

# TEST REPORT



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
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Fax: +82-31-624-9501

Report No.:  
CTK-2017-01211  
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## 1. Client

- Name : Humax Automotive Co., Ltd.
- Address : (Yubang-dong, 3F), 2, Yeongmulro, Cheoin-gu Yong-in-si, Gyeonggi-do, Korea

## 2. Manufacturer

- Name : Humax Automotive Co., Ltd.
- Address : (Yubang-dong, 3F), 2, Yeongmulro, Cheoin-gu Yong-in-si, Gyeonggi-do, Korea

## 3. Use of Report : For FCC Certification

## 4. Test Sample / Model: Car Audio / HAGM4001

## 5. Date of Test : 2017-06-03 to 2017-06-19

## 6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247

## 7. Testing Environment: Temp.: (20 ± 5) °C, Humidity: (51 ± 3) % R.H.

## 8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by  Bongseok, Kim: (Signature)	Technical Manager  Young-taek, Lee: (Signature)
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2017-06-20

Republic of KOREA **CTK Co., Ltd.**



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## REPORT REVISION HISTORY

Date	Revision	Page No
2017-06-20	Issued (CTK-2017-01211)	all

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## 1. General Product Description

### 1.1 Client Information

<b>Company</b>	Humax Automotive Co., Ltd.
<b>Contact Point</b>	(Yubang-dong, 3F), 2, Yeongmulro, Cheoin-gu Yong-in-si, Gyeonggi-do, Korea
<b>Contact Person</b>	Name : Il Kwon Lee E-mail : ilkwon.lee@humaxauto.com Tel : +82-31-697-4883

### 1.2 Product Information

<b>FCC ID</b>	YRN-HAGM4001
<b>Product Description</b>	Car Audio
<b>Model name</b>	HAGM4001
<b>Operating Frequency</b>	2412 MHz - 2462 MHz
<b>RF Output Power</b>	802.11b : 16.57 dBm (45.394 mW) 802.11g : 13.96 dBm (24.889 mW) 802.11n : 12.80 dBm (19.055 mW)
<b>Antenna Specification</b>	Antenna type : PCB Antenna Peak Gain : -0.31 dBi
<b>Number of channels</b>	11
<b>Channel Spacing</b>	5 MHz
<b>Type of Modulation</b>	802.11b : DSSS 802.11g/n : OFDM
<b>Data Rate</b>	802.11b : 11 / 5.5 / 2 / 1 Mbps 802.11g : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n: MCS0-7, up to 72.2 Mbps
<b>Power Source</b>	DC 13.5 V

### 1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Notebook	Hewlett Packard Co.,Ltd	HP ProBook 650 G1	5CG5114K13
AC Adapter	Hewlett Packard Co.,Ltd	PPP012D-S	WCNXF0AAR8T4UV

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## 2. Facility and Accreditations

### 2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

### 2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	IC	IC EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

### 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

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### 3. Test Specifications

#### 3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	6 dB Bandwidth	C	Conducted
15.247(b)	Maximum Output Power	C	
15.247(d)	Conducted Spurious emission	C	
15.247(d)	Unwanted Emission(Conducted)	C	
15.247(e)	Power Spectral Density	C	
15.209	Radiated Emissions	C	Radiated
15.207	AC Conducted Emission	NA(Note 3)	Line Conducted
<u>Note 1:</u> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
<u>Note 2:</u> The data in this test report are traceable to the national or international standards.			
<u>Note 3:</u> The equipment is operated on Car battery power only.			
<u>Note 4:</u> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013			
<u>Note 5:</u> The tests were performed according to the method of measurements prescribed in KDB No.558074.			

#### 3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments.

During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests.

The results are only attached worst cases.

#### Test Frequency

Lowest channel	Middle channel	Highest channel
2412 MHz	2437 MHz	2462 MHz

#### Test mode

Test mode	Modulation	Data rate	Duty Cycle
802.11b	DSSS	11 Mbps	92.6%
802.11g	OFDM	54 Mbps	70.8%
802.11n	OFDM	MCS 7	68.9%



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### 3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.  
Coverage factor  $k = 2$ , Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	1.5 dB
Occupied Bandwidth	0.1 MHz
Unwanted Emission(conducted)	3.0 dB
Radiated Emissions ( $f \leq 1$ GHz)	4.0 dB
Radiated Emissions ( $f > 1$ GHz)	5.0 dB



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## 4. Technical Characteristic Test

### 4.1 6dB Bandwidth

#### Test Procedures(ANSI C63.10-2013 6.9.2)

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.

#### Test Procedures(ANSI C63.10-2013 6.9.3)

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

#### Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW  $\geq 3 \times$  RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) 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.

#### Limit :

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6 dB Bandwidth > 500kHz

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## Test Data :

### Test mode : 802.11b

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2412	7.077	13.372	Complies
Middle	2437	7.120	13.415	Complies
High	2462	6.686	13.242	Complies

### Test mode : 802.11g

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2412	15.803	16.368	Complies
Middle	2437	15.803	16.324	Complies
High	2462	15.586	16.324	Complies

### Test mode : 802.11n

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2412	16.411	17.496	Complies
Middle	2437	16.411	17.540	Complies
High	2462	16.368	17.540	Complies

See next pages for actual measured spectrum plots.



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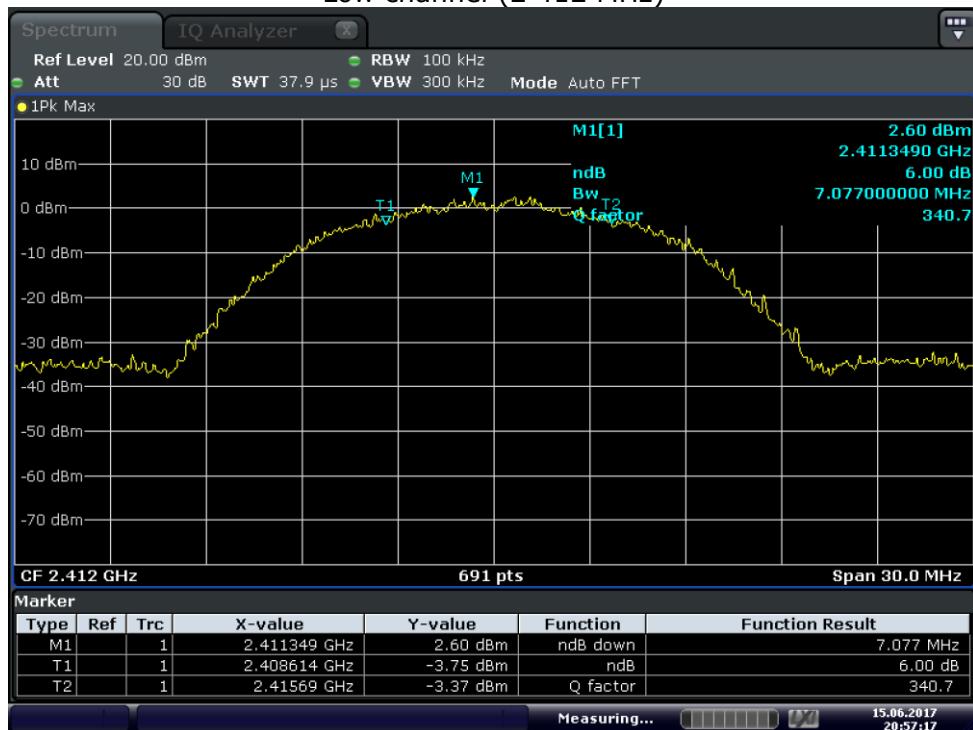
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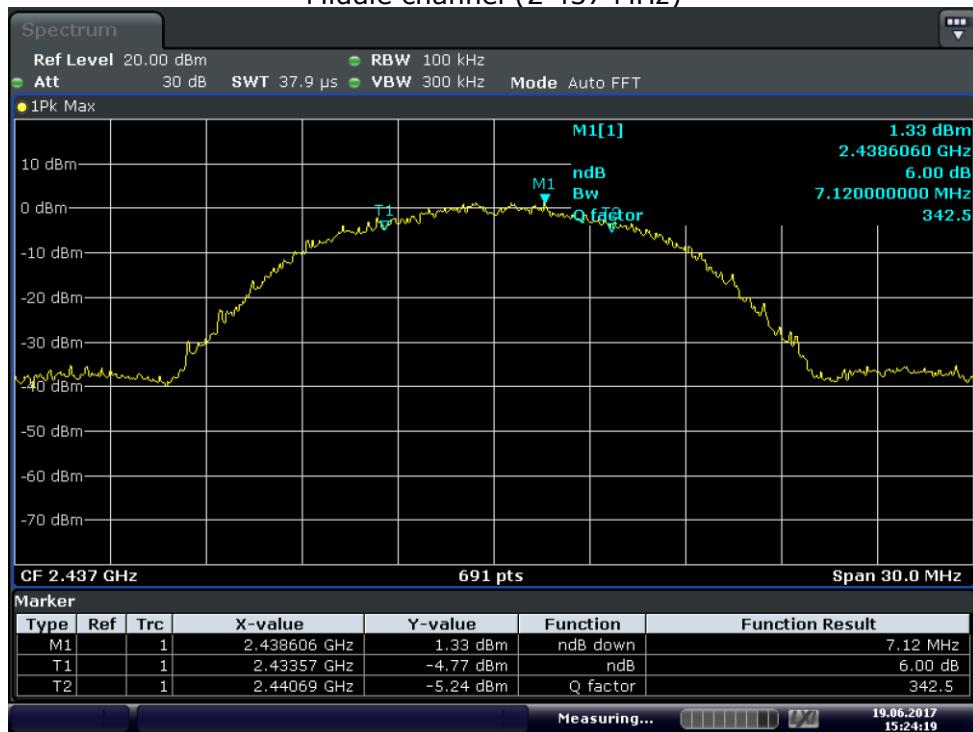
## 6dB Bandwidth

**Mode : 802.11b**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



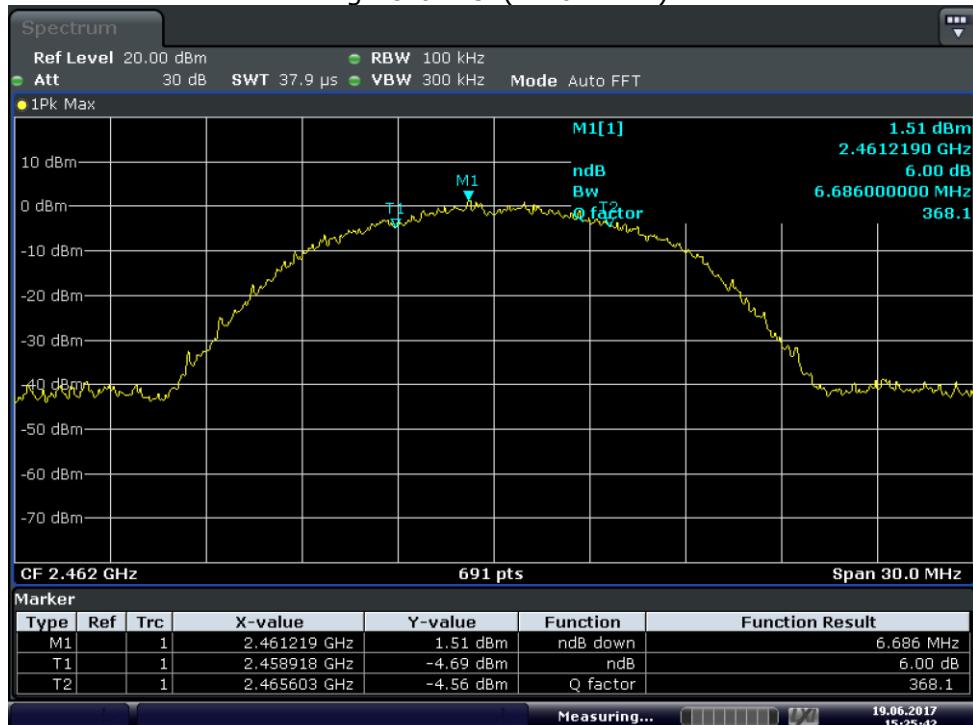


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### High channel (2 462 MHz)



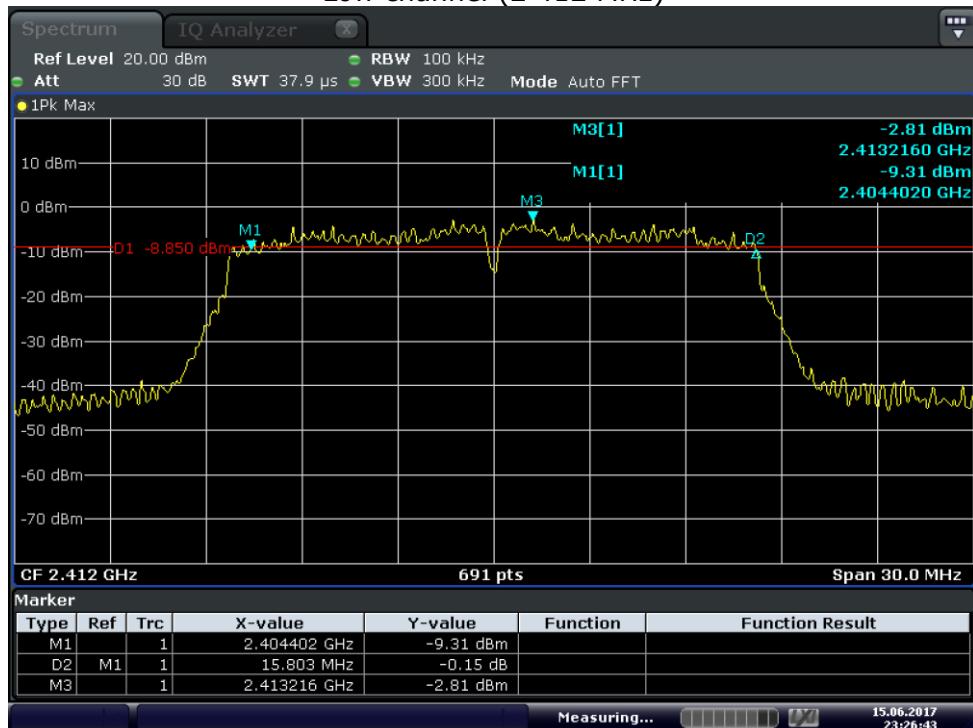
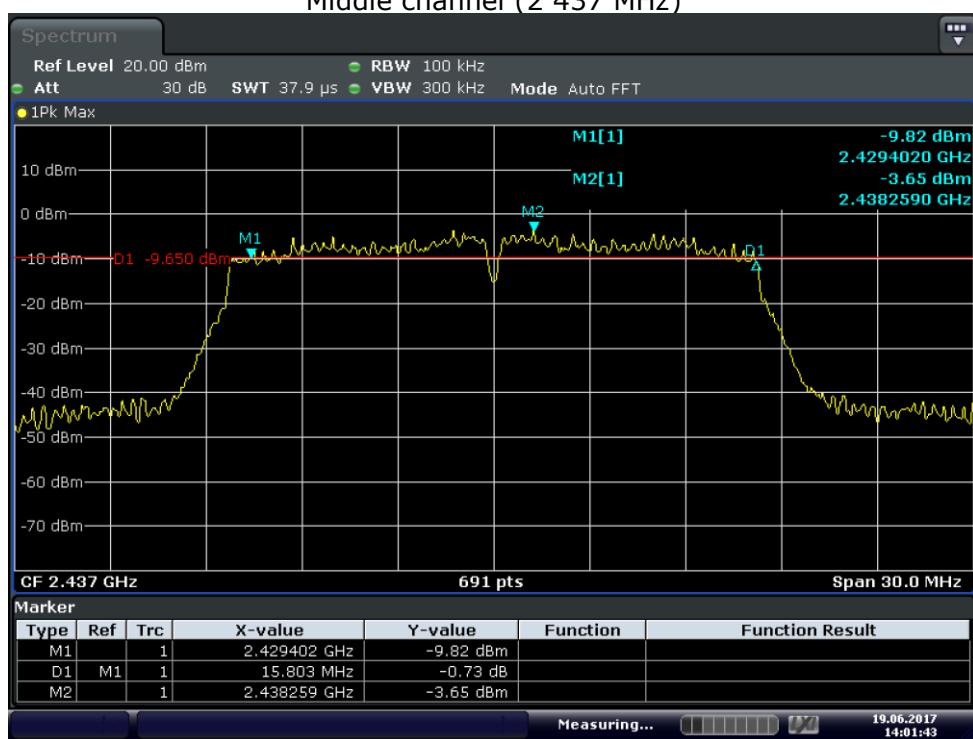
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**Mode : 802.11g**

Low channel (2 412 MHz)

