above 3 000.000	Not Detected	-	-	-	-	-	-

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 30 MHz (3m Distance)							
Below 30.000	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
30.728	120	V	35.6	-15.9	19.7	40.0	20.3
40.913	120	V	35.5	-15.0	20.5	40.0	19.5
42.974	120	V	36.2	-14.8	21.4	40.0	18.6
Above 100.000	Not Detected	-	-	-	-	-	-
Peak DATA. Emissions above 1 GHz							
2 304.000	1 000	H	63.3	-8.0	55.3	74.0	18.7
Above 3 000.000	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
2 304.000	1 000	H	45.5	-8.0	37.5	54.0	16.5
Above 3 000.000	Not Detected	-	-	-	-	-	-

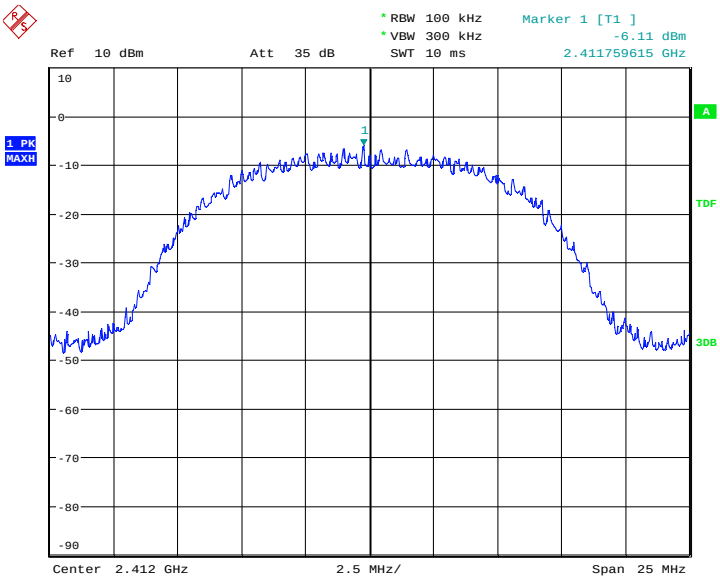
5.5.4 Test Plot

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

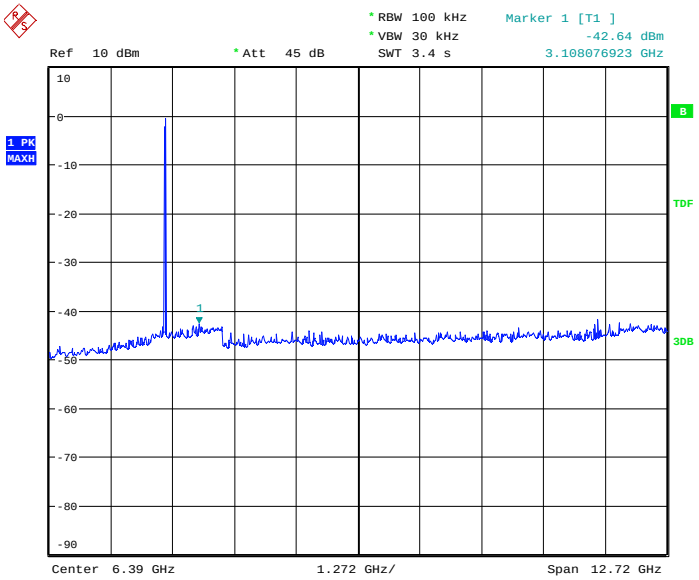
*** 802.11b**

Lowest Channel (2 412 MHz)

Reference

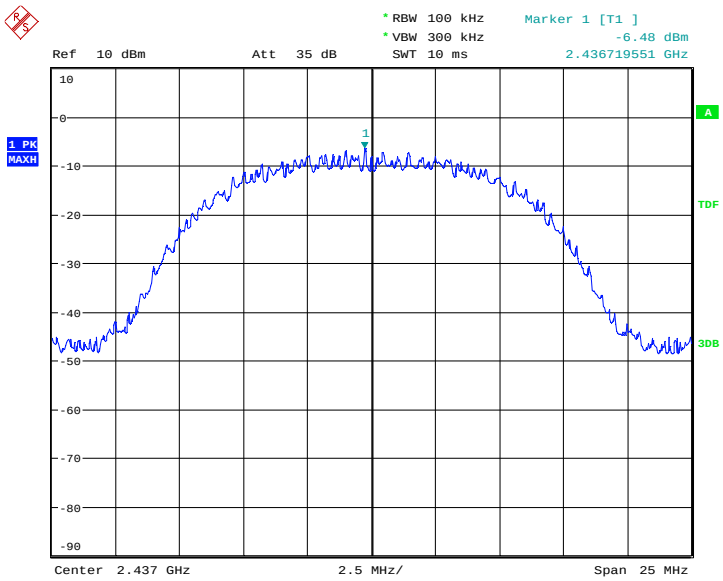


Conducted Spurious Emissions

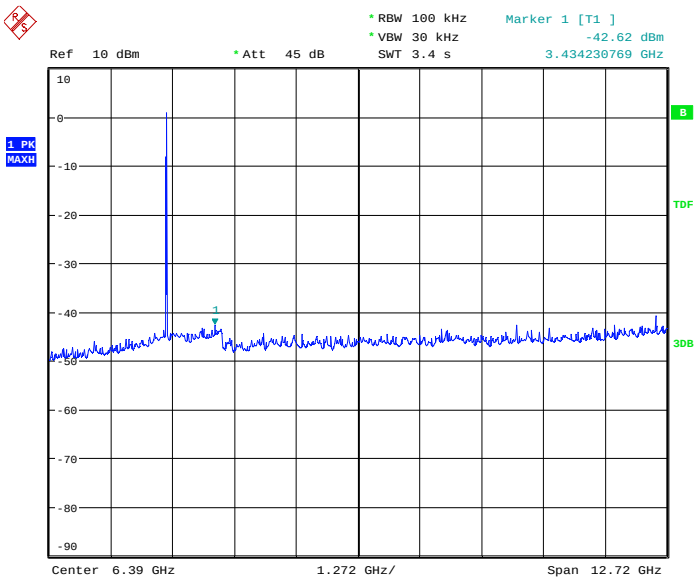


Middle Channel (2 437 MHz)

