RF TEST REPORT

Test item	:	Wi-Fi Module
Model No.	:	TWFMKB304D
Order No.	:	DEMC1203-00186
Date of receipt	:	2012-03-27
Test duration	:	2012-04-05 ~ 2012-04-30
Date of issue	:	2012-05-11
Use of report	:	FCC Original Grant

Applicant : LG Innotek Co., Ltd.
#978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731, Korea

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

Test specification	:	FCC Part 15 Subpart C 247
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer J.J.Lee	N/A	Technical Director Harvey Sung

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1. GENERAL INFORMATION

Applicant	:	LG Innotek Co., Ltd.
Address	:	#978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731, Korea
FCC ID	:	YZP-TWFMKB304D
EUT	:	Wi-Fi Module
Model	:	TWFMKB304D
Additional Model(s)	:	TWFM-B304D
Data of Test	:	2012-04-05 ~ 2012-04-30
Contact person	:	Je-hyuk, Moon

2. EUT DESCRIPTION

Product	Wi-Fi Module
Model Name	TWFMKB304D, TWFM-B304D ※ 2 models are same mechanical, electrical and functional. ※ The only difference is the model name, which are changed for marketing purpose.
Power Supply	DC 5V
Frequency Range	802.11b/g/n(20MHz): 2412 ~ 2462 MHz 802.11n(40MHz): 2422~2452 MHz
Max. RF Output Power	802.11b: 20.93 dBm 802.11g: 24.74 dBm 802.11n(HT20): 22.96 dBm 802.11n(HT40): 23.08 dBm
Modulation Type	802.11b: DSSS/CCK 802.11g/n: OFDM
Antenna Specification	Antenna Type: Internal PIFA antenna Gain: 0.77 dBi(PK)

3. TEST METHODOLOGY

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz(ANSI C63.4-2003) and KDB558074 D01

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version: 2003)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting. The following test modes were chosen as the worst case mode for full test.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 683-3, Yubang-Dong, Yongin-Si, Gyunggi-Do, 449-080, South Korea. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number : 678747

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:
“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antennas of this E.U.T are permanently attached.
* Therefore this E.U.T Complies with the requirement of §15.203

7. TEST RESULT

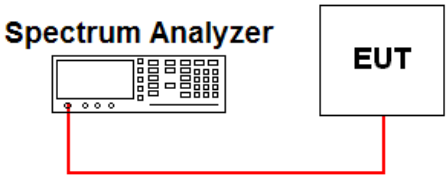
7.1 6dB Bandwidth Measurement

Test Requirements and limit, §15.247(d)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6dB bandwidth is 500 kHz.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of KDB558074.

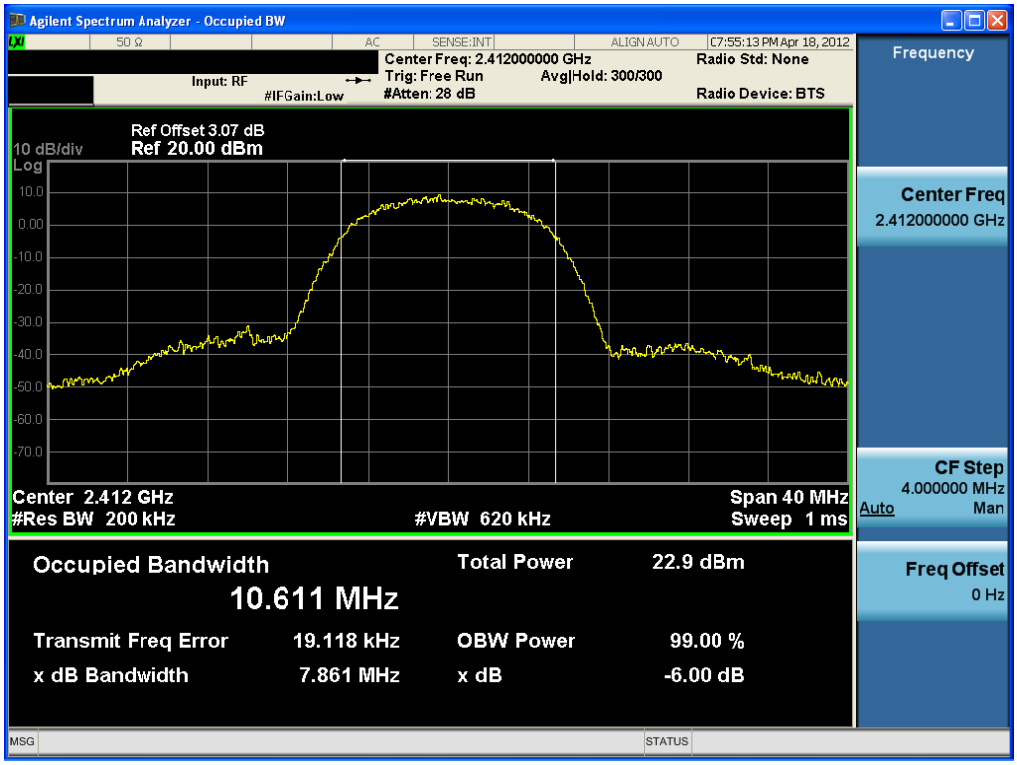
1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = **Peak**.
4. Trace mode = **max hold**.
5. Sweep = **auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

▣ TEST RESULTS: Comply

Test Mode	Data Rate	Frequency [MHz]	Test Results [MHz]
802.11b	11Mbps	2412	7.861
		2437	7.933
		2462	8.267
802.11g	54Mbps	2412	15.570
		2437	15.610
		2462	15.770
802.11n(HT20)	MCS 7	2412	17.030
		2437	17.420
		2462	17.350
802.11n(HT40)	MCS 7	2422	36.550
		2437	36.470
		2452	36.370

▣ RESULT PLOTS

6 dB Bandwidth Test Mode: 802.11b & 11Mbps & 2412MHz



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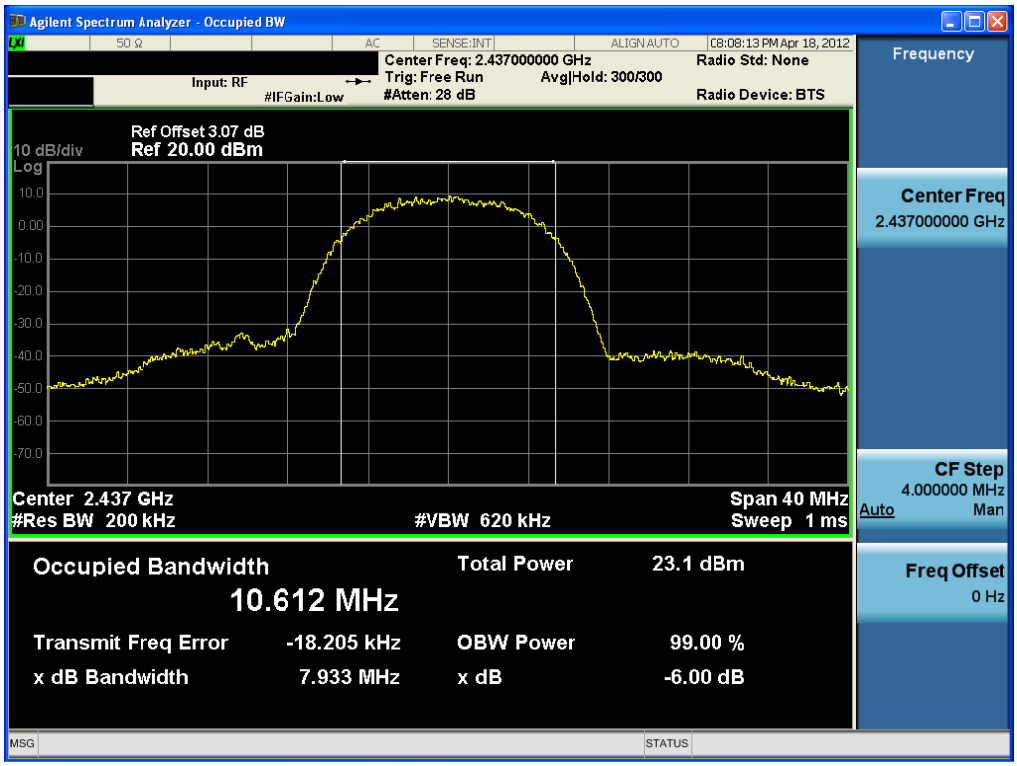
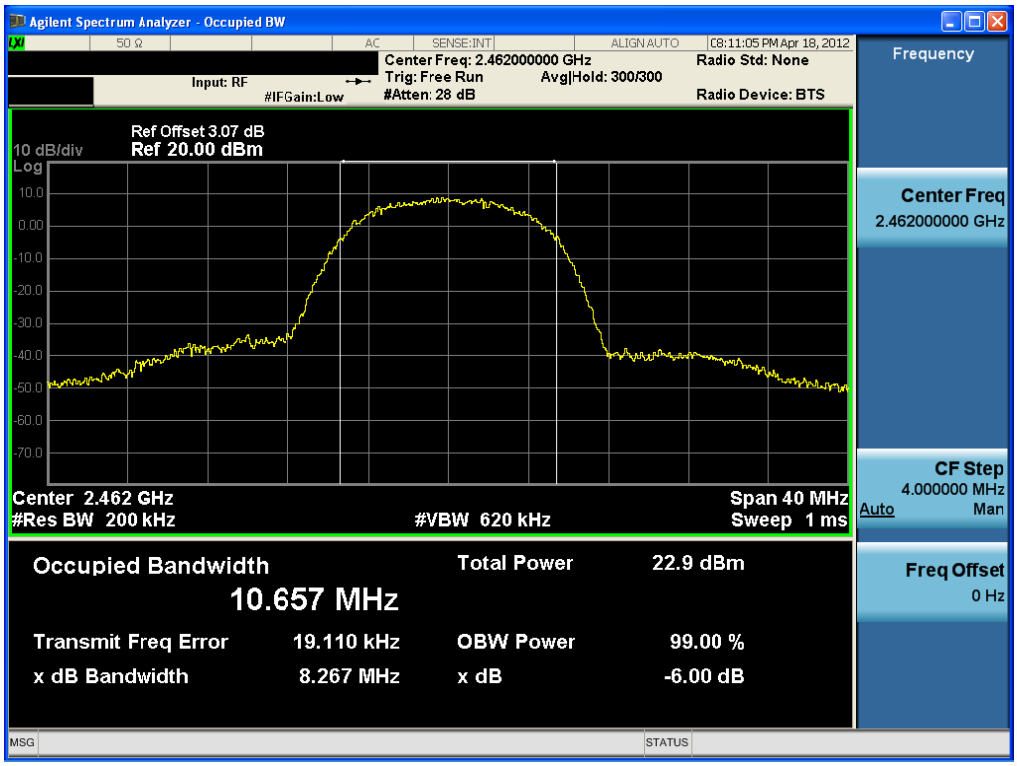
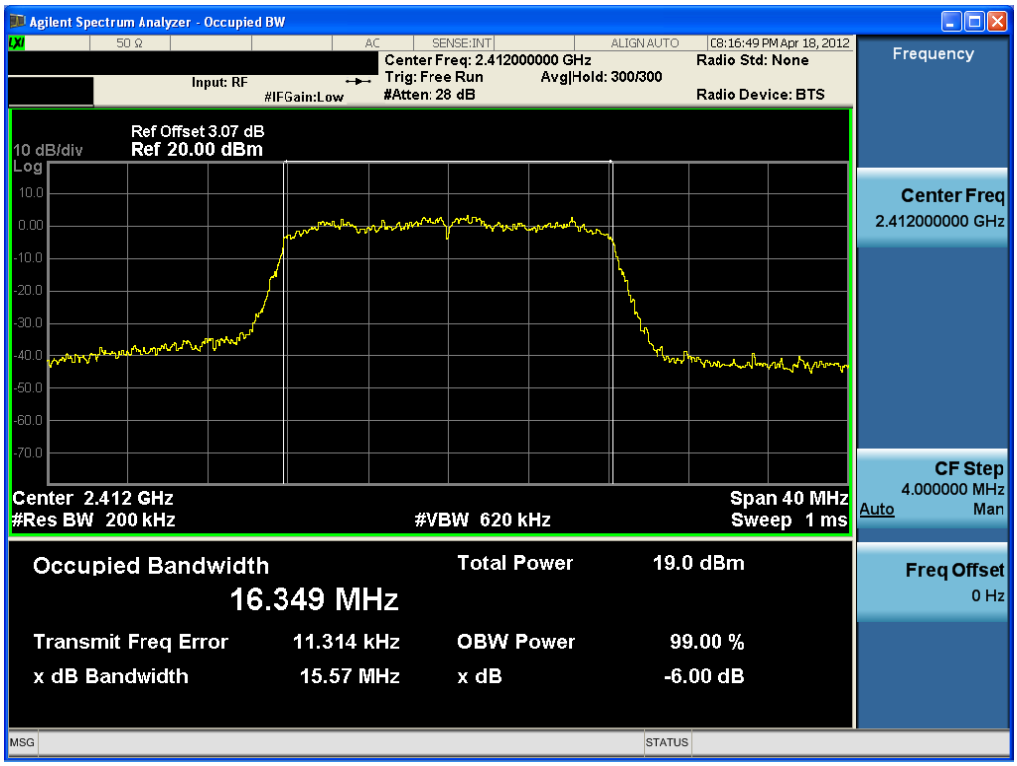


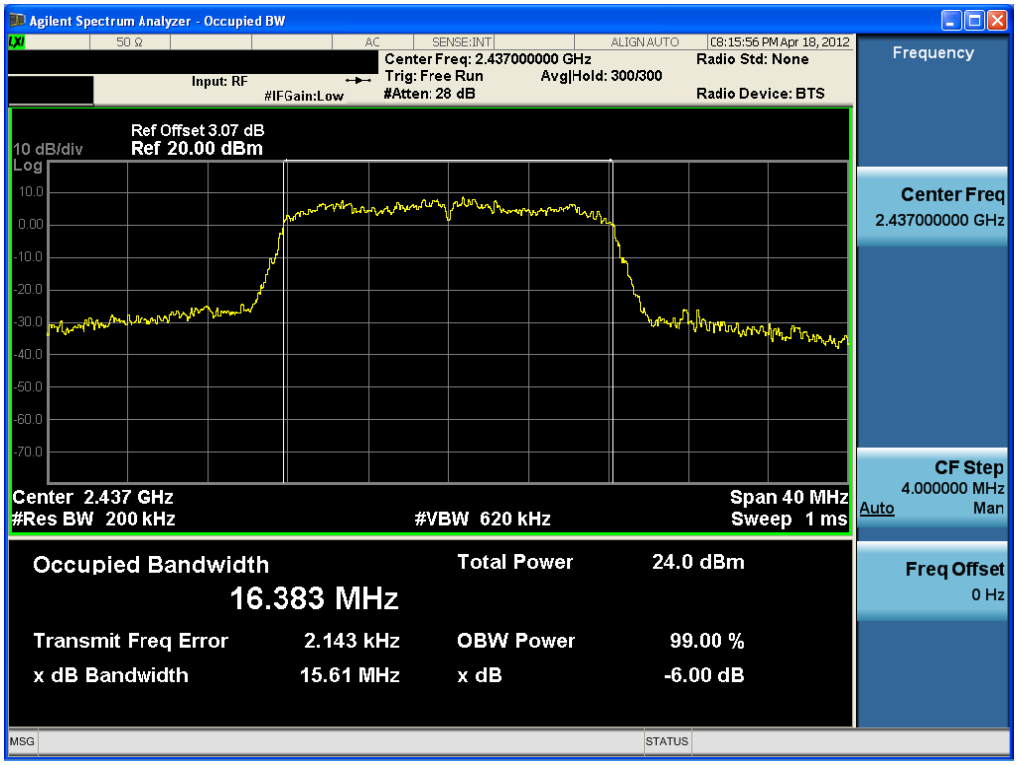
6 dB Bandwidth Test Mode: 802.11b & 11Mbps & 2462MHz



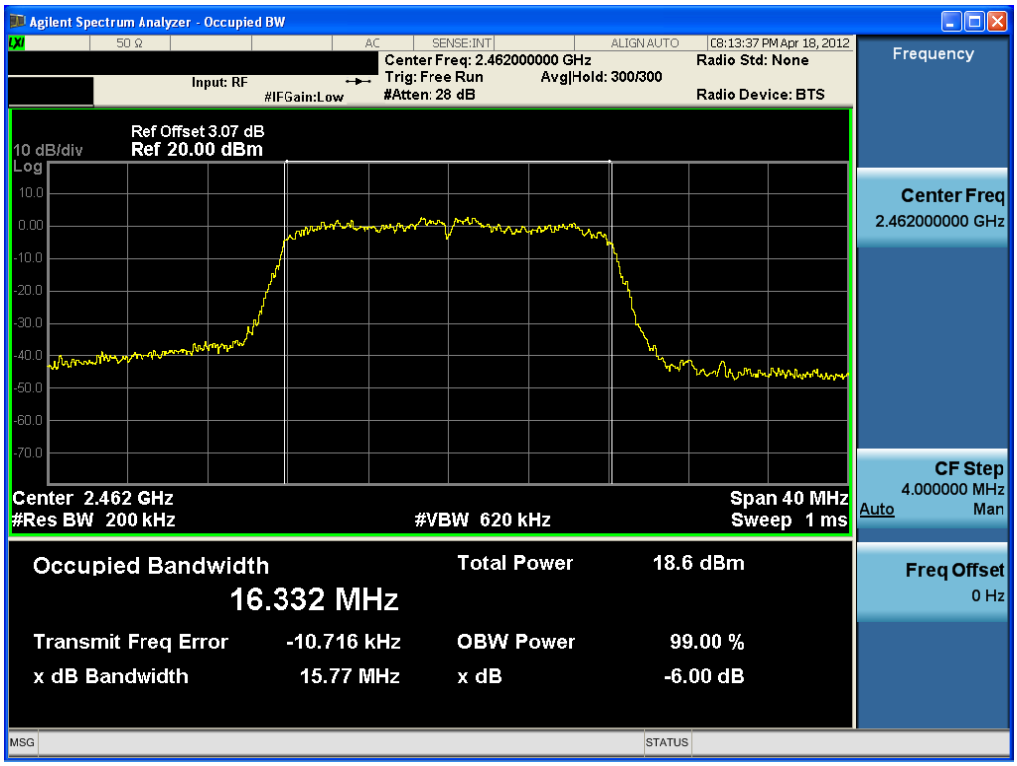
6 dB Bandwidth Test Mode: 802.11g & 54Mbps & 2412MHz



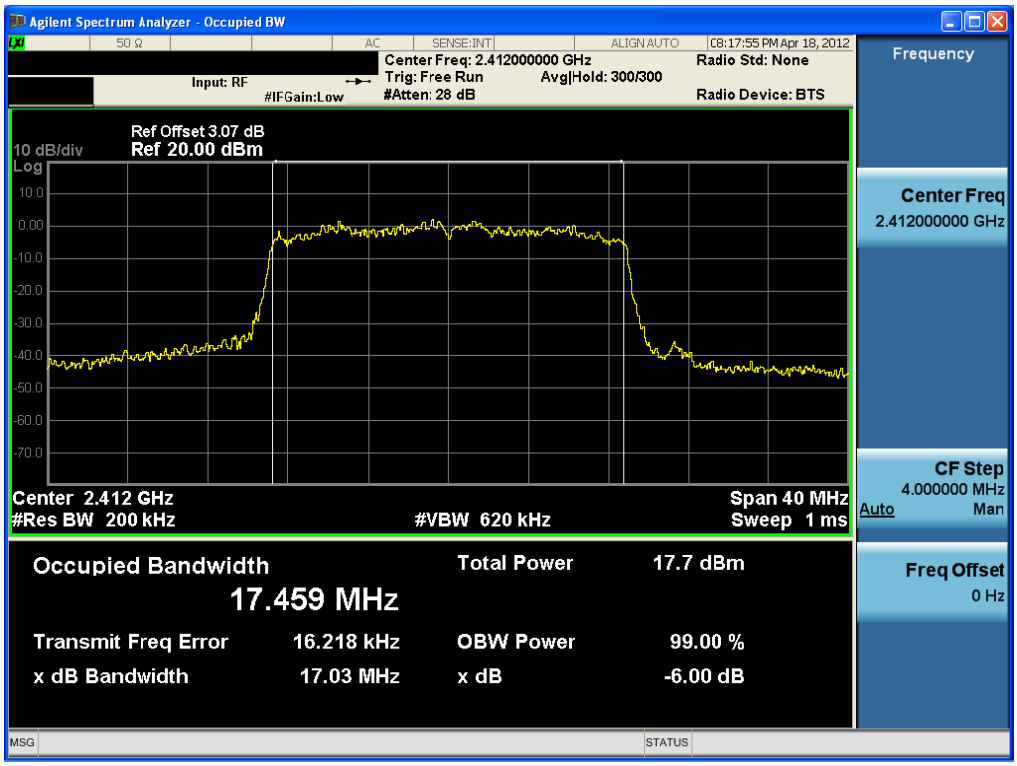
6 dB Bandwidth Test Mode: 802.11g & 54Mbps & 2437MHz