**Middle channel (2 437 MHz)**

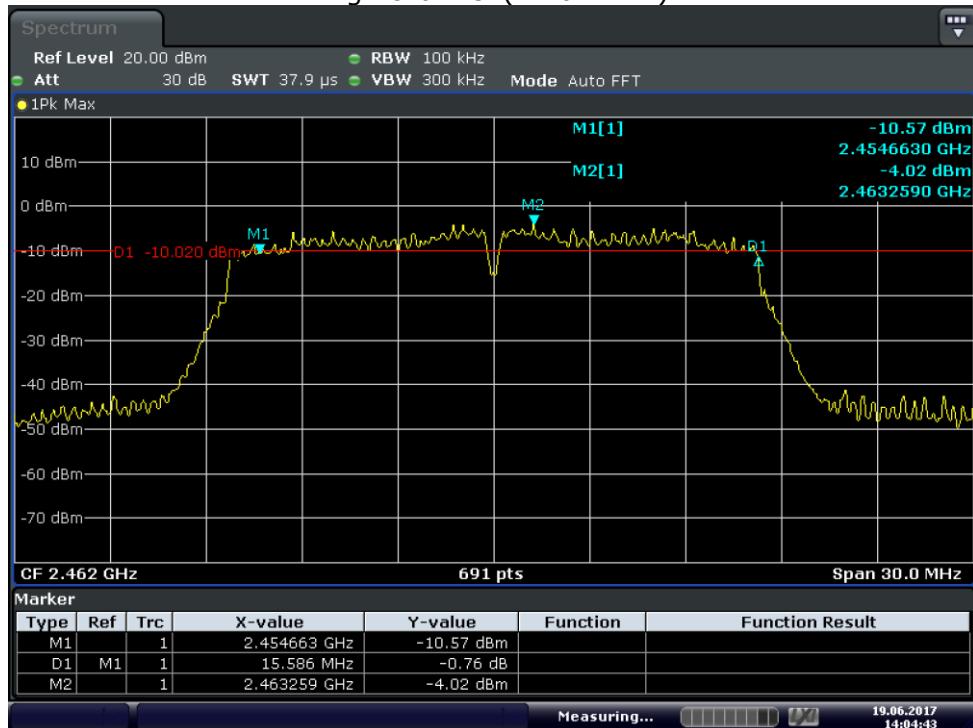


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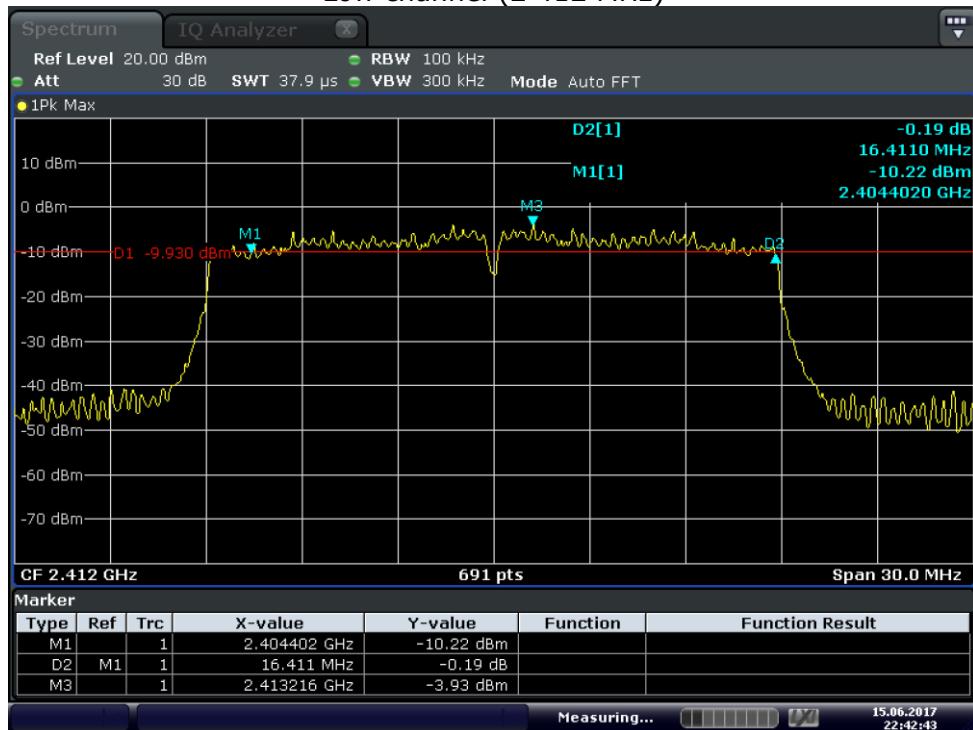
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High channel (2 462 MHz)

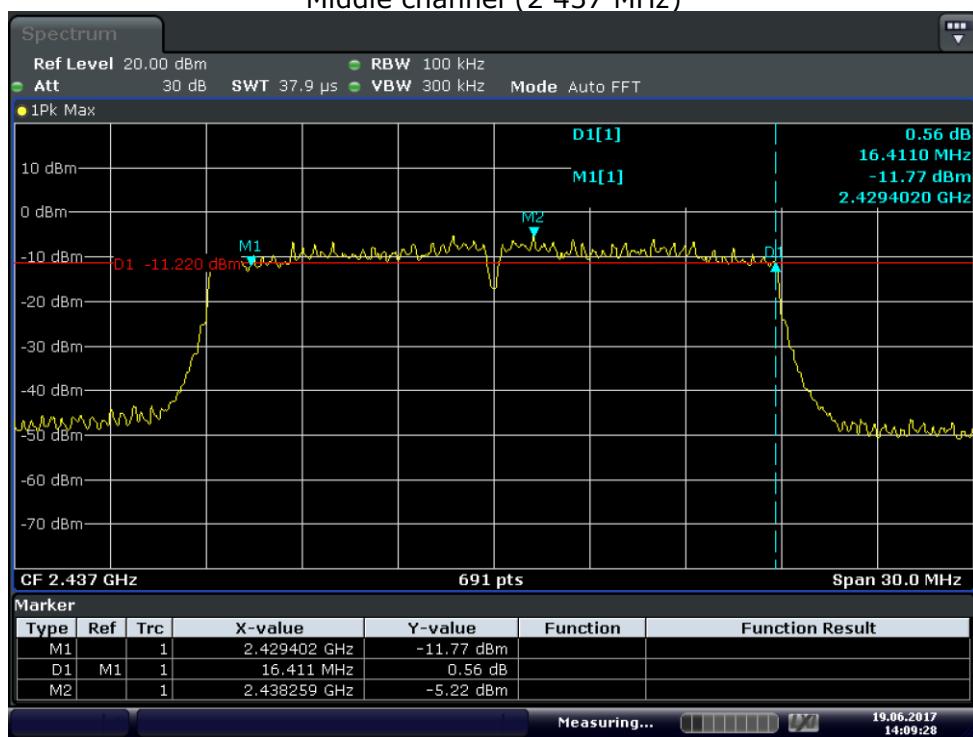


### Mode : 802.11n

Low channel (2 412 MHz)



Middle channel (2 437 MHz)

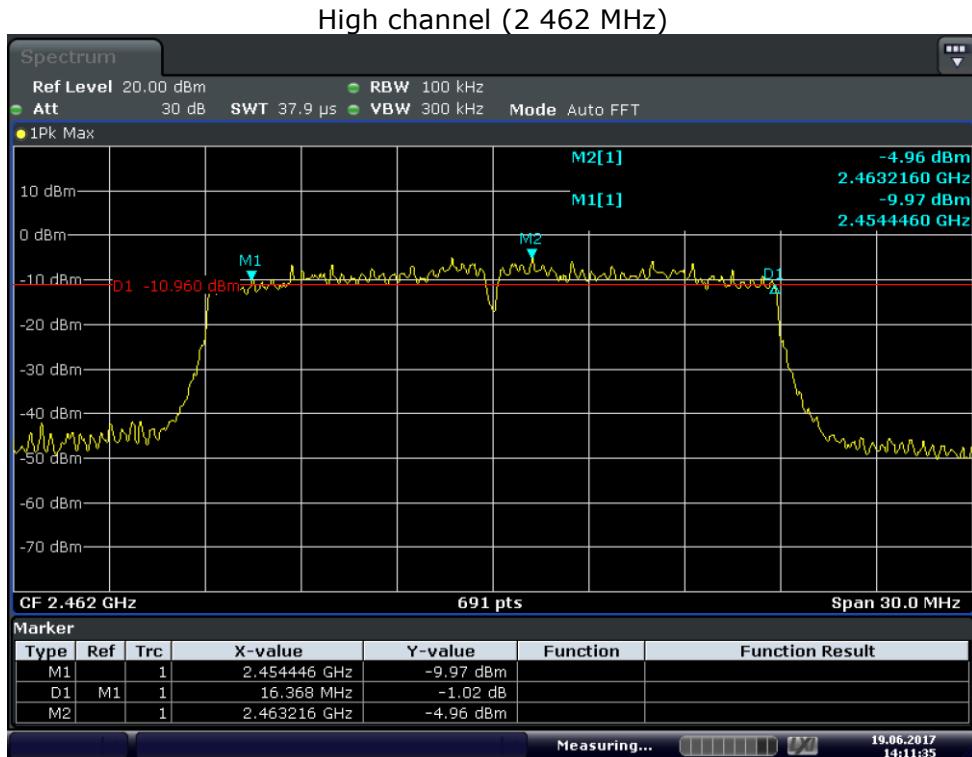




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## 99% Bandwidth

**Mode : 802.11b**

Low channel (2.412 MHz)



Middle channel (2.437 MHz)



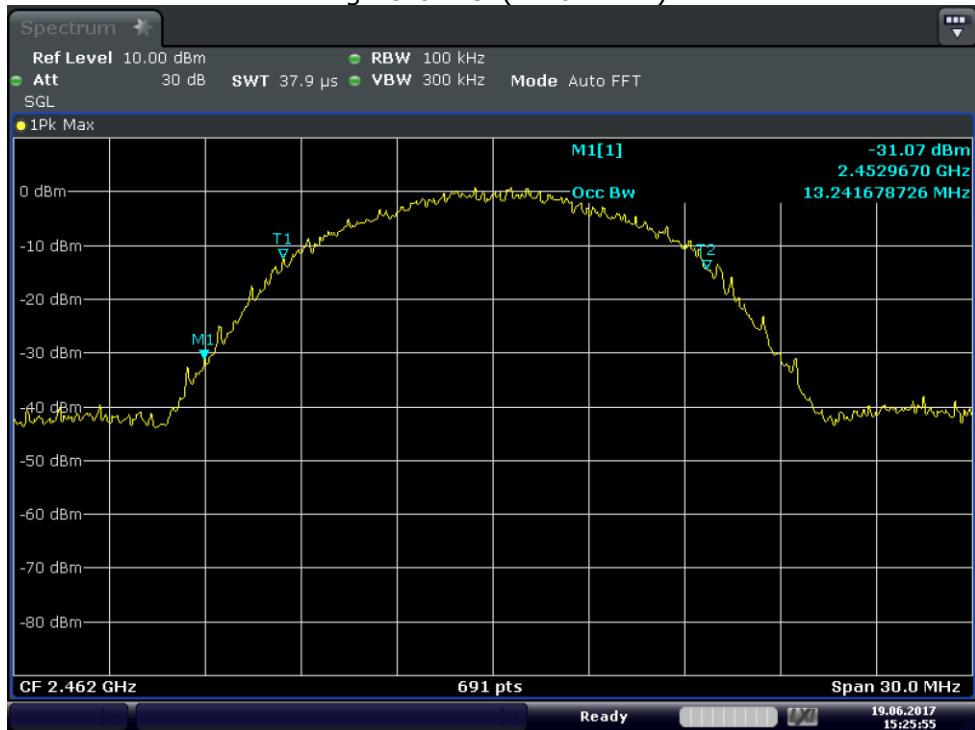


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High channel (2 462 MHz)





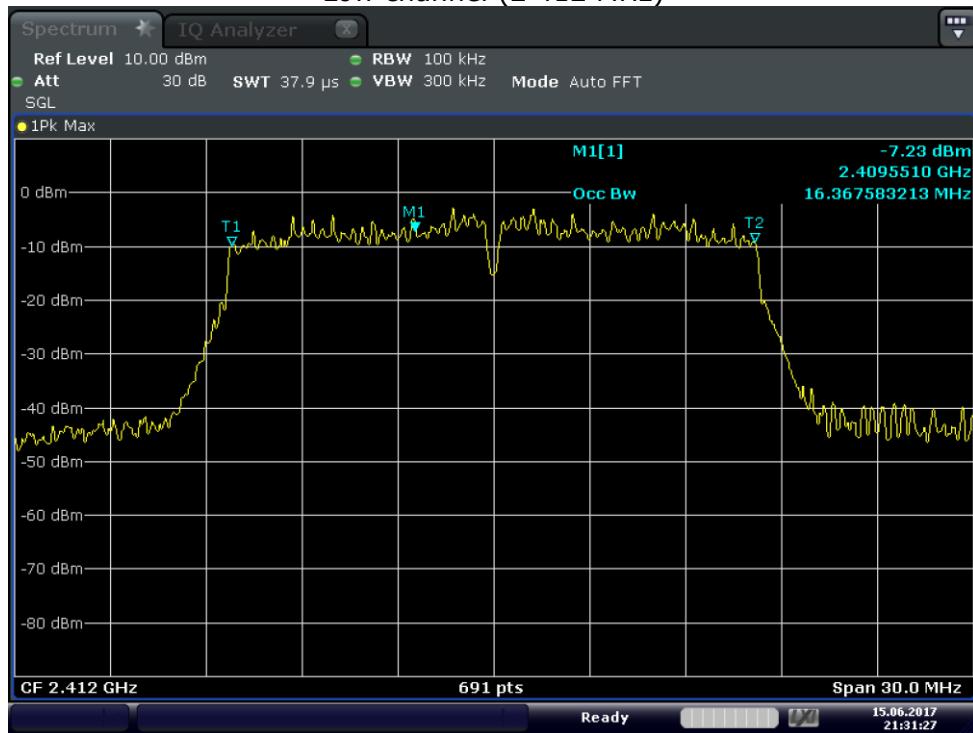
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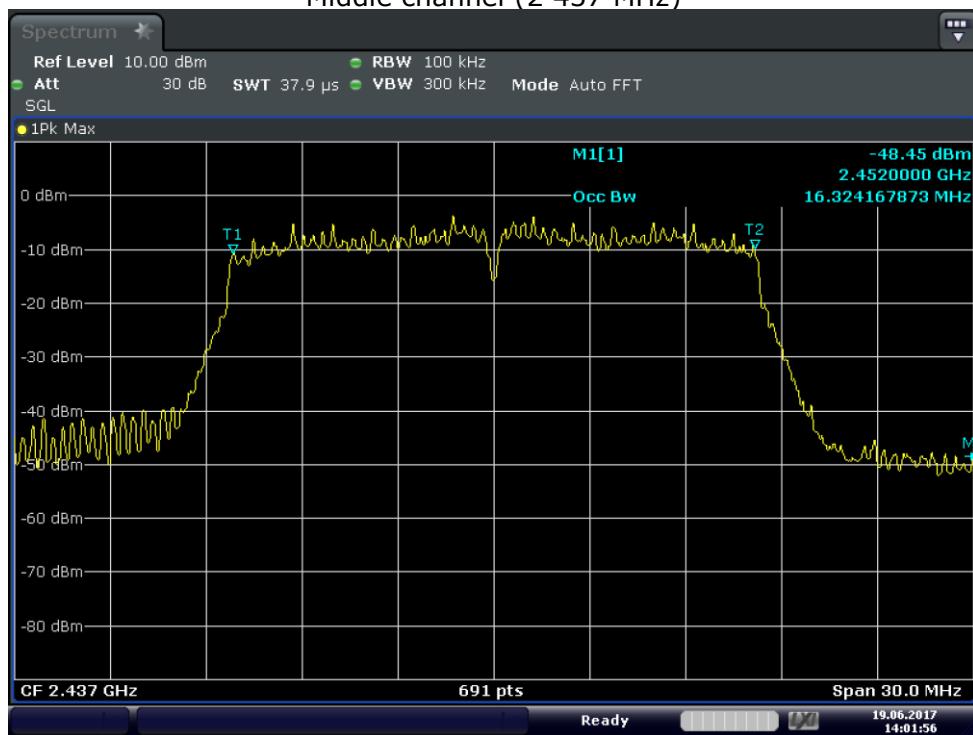
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### Mode : 802.11g

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



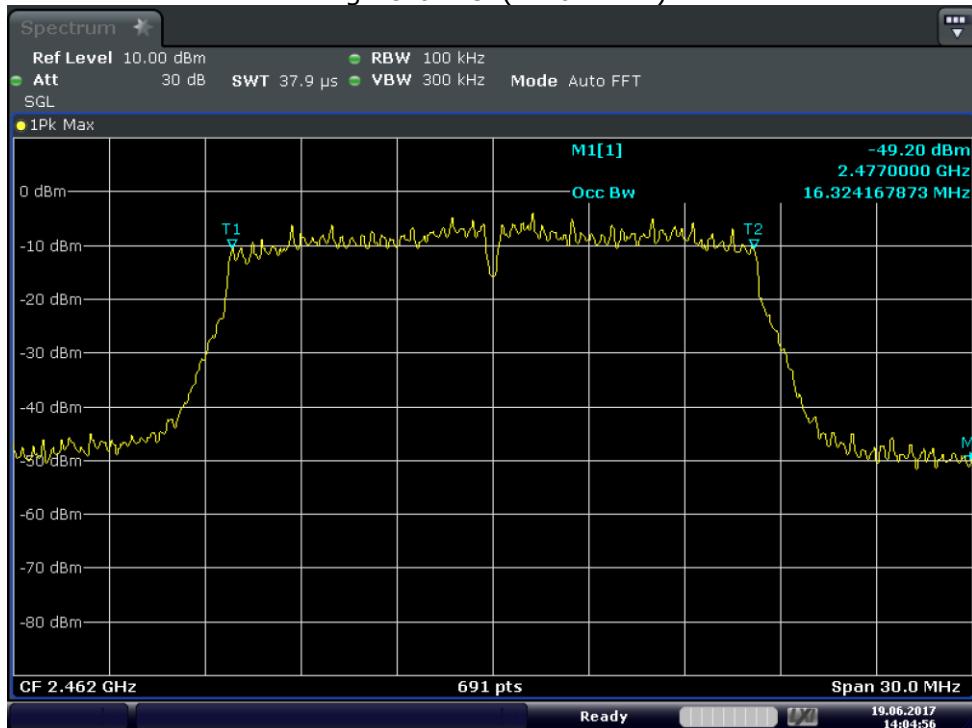


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High channel (2.462 MHz)