Reference

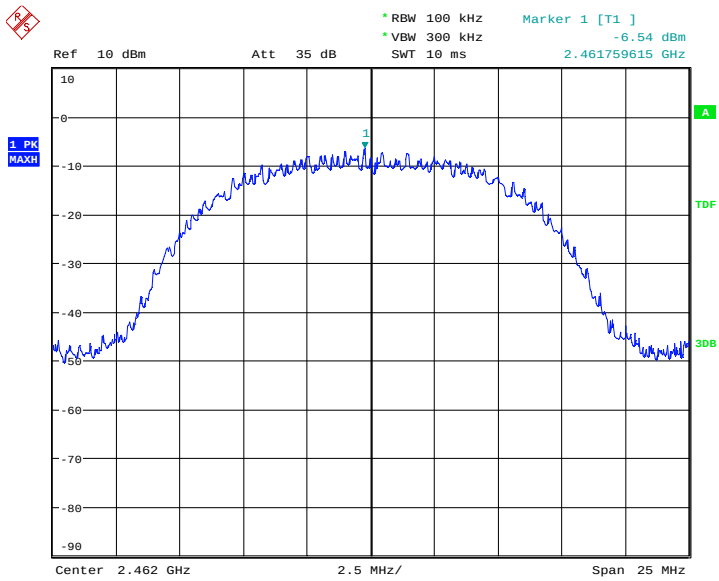


Conducted Spurious Emissions

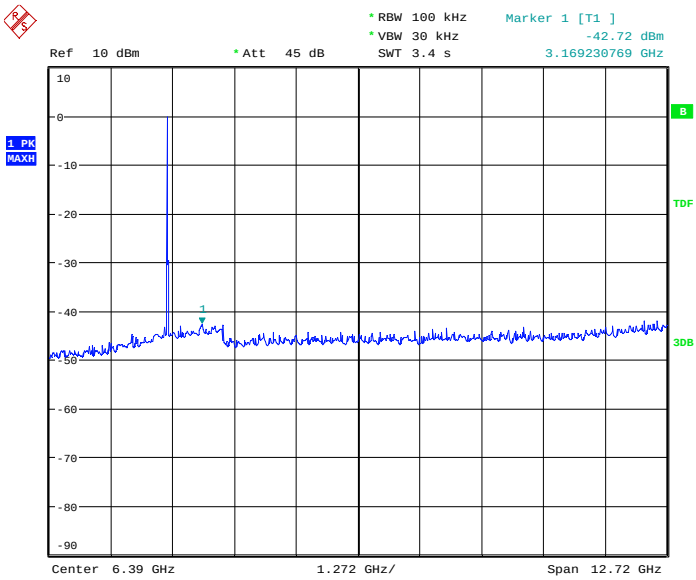


Highest Channel (2 462 MHz)