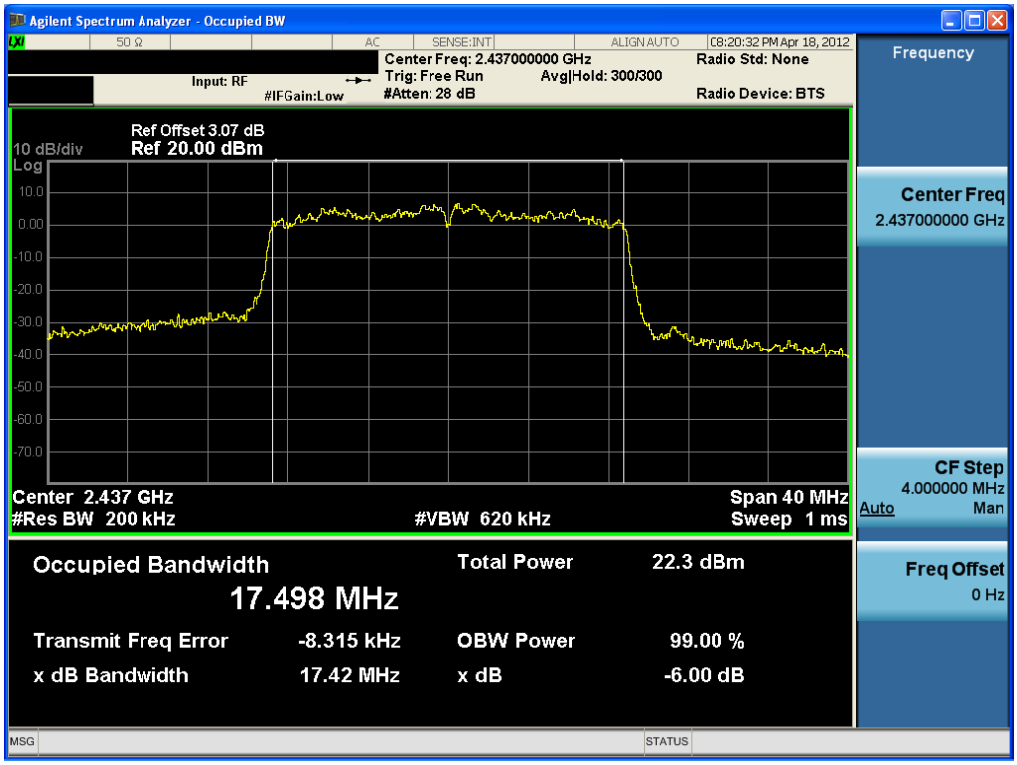
6 dB Bandwidth Test Mode: 802.11g & 54Mbps & 2462MHz



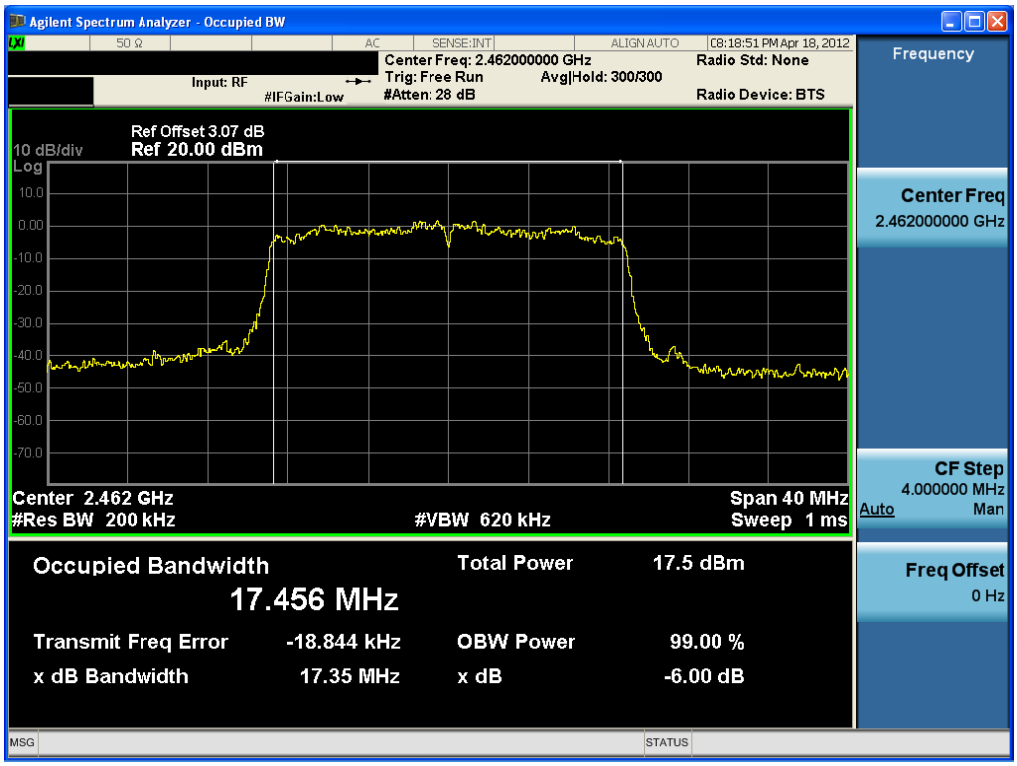
6 dB Bandwidth Test Mode: 802.11n(HT20) & MCS 7 & 2412MHz



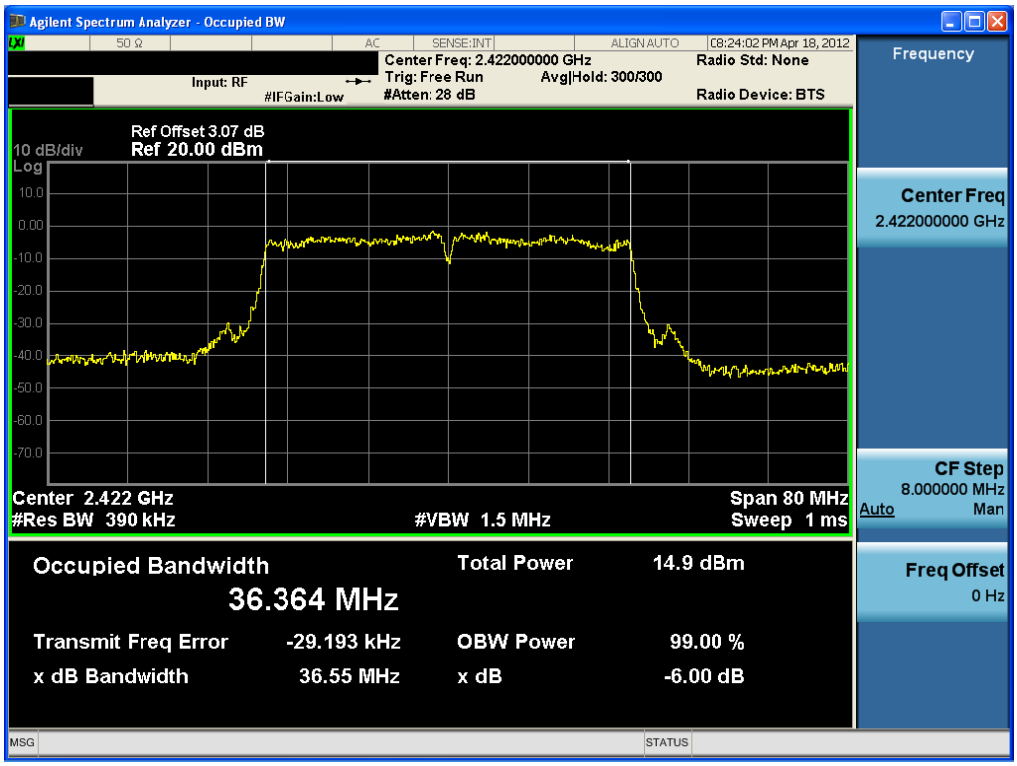
6 dB Bandwidth Test Mode: 802.11n(HT20) & MCS 7 & 2437MHz



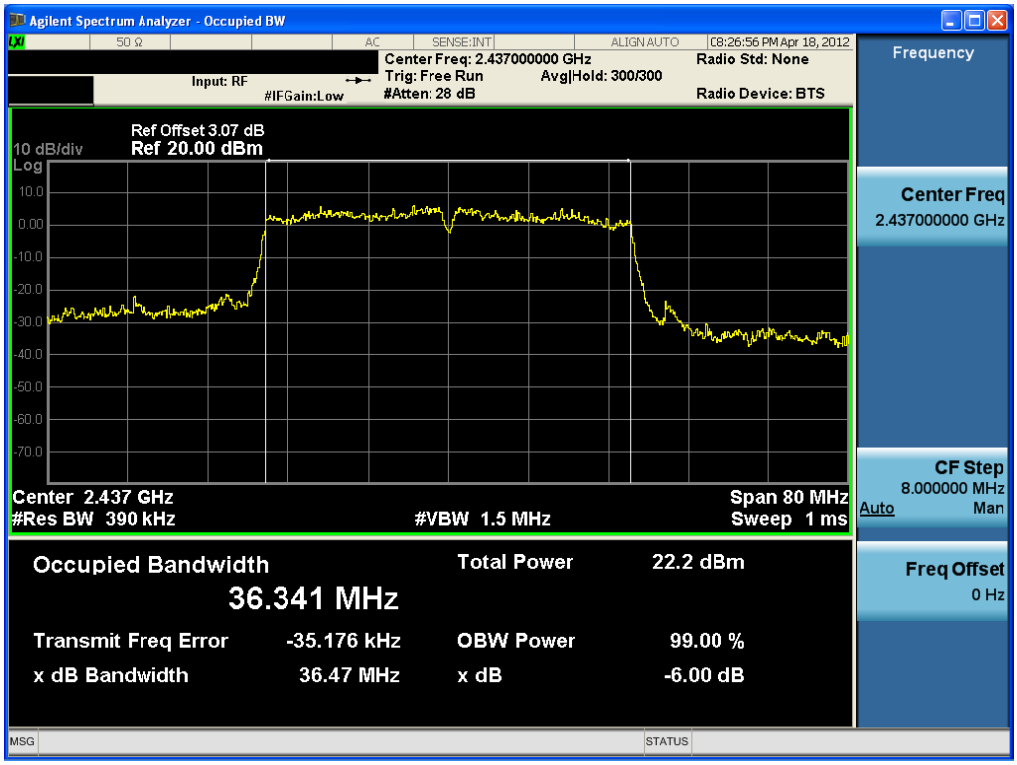
6 dB Bandwidth Test Mode: 802.11n(HT20) & MCS 7 & 2462MHz



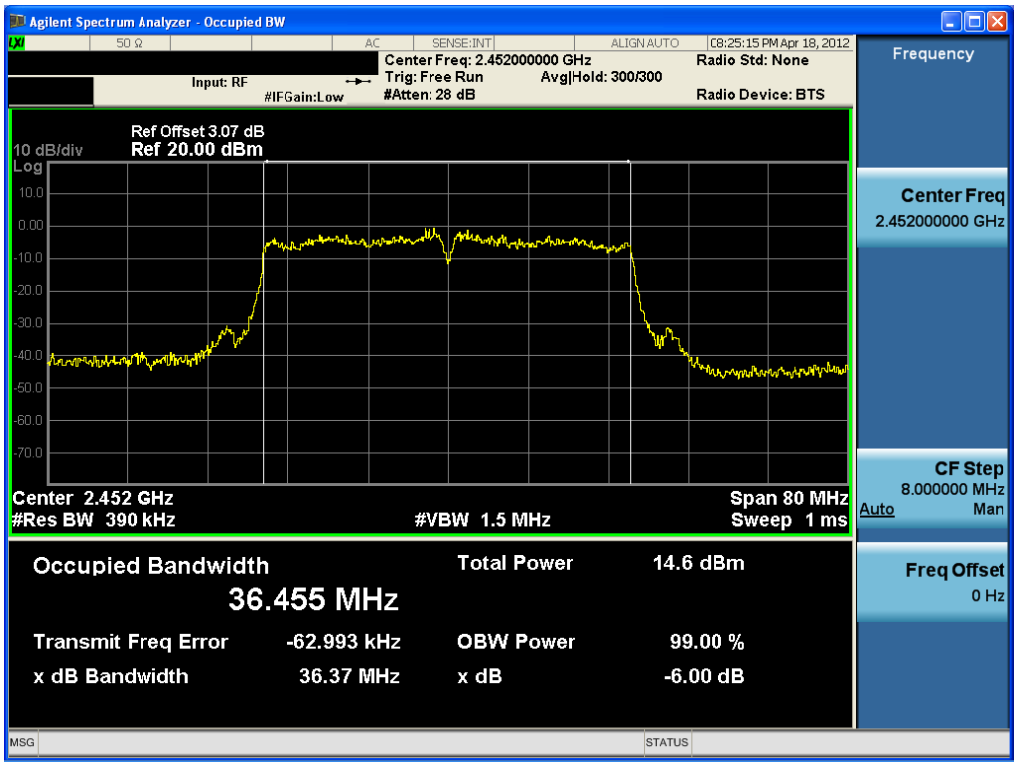
6 dB Bandwidth Test Mode: 802.11n(HT40) & MCS 7 & 2422MHz



6 dB Bandwidth Test Mode: 802.11n(HT40) & MCS 7 & 2437MHz



6 dB Bandwidth Test Mode: 802.11n(HT40) & MCS 7 & 2452MHz



7.2 Maximum Peak Conducted Output Power

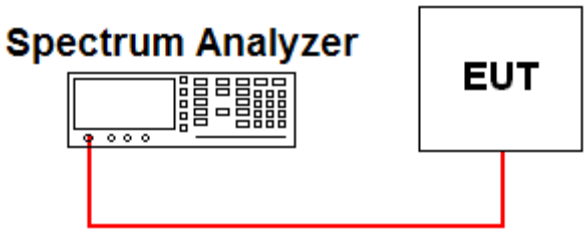
Test Requirements and limit, §15.247(d)

A transmitter antenna terminal of EUT is connected to the input of a spectrum analyzer.

Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

▣ TEST CONFIGURATION



Note: Tests were performed all possible data rates and the worst case data were reported.

▣ TEST PROCEDURE:

Maximum Peak Conducted Output Power is measured using Measurement Procedure PK2 of KDB558074.

1. Set the **RBW = 1 MHz**.
2. Set the **VBW = 3 MHz**.
3. Set the span to a value that is **5-30 %** greater than the EBW.
4. Detector = **peak**.
5. Sweep time = **auto couple**.
6. Trace mode = **max hold**.
7. Allow trace to fully stabilize.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at 1 MHz intervals extending across the EBW of the spectrum.

▣ TEST RESULTS: Comply

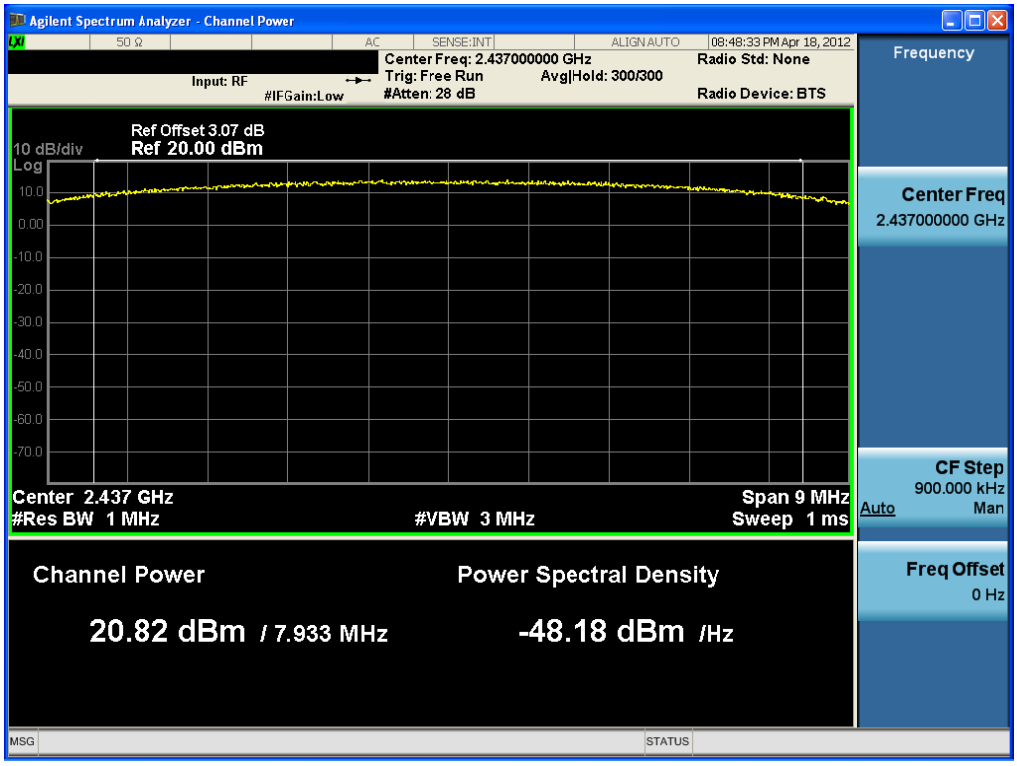
Test Mode	Data Rate	Test Results[dBm]		
		Lowest	Middle	Highest
802.11b	**11 Mbps**	***20.93***	20.82	20.85
802.11g	**54 Mbps**	19.57	***24.74***	19.50
802.11n(HT20)	**MCS 7**	18.29	***22.96***	18.15
802.11n(HT40)	**MCS 7**	15.61	***23.08***	15.86

Note : The cable loss was corrected using the offset value of the spectrum analyzer.