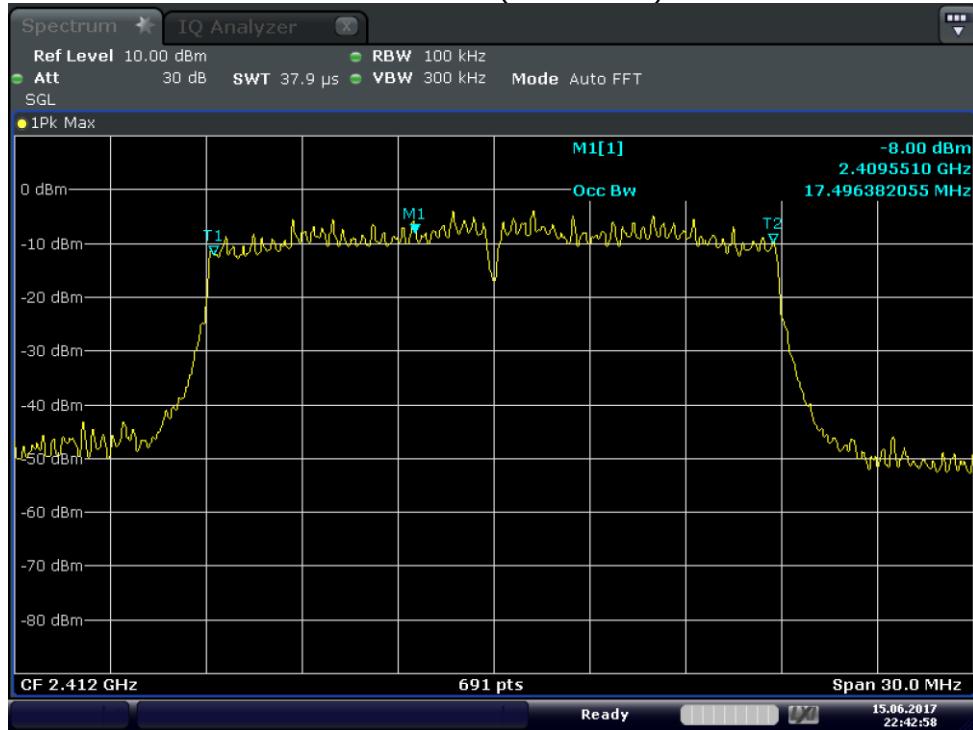
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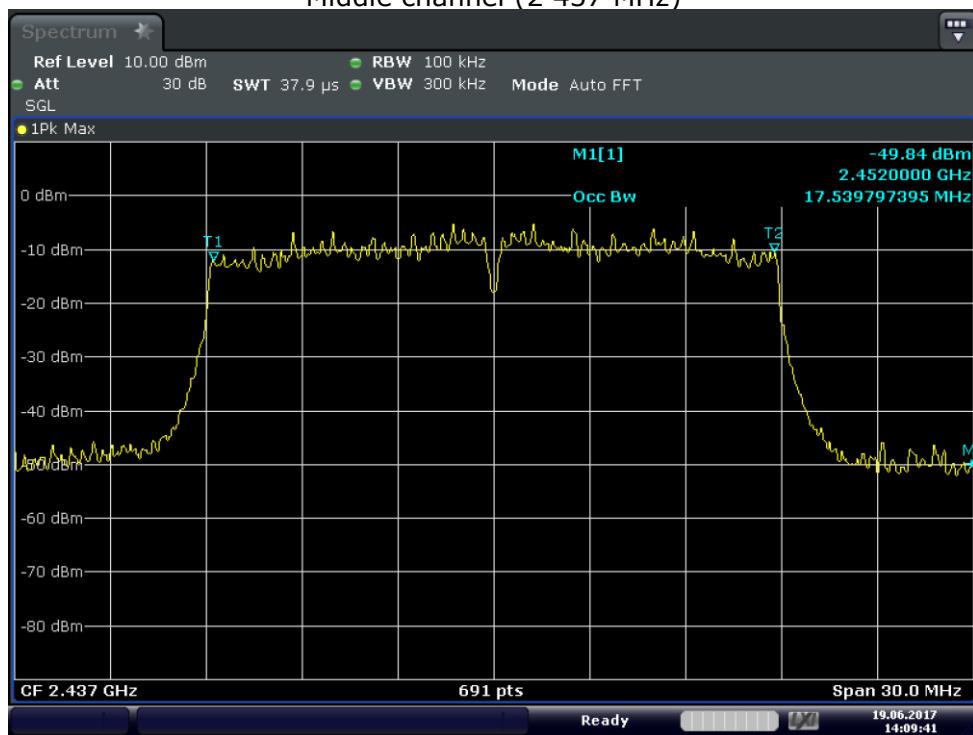
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### Mode : 802.11n

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



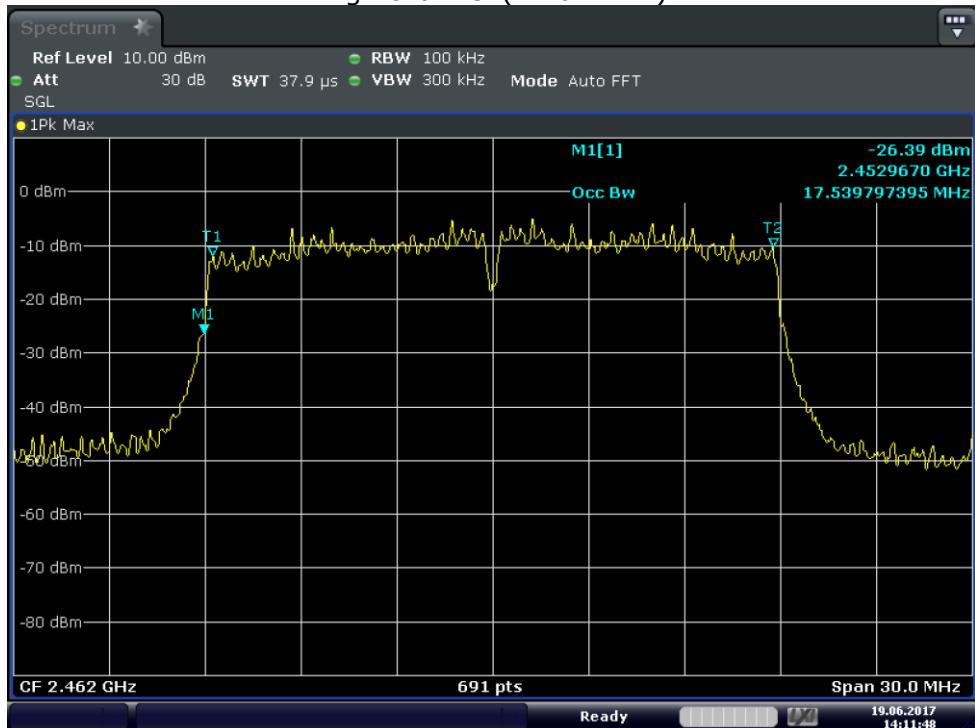


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## 4.2 Maximum peak Conducted Output Power

### Test Procedures(ANSI C63.10-2013 11.9.1)

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth:

#### Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW = 1 MHz
- b) VBW  $\geq$  3 x RBW
- c) span  $\geq$  1.5 x DTS Bandwidth
- d) Sweep time = auto couple
- e) Detector = peak
- 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 the peak detector).

#### Limit :

Maximum Output Power < 1 W (30 dBm)

#### Test Data :

##### **Test mode : 802.11b**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	16.57	30	Complies
Middle	2437	15.19	30	Complies
High	2462	14.91	30	Complies

##### **Test mode : 802.11g**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	13.96	30	Complies
Middle	2437	13.03	30	Complies
High	2462	12.68	30	Complies

##### **Test mode : 802.11n**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	12.80	30	Complies
Middle	2437	11.57	30	Complies
High	2462	11.59	30	Complies

See next pages for actual measured spectrum plots.



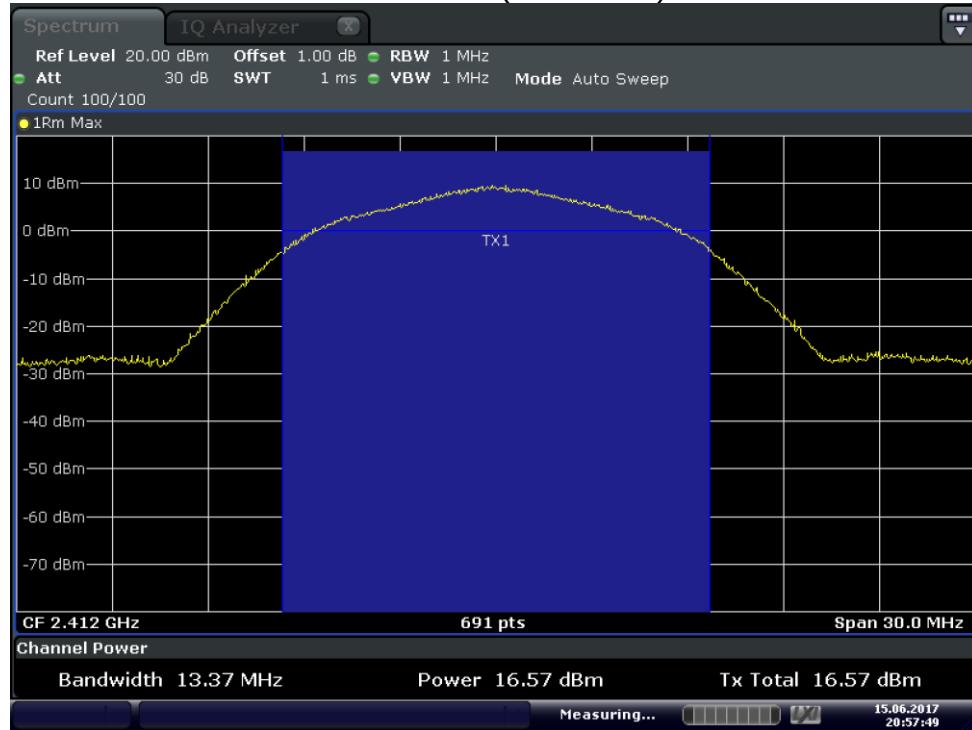
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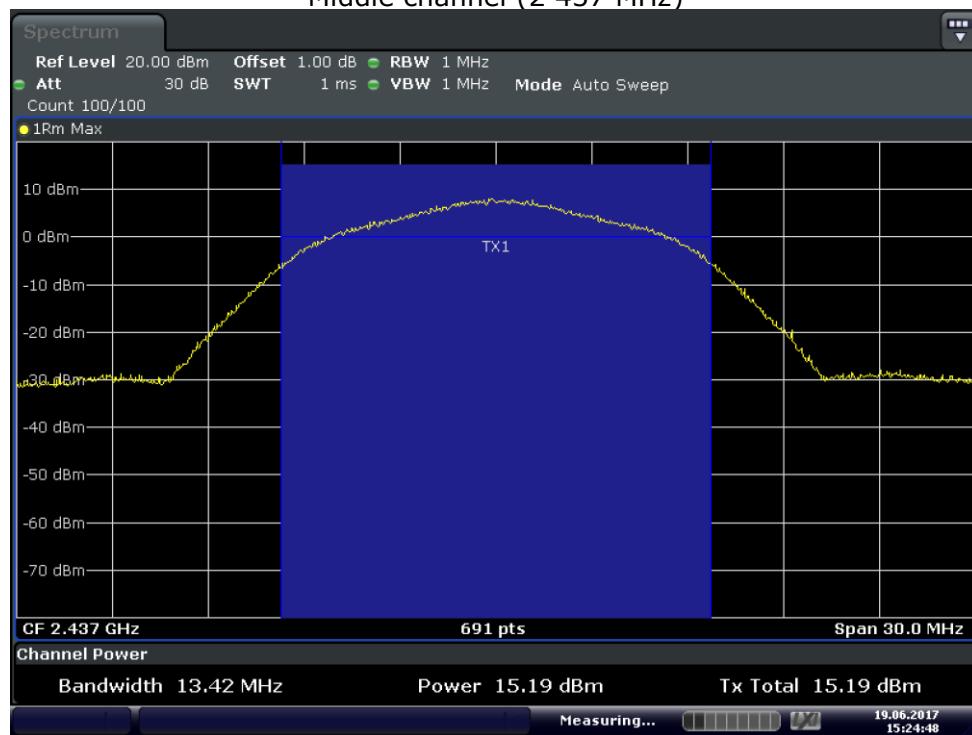
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**Mode : 802.11b**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)





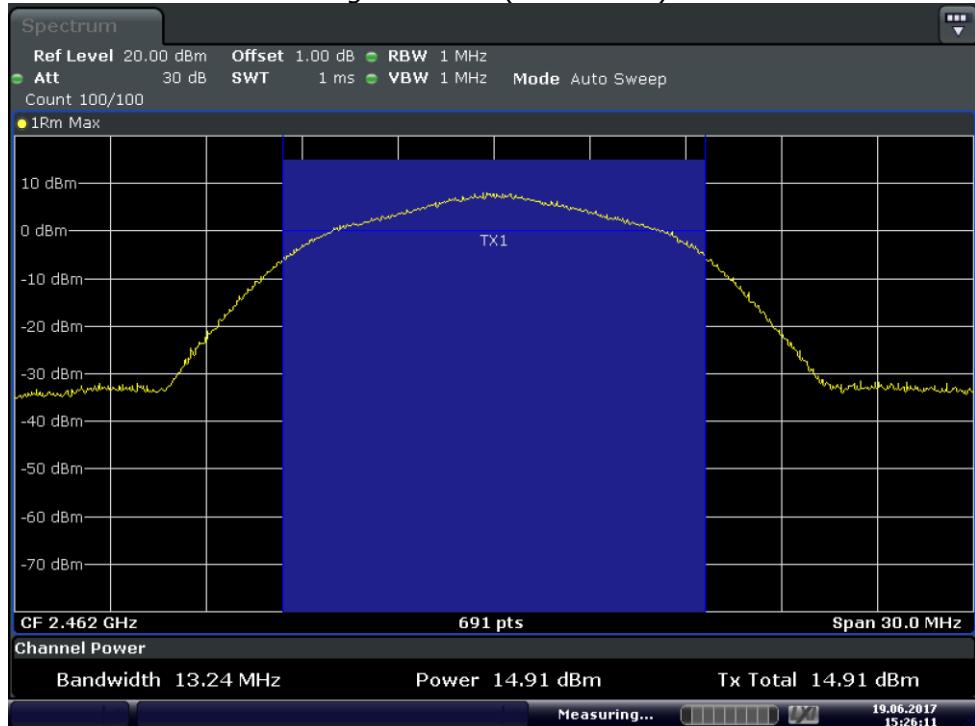
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High channel (2.462 MHz)





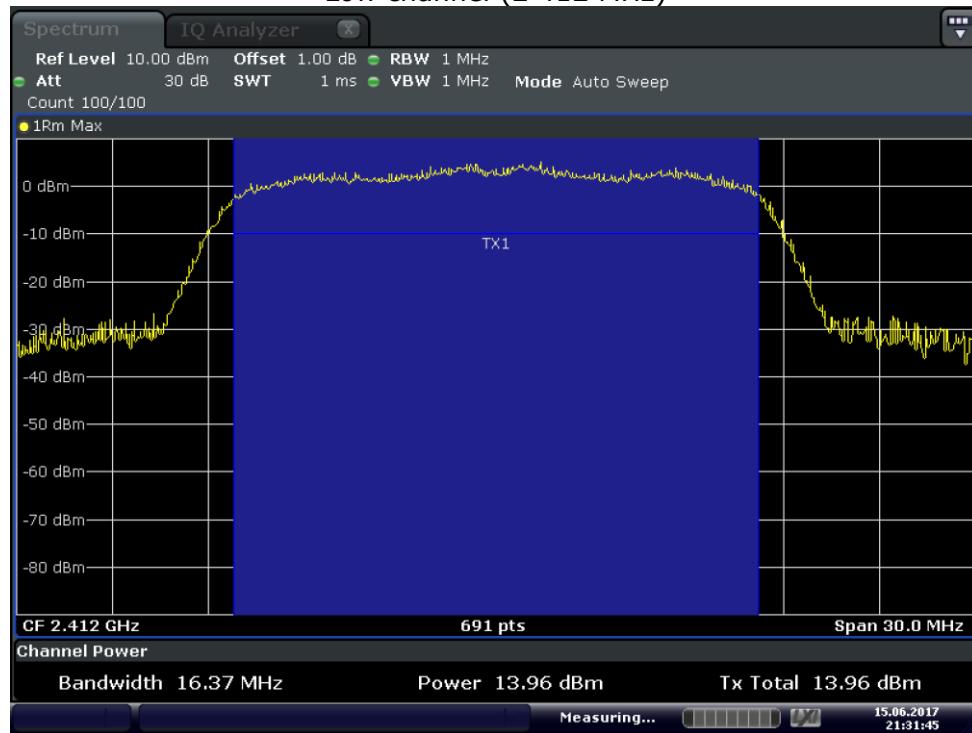
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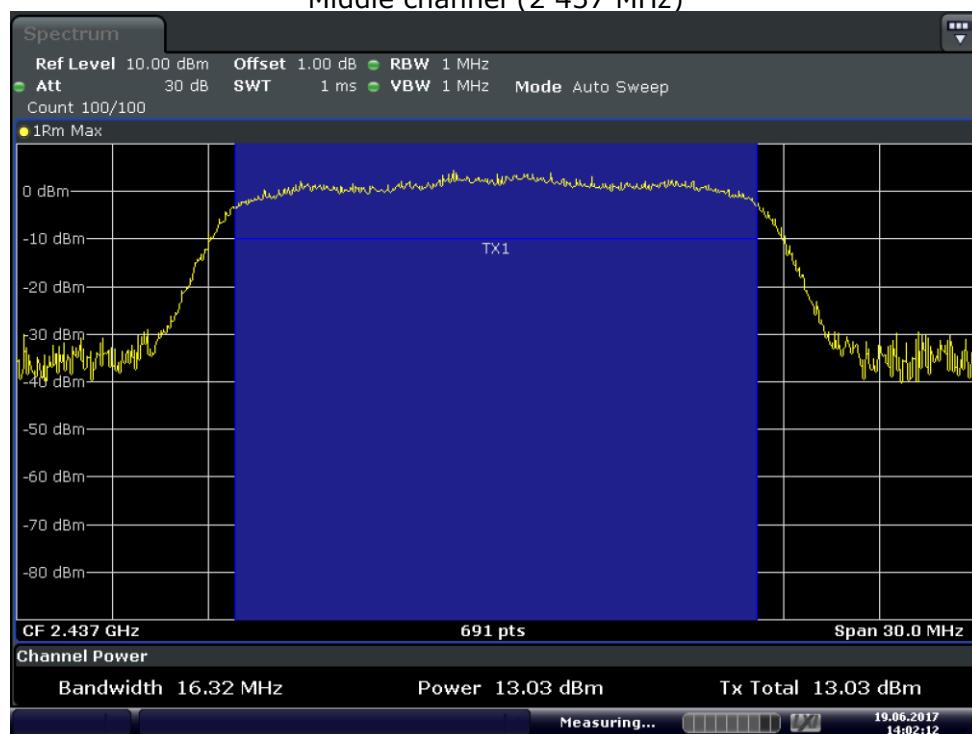
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**Mode : 802.11g**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