Reference



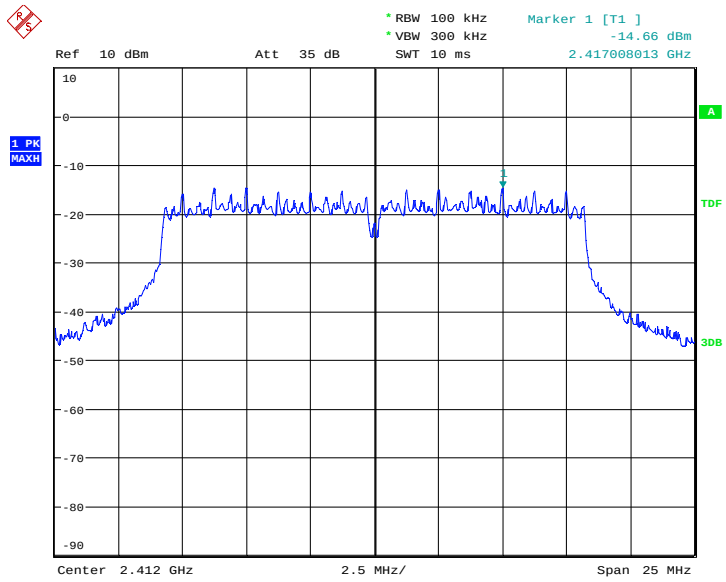
Conducted Spurious Emissions



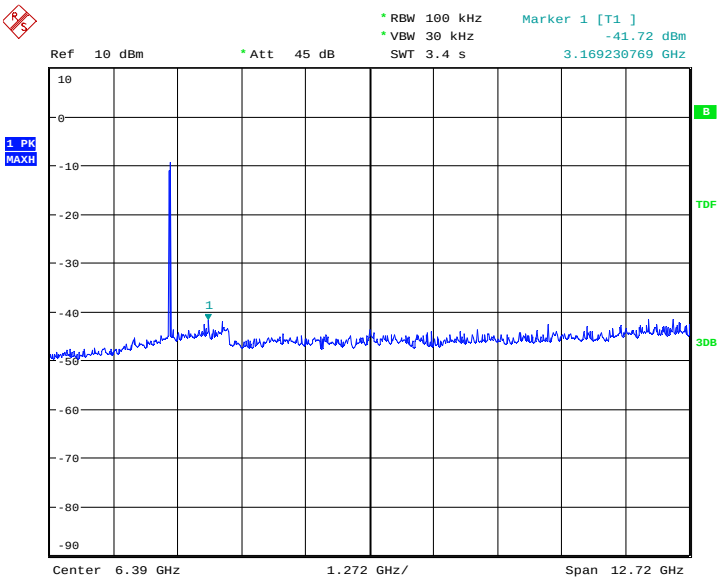
*** 802.11g**

Lowest Channel (2 412 MHz)

Reference

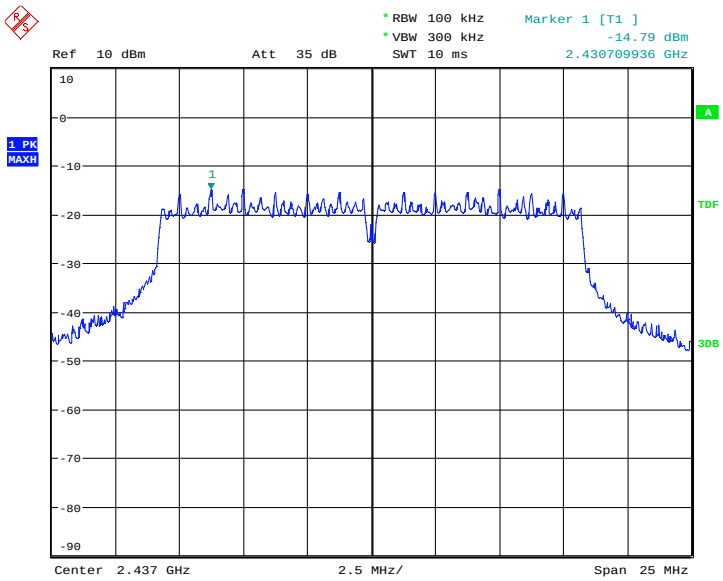


Conducted Spurious Emissions

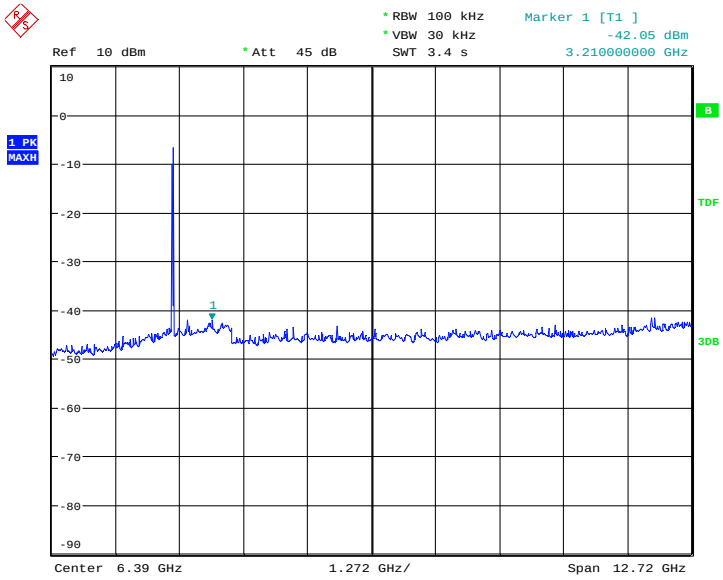


Middle Channel (2 437 MHz)