▣ RESULT PLOTS

Peak Output Power Test Mode: 802.11b & 11Mbps & 2412MHz

Peak Output Power Test Mode: 802.11b & 11Mbps & 2437MHz



Peak Output Power Test Mode: 802.11b & 11Mbps & 2462MHz

Peak Output Power Test Mode: 802.11g & 54Mbps & 2412MHz

Peak Output Power Test Mode: 802.11g & 54Mbps & 2437MHz

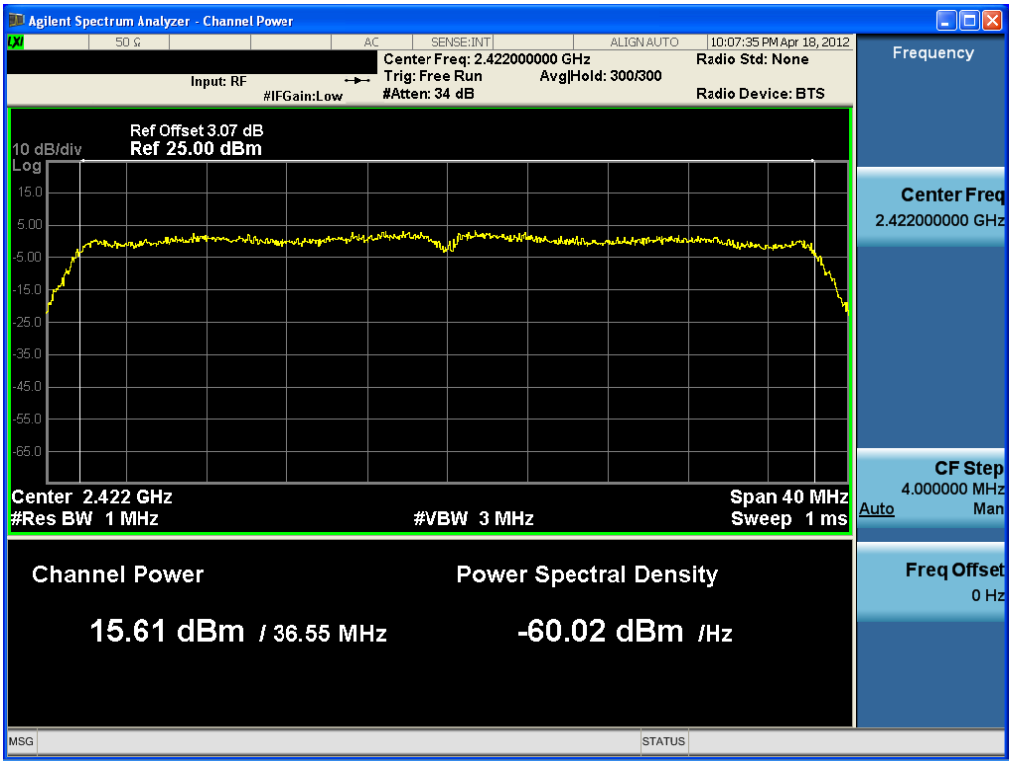
Peak Output Power Test Mode: 802.11g & 54Mbps & 2462MHz

Peak Output Power Test Mode: 802.11n(HT20) & MCS 7 & 2412MHz

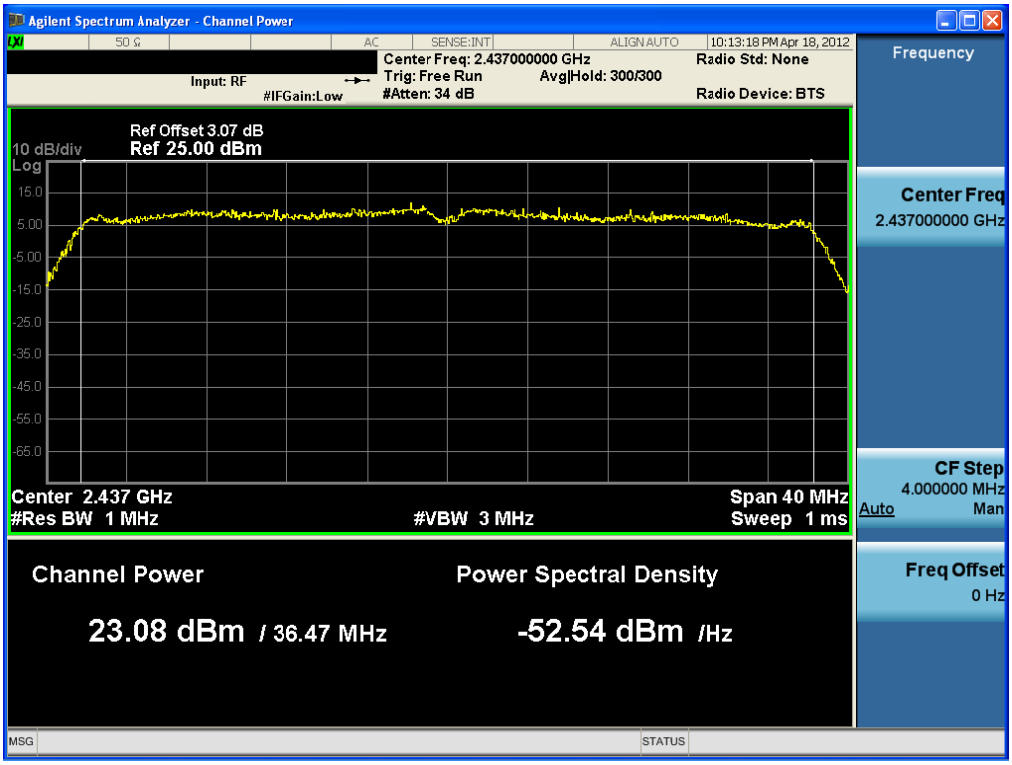
Peak Output Power Test Mode: 802.11n(HT20) & MCS 7 & 2437MHz

Peak Output Power Test Mode: 802.11n(HT20) & MCS 7 & 2462MHz

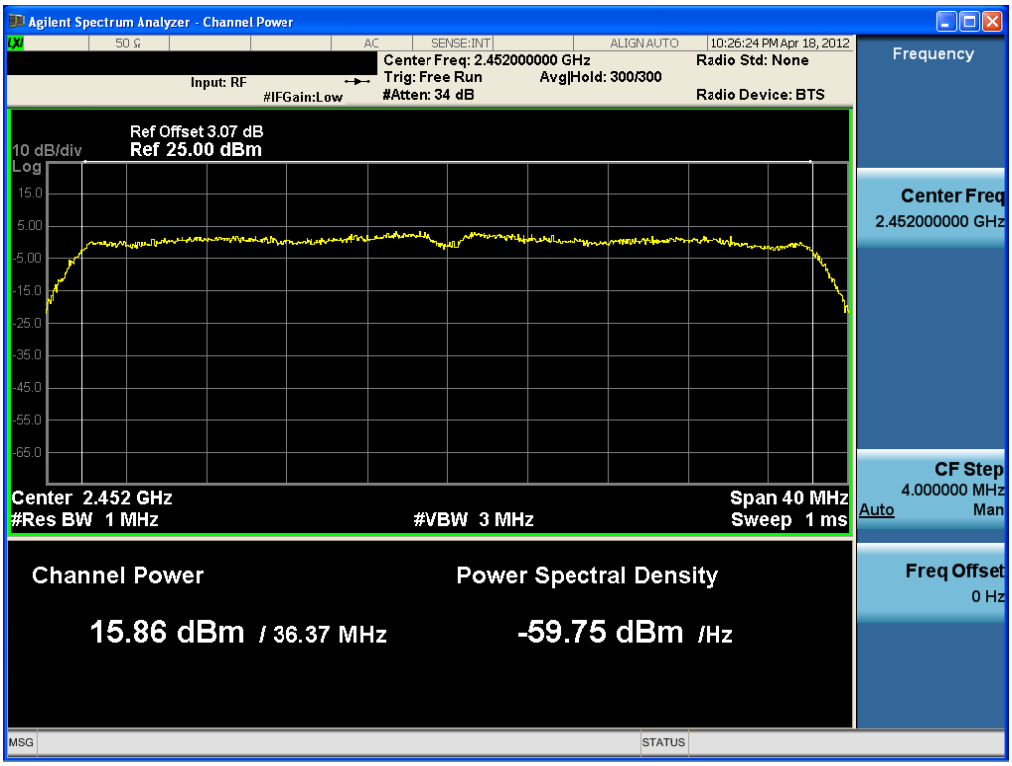
Peak Output Power Test Mode: 802.11n(HT40) & MCS 7 & 2422MHz



Peak Output Power Test Mode: 802.11n(HT40) & MCS 7 & 2437MHz



Peak Output Power Test Mode: 802.11n(HT40) & MCS 7 & 2452MHz



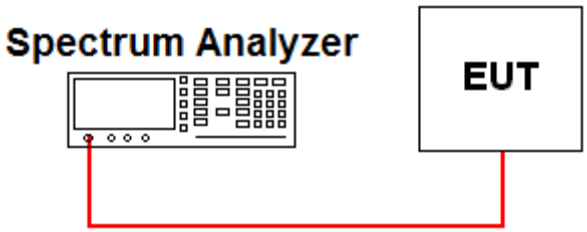
7.3 Maximum Power Spectral Density.

Test requirements and limit, §15.247(d)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard –specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE:

The Measurement Procedure **PKPSD of KDB558074** is used.
1. Set the **RBW = 100 kHz**.
2. Set the **VBW ≥ 300 kHz**.
3. Set the span to **5-30 %** greater than the EBW.
4. Detector = **peak**.
5. Sweep time = **auto couple**.
6. Trace mode = **max hold**.
7. Allow trace to fully stabilize.
8. Use the **peak marker function** to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
9. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where **BWCF = 10log (3 kHz/100 kHz = -15.2 dB)**.
10. The resulting peak PSD level must be ≤ 8 dBm.

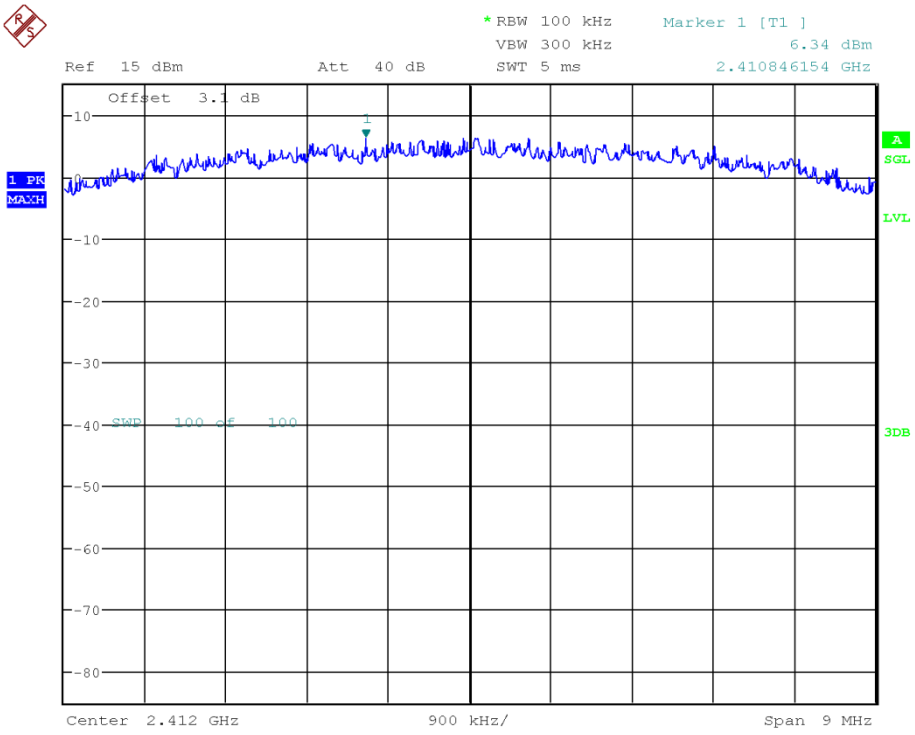
▣ TEST RESULTS: Comply

Test Mode	Data Rate	Frequency [MHz]	S/A Reading [dBm]	B.W.C.F [dB]	PKPSD [dBm]
802.11b	11Mbps	2412	6.34	-15.2	-8.86
		2437	6.72	-15.2	-8.48
		2462	6.28	-15.2	-8.92
802.11g	54Mbps	2412	0.99	-15.2	-14.21
		2437	5.88	-15.2	-9.32
		2462	0.17	-15.2	-15.03
802.11n(HT20)	MCS 7	2412	-0.38	-15.2	-15.58
		2437	4.44	-15.2	-10.76
		2462	-0.98	-15.2	-16.18
802.11n(HT40)	MCS 7	2422	-5.53	-15.2	-20.73
		2437	1.39	-15.2	-13.81
		2452	-6.27	-15.2	-21.47

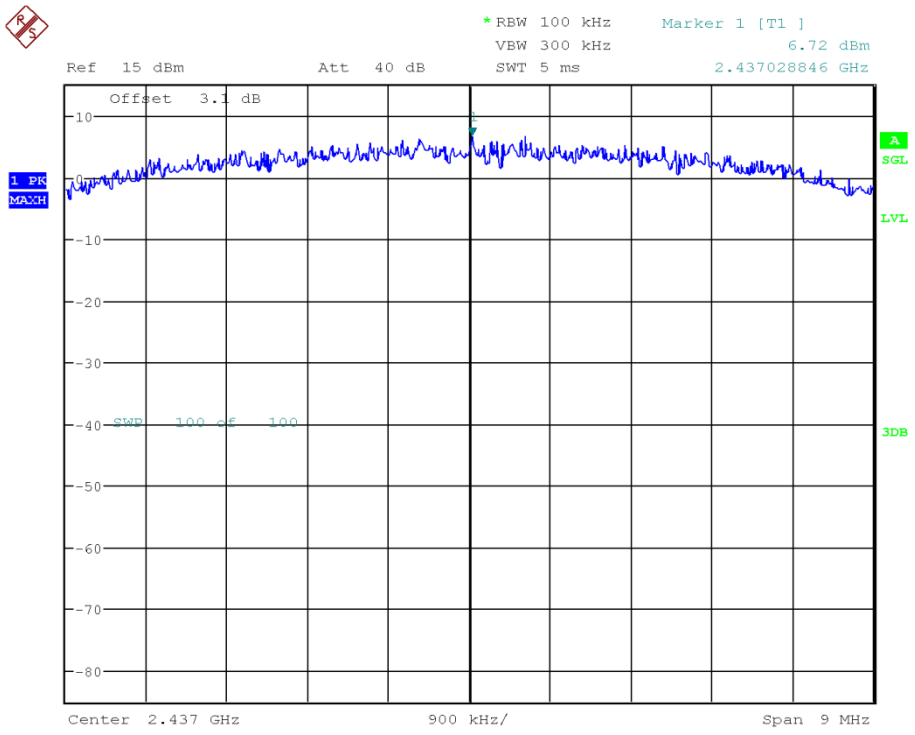
Note : The cable loss was corrected using the offset value of the spectrum analyzer.

▣ RESULT PLOTS

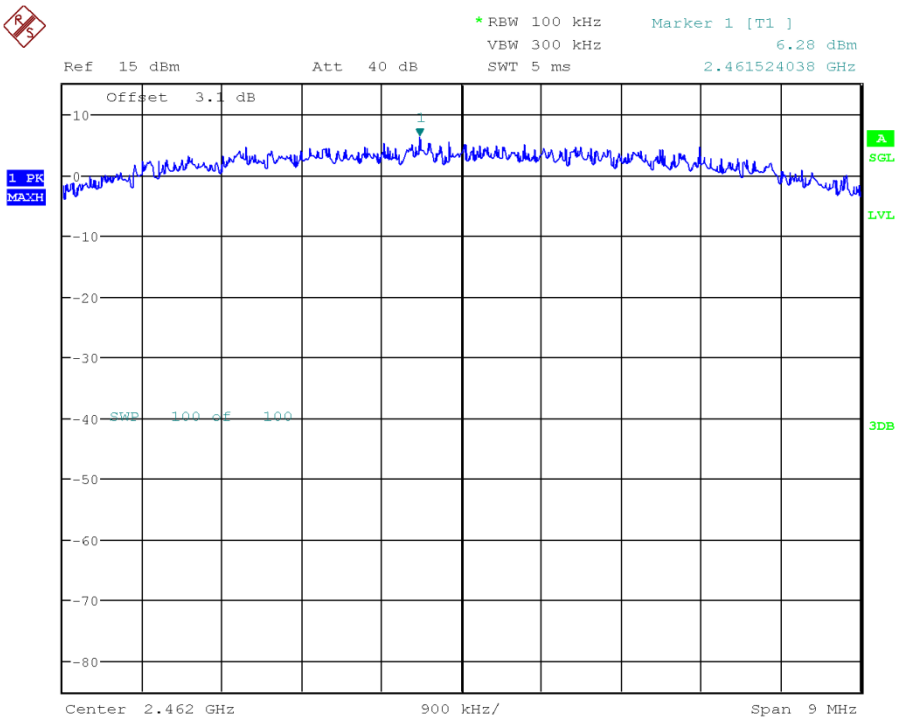
Maximum PKPSD Test Mode: 802.11b & 11Mbps & 2412MHz



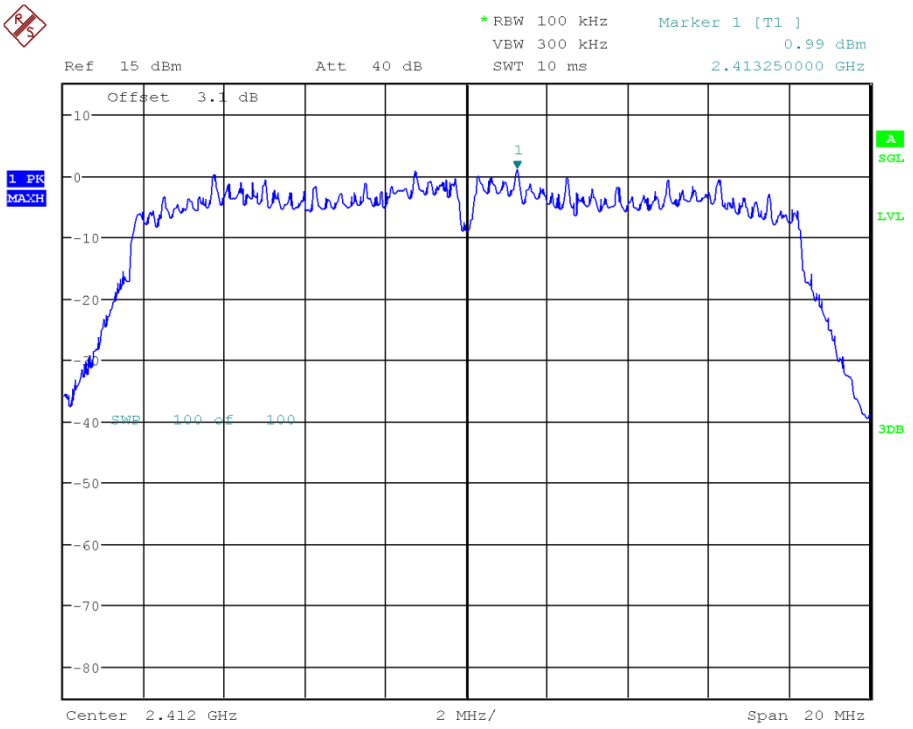
Maximum PKPSD Test Mode: 802.11b & 11Mbps & 2437MHz



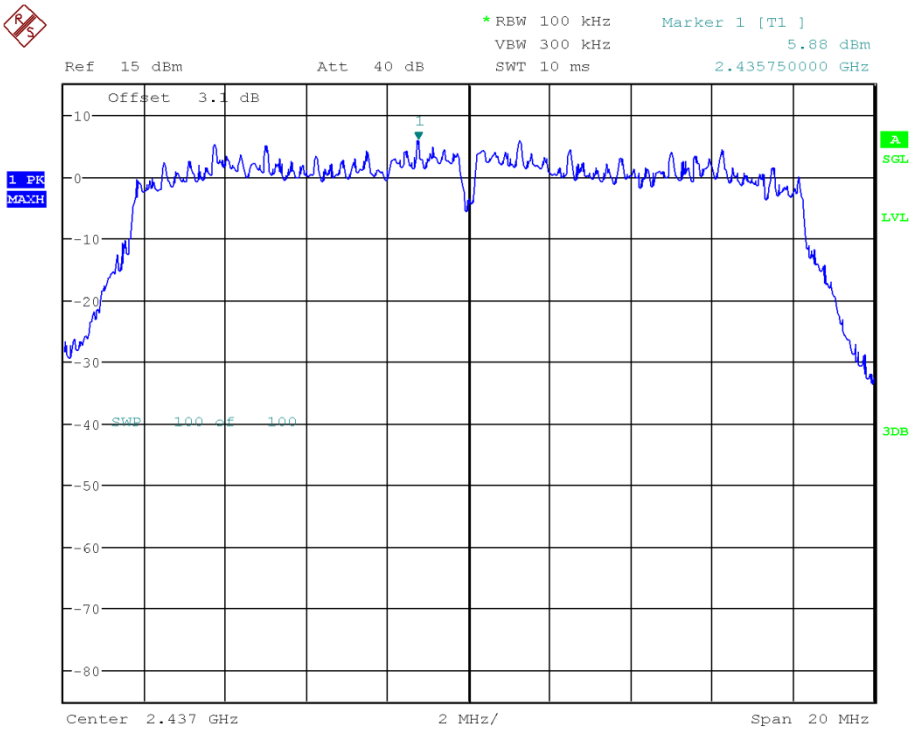
Maximum PKPSD Test Mode: 802.11b & 11Mbps & 2462MHz