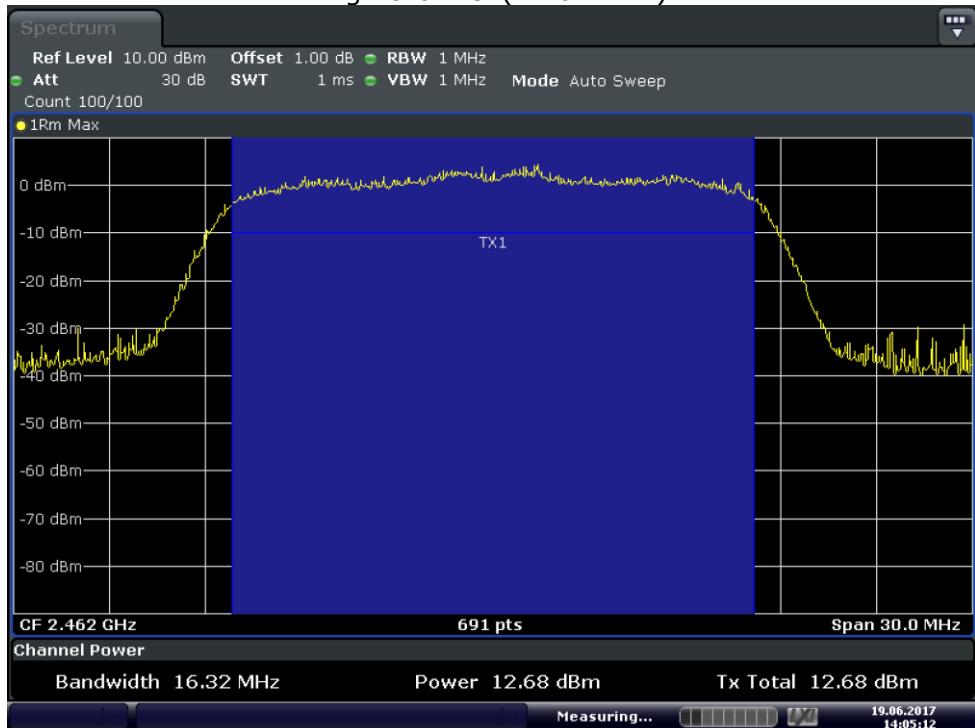


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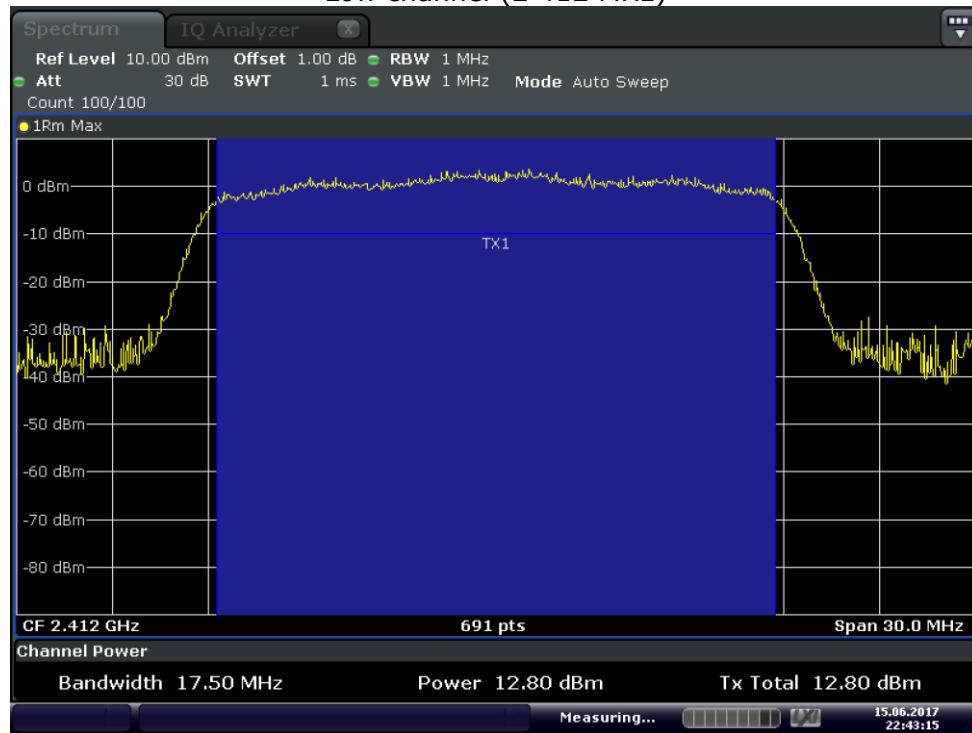
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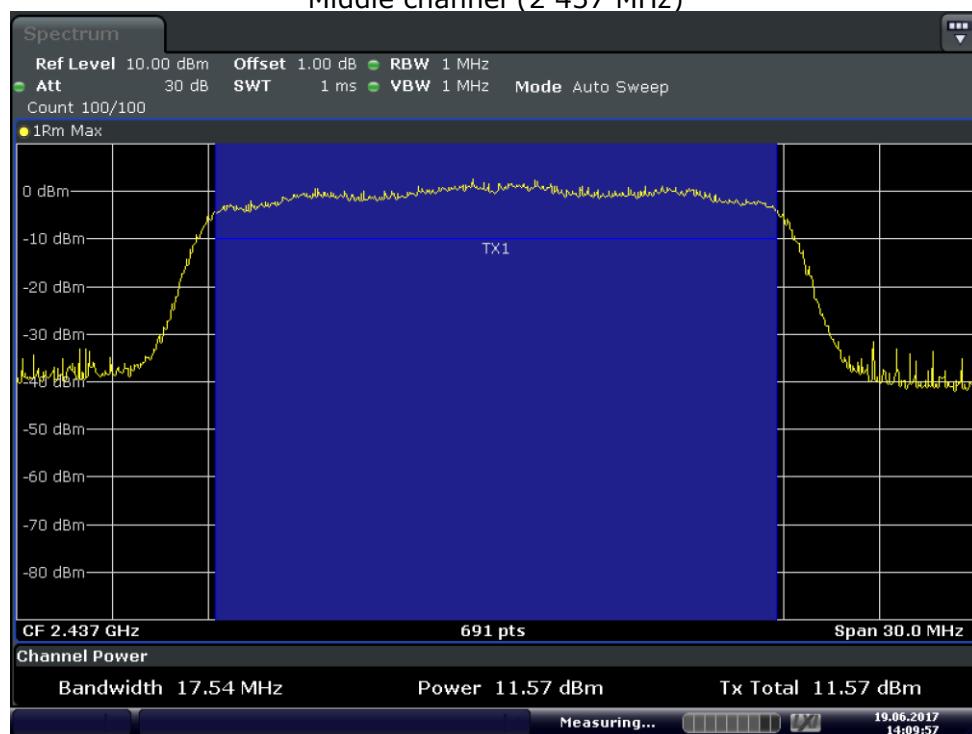
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**Mode : 802.11n**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)





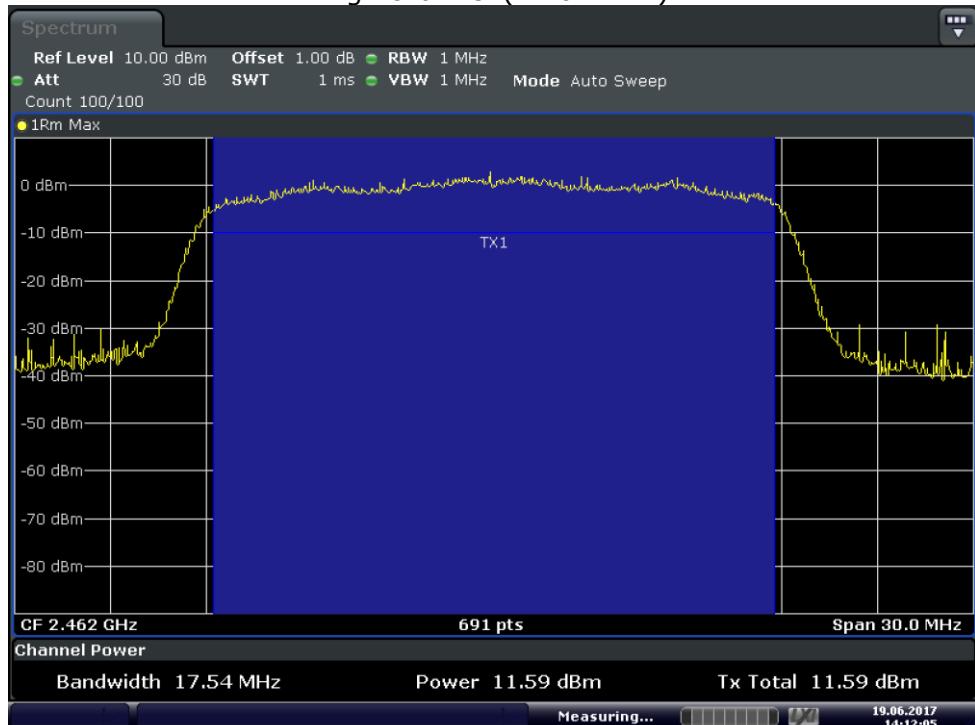
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High channel (2.462 MHz)



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## 4.3 Power Spectral Density

### Test Procedures(ANSI C63.10-2013 11.10.2)

Power Spectral Density from the EUT were measured according to the dictates PKPSD measurement procedure in 10.2 of KDB 558074.

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

#### Test Settings:

Center frequency = the highest, middle and the lowest channels

- |  |                                   |
|--|-----------------------------------|
| a) RBW : $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$                            | b) VBW $\geq 3 \times \text{RBW}$ |
| c) span $\geq 1.5 \times \text{DTS bandwidth}$   | d) Sweep time = auto couple       |
| e) Detector = peak   | f) Trace mode= max hold           |
| g) Allow trace to fully stabilize  |                                   |
| h) Use the peak marker function to determine the maximum amplitude level within the RBW. |                                   |

#### Limit :

Power Spectral Density < 8dBm @ 3 kHz BW

#### **Test Data :**

##### **Test mode : 802.11b**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	-1.72	8	Complies
Middle	2437	-2.55	8	Complies
High	2462	-3.17	8	Complies

##### **Test mode : 802.11g**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	-8.06	8	Complies
Middle	2437	-9.15	8	Complies
High	2462	-8.63	8	Complies

##### **Test mode : 802.11n**

Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2412	-9.41	8	Complies
Middle	2437	-10.64	8	Complies
High	2462	-10.69	8	Complies

See next pages for actual measured spectrum plots.



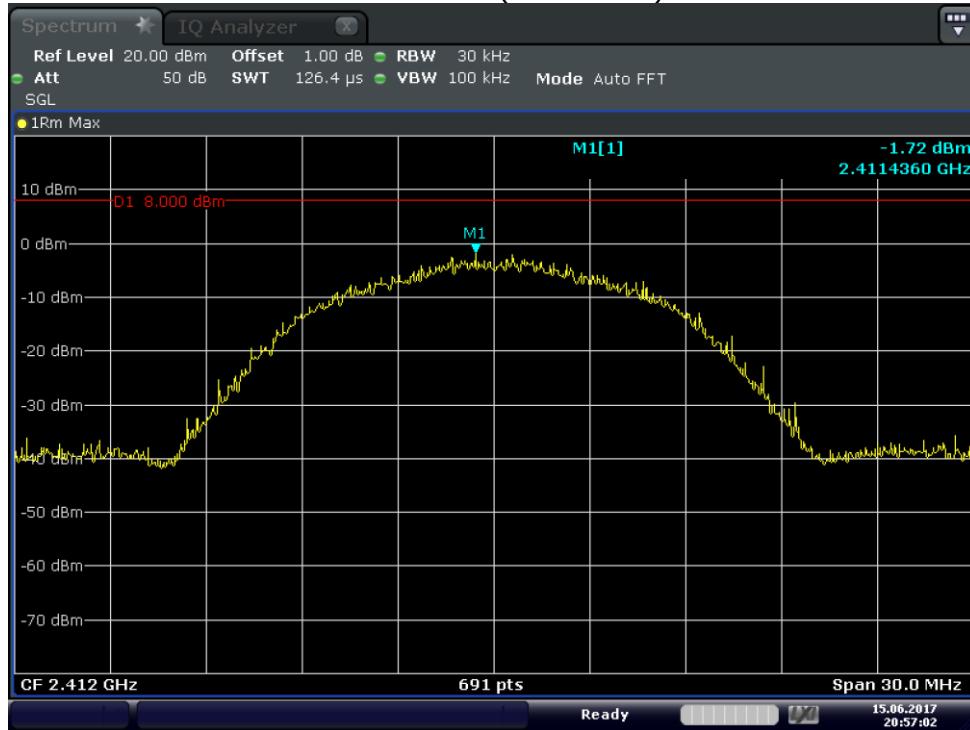
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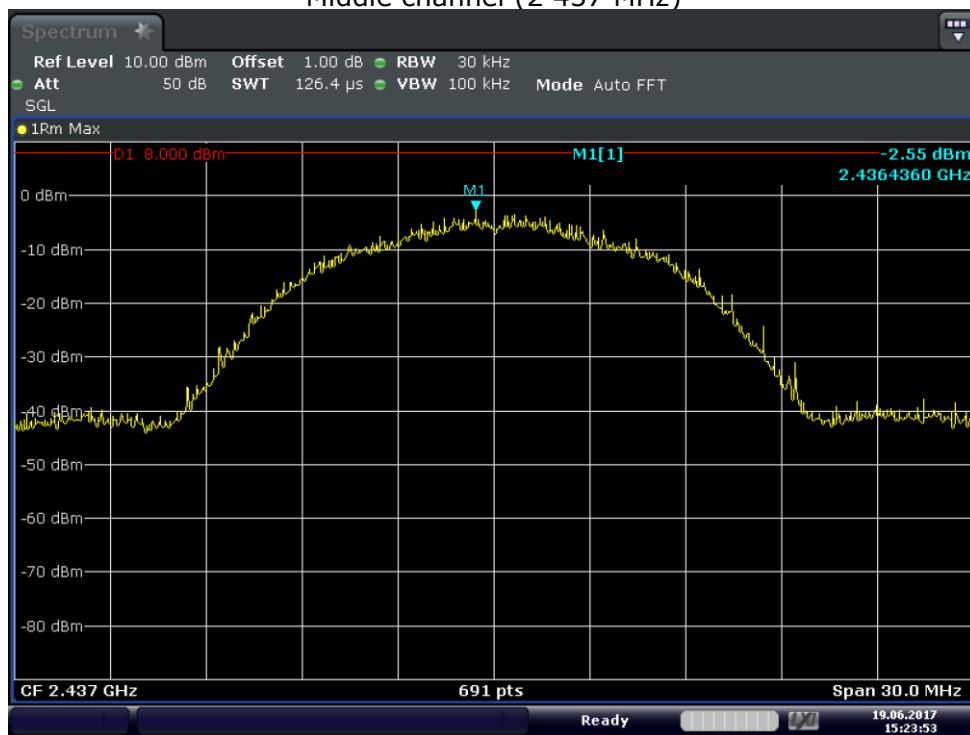
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**Mode : 802.11b**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)