Reference

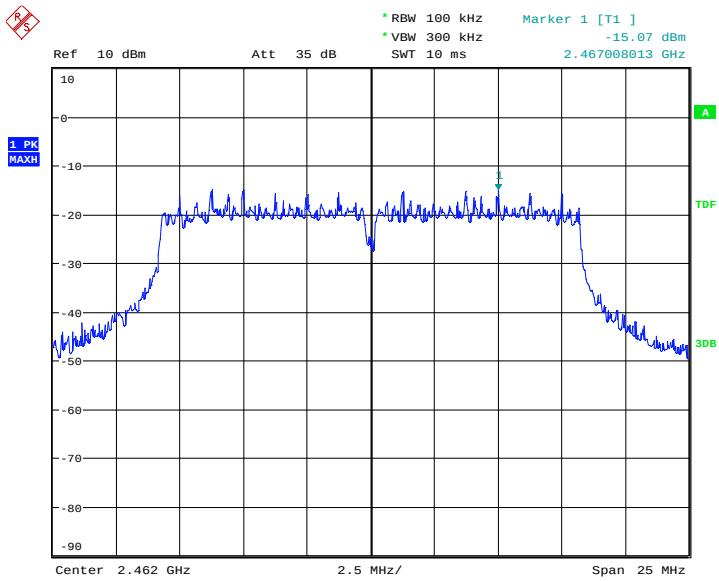


Conducted Spurious Emissions

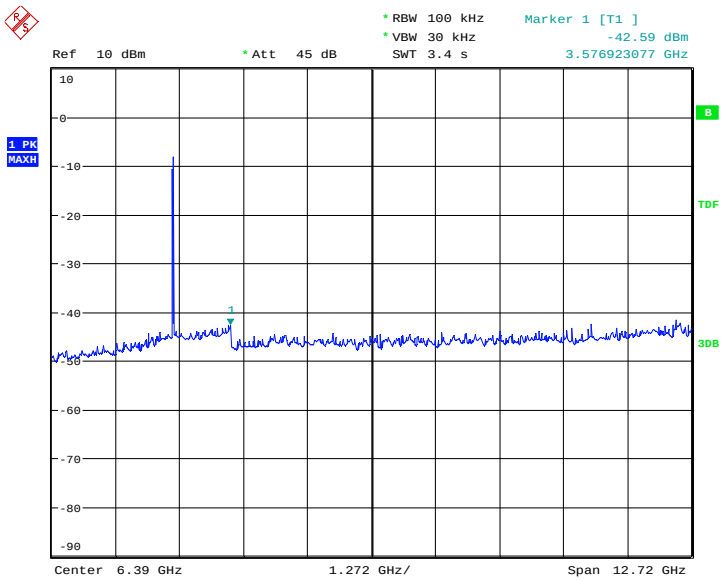


Highest Channel (2 462 MHz)

Reference



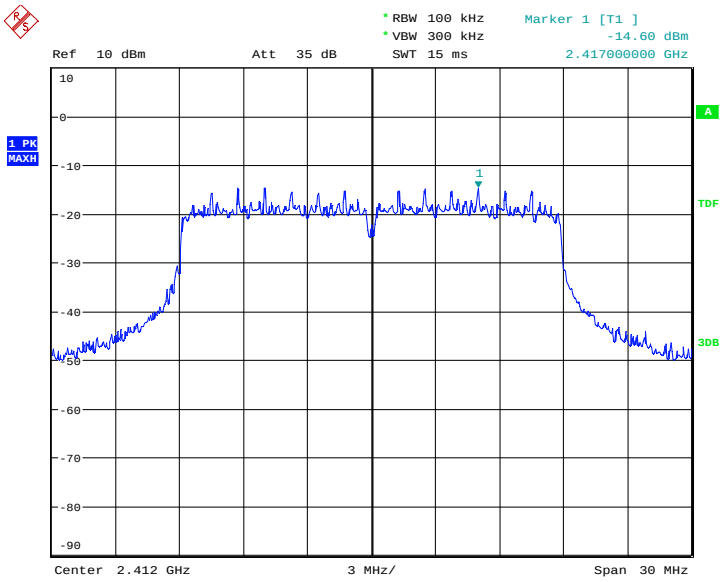
Conducted Spurious Emissions



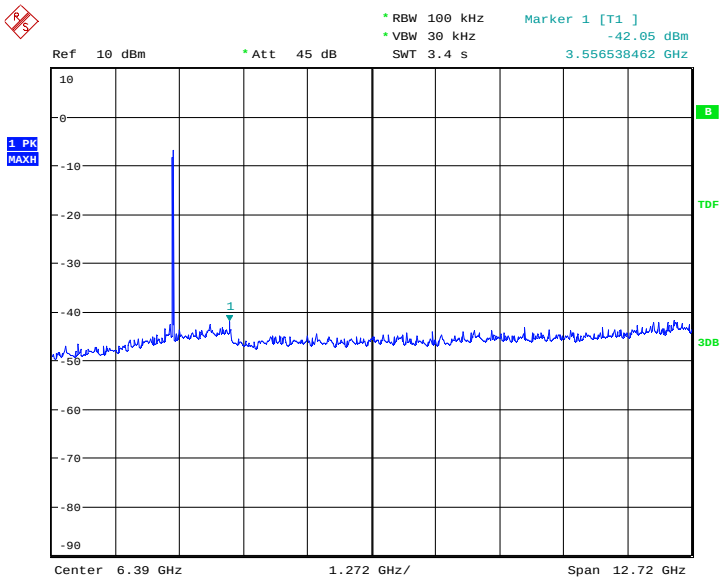
*** 802.11n HT20**

Lowest Channel (2 412 MHz)