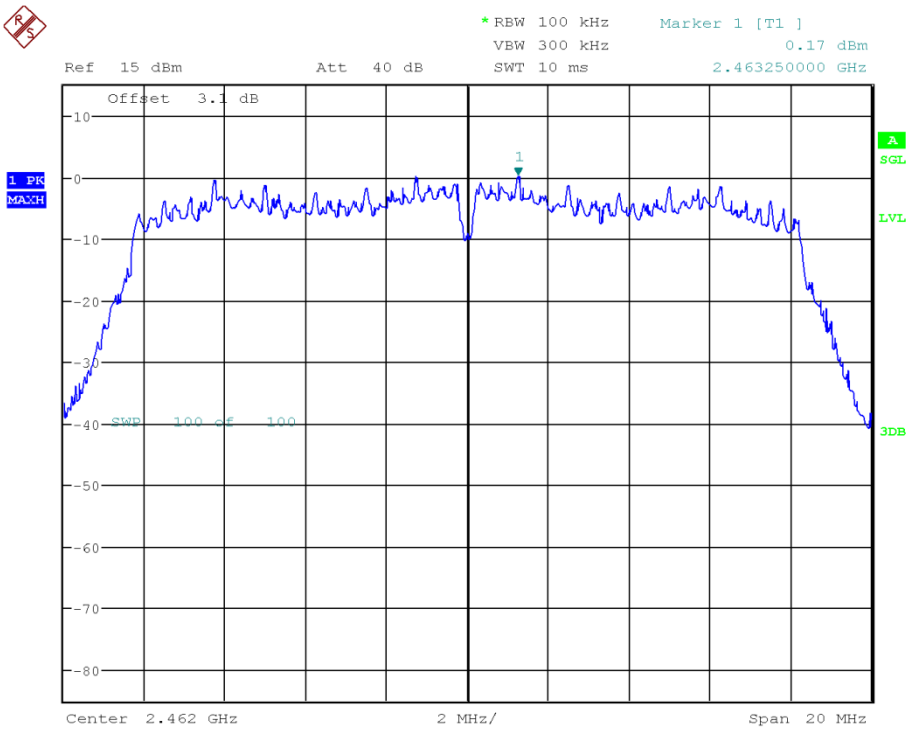
Maximum PKPSD Test Mode: 802.11g & 54Mbps & 2412MHz



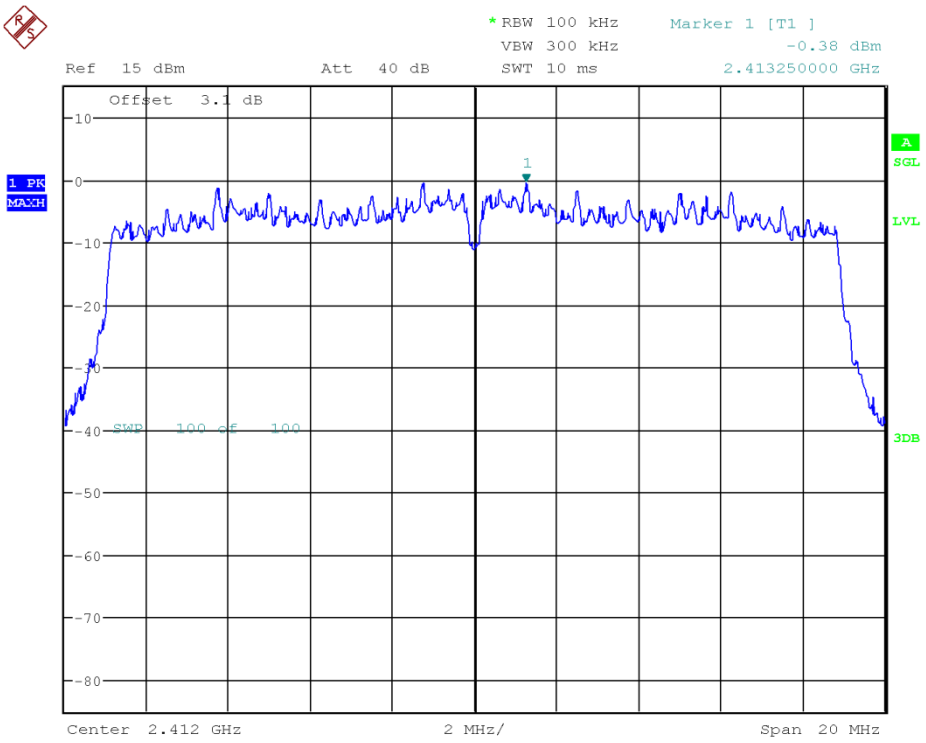
Maximum PKPSD Test Mode: 802.11g & 54Mbps & 2437MHz



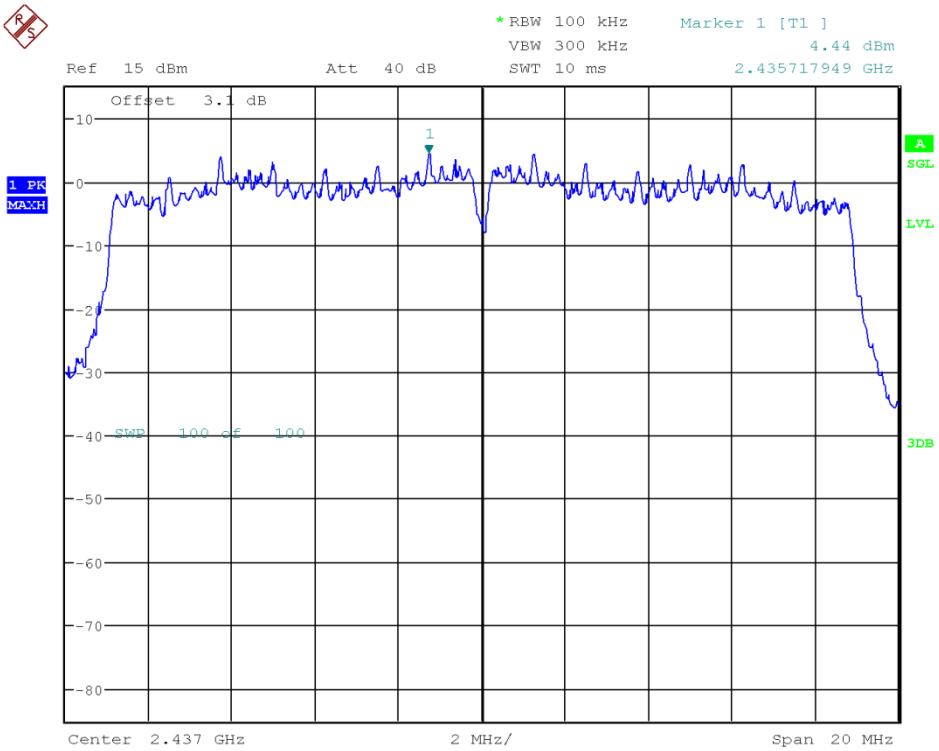
Maximum PKPSD Test Mode: 802.11g & 54Mbps & 2462MHz



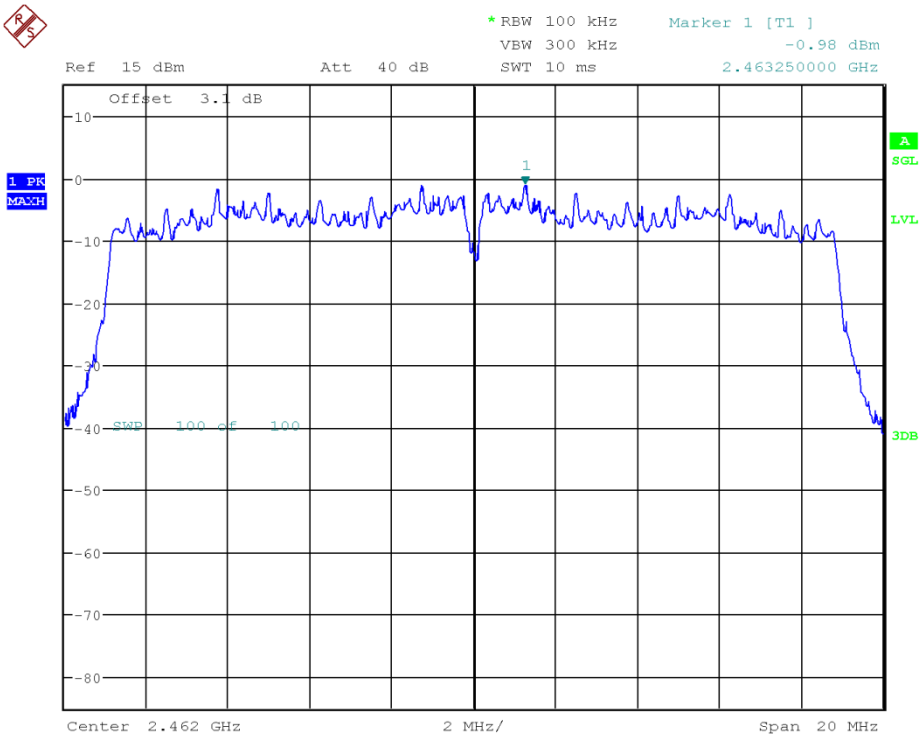
Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 7 & 2412MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 4 & 2437MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 7 & 2462MHz



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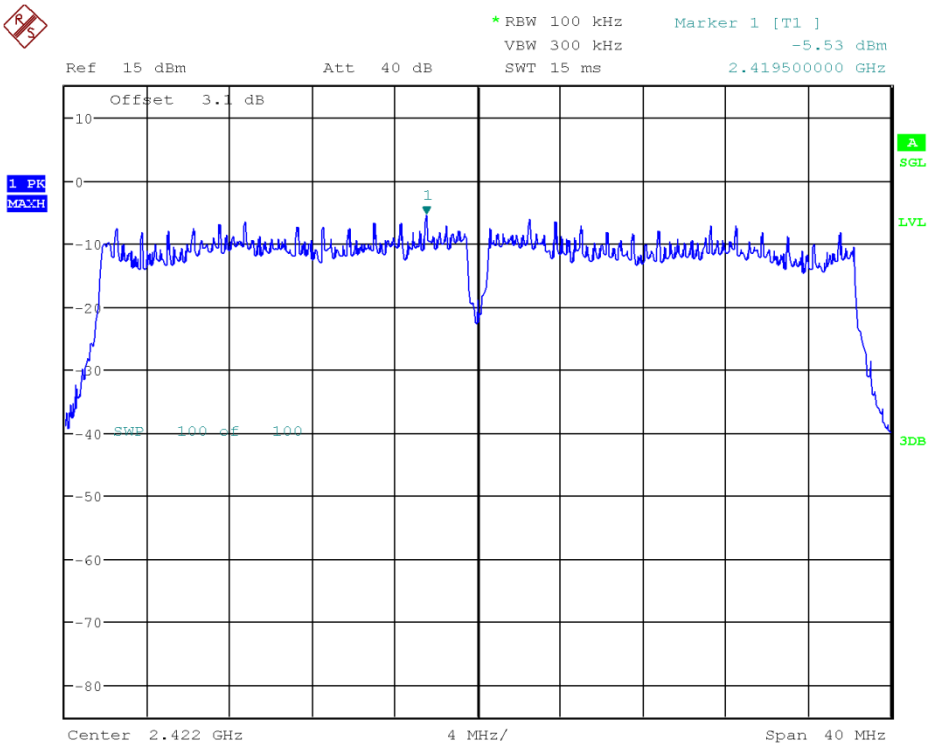
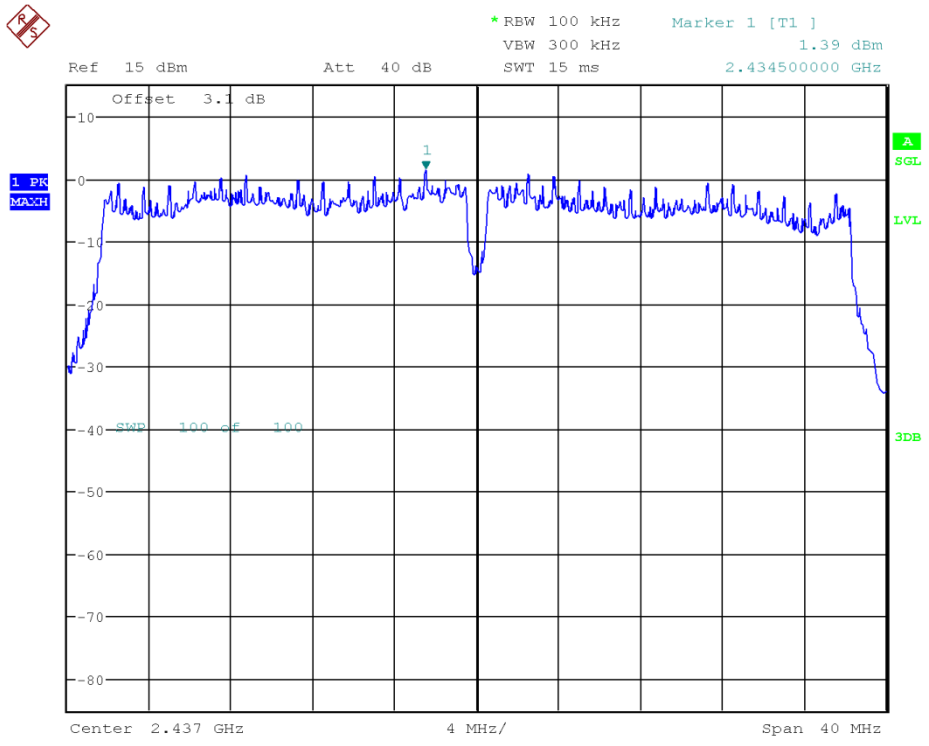
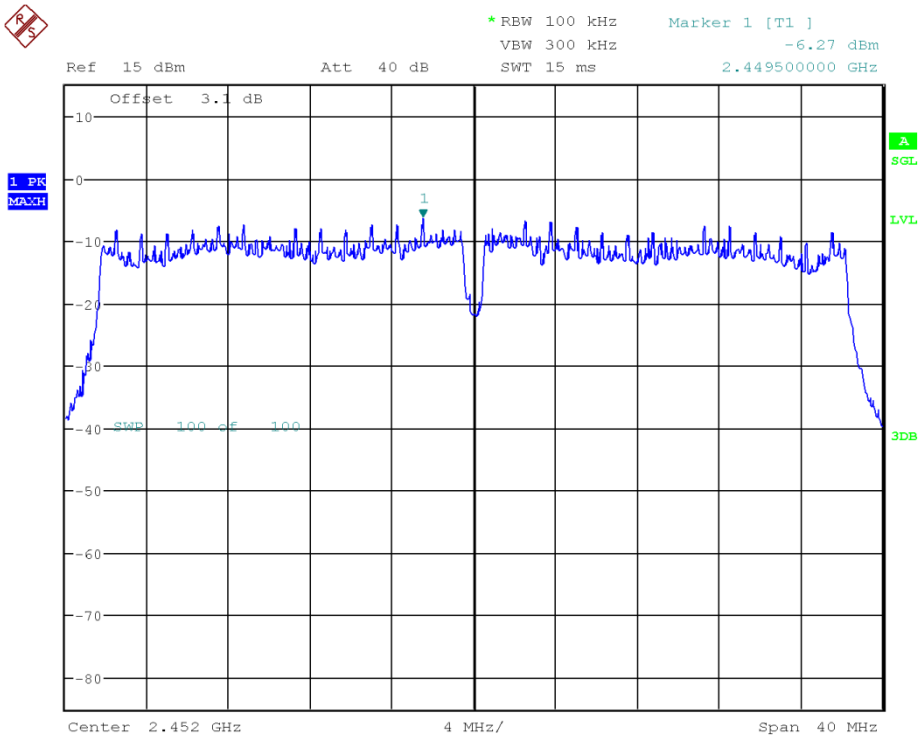


Maximum PKPSD Test Mode: 802.11n(HT40) & MCS 4 & 2437MHz



Maximum PKPSD Test Mode: 802.11n(HT40) & MCS 7 & 2452MHz



7.4 Out of Band Emissions at the Band Edge/ Conducted Spurious Emissions

Test requirements and limit, §15.247(d)

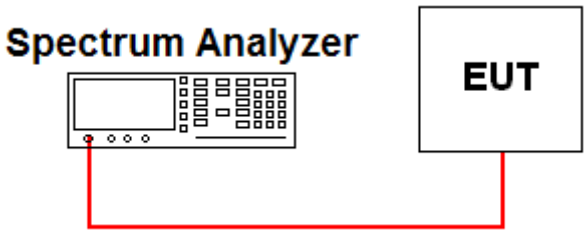
§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured inband average PSD level.