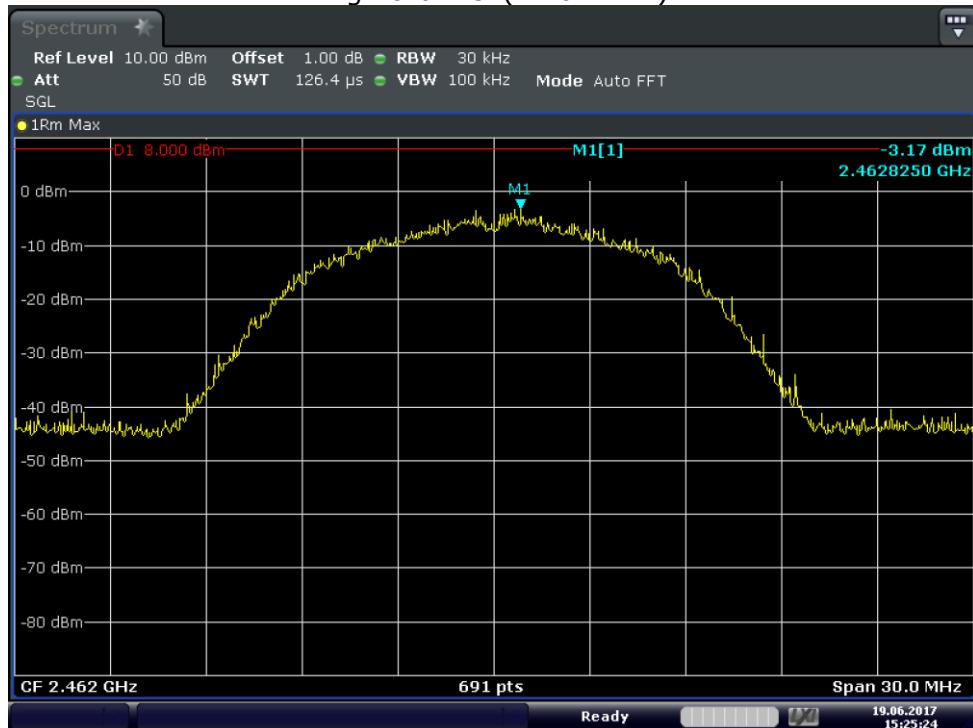
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High channel (2 462 MHz)





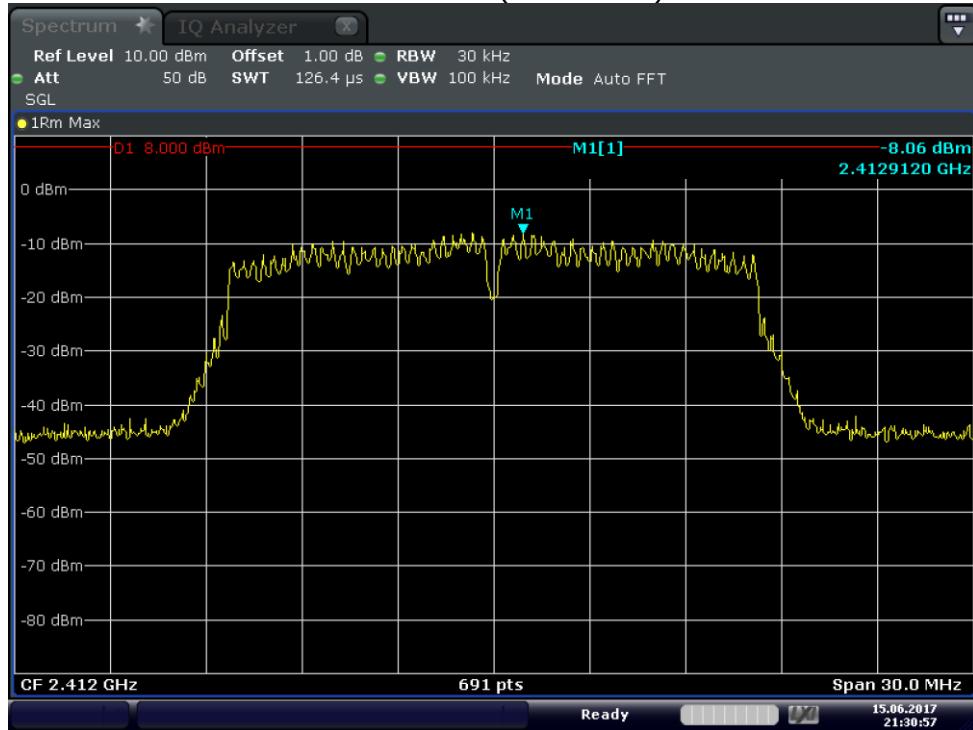
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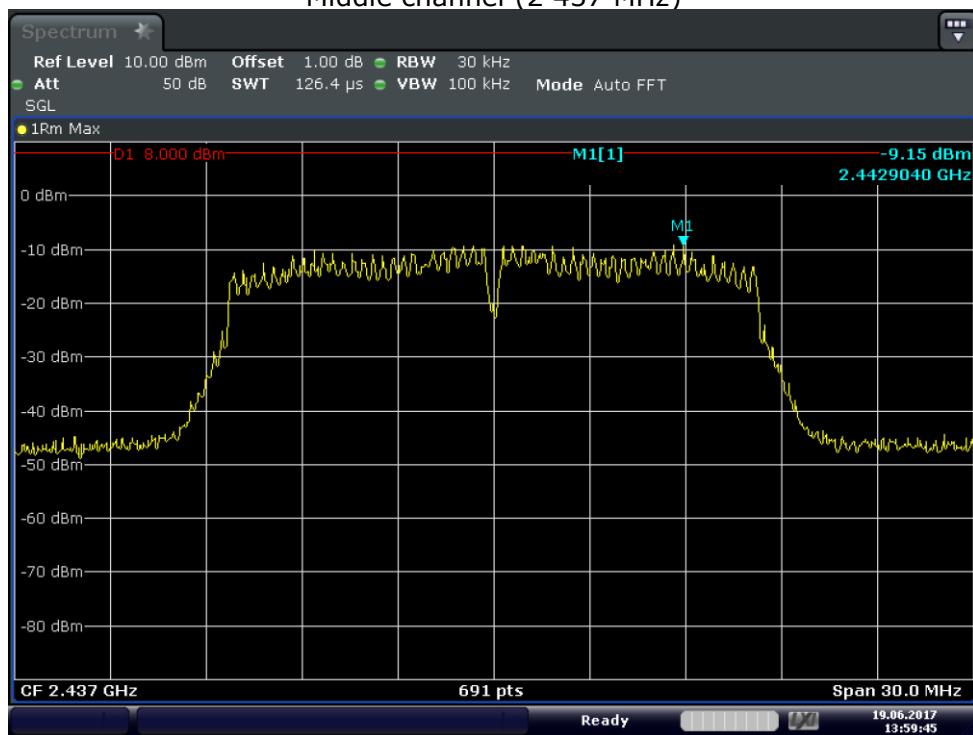
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**Mode : 802.11g**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



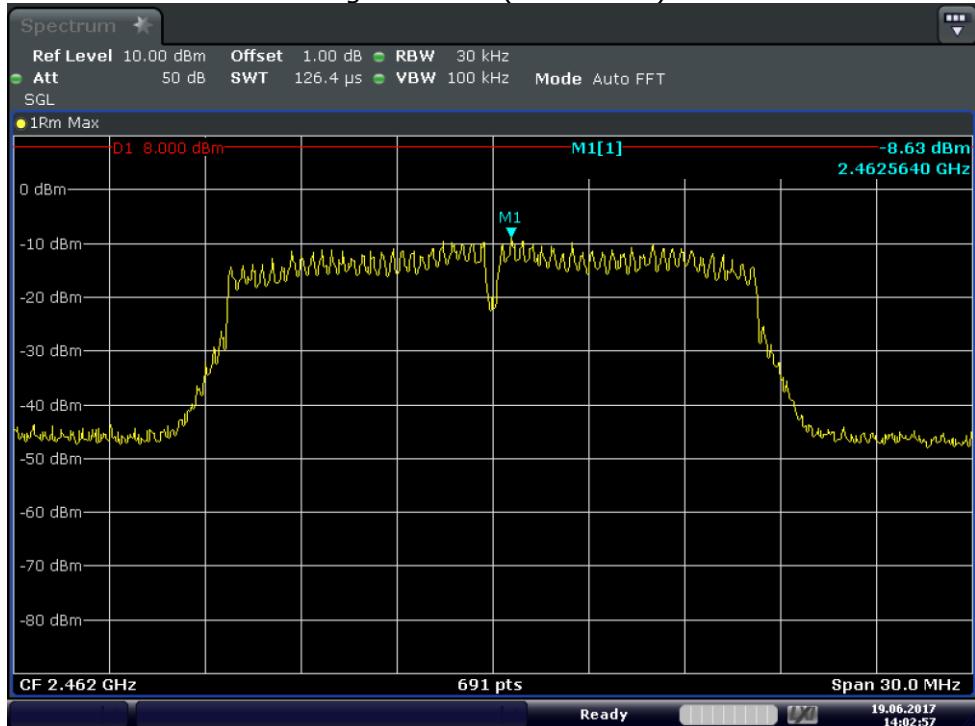


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High channel (2.462 MHz)





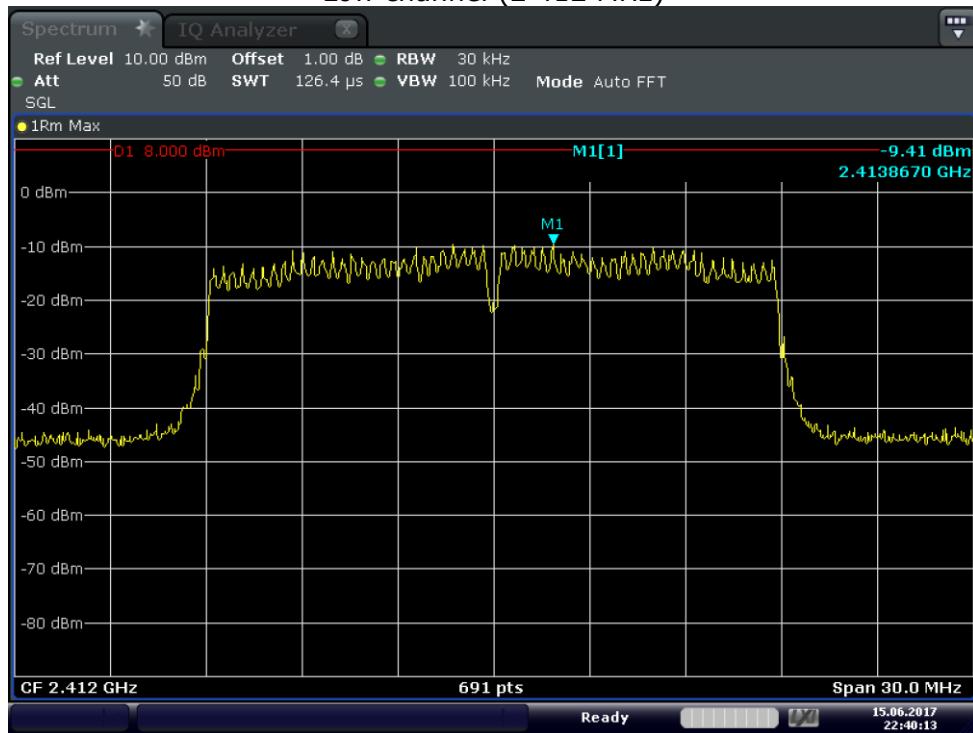
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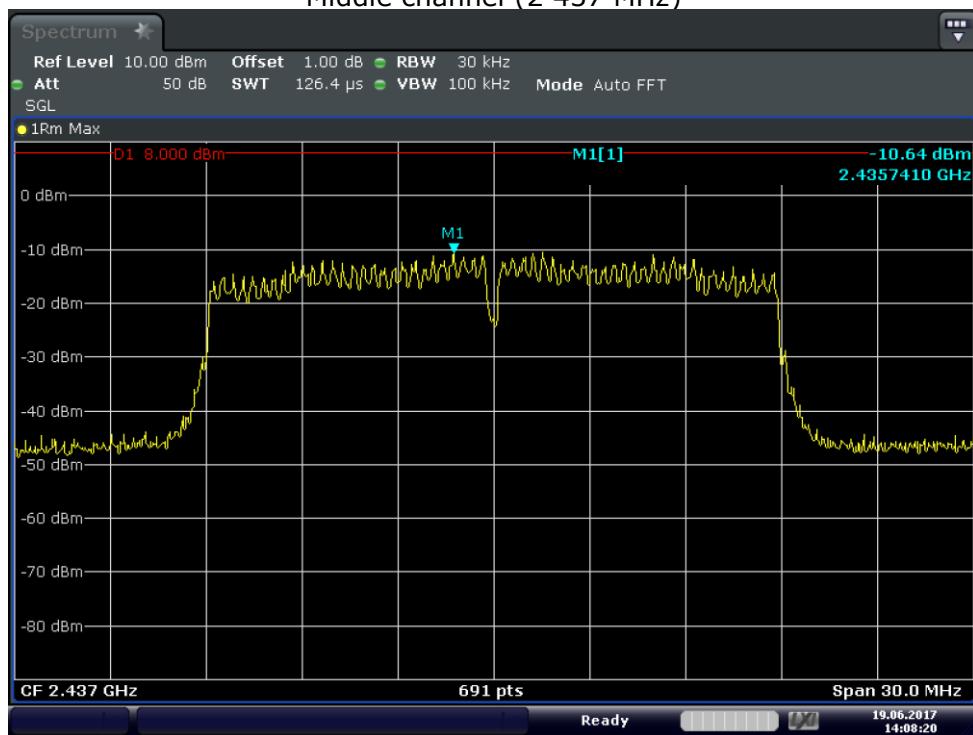
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**Mode : 802.11n**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)





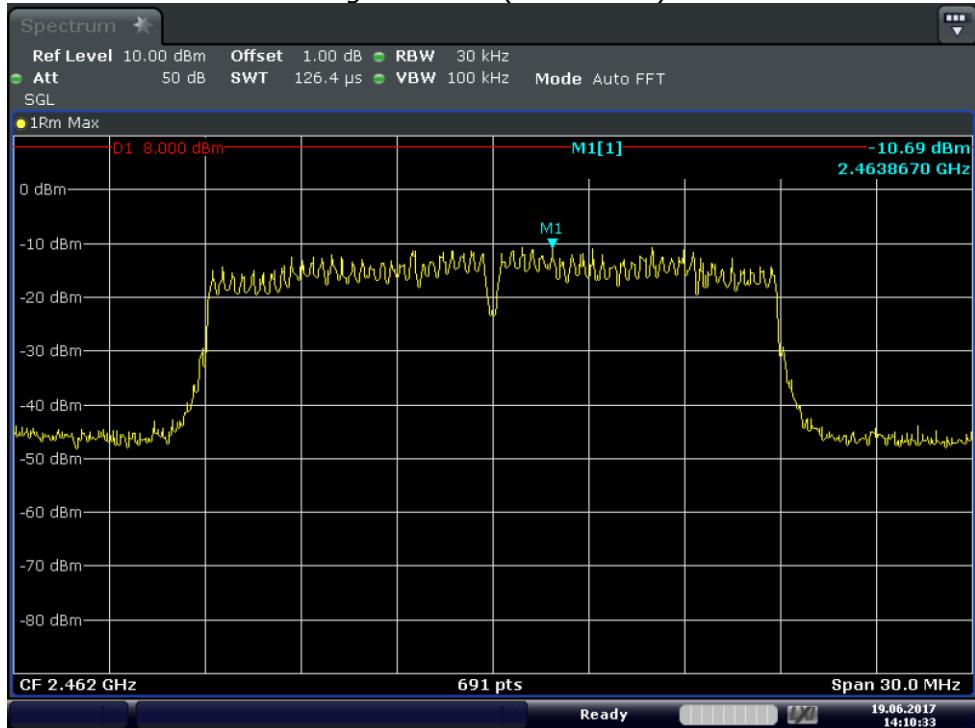
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High channel (2.462 MHz)





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## 4.4 Band Edge & Conducted Spurious emission

### Test Procedures(ANSI C63.10-2013 11.11.3)

The Unwanted emission from the EUT were measured according to the dictates PKPSD measurement procedure in section 11.11 of ANSI C63.10-2013.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

#### Test Settings:

Center frequency = the highest, middle and the lowest channels

- |   |                             |
|---|-----------------------------|
| a) RBW = 100 kHz  | b) VBW $\geq$ 3 x RBW       |
| c) Detector = peak  | d) Sweep time = auto couple |
| e) Trace mode= max hold   |                             |
| f) Allow trace to fully stabilize   |                             |
| g) Use the peak marker function to determine the maximum amplitude level. |                             |

#### Limit :

Emission level < 20 dBc

#### **Test results: Complies**

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest in-band spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