Reference

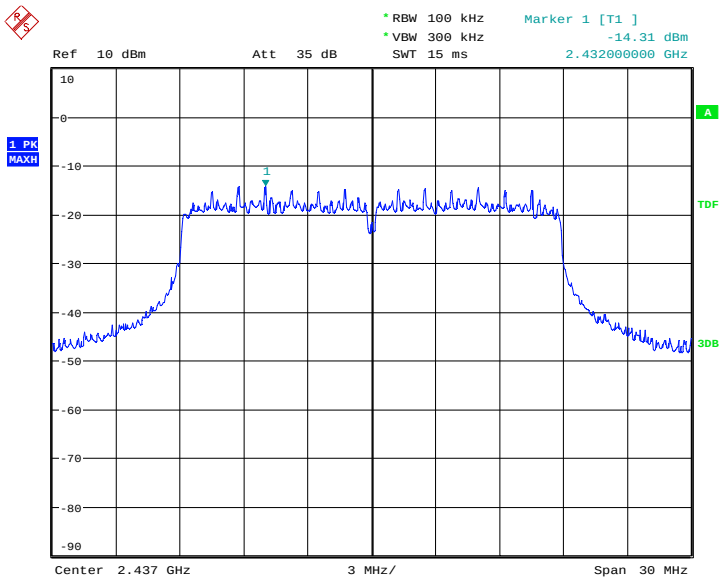


Conducted Spurious Emissions

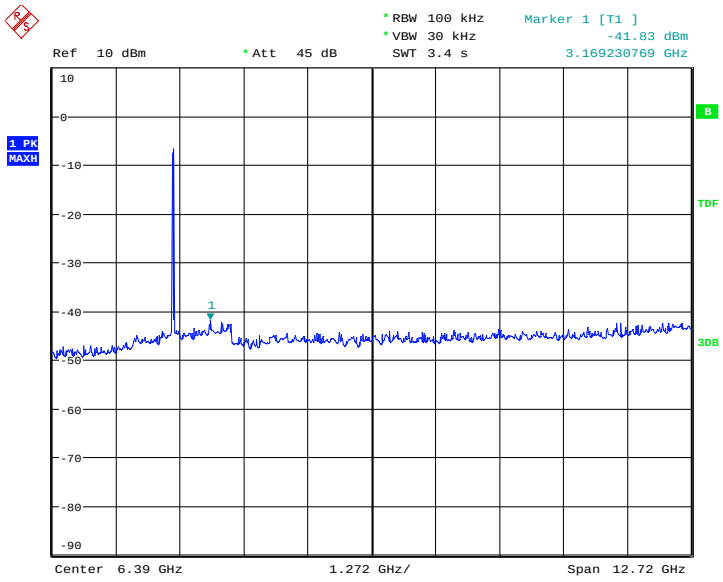


Middle Channel (2 437 MHz)

Reference

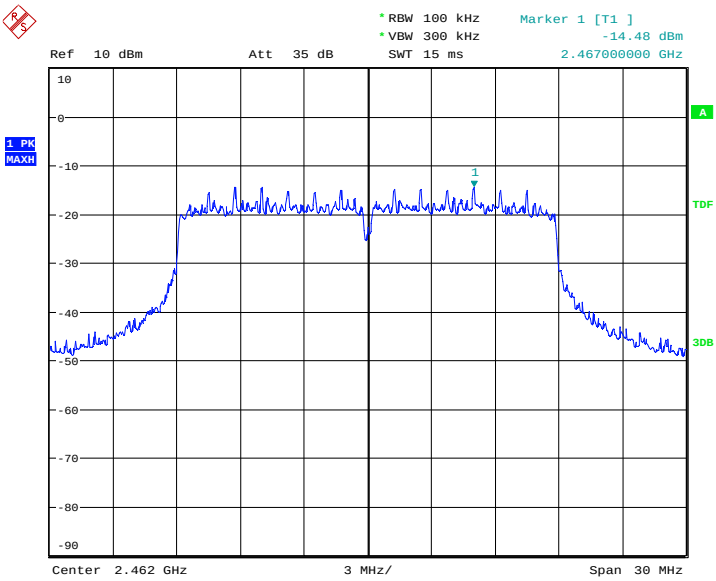


Conducted Spurious Emissions

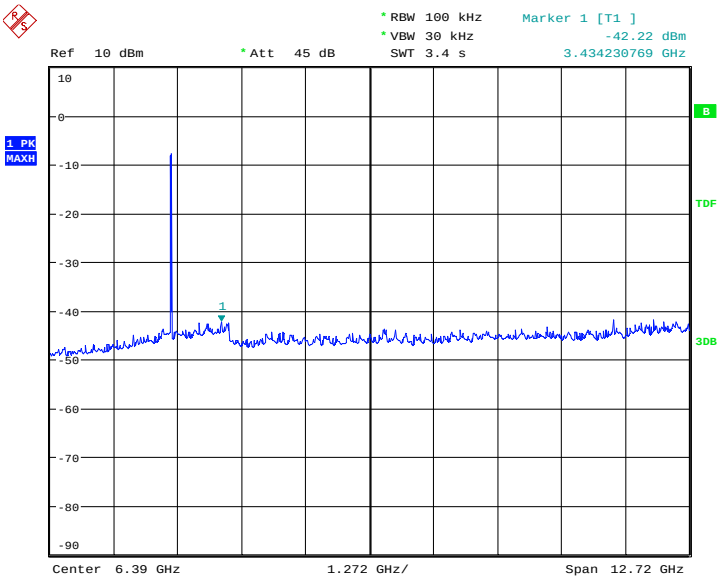


Highest Channel (2 462 MHz)

Reference



Conducted Spurious Emissions

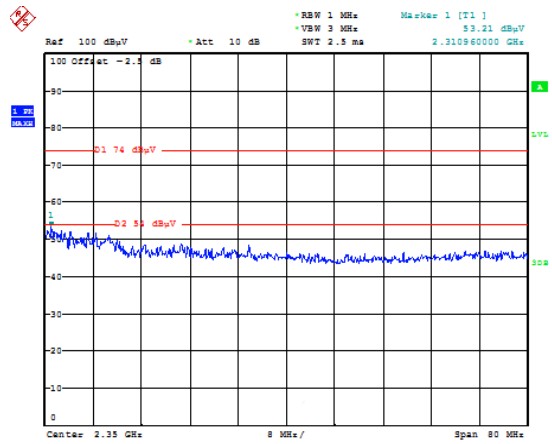


5.5.4 Test Plot (Continue)

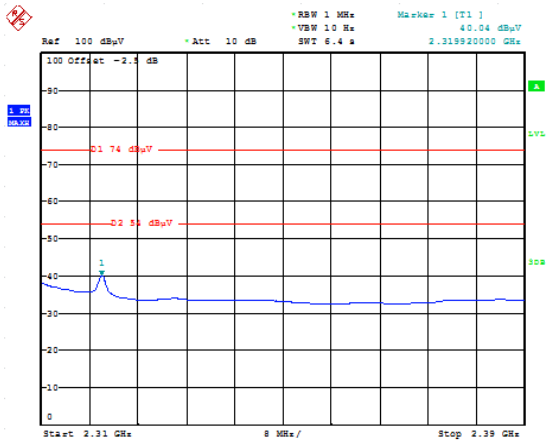
Figure 6. Plot of the Band Edge (Radiated Restricted Bands)