In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level

1. Set the **RBW = 100 kHz**.
2. Set the **VBW ≥ 300 kHz**.
3. Set the span to **5-30 %** greater than the EBW.
4. Detector = **peak**.
5. Sweep time = **auto couple**.
6. Trace mode = **max hold**.
7. Allow trace to fully stabilize.
8. Use the **peak marker function** to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
   Next, **determine the power** in 100 kHz band segments outside of the authorized frequency band using the following measurement:

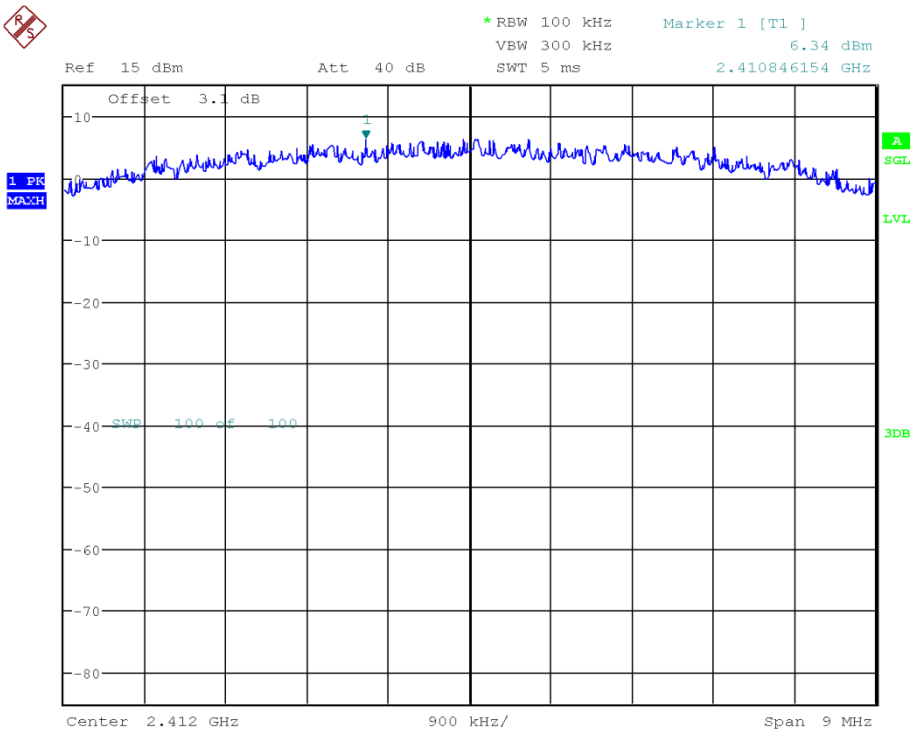
- Measurement Procedure 2 - Unwanted Emissions

1. Set **RBW = 100 kHz**.
2. Set **VBW ≥ 300 kHz**.
3. Set **span to encompass the spectrum** to be examined.
4. Detector = **peak**.
5. Trace Mode = **max hold**.
6. Sweep = **auto couple**.
7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

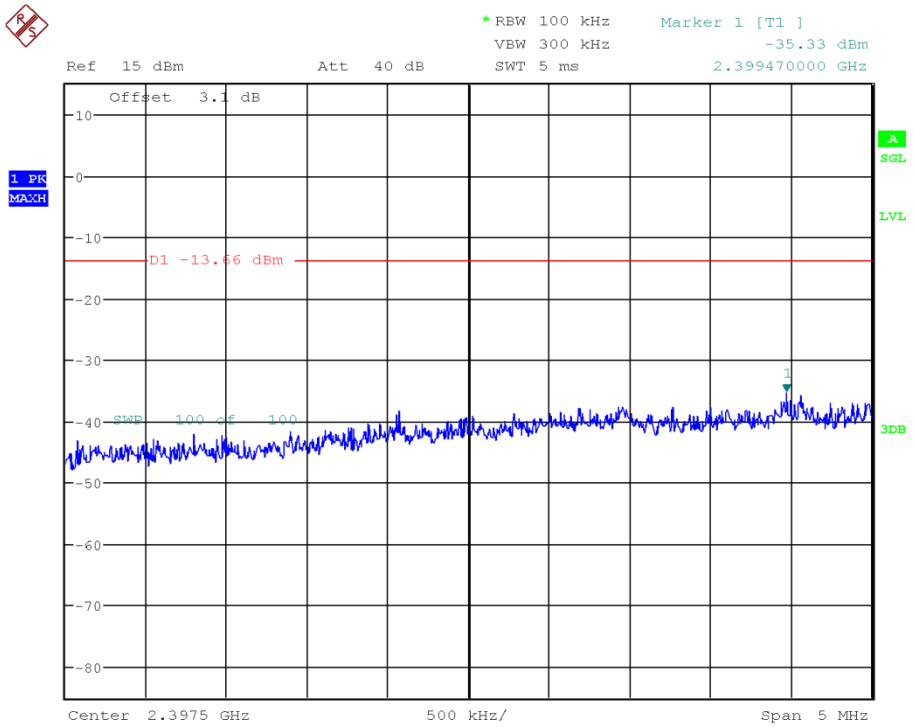
▣ RESULT PLOTS

802.11b & 11Mbps & 2412MHz

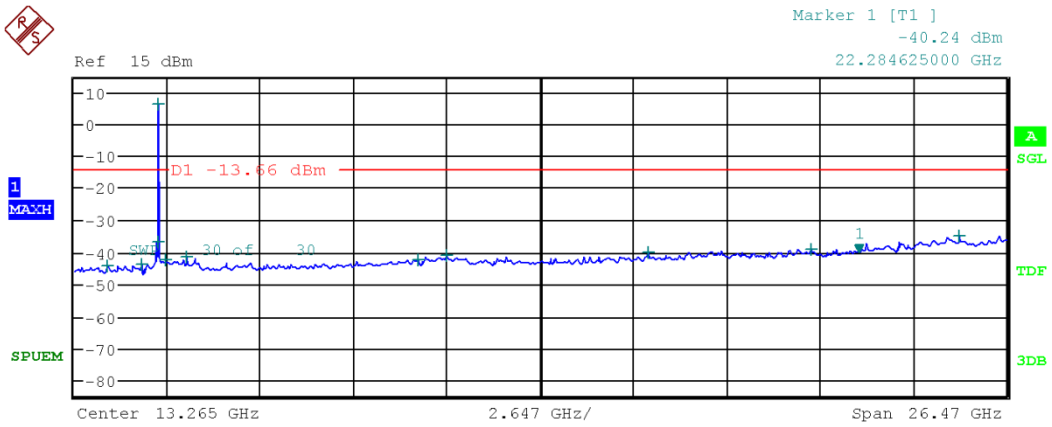
Reference



Low Band-edge



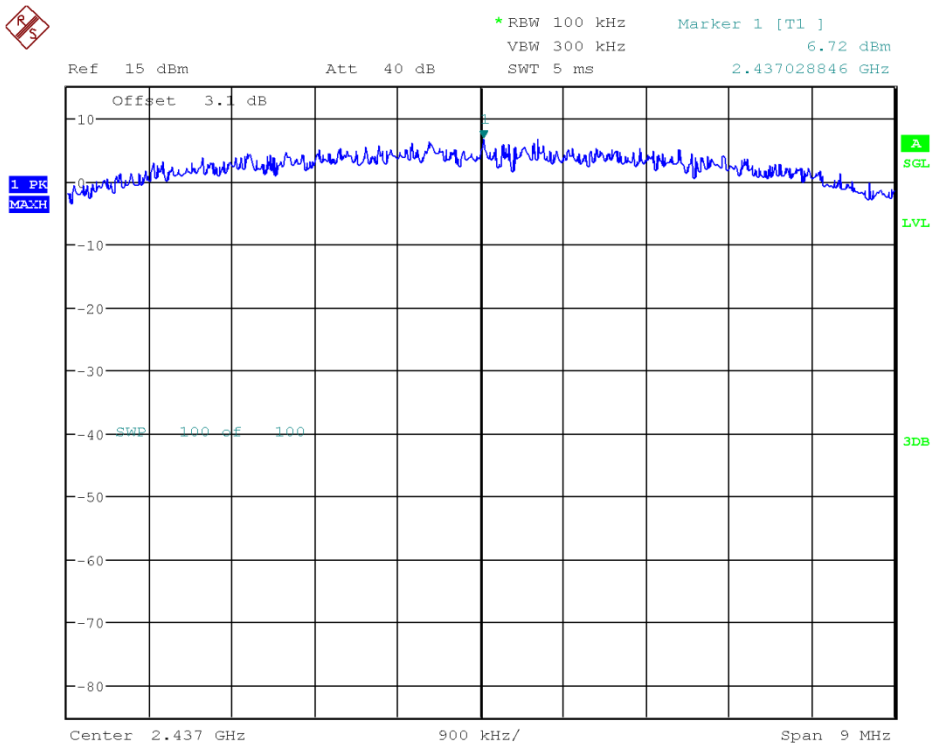
Conducted Spurious Emissions



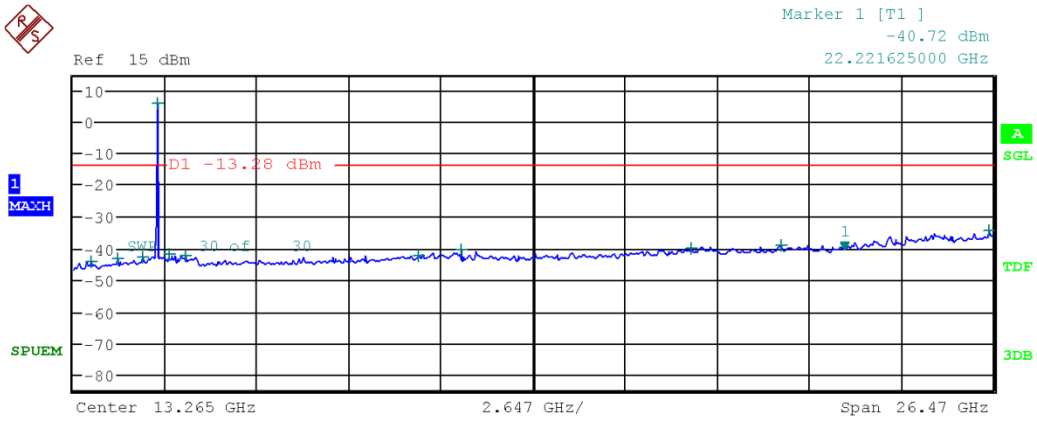
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	965.080000 M	-44.25	-200.00
1.000 G	2.000 G	100.00 k	1.939600 G	-44.15	-200.00
2.000 G	2.400 G	100.00 k	2.398667 G	-37.05	-200.00
2.400 G	2.483 G	100.00 k	2.412558 G	6.19	-200.00
2.483 G	3.000 G	100.00 k	2.620258 G	-42.67	-200.00
3.000 G	6.000 G	100.00 k	3.216000 G	-41.74	-200.00
6.000 G	10.000 G	100.00 k	9.777500 G	-42.35	-200.00
10.000 G	14.000 G	100.00 k	10.604500 G	-41.33	-200.00
14.000 G	18.000 G	100.00 k	16.318500 G	-40.27	-200.00
18.000 G	22.000 G	100.00 k	20.951500 G	-39.00	-200.00
22.000 G	26.500 G	100.00 k	25.153375 G	-35.07	-200.00

802.11b & 11Mbps & 2437MHz

Reference



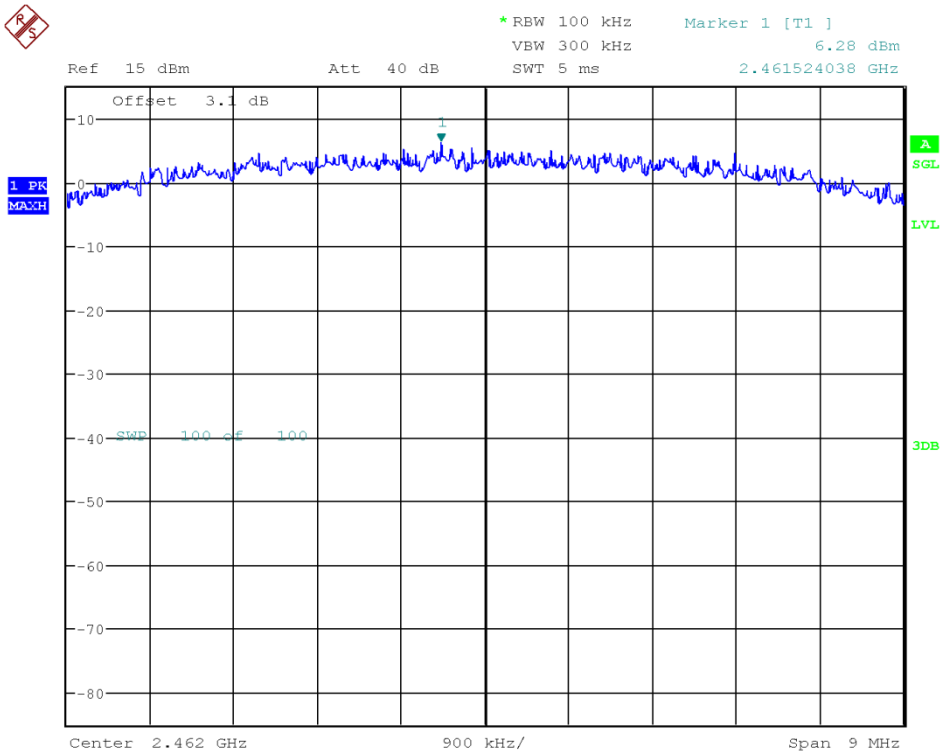
Conducted Spurious Emissions



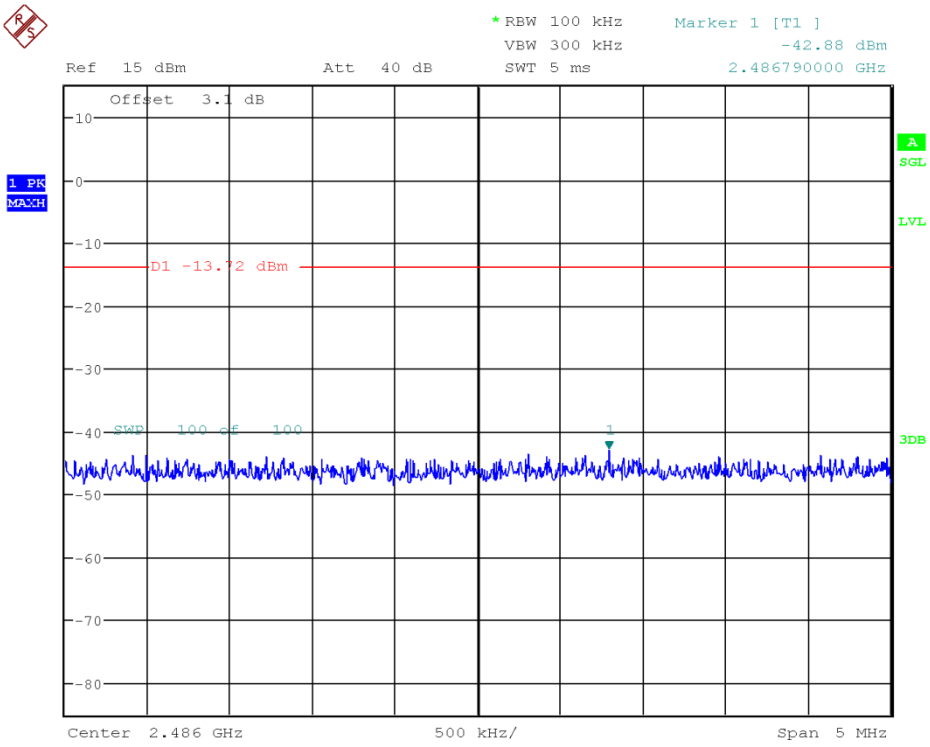
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	550.890000 M	-44.16	-200.00
1.000 G	2.000 G	100.00 k	1.308800 G	-43.64	-200.00
2.000 G	2.400 G	100.00 k	2.042578 G	-43.05	-200.00
2.400 G	2.483 G	100.00 k	2.436439 G	5.91	-200.00
2.483 G	3.000 G	100.00 k	2.801951 G	-42.21	-200.00
3.000 G	6.000 G	100.00 k	3.249375 G	-42.40	-200.00
6.000 G	10.000 G	100.00 k	9.944500 G	-42.33	-200.00
10.000 G	14.000 G	100.00 k	11.185500 G	-40.81	-200.00
14.000 G	18.000 G	100.00 k	17.789000 G	-40.07	-200.00
18.000 G	22.000 G	100.00 k	20.371000 G	-39.27	-200.00
22.000 G	26.500 G	100.00 k	26.354312 G	-34.71	-200.00

802.11b & 11Mbps & 2462MHz

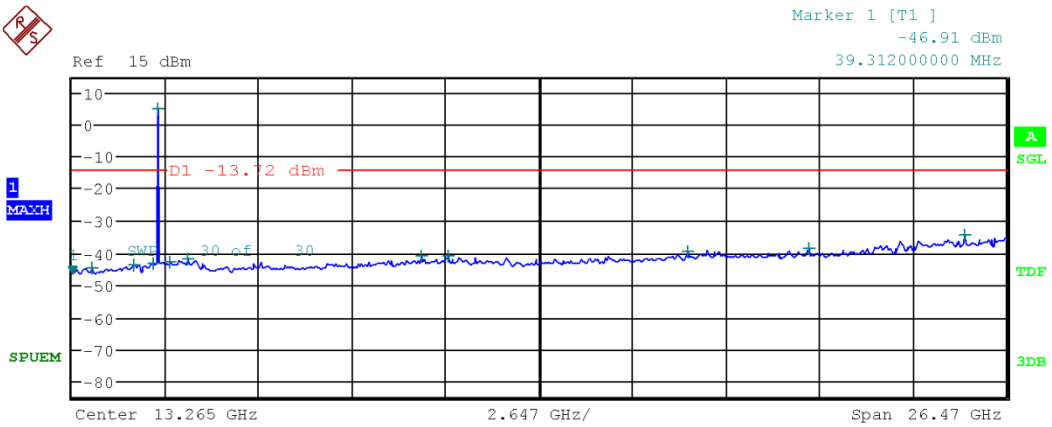
Reference



High Band-edge



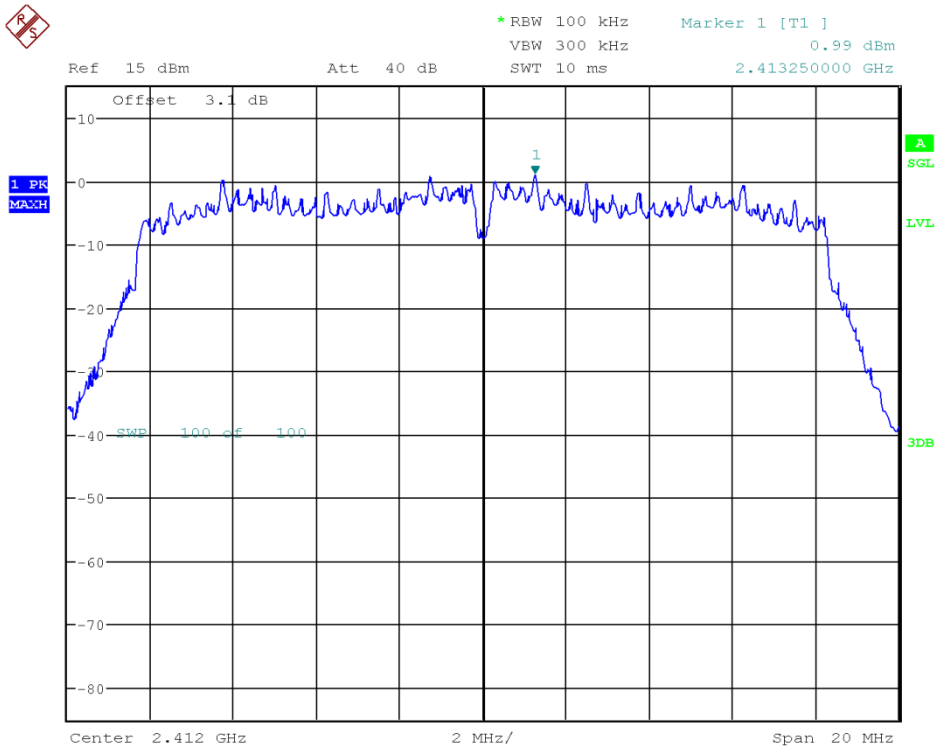
Conducted Spurious Emissions



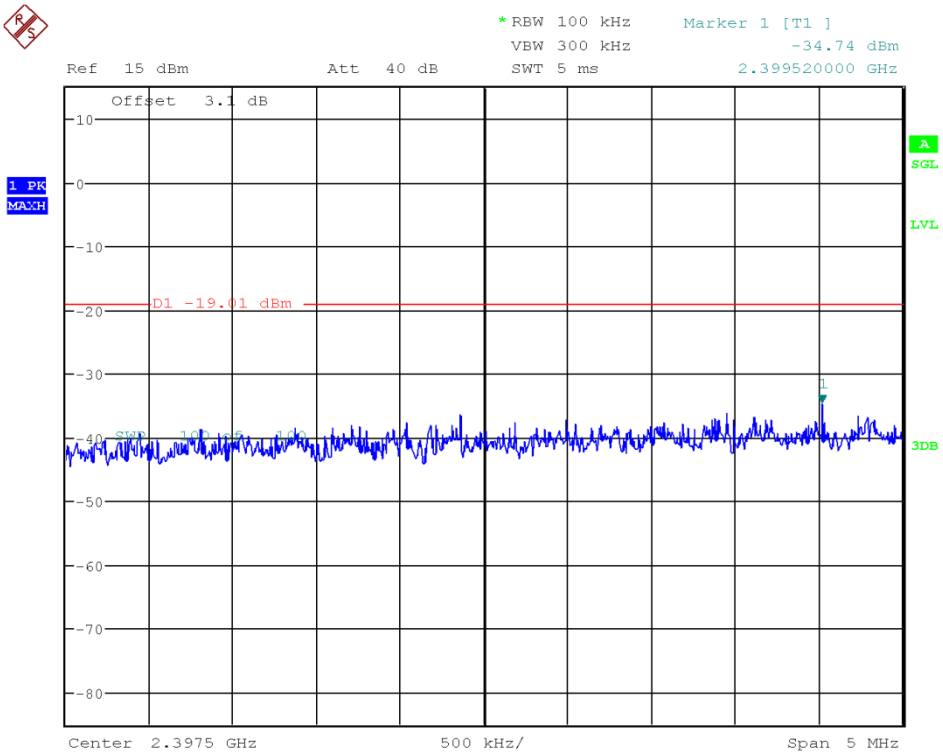
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	581.154000 M	-44.74	-200.00
1.000 G	2.000 G	100.00 k	1.763000 G	-43.69	-200.00
2.000 G	2.400 G	100.00 k	2.324756 G	-43.22	-200.00
2.400 G	2.483 G	100.00 k	2.462341 G	4.93	-200.00
2.483 G	3.000 G	100.00 k	2.793457 G	-42.85	-200.00
3.000 G	6.000 G	100.00 k	3.282750 G	-41.96	-200.00
6.000 G	10.000 G	100.00 k	9.910000 G	-41.28	-200.00
10.000 G	14.000 G	100.00 k	10.664500 G	-41.24	-200.00
14.000 G	18.000 G	100.00 k	17.450000 G	-39.77	-200.00
18.000 G	22.000 G	100.00 k	20.894000 G	-38.86	-200.00
22.000 G	26.500 G	100.00 k	25.295125 G	-34.72	-200.00