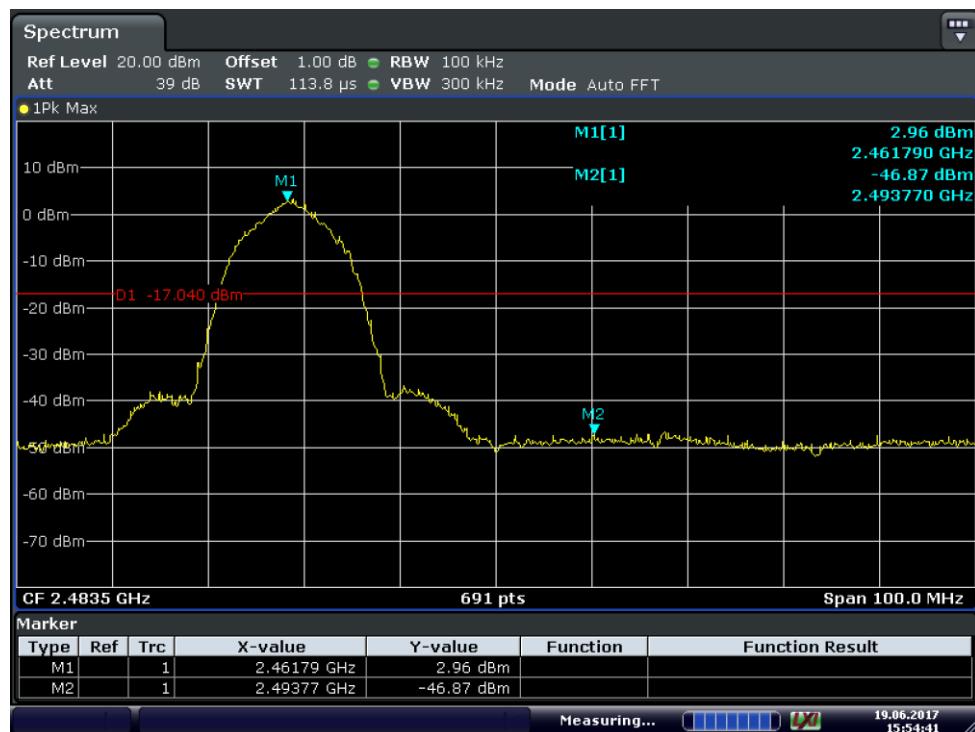
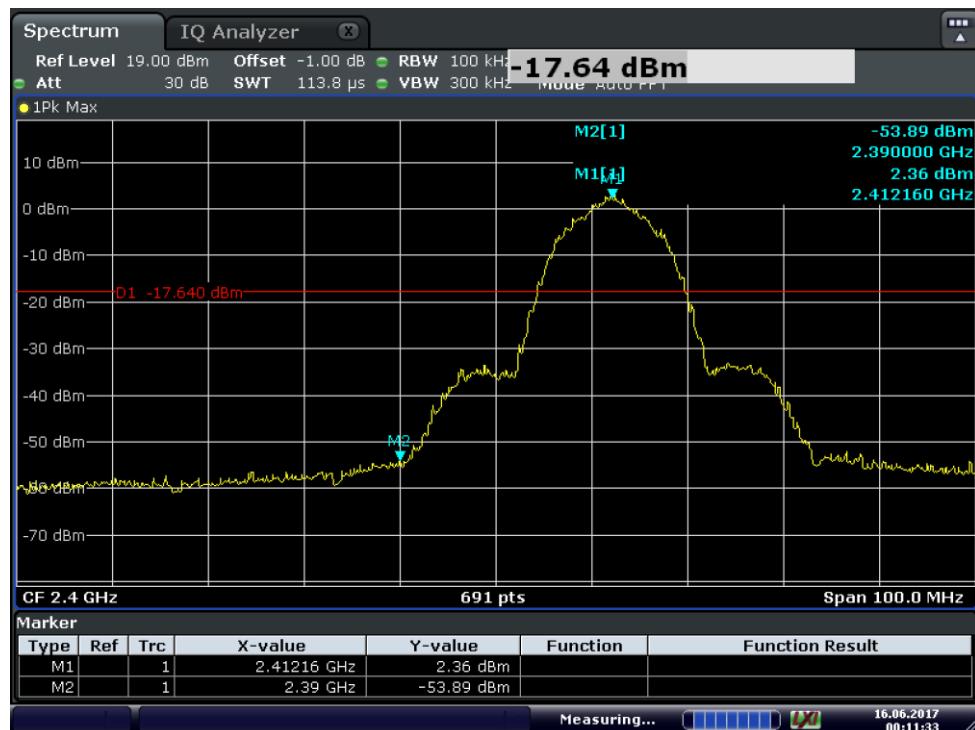
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## Band-edge

Mode : 802.11b



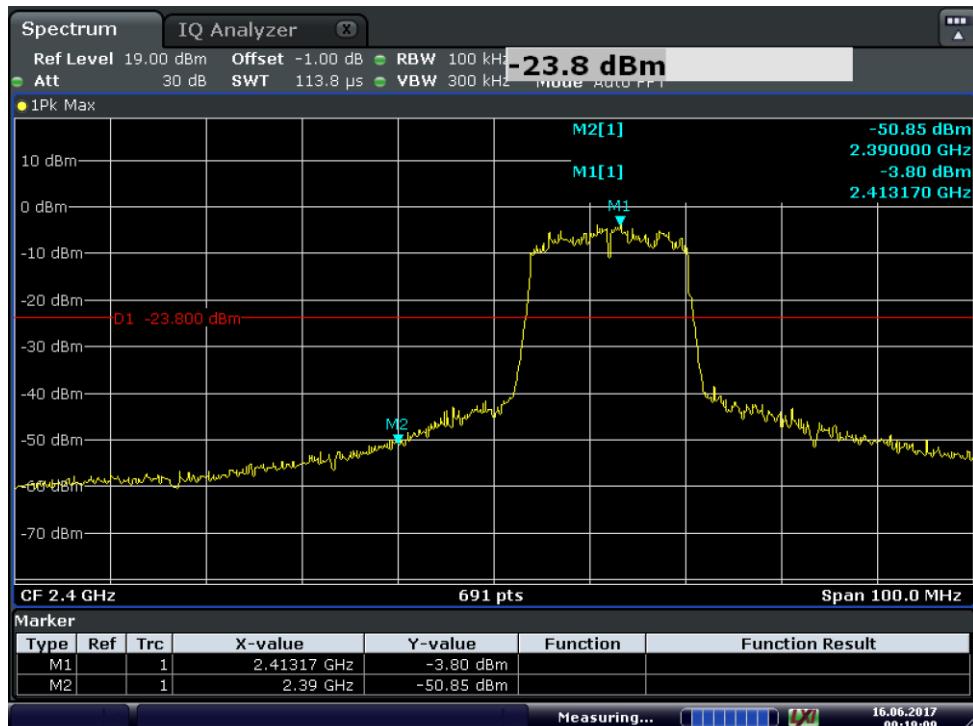


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Mode : 802.11g





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Mode : 802.11n





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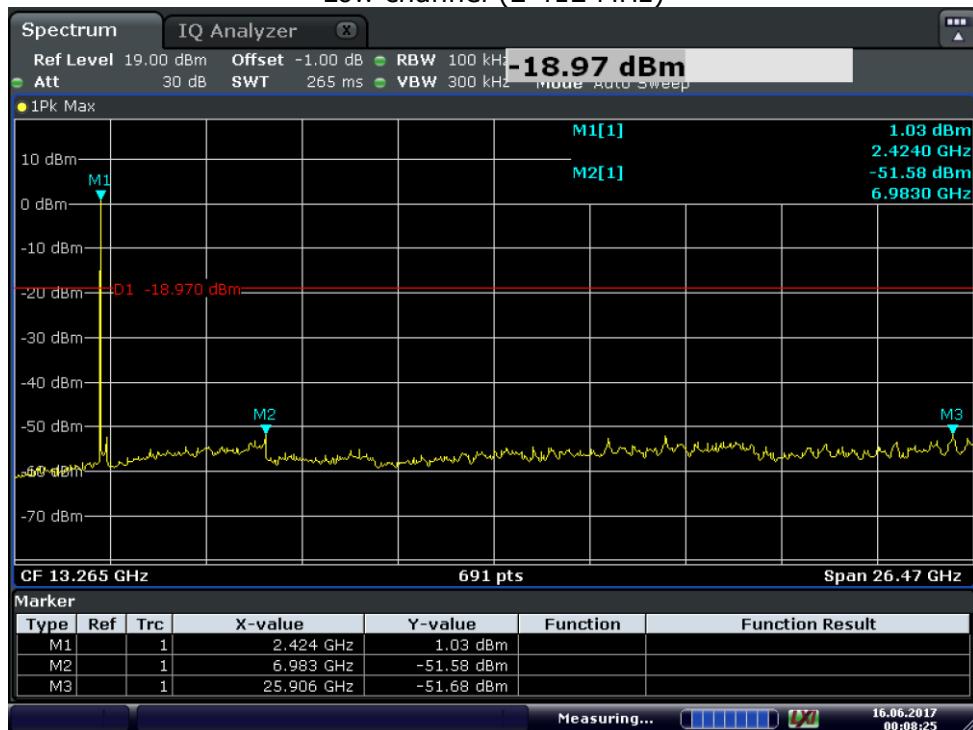
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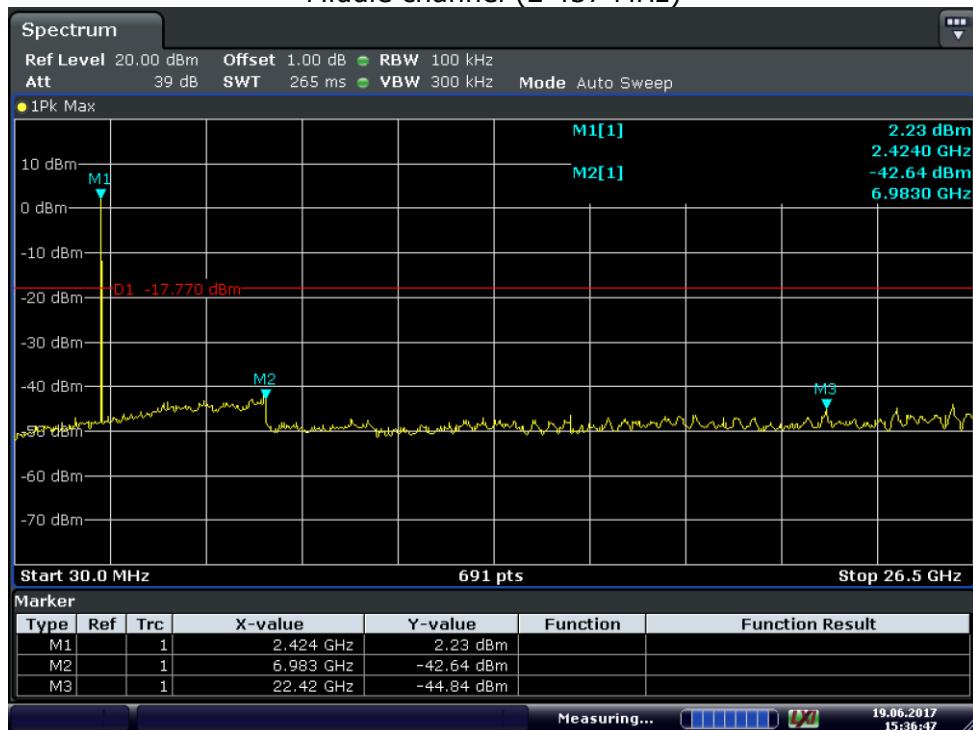
## Conducted Spurious emission

**Mode : 802.11b**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



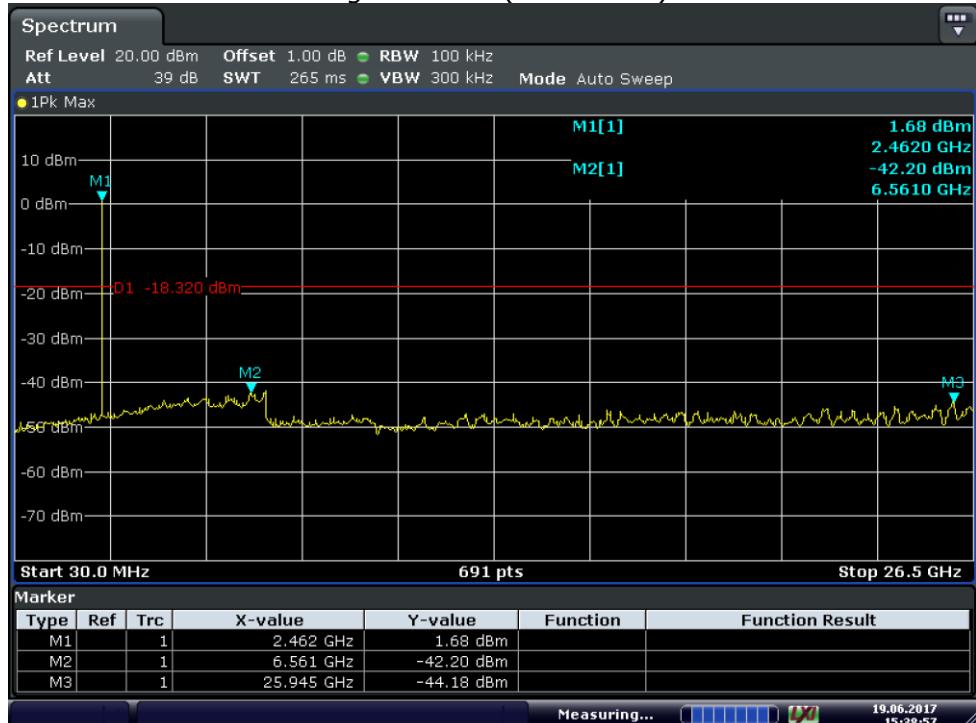


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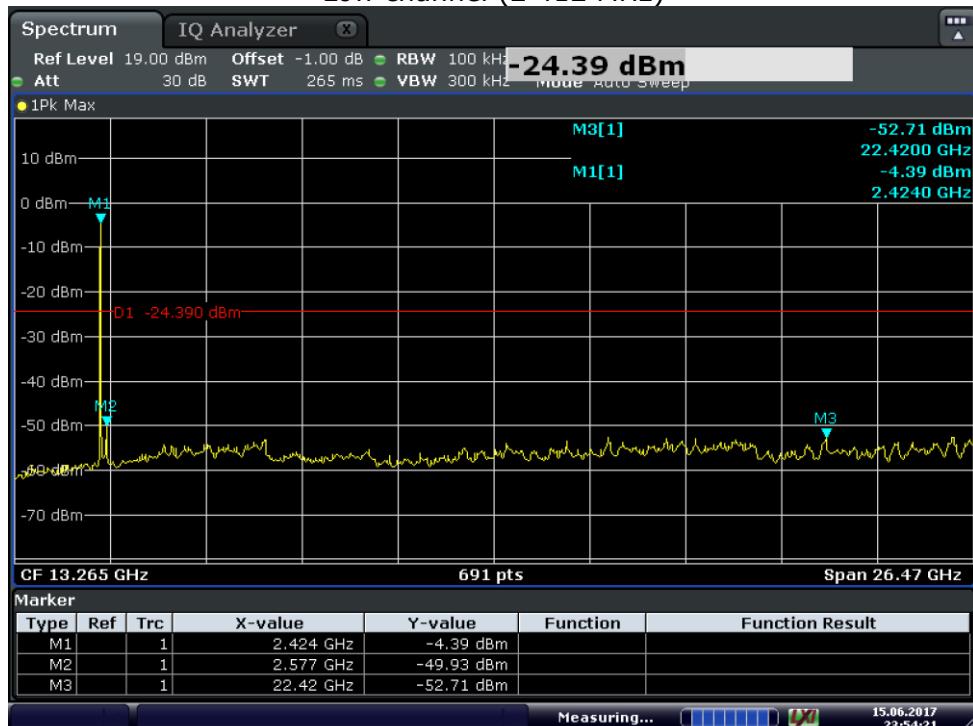
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### High channel (2 462 MHz)

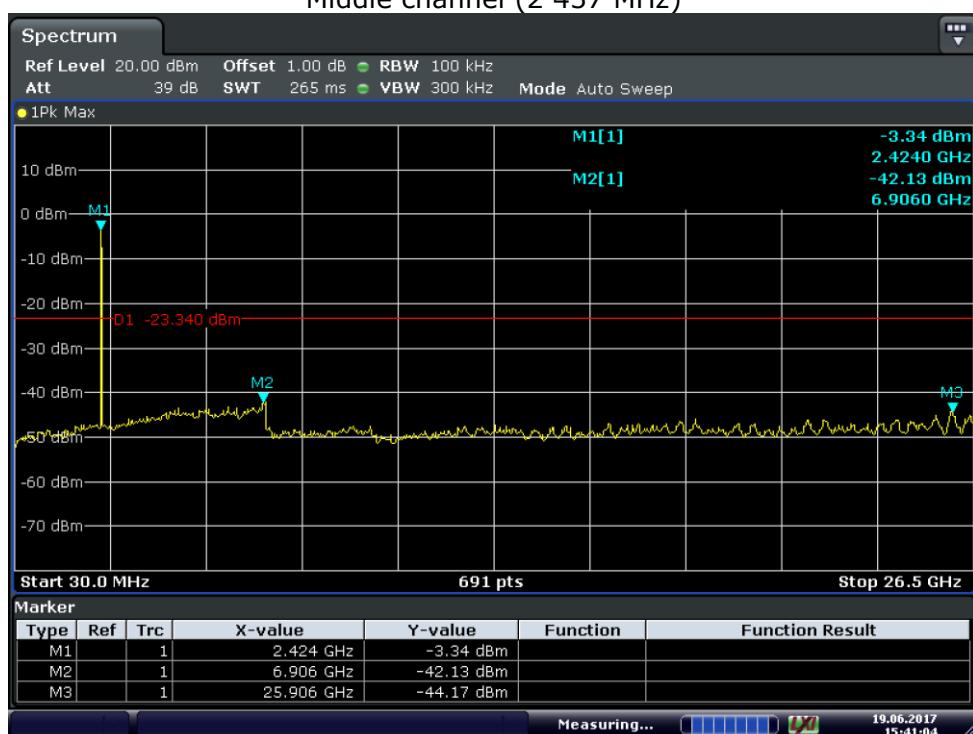


### Mode : 802.11g

Low channel (2 412 MHz)



Middle channel (2 437 MHz)