*** 802.11b**

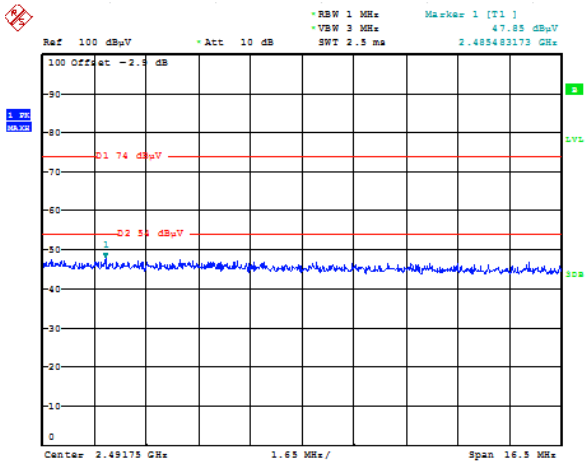
Lowest Channel(2 412 MHz): Peak



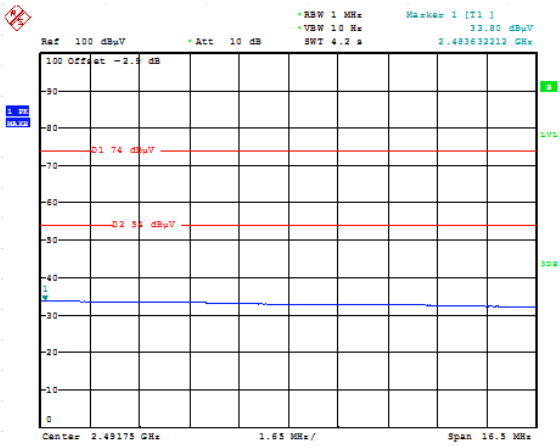
Lowest Channel(2 412 MHz): Average



Highest Channel(2 462 MHz): Peak



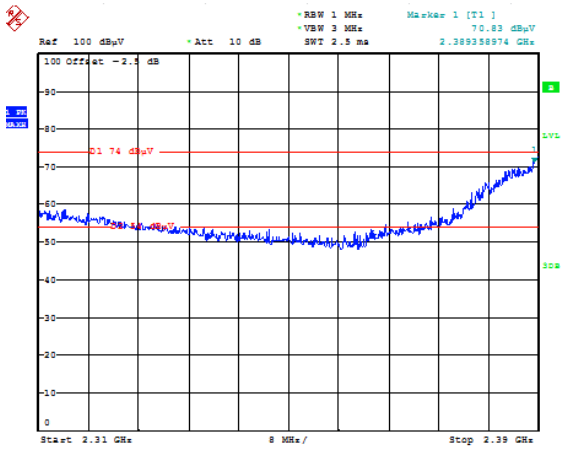
Highest Channel(2 462 MHz): Average



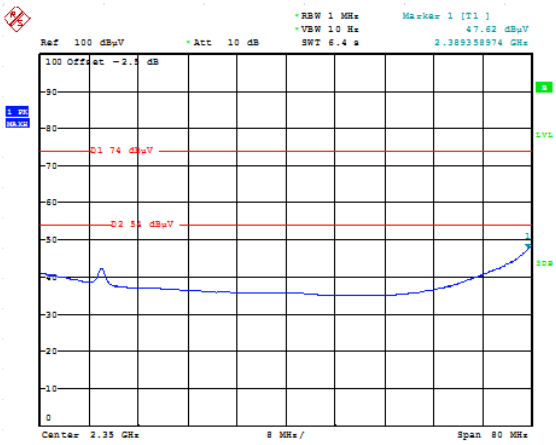
* **offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= -2.5 dB (2 412 MHz)
= -2.9 dB (2 462 MHz)