802.11g & 54Mbps & 2412MHz

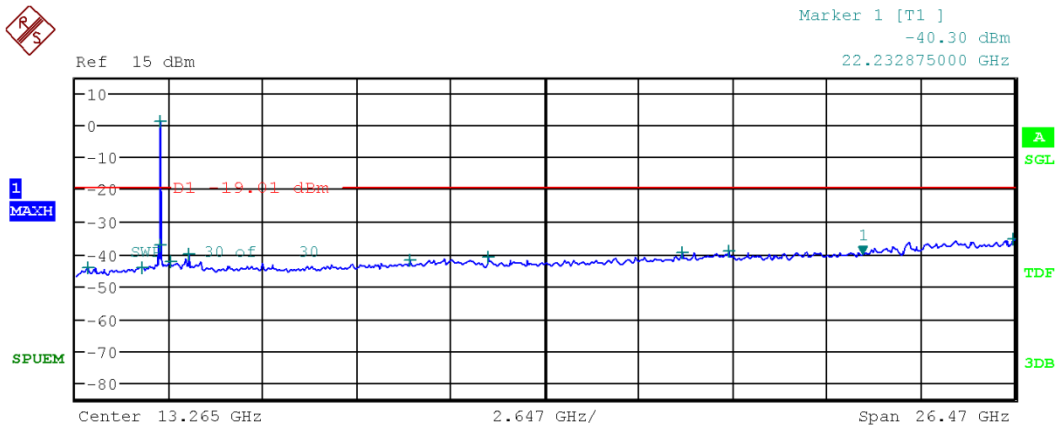
Reference



Low Band-edge



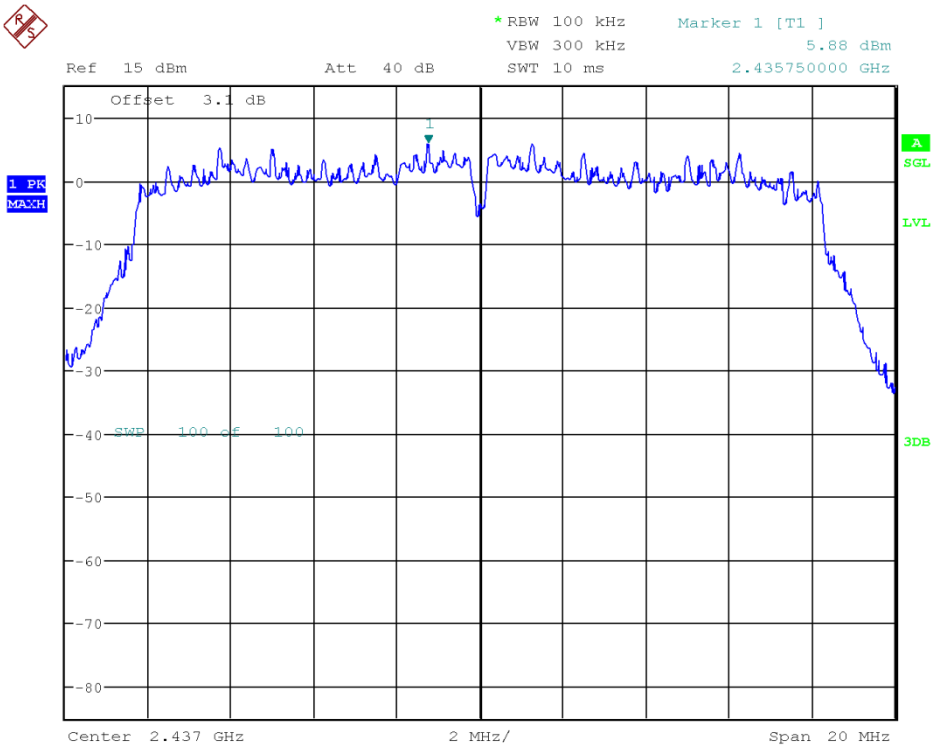
Conducted Spurious Emissions



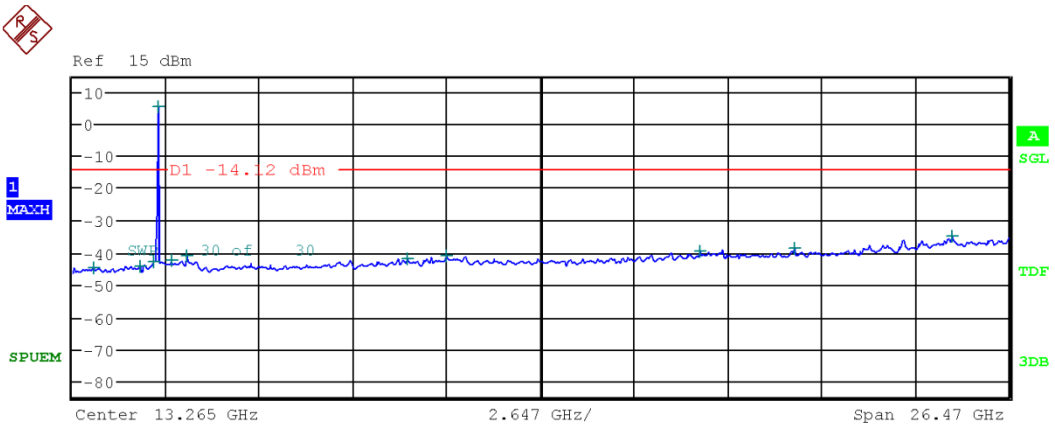
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	368.336000 M	-44.55	-200.00
1.000 G	2.000 G	100.00 k	1.904000 G	-44.29	-200.00
2.000 G	2.400 G	100.00 k	2.399689 G	-37.15	-200.00
2.400 G	2.483 G	100.00 k	2.413243 G	0.97	-200.00
2.483 G	3.000 G	100.00 k	2.701980 G	-42.67	-200.00
3.000 G	6.000 G	100.00 k	3.216000 G	-39.98	-200.00
6.000 G	10.000 G	100.00 k	9.464000 G	-42.18	-200.00
10.000 G	14.000 G	100.00 k	11.673000 G	-41.18	-200.00
14.000 G	18.000 G	100.00 k	17.135500 G	-39.72	-200.00
18.000 G	22.000 G	100.00 k	18.421000 G	-39.46	-200.00
22.000 G	26.500 G	100.00 k	26.447125 G	-35.69	-200.00

802.11g & 54Mbps & 2437MHz

Reference



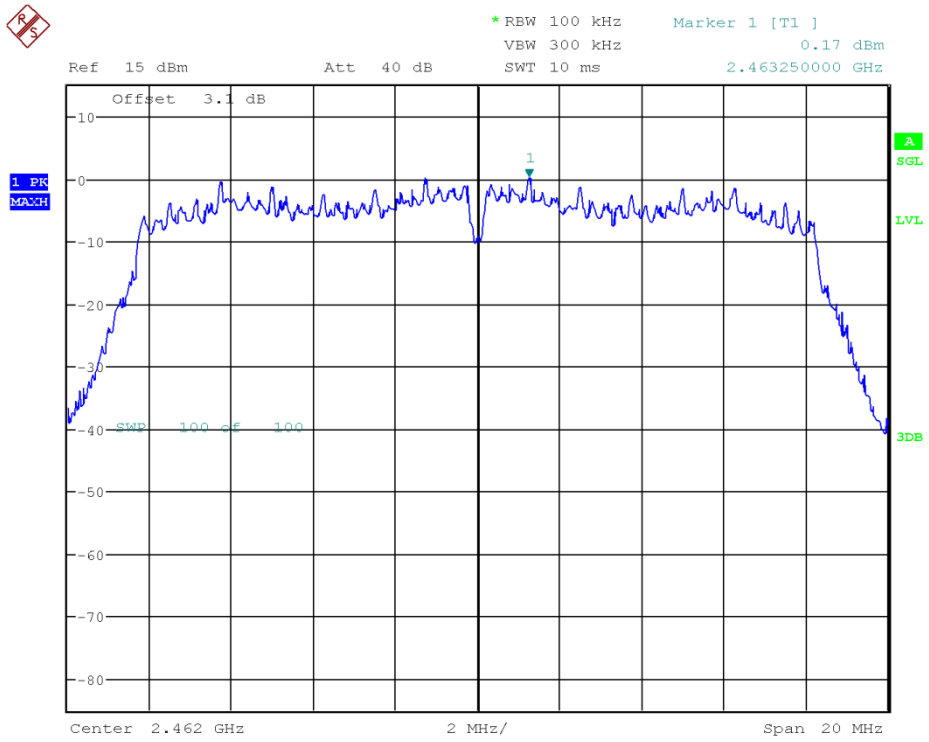
Conducted Spurious Emissions



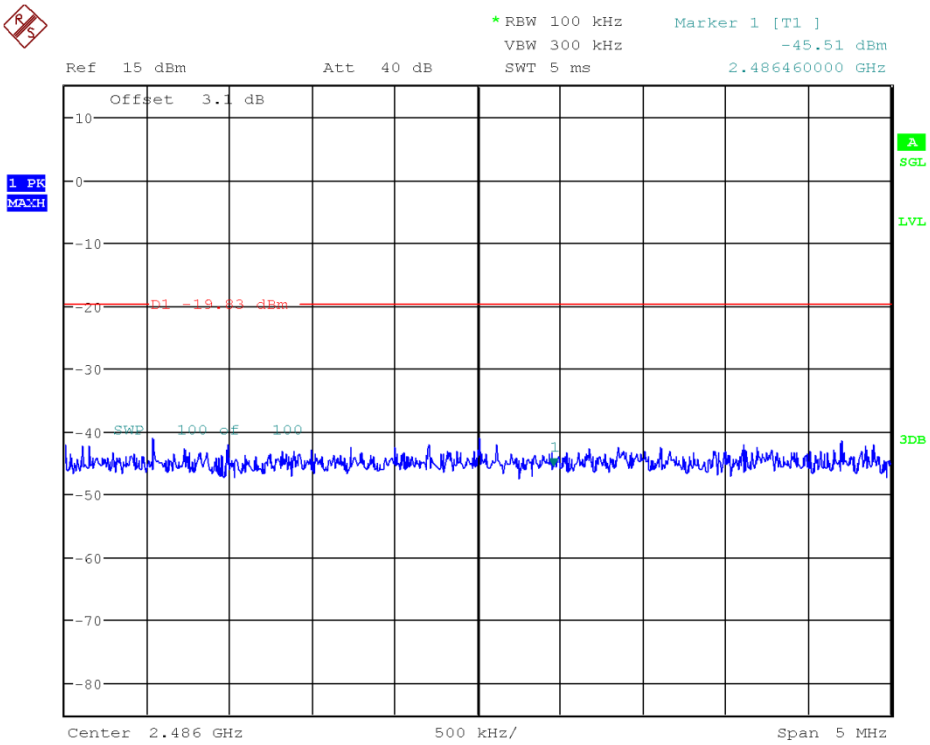
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	619.372000 M	-44.66	-200.00
1.000 G	2.000 G	100.00 k	1.918400 G	-44.23	-200.00
2.000 G	2.400 G	100.00 k	2.331778 G	-42.75	-200.00
2.400 G	2.483 G	100.00 k	2.438243 G	5.41	-200.00
2.483 G	3.000 G	100.00 k	2.826513 G	-42.48	-200.00
3.000 G	6.000 G	100.00 k	3.249375 G	-40.96	-200.00
6.000 G	10.000 G	100.00 k	9.473000 G	-42.11	-200.00
10.000 G	14.000 G	100.00 k	10.584000 G	-41.08	-200.00
14.000 G	18.000 G	100.00 k	17.755000 G	-39.80	-200.00
18.000 G	22.000 G	100.00 k	20.418000 G	-38.78	-200.00
22.000 G	26.500 G	100.00 k	24.877188 G	-35.21	-200.00

802.11g & 54Mbps & 2462MHz

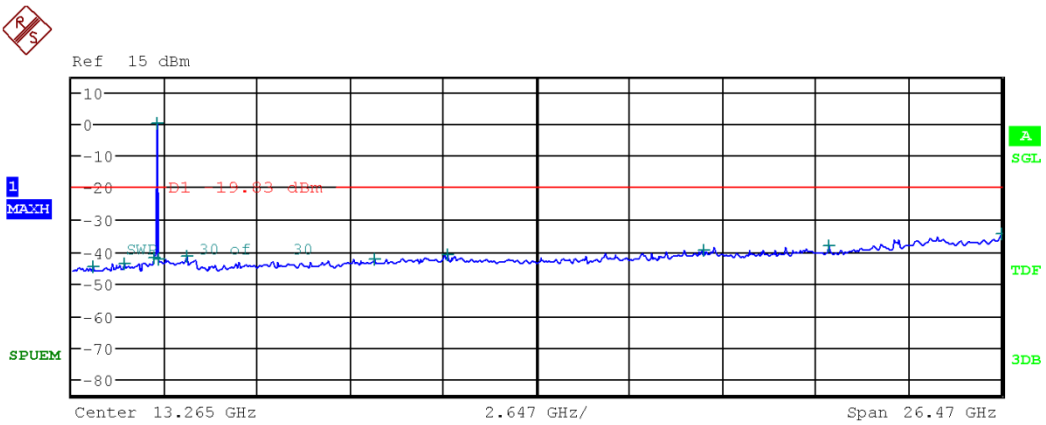
Reference



High Band-edge



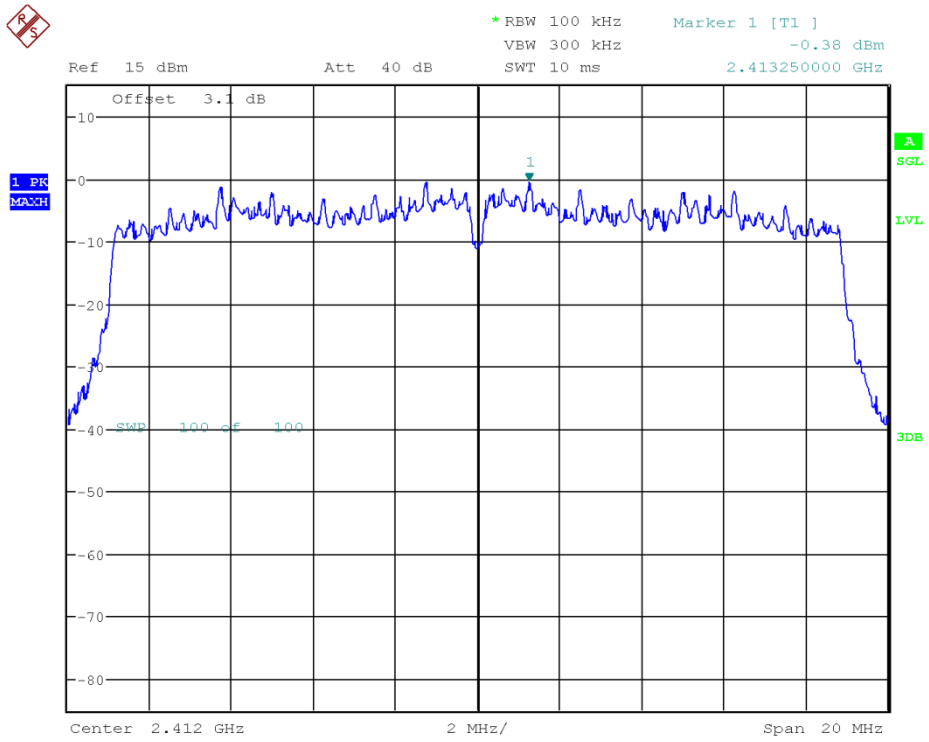
Conducted Spurious Emissions



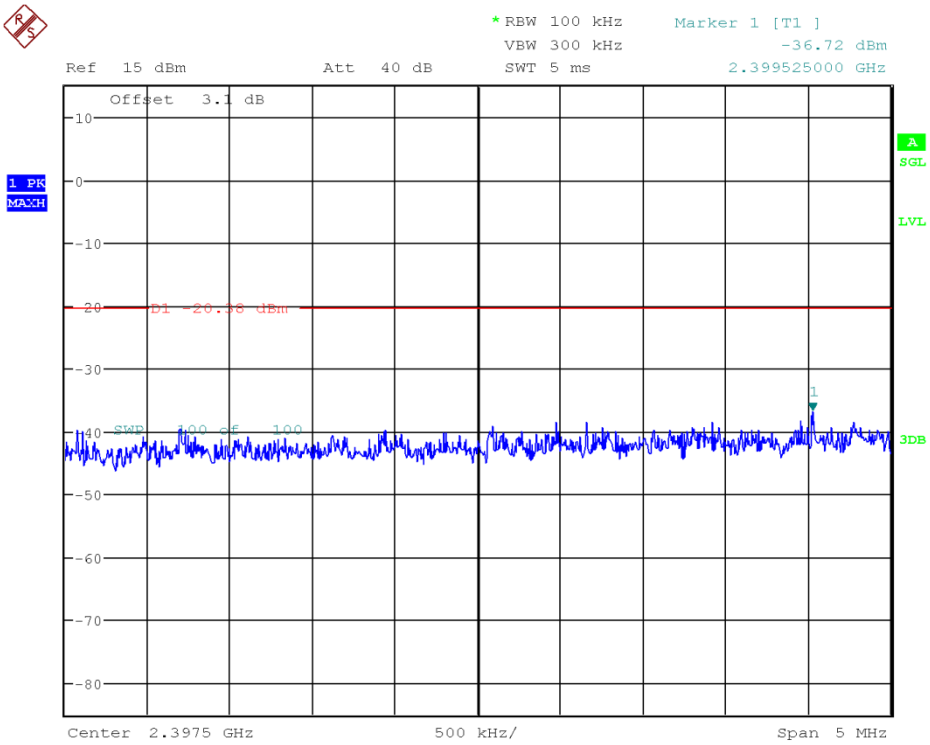
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	616.462000 M	-44.75	-200.00
1.000 G	2.000 G	100.00 k	1.516200 G	-43.86	-200.00
2.000 G	2.400 G	100.00 k	2.367467 G	-42.22	-200.00
2.400 G	2.483 G	100.00 k	2.463243 G	0.17	-200.00
2.483 G	3.000 G	100.00 k	2.486943 G	-42.31	-200.00
3.000 G	6.000 G	100.00 k	3.282750 G	-41.37	-200.00
6.000 G	10.000 G	100.00 k	8.639500 G	-42.34	-200.00
10.000 G	14.000 G	100.00 k	10.709500 G	-41.00	-200.00
14.000 G	18.000 G	100.00 k	17.997500 G	-39.81	-200.00
18.000 G	22.000 G	100.00 k	21.582500 G	-38.08	-200.00
22.000 G	26.500 G	100.00 k	26.482000 G	-34.67	-200.00