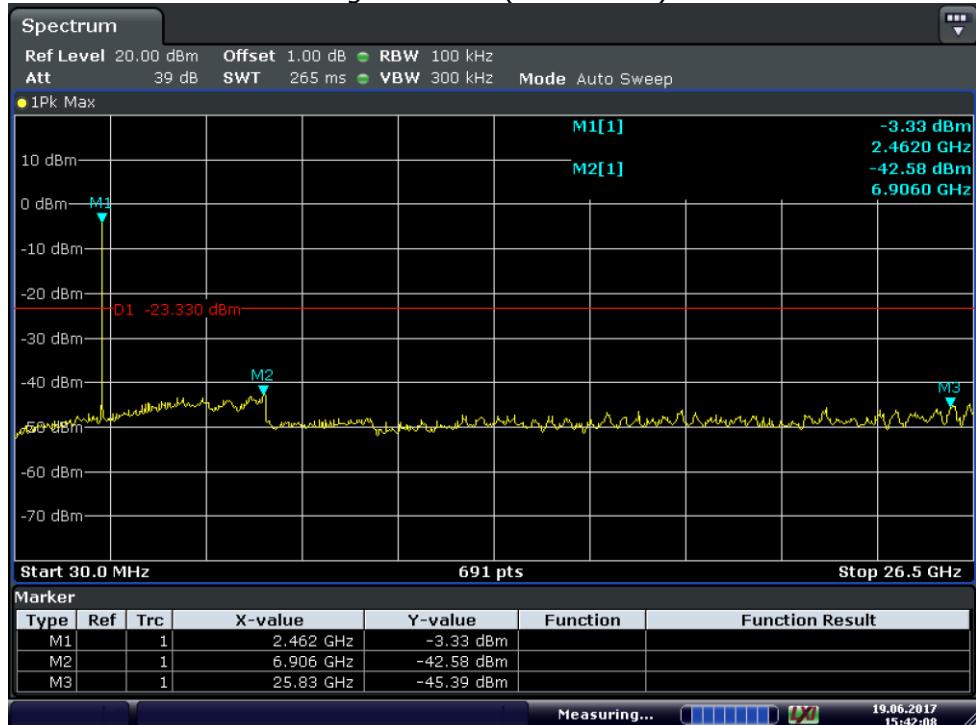


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### High channel (2 462 MHz)





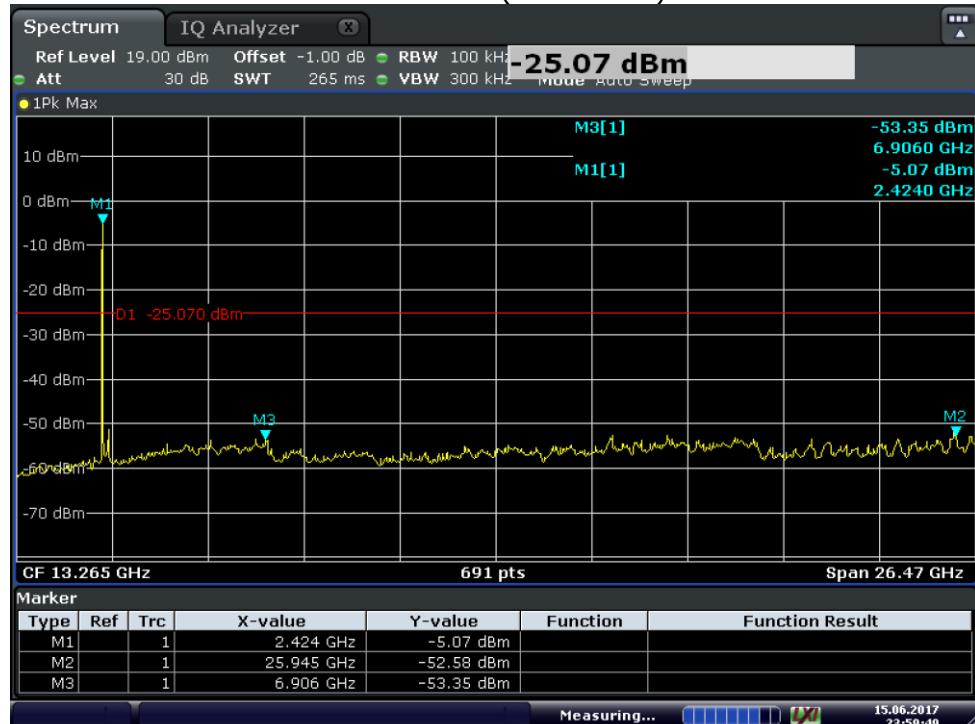
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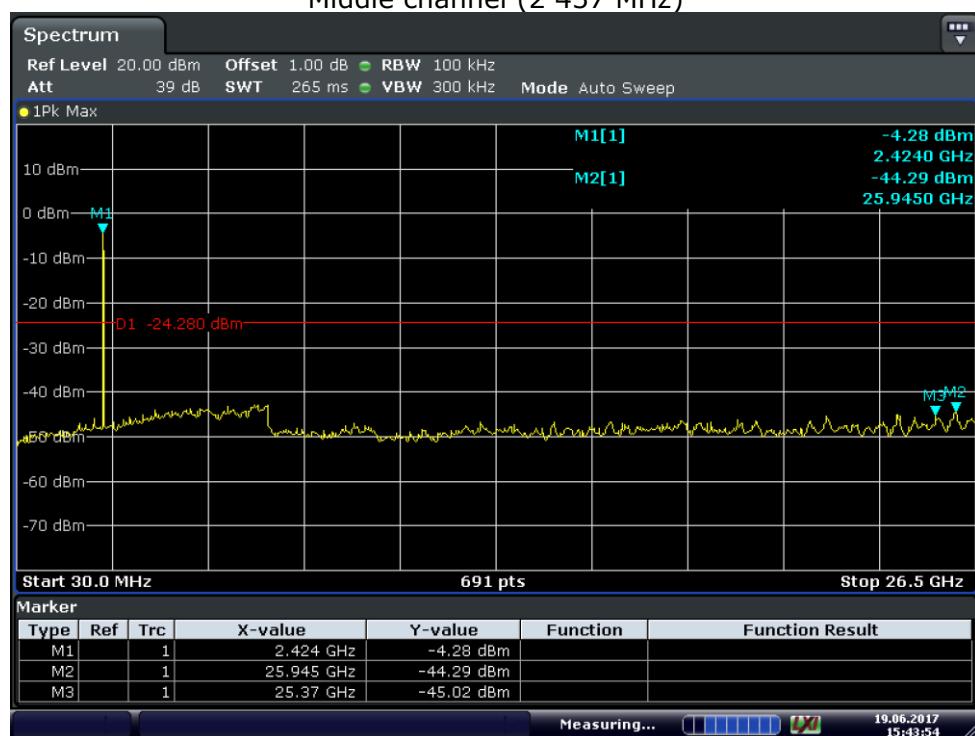
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**Mode : 802.11n**

Low channel (2 412 MHz)



Middle channel (2 437 MHz)





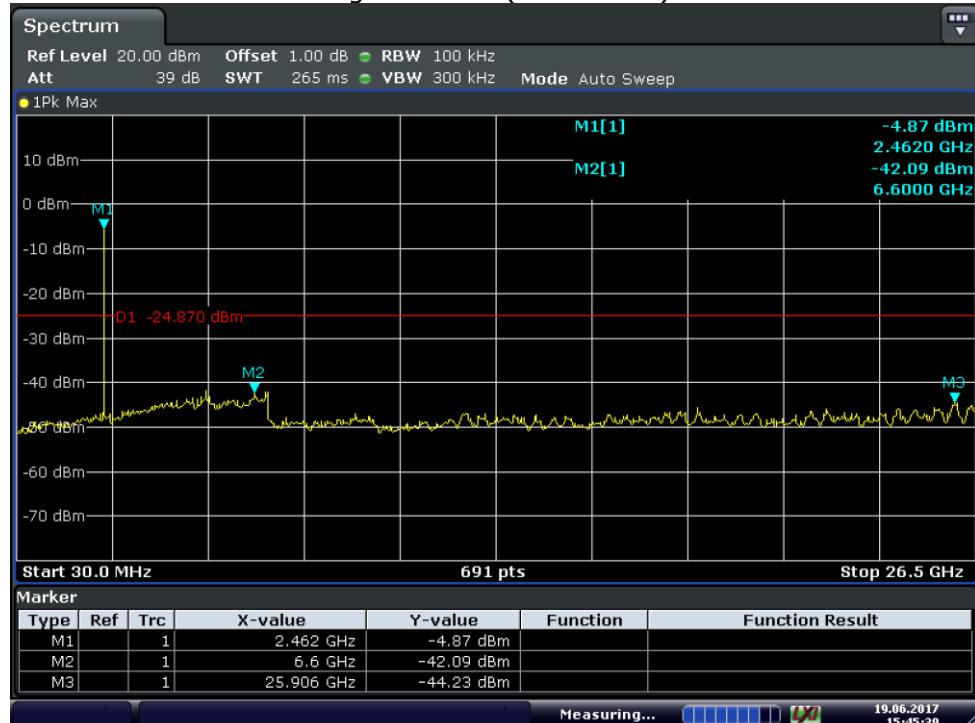
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High channel (2 462 MHz)





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## 4.5 Radiated Emission

### Test Location

- 10 m SAC (test distance :  10 m,  3 m)
- 3 m SAC (test distance : 3 m)

### Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

### Test Settings:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10<sup>th</sup> harmonic)

- a) RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz, 9 kHz for  $f < 30$  MHz
- b) VBW  $\geq$  RBW
- c) Sweep time = auto couple

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**Limit :**

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
<sup>1</sup> 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475- 156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	<sup>2</sup> Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

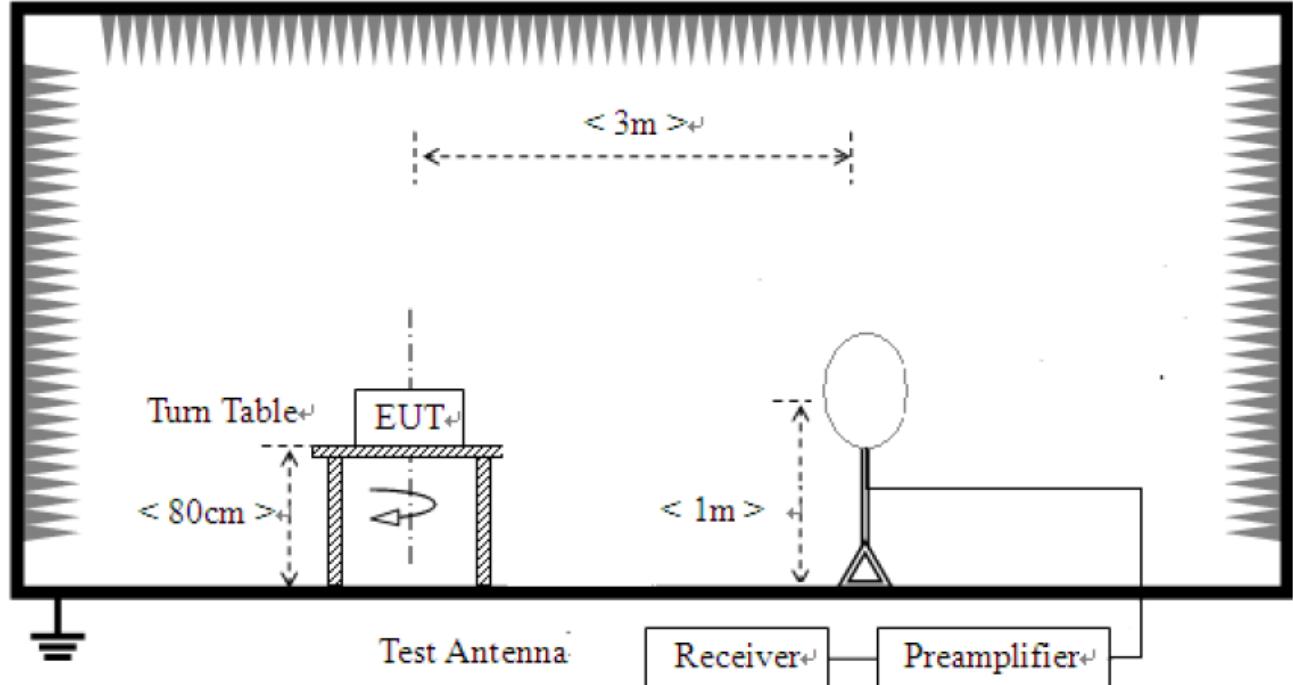
\*\* Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

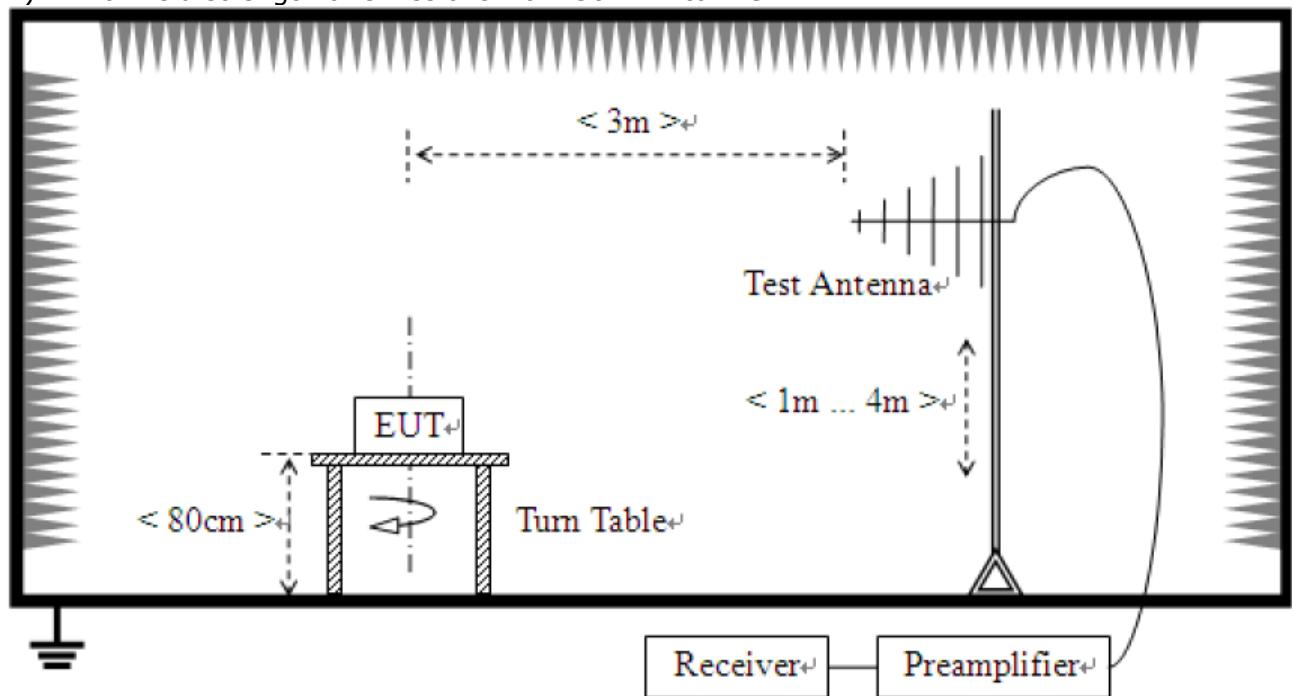
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.(Duty Cycle is > 98%,)
- 4) Duty Cycle is < 98%, VBW setting will need to > 1/T.

**Test Setup:**

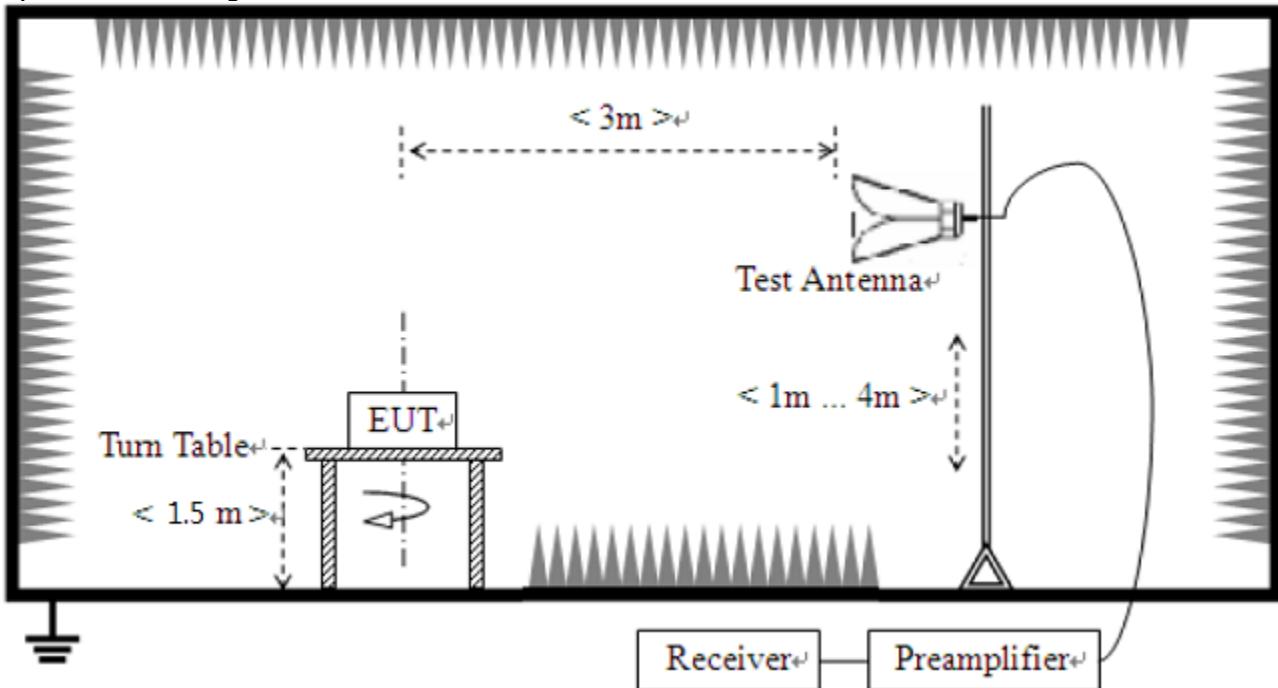
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



### Test results

#### 1) 9 kHz to 30 MHz

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

**Note :**

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB)