*** 802.11g**

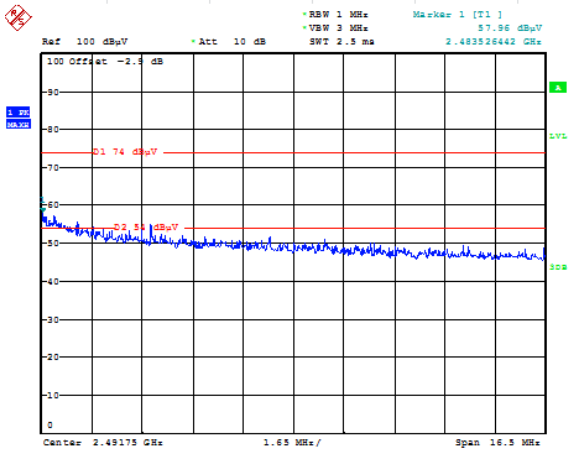
Lowest Channel(2 412 MHz): Peak



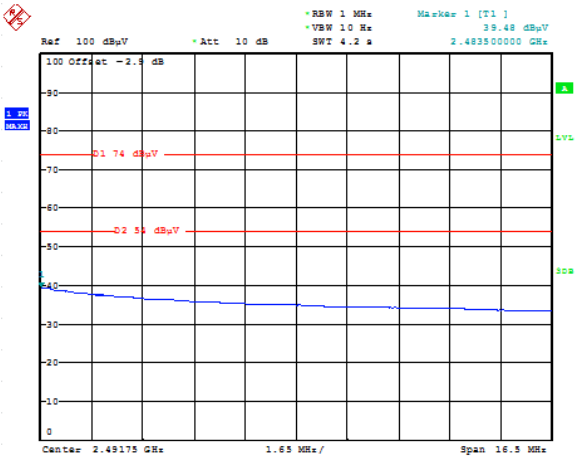
Lowest Channel(2 412 MHz): Average



Highest Channel(2 462 MHz): Peak



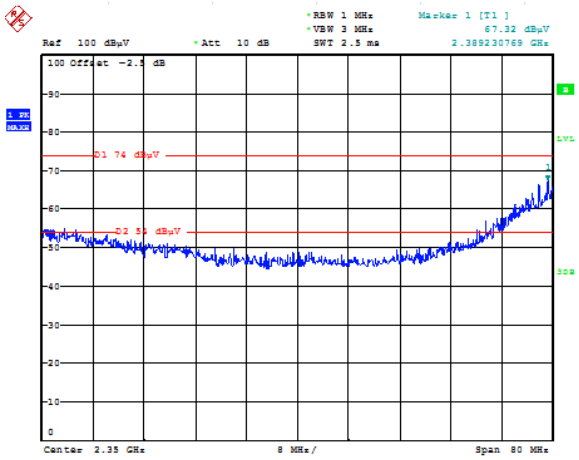
Highest Channel(2 462 MHz): Average



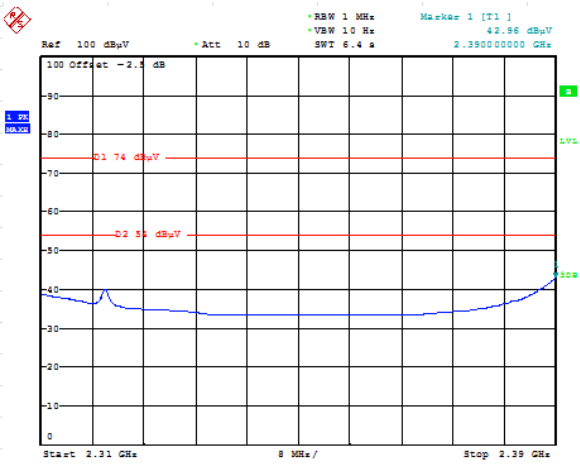
* **offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= -2.5 dB (2 412 MHz)
= -2.9 dB (2 462 MHz)

*** 802.11n HT20**

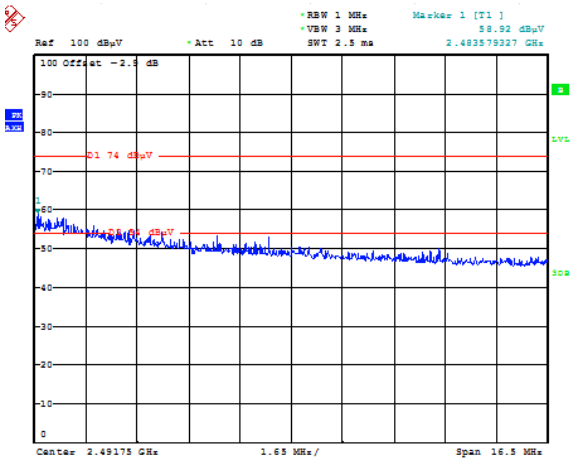
Lowest Channel(2 412 MHz): Peak



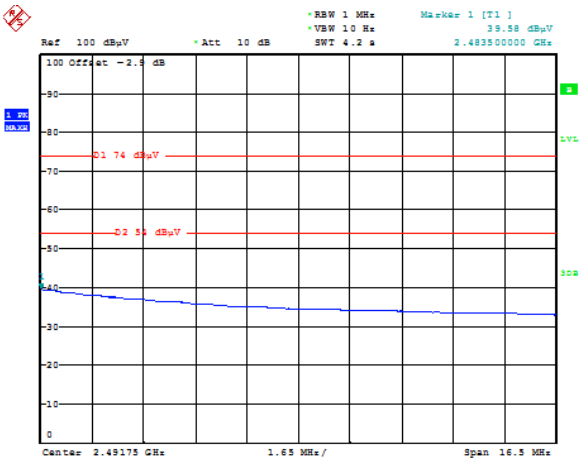
Lowest Channel(2 412 MHz): Average



Highest Channel(2 462 MHz): Peak



Highest Channel(2 462 MHz): Average



* **offset = Factor (ANT Factor+ Amp Gain + Cable Loss) [dB]**
= -2.5 dB (2 412 MHz)
= -2.9 dB (2 462 MHz)

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.