802.11n(HT20) & MCS 7 & 2412MHz

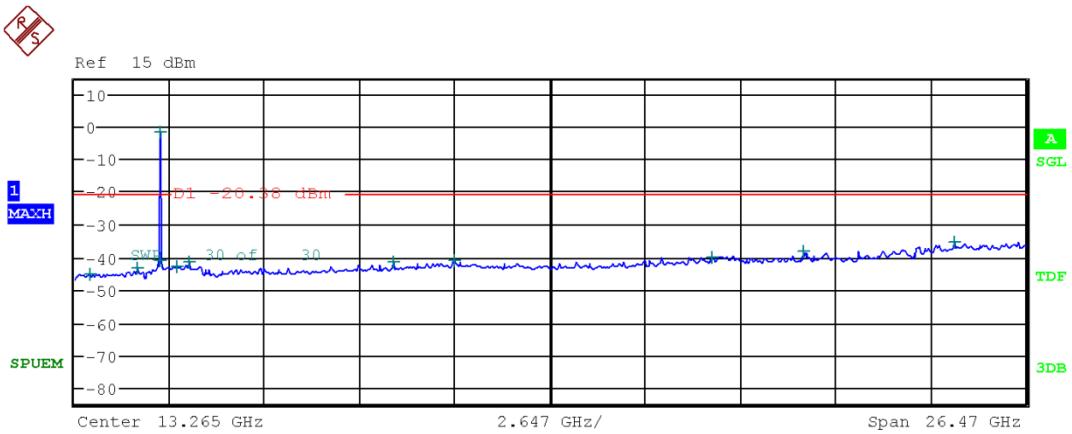
Reference



Low Band-edge



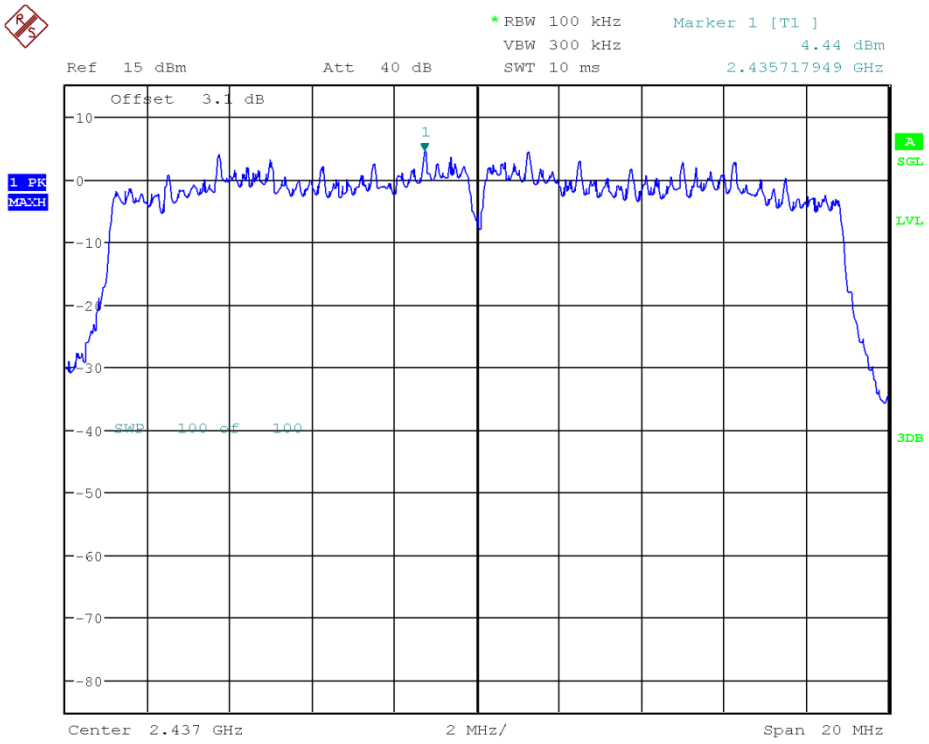
Conducted Spurious Emissions



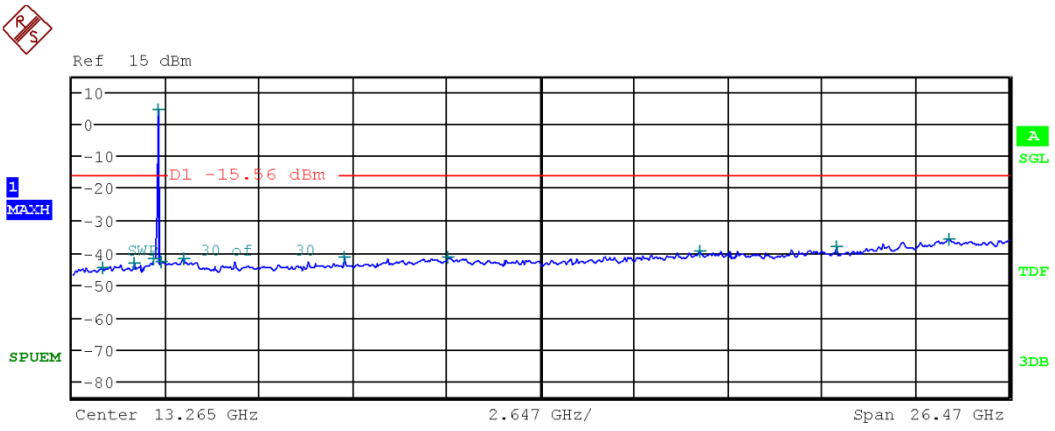
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	452.920000 M	-45.25	-200.00
1.000 G	2.000 G	100.00 k	1.757600 G	-43.64	-200.00
2.000 G	2.400 G	100.00 k	2.398578 G	-40.88	-200.00
2.400 G	2.483 G	100.00 k	2.410755 G	-1.49	-200.00
2.483 G	3.000 G	100.00 k	2.863185 G	-42.80	-200.00
3.000 G	6.000 G	100.00 k	3.216000 G	-41.39	-200.00
6.000 G	10.000 G	100.00 k	8.912000 G	-41.80	-200.00
10.000 G	14.000 G	100.00 k	10.574500 G	-41.32	-200.00
14.000 G	18.000 G	100.00 k	17.753000 G	-40.06	-200.00
18.000 G	22.000 G	100.00 k	20.303000 G	-38.18	-200.00
22.000 G	26.500 G	100.00 k	24.485125 G	-35.51	-200.00

802.11n(HT20) & MCS 7 & 2437MHz

Reference



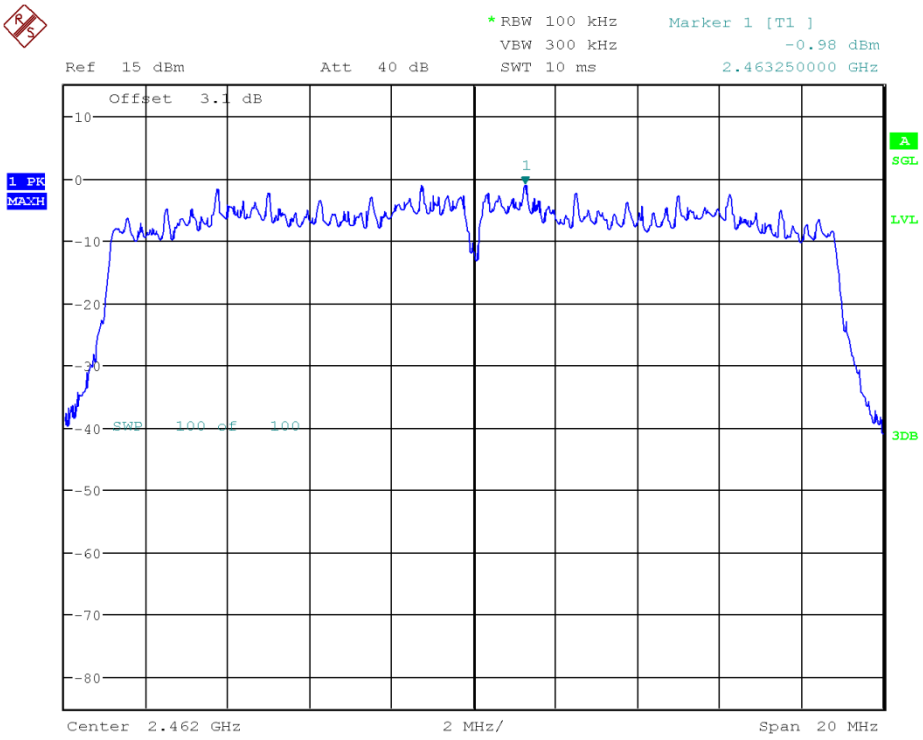
Conducted Spurious Emissions



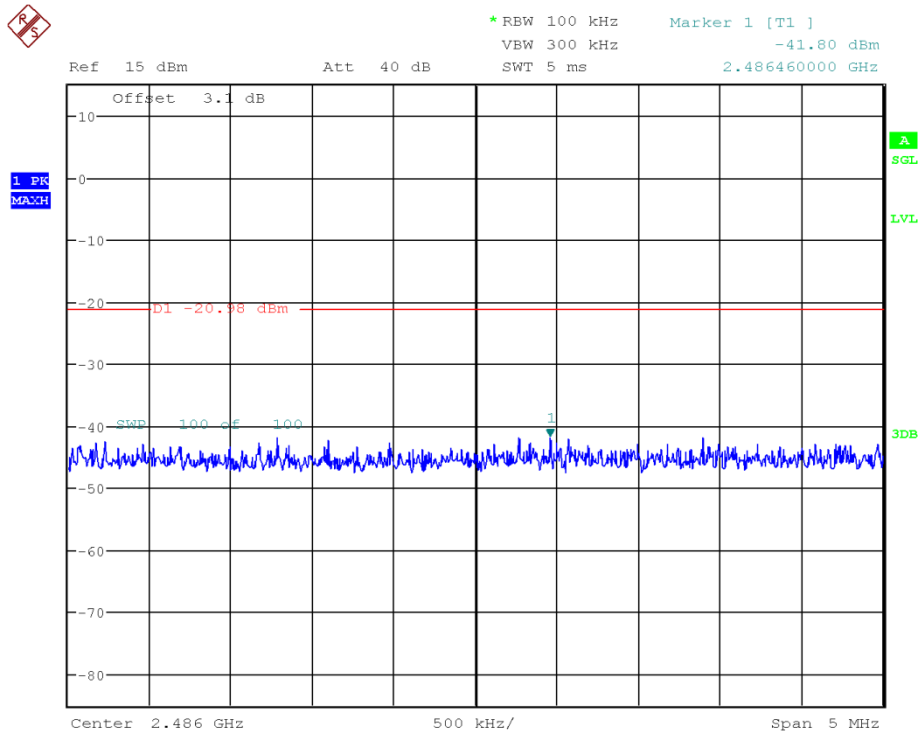
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	882.242000 M	-44.82	-200.00
1.000 G	2.000 G	100.00 k	1.764200 G	-43.58	-200.00
2.000 G	2.400 G	100.00 k	2.333067 G	-41.92	-200.00
2.400 G	2.483 G	100.00 k	2.438243 G	4.42	-200.00
2.483 G	3.000 G	100.00 k	2.519196 G	-42.97	-200.00
3.000 G	6.000 G	100.00 k	3.171750 G	-42.06	-200.00
6.000 G	10.000 G	100.00 k	7.694500 G	-41.63	-200.00
10.000 G	14.000 G	100.00 k	10.646500 G	-41.40	-200.00
14.000 G	18.000 G	100.00 k	17.777000 G	-39.92	-200.00
18.000 G	22.000 G	100.00 k	21.607500 G	-38.14	-200.00
22.000 G	26.500 G	100.00 k	24.792250 G	-35.99	-200.00

802.11n(HT20) & MCS 7 & 2462MHz

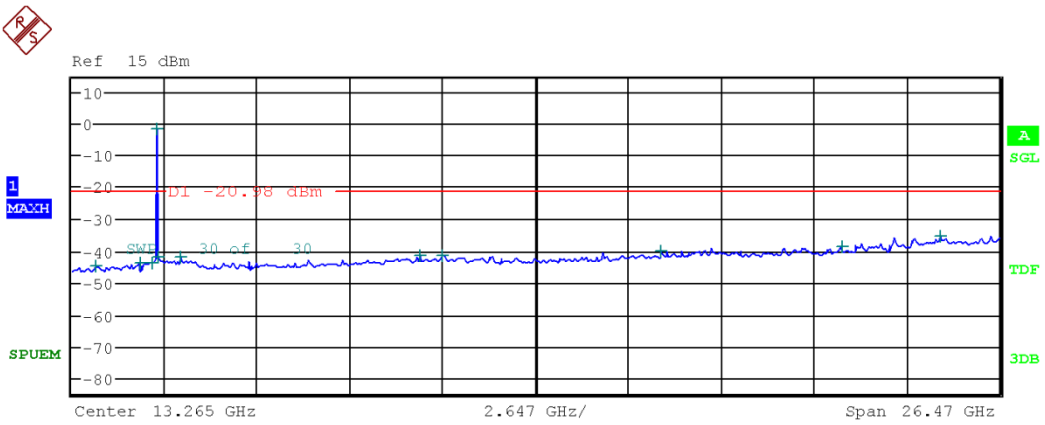
Reference



High Band-edge



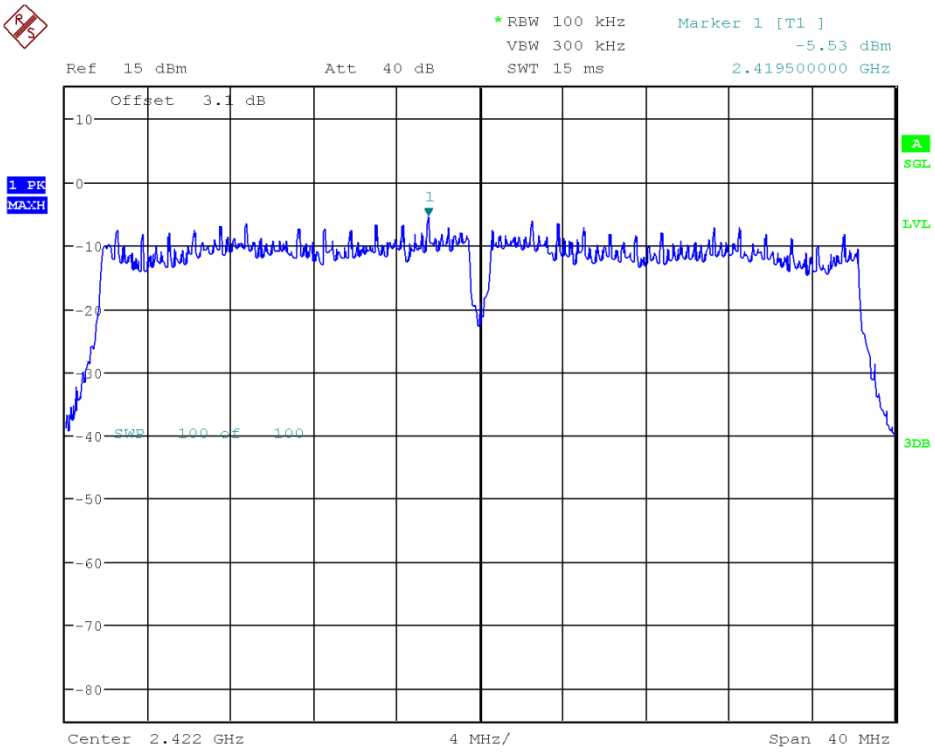
Conducted Spurious Emissions



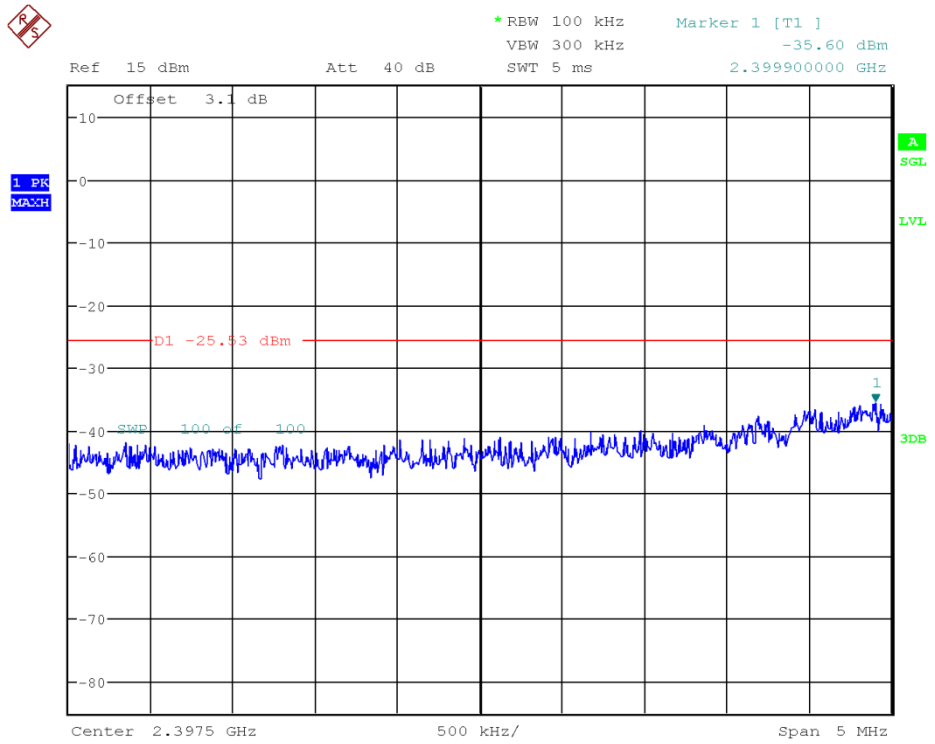
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	696.584000 M	-44.94	-200.00
1.000 G	2.000 G	100.00 k	1.998000 G	-44.03	-200.00
2.000 G	2.400 G	100.00 k	2.326978 G	-43.93	-200.00
2.400 G	2.483 G	100.00 k	2.463260 G	-1.58	-200.00
2.483 G	3.000 G	100.00 k	2.493773 G	-41.96	-200.00
3.000 G	6.000 G	100.00 k	3.115125 G	-42.00	-200.00
6.000 G	10.000 G	100.00 k	9.971500 G	-41.67	-200.00
10.000 G	14.000 G	100.00 k	10.601000 G	-41.72	-200.00
14.000 G	18.000 G	100.00 k	16.841000 G	-39.97	-200.00
18.000 G	22.000 G	100.00 k	21.994000 G	-38.80	-200.00
22.000 G	26.500 G	100.00 k	24.823750 G	-35.34	-200.00