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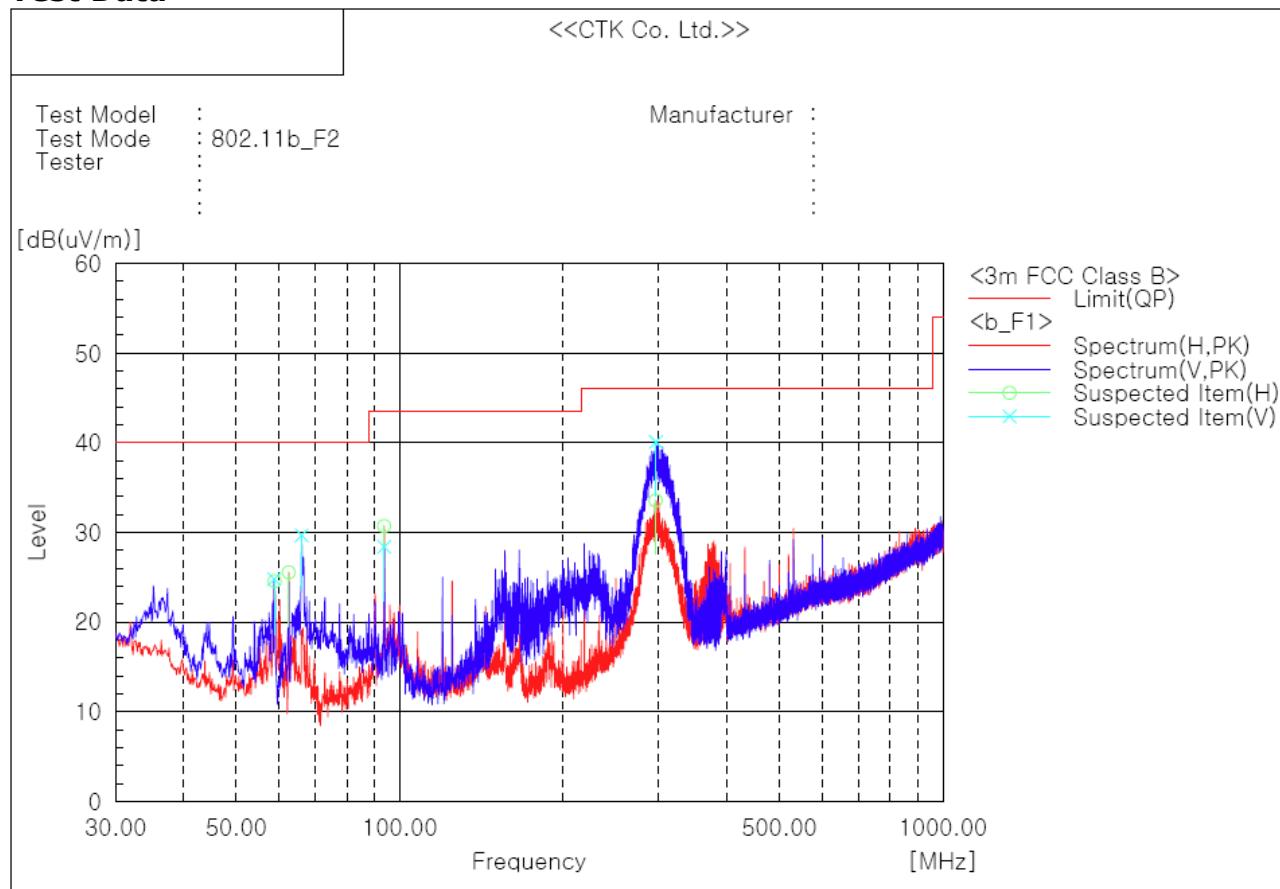
## 2) 30 MHz to 1 GHz

### Test mode : 802.11b, Middle Channel(Worst Case)

The requirements are:

Complies

### Test Data



### Spectrum Selection

No.	Frequency [MHz]	(P) [dB(uV)]	Reading [dB(1/m)]	c.f. [-]	Result PK [dB(uV/m)]	Limit QP [dB]	Margin QP [dB]	Height [cm]	Angle [deg]
1	58.736	V 43.7	-18.9	24.8	40.0	15.2	101.0	295.0	
2	58.858	H 43.5	-18.9	24.6	40.0	15.4	299.0	357.0	
3	62.495	H 44.5	-19.0	25.5	40.0	14.5	101.0	65.0	
4	66.011	V 48.6	-18.9	29.7	40.0	10.3	101.0	321.0	
5	93.656	H 45.5	-14.8	30.7	43.5	12.8	299.0	169.0	
6	93.656	V 43.2	-14.8	28.4	43.5	15.1	101.0	321.0	
7	296.023	H 41.9	-8.4	33.5	46.0	12.5	200.0	86.0	
8	296.386	V 48.5	-8.4	40.1	46.0	5.9	101.0	217.0	

### Remark :

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

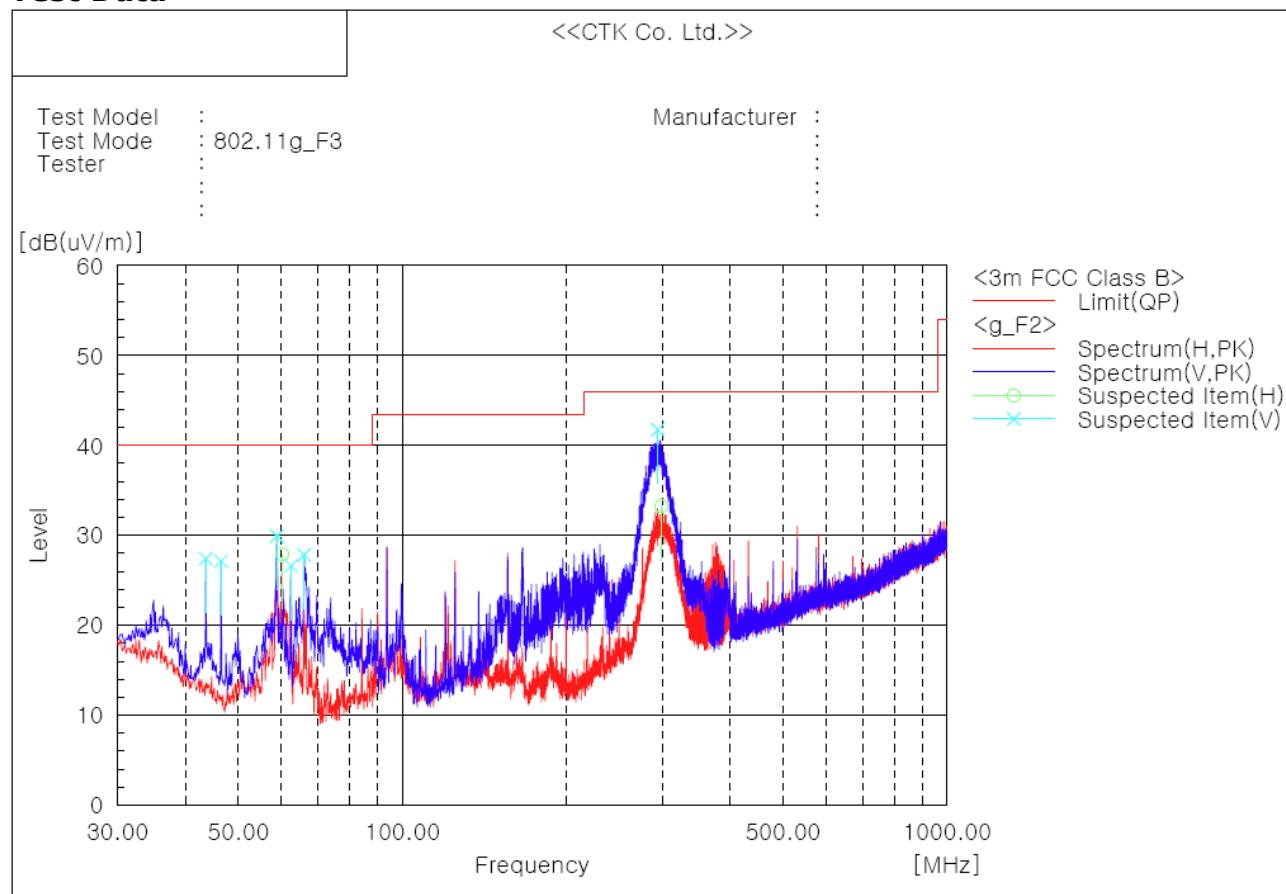
**CTK Co., Ltd.**

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**Test mode : 802.11g, Highest Channel(Worst Case)**

The requirements are:

 Complies**Test Data****Spectrum Selection**

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f	Result PK [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB]	Margin QP [dB]	Height [cm]	Angle [deg]
1	43.580	V	40.3	-12.9	27.4	40.0	12.6	200.0	196.0	
2	46.490	V	41.1	-14.0	27.1	40.0	12.9	101.0	269.0	
3	58.858	V	48.8	-18.9	29.9	40.0	10.1	200.0	91.0	
4	60.191	H	46.9	-19.0	27.9	40.0	12.1	300.0	39.0	
5	62.495	V	45.6	-19.0	26.6	40.0	13.4	101.0	295.0	
6	66.011	V	46.7	-18.9	27.8	40.0	12.2	101.0	0.0	
7	294.446	V	50.2	-8.4	41.8	46.0	4.2	101.0	191.0	
8	299.175	H	41.7	-8.4	33.3	46.0	12.7	200.0	86.0	

**Remark :**

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

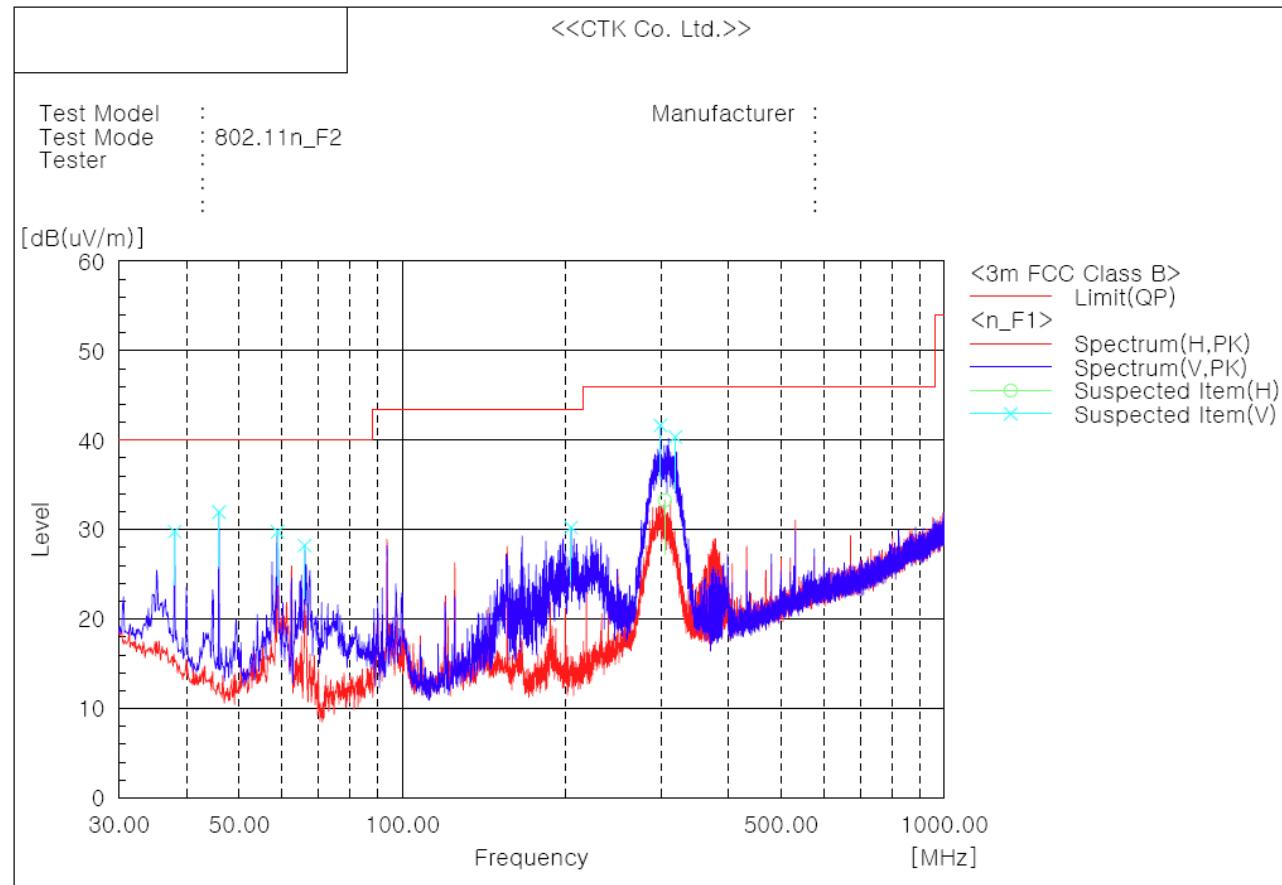
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**Test mode : 802.11n Lowest Channel(Worst Case)**

The requirements are:

 Complies**Test Data**

## Spectrum Selection

No.	Frequency (P)	Reading	c.f	Result PK	Limit QP	Margin QP	Height	Angle
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	38.003	V	40.1	-10.3	29.8	40.0	10.2	201.0
2	45.884	V	45.8	-13.8	32.0	40.0	8.0	201.0
3	58.858	V	48.7	-18.9	29.8	40.0	10.2	201.0
4	66.011	V	47.1	-18.9	28.2	40.0	11.8	101.0
5	204.843	V	43.9	-13.7	30.2	43.5	13.3	101.0
6	299.539	V	50.1	-8.4	41.7	46.0	4.3	101.0
7	305.116	H	41.6	-8.3	33.3	46.0	12.7	200.0
8	319.060	V	48.3	-7.9	40.4	46.0	5.6	101.0

**Remark :**

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

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### 3) above 1 GHz

**Test mode : 802.11b**

The requirements are:

- Complies

#### Test Data

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2390.0	V	54.00	74.00	39.61	51.71	14.39	22.29
1800.0	V	54.00	74.00	42.83	45.52	11.17	28.48
4824.0	H	54.00	74.00	41.30	47.43	12.70	26.57
7236.0	H	54.00	74.00	41.36	51.17	12.64	22.83

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
1800.0	V	54.00	74.00	42.83	46.29	11.17	27.71
4874.0	H	54.00	74.00	43.04	48.06	10.96	25.94
7311.0	H	54.00	74.00	44.21	53.80	9.79	20.20

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2483.5	V	54.00	74.00	47.49	58.76	6.51	15.24
1800.0	V	54.00	74.00	42.39	45.89	11.61	28.11
4924.0	H	54.00	74.00	42.88	47.97	11.12	26.03
7386.0	H	54.00	74.00	46.78	56.54	7.22	17.46

#### Remarks

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.

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**Test mode : 802.11g**

The requirements are:

- 
- Complies

**Test Data**

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2390.0	V	54.00	74.00	44.18	56.21	9.82	17.79
1800.0	V	54.00	74.00	42.54	44.67	11.46	29.33
4824.0	H	54.00	74.00	35.35	45.54	18.65	28.46
7236.0	H	54.00	74.00	37.50	50.03	16.50	23.97

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
1800.0	V	54.00	74.00	42.74	46.45	11.26	27.55
4874.0	H	54.00	74.00	36.04	47.04	17.96	26.96
7311.0	H	54.00	74.00	38.98	51.94	15.02	22.06

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2483.5	V	54.00	74.00	48.01	61.45	5.99	12.55
1800.0	V	54.00	74.00	42.40	45.18	11.60	28.82
4924.0	H	54.00	74.00	35.64	45.98	18.36	28.02
7386.0	H	54.00	74.00	38.86	53.56	15.14	20.44

**Remarks**

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.

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**Test mode : 802.11n**

The requirements are:

- 
- Complies

**Test Data**

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2390.0	V	54.00	74.00	43.30	57.10	10.70	16.90
1800.0	V	54.00	74.00	42.55	44.61	11.45	29.39
4824.0	H	54.00	74.00	34.63	45.04	19.37	28.96
7236.0	H	54.00	74.00	36.91	49.38	17.09	24.62

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
1800.0	V	54.00	74.00	42.63	45.70	11.37	28.30
4874.0	H	54.00	74.00	35.30	45.81	18.70	28.19
7311.0	H	54.00	74.00	38.15	49.89	15.85	24.11

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2483.5	V	54.00	74.00	47.53	63.17	6.47	10.83
1800.0	V	54.00	74.00	42.57	45.50	11.43	28.50
4924.0	H	54.00	74.00	35.25	45.41	18.75	28.59
7386.0	H	54.00	74.00	39.54	51.99	14.46	22.01

**Remarks**

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.

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## APPENDIX A – Test Equipment Used For Tests

	<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Date of Calibration</b>	<b>Due Date</b>
1	Signal Analyzer	R&S	FSV30	100925	2017-02-02	2018-02-02
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2016-11-01	2017-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2016-11-01	2017-11-01
4	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2016-05-25	2018-05-25
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2016-11-01	2017-11-01
7	6dB Attenuator	R&S	DNF	272.4110.50-1	2017-02-03	2018-02-03
8	AMPLIFIER	SONOMA	310	291721	2017-02-02	2018-02-02
9	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2017-05-12	2018-05-12
10	Preamplifier	Agilent	8449B	3008A02011	2016-12-01	2017-12-01
11	Horn Antenna	ETS-Lindgren	3115	00078894	2015-09-02	2017-09-02
12	Horn Antenna	ETS-Lindgren	3116	00062504	2015-09-04	2017-09-04
13	Horn Antenna	ETS-Lindgren	3117	00154525	2015-09-02	2017-09-02
14	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2017-05-16	2018-05-16
15	Band Reject Filter	Micro Tronics	BRM50702	G233	2017-02-03	2018-02-03
16	DC Power Supply	Topward	6303D	711196	2017-02-02	2018-02-02