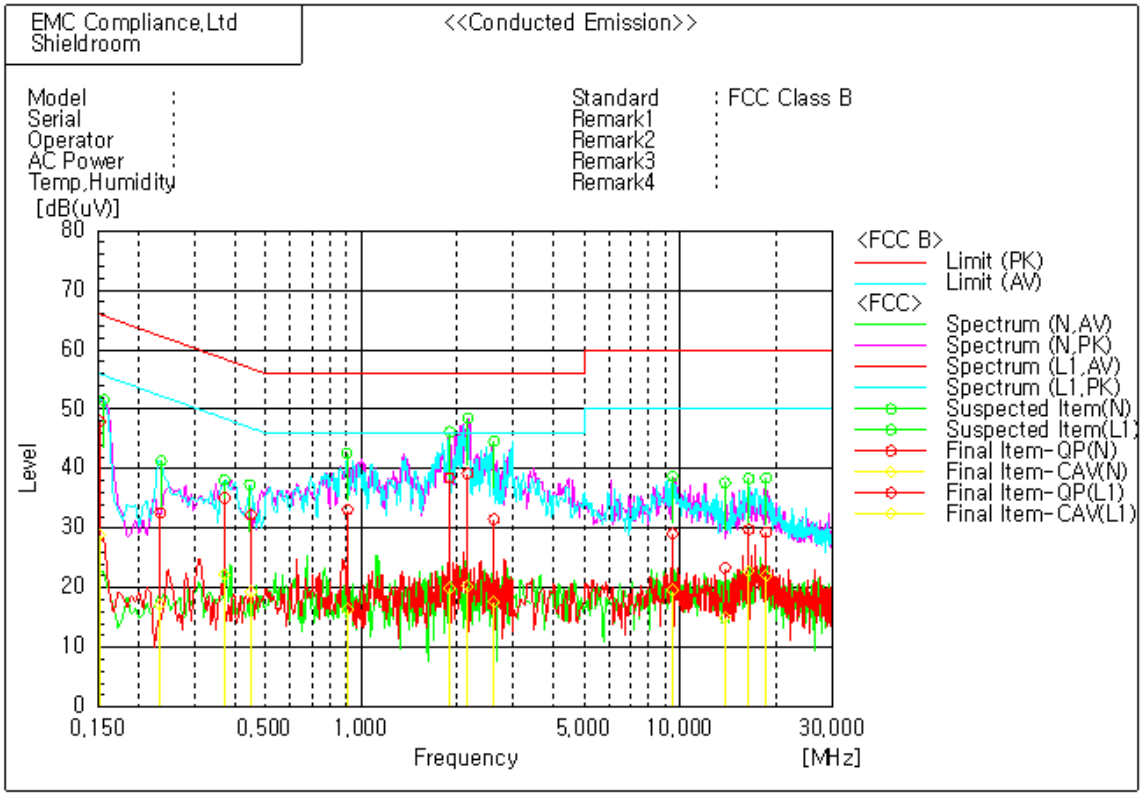
3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory 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

- Complied



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c,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	1.89654	28.7	10.2	9.8	38.5	20.0	56.0	46.0	17.5	26.0
2	2.15626	29.4	10.4	9.8	39.2	20.2	56.0	46.0	16.8	25.8
3	2.61134	21.7	7.9	9.8	31.5	17.7	56.0	46.0	24.5	28.3
4	9.47778	19.4	9.9	9.7	29.1	19.6	60.0	50.0	30.9	30.4

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c,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	0.15078	38.0	18.9	10.0	48.0	28.9	66.0	56.0	18.0	27.1
2	0.23386	22.8	7.3	9.9	32.7	17.2	62.3	52.3	29.6	35.1
3	0.37206	25.0	12.1	10.1	35.1	22.2	58.5	48.5	23.4	26.3
4	0.45058	22.1	9.2	10.1	32.2	19.3	56.9	46.9	24.7	27.6
5	0.90646	23.2	6.5	9.9	33.1	16.4	56.0	46.0	22.9	29.6
6	13.85216	13.5	5.2	9.8	23.3	15.0	60.0	50.0	36.7	35.0
7	16.49668	20.0	13.0	9.8	29.8	22.8	60.0	50.0	30.2	27.2
8	18.65902	19.5	12.2	9.9	29.4	22.1	60.0	50.0	30.6	27.9

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 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	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

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

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]

EUT: Maximum peak output power = 233.88 [mW] (23.69 dBm) Antenna gain = 1.38 (1.4 [dBi])	
100 mW, at 20 cm from an antenna 6 [dBi]	S = PG/4πR² = 100 × 3.98 / (4 × π × 400) = 0.079 18 [mW/cm^2] < 1.0 [mW/cm^2]
43.954 mW, at 20 cm from an antenna 1.4 [dBi]	S = PG/4πR² = 0.064 23 [mW/cm^2] < 1.0 [mW/cm^2]

* In addition, It is complied with the 1-g SAR test exclusion thresholds for 100MHz – 6GHz and > 50 mm according to KDB 447498 clause 4.3.1

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.
This device is a handheld type and does not require SAR since the unit is only used while at arms length with a communications interval that is very short the commission considers the application to be a mobile device.

5.7.3 Calculation Result of RF Exposure

*** 802.11b**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm^2]
Lowest	2 412	1.38	13.72	23.55	0.006 47
Middle	2 437	1.38	13.37	21.73	0.005 97
Highest	2 462	1.38	13.29	21.33	0.005 86

*** 802.11g**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm^2]
Lowest	2 412	1.38	23.69	233.88	0.064 23
Middle	2 437	1.38	23.07	202.77	0.055 68
Highest	2 462	1.38	22.45	175.79	0.048 28

*** 802.11n HT20**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm^2]
Lowest	2 412	1.38	21.30	134.90	0.037 05
Middle	2 437	1.38	20.84	121.34	0.033 32
Highest	2 462	1.38	20.74	118.58	0.032 56

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
■	Test Receiver	R&S	ESCI7	100732	14.02.18
■	LISN	R&S	ENV216	101352	14.01.07
■	DC Power Supply	Tektronix	PS2521G	TW53135	14.10.21
■	Signal Generator	R&S	SMR40	100007	14.06.11
■	Spectrum Analyzer	R&S	FSP40	100209	14.10.21
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	14.07.18
■	Amplifier	Sonoma	310N	186280	14.02.15
■	Attenuator	HP	8491A	16861	14.07.08
■	Amplifier	Agilent	8449B	3008A02343	14.10.31
■	Horn Antenna	ETS-Lindgren	3115	86706	14.08.20
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-