802.11n(HT40) & MCS 7 & 2422MHz

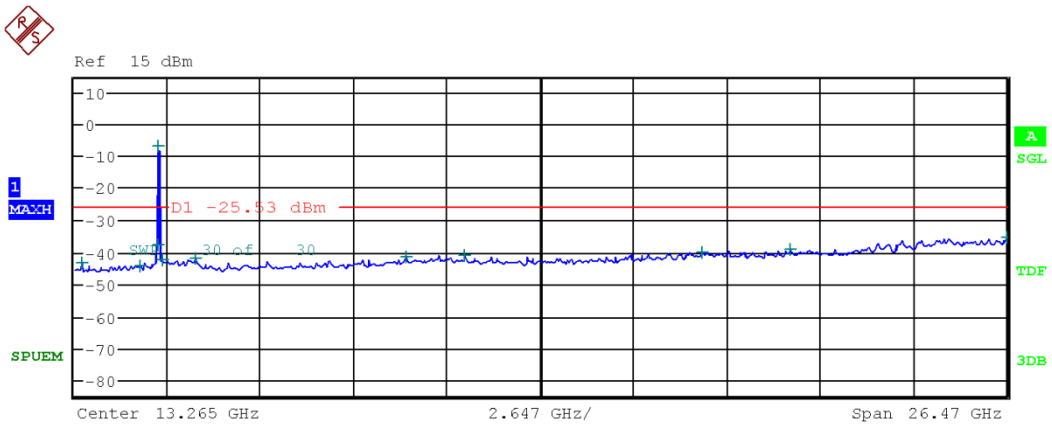
Reference



Low Band-edge



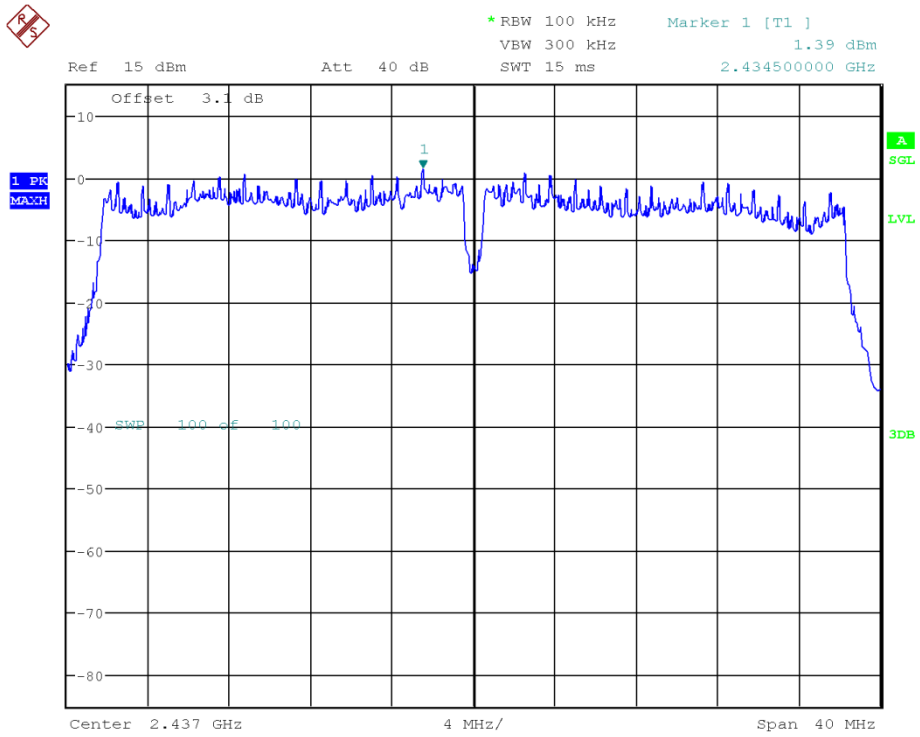
Conducted Spurious Emissions



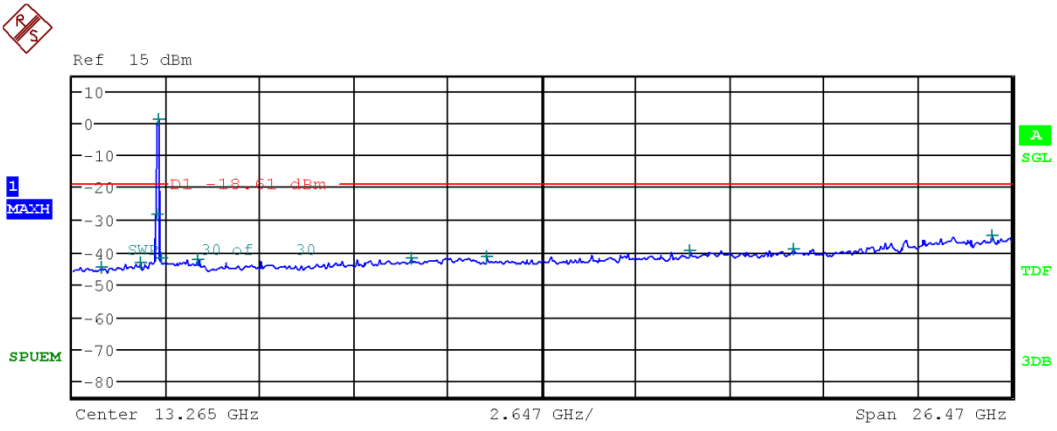
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	224.388000 M	-43.27	-200.00
1.000 G	2.000 G	100.00 k	1.905600 G	-44.25	-200.00
2.000 G	2.400 G	100.00 k	2.399467 G	-37.94	-200.00
2.400 G	2.483 G	100.00 k	2.419489 G	-6.82	-200.00
2.483 G	3.000 G	100.00 k	2.548981 G	-42.64	-200.00
3.000 G	6.000 G	100.00 k	3.476250 G	-42.24	-200.00
6.000 G	10.000 G	100.00 k	9.449000 G	-41.53	-200.00
10.000 G	14.000 G	100.00 k	11.111000 G	-41.04	-200.00
14.000 G	18.000 G	100.00 k	17.836500 G	-40.02	-200.00
18.000 G	22.000 G	100.00 k	20.358500 G	-39.30	-200.00
22.000 G	26.500 G	100.00 k	26.482000 G	-35.40	-200.00

802.11n(HT40) & MCS 7 & 2437MHz

Reference



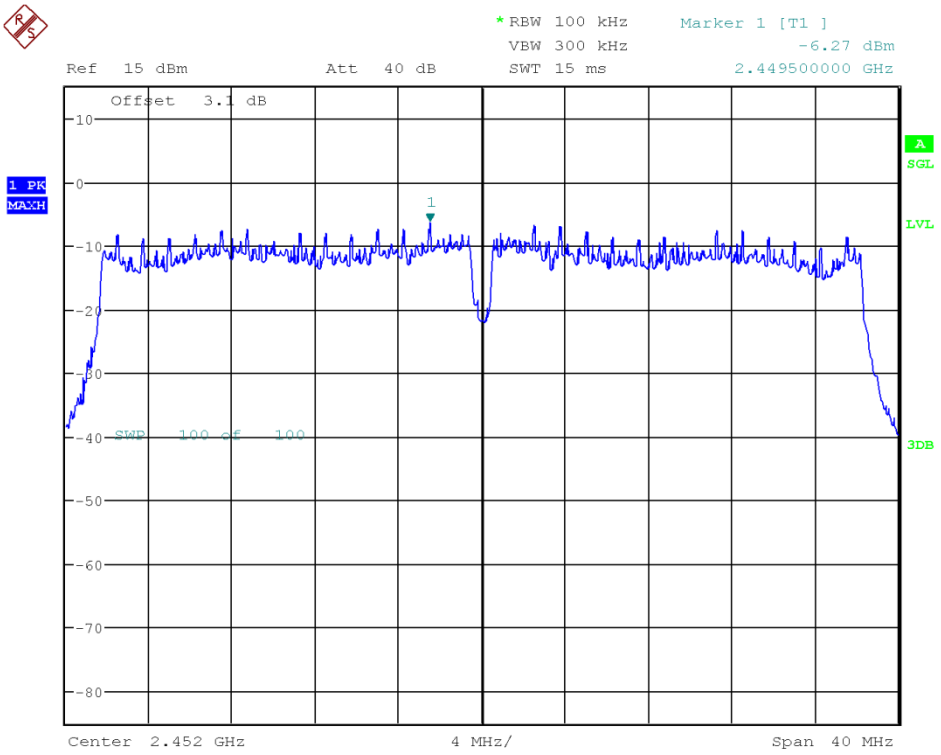
Conducted Spurious Emissions



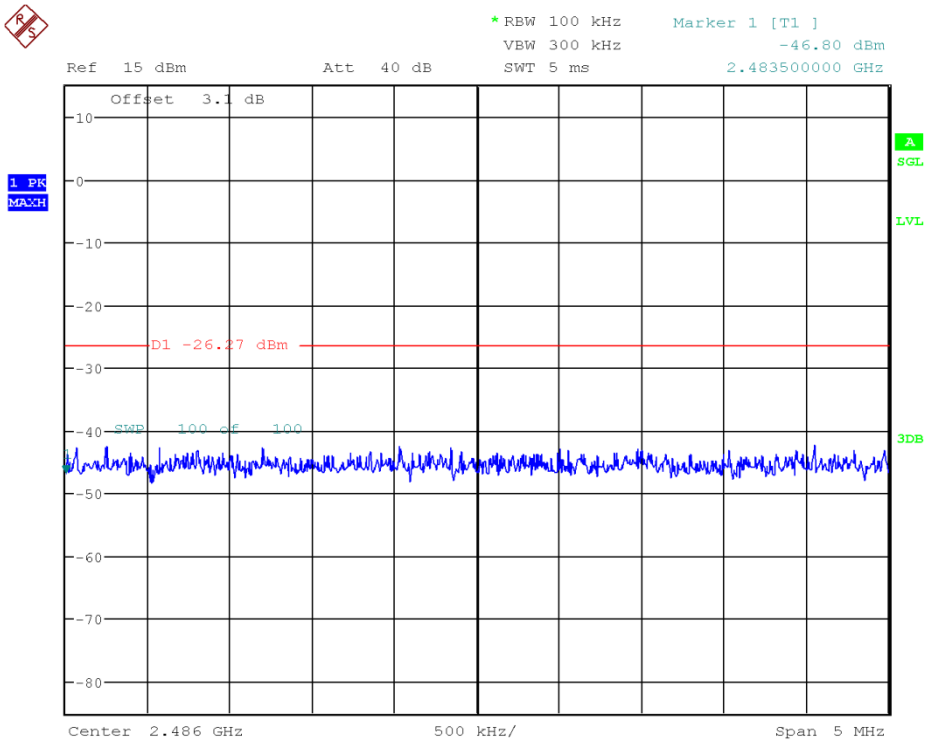
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	840.532000 M	-44.78	-200.00
1.000 G	2.000 G	100.00 k	1.945600 G	-43.59	-200.00
2.000 G	2.400 G	100.00 k	2.399511 G	-28.39	-200.00
2.400 G	2.483 G	100.00 k	2.434486 G	1.00	-200.00
2.483 G	3.000 G	100.00 k	2.534634 G	-41.93	-200.00
3.000 G	6.000 G	100.00 k	3.535125 G	-42.59	-200.00
6.000 G	10.000 G	100.00 k	9.559000 G	-42.17	-200.00
10.000 G	14.000 G	100.00 k	11.710500 G	-41.66	-200.00
14.000 G	18.000 G	100.00 k	17.433000 G	-39.64	-200.00
18.000 G	22.000 G	100.00 k	20.355000 G	-39.27	-200.00
22.000 G	26.500 G	100.00 k	25.968438 G	-35.23	-200.00

802.11n(HT40) & MCS 7 & 2452MHz

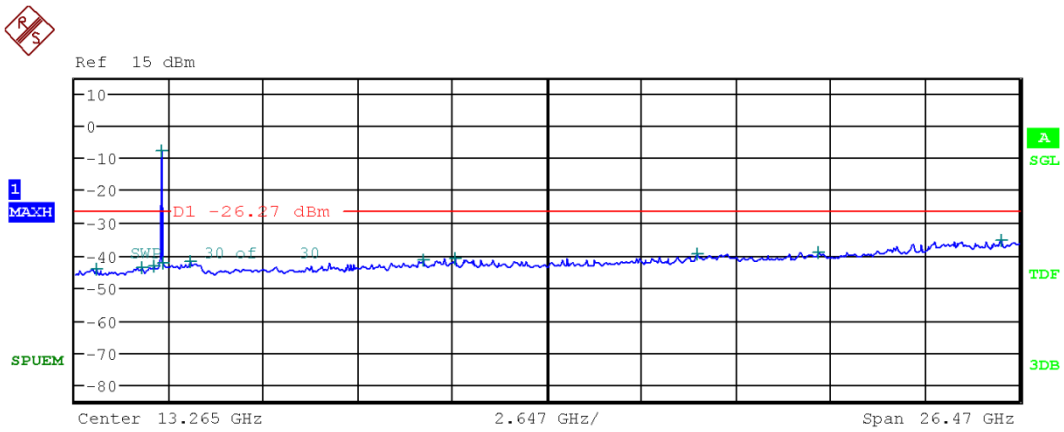
Reference



High Band-edge



Conducted Spurious Emissions



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	615.492000 M	-44.51	-200.00
1.000 G	2.000 G	100.00 k	1.916400 G	-44.10	-200.00
2.000 G	2.400 G	100.00 k	2.218933 G	-43.54	-200.00
2.400 G	2.483 G	100.00 k	2.449499 G	-7.60	-200.00
2.483 G	3.000 G	100.00 k	2.492969 G	-42.59	-200.00
3.000 G	6.000 G	100.00 k	3.269250 G	-41.99	-200.00
6.000 G	10.000 G	100.00 k	9.800500 G	-41.73	-200.00
10.000 G	14.000 G	100.00 k	10.674000 G	-40.87	-200.00
14.000 G	18.000 G	100.00 k	17.466500 G	-39.49	-200.00
18.000 G	22.000 G	100.00 k	20.861500 G	-39.11	-200.00
22.000 G	26.500 G	100.00 k	25.991500 G	-35.40	-200.00

7.5 Radiated Spurious Emissions

Test Requirements and limit, §15.247(d)

1. In any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

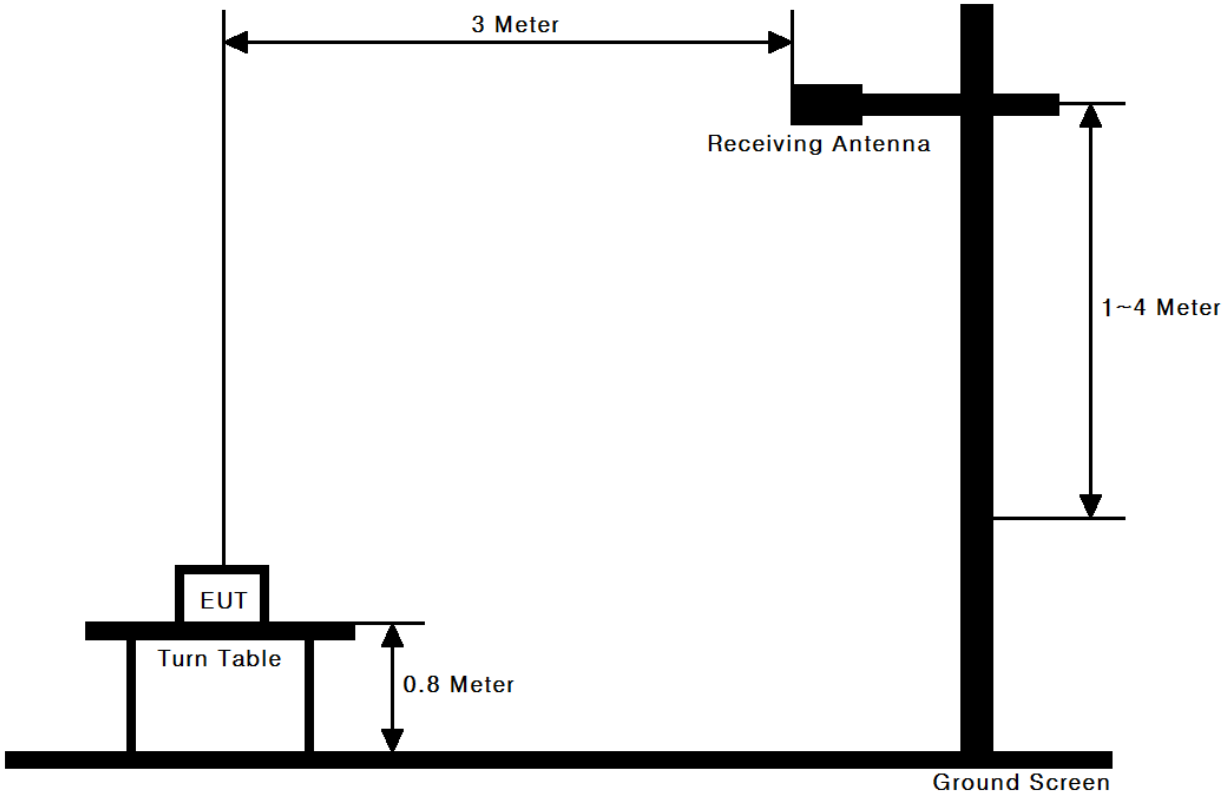
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240			
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** 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 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 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.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

30MHz ~ 25GHz Data(*802.11b & 11Mbps*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.442	H	Z	QP	41.92	-4.00	37.92	46.00	8.08
265.385	H	Z	QP	44.70	-3.00	41.70	46.00	4.30
2385.660	V	Y	PK	59.37	-2.20	57.17	74.00	16.83
2383.820	V	Y	AV	46.69	-2.20	44.49	54.00	9.51
3216.110	V	Y	PK	51.70	0.71	52.41	74.00	21.59
3216.040	V	Y	AV	46.53	0.71	47.24	54.00	6.76
4824.050	H	Y	PK	48.23	6.91	55.14	74.00	18.86
4824.070	H	Y	AV	43.76	6.91	50.67	54.00	3.33

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.440	H	Z	QP	40.84	-4.00	36.84	46.00	9.16
265.361	H	Z	QP	44.62	-3.00	41.62	46.00	4.38
3249.310	V	Y	PK	50.62	0.81	51.43	74.00	22.57
3249.340	V	Y	AV	46.43	0.81	47.24	54.00	6.76
4873.900	H	Y	PK	47.97	7.30	55.27	74.00	18.73
4874.130	H	Y	AV	43.04	7.30	50.34	54.00	3.66

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.428	H	Z	QP	41.76	-4.00	37.76	46.00	8.24
265.360	H	Z	QP	45.28	-3.00	42.28	46.00	3.72
2483.560	V	Y	PK	60.49	-2.39	58.10	74.00	15.90
2483.500	V	Y	AV	47.44	-2.39	45.05	54.00	8.95
3282.650	V	Y	PK	51.32	0.88	52.20	74.00	21.80
3282.660	V	Y	AV	46.79	0.88	47.67	54.00	6.33
4924.110	H	Y	PK	47.73	7.21	54.94	74.00	19.06
4924.080	H	Y	AV	44.09	7.21	51.30	54.00	2.70

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

30MHz ~ 25GHz Data(*802.11g & 54Mbps*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.438	H	Z	QP	41.64	-4.00	37.64	46.00	8.36
265.365	H	Z	QP	44.26	-3.00	41.26	46.00	4.74
2389.960	H	Z	PK	70.54	-2.20	68.34	74.00	5.66
2390.000	H	Z	AV	53.79	-2.20	51.59	54.00	2.41
3216.050	V	Y	PK	52.50	0.71	53.21	74.00	20.79
3216.040	V	Y	AV	46.75	0.71	47.46	54.00	6.54

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.440	H	Z	QP	40.92	-4.00	36.92	46.00	9.08
265.389	H	Z	QP	45.13	-3.00	42.13	46.00	3.87
3249.120	V	Y	PK	50.59	0.81	51.40	74.00	22.60
3249.360	V	Y	AV	45.17	0.81	45.98	54.00	8.02

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.446	H	Z	QP	41.54	-4.00	37.54	46.00	8.46
265.374	H	Z	QP	44.72	-3.00	41.72	46.00	4.28
2484.370	H	Z	PK	70.13	-2.39	67.74	74.00	6.26
2483.500	H	Z	AV	53.95	-2.39	51.56	54.00	2.44
3282.670	V	Y	PK	51.08	0.88	51.96	74.00	22.04
3282.650	V	Y	AV	46.11	0.88	46.99	54.00	7.01

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

30MHz ~ 25GHz Data(*802.11n HT20 & MCS 7*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.440	H	Z	QP	41.83	-4.00	37.83	46.00	8.17
265.362	H	Z	QP	44.47	-3.00	41.47	46.00	4.53
2389.260	H	Z	PK	68.76	-2.20	66.56	74.00	7.44
2389.260	H	Z	AV	52.93	-2.20	50.73	54.00	3.27
3215.810	V	Y	PK	49.58	0.71	50.29	74.00	23.71
3216.030	V	Y	AV	45.67	0.71	46.38	54.00	7.62

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.434	H	Z	QP	41.26	-4.00	37.26	46.00	8.74
265.536	H	Z	QP	45.05	-3.00	42.05	46.00	3.95
3249.430	V	Y	PK	50.15	0.81	50.96	74.00	23.04
3249.350	V	Y	AV	46.35	0.81	47.16	54.00	6.84

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.451	H	Z	QP	41.78	-4.00	37.78	46.00	8.22
265.352	H	Z	QP	44.55	-3.00	41.55	46.00	4.45
2484.460	H	Z	PK	70.01	-2.39	67.62	74.00	6.38
2390.000	H	Z	AV	53.42	-2.39	51.03	54.00	2.97
3282.610	V	Y	PK	50.13	0.88	51.01	74.00	22.99
3282.670	V	Y	AV	44.74	0.88	45.62	54.00	8.38

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

30MHz ~ 25GHz Data(*802.11n HT40 & MCS 7*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.428	H	Z	QP	41.98	-4.00	37.98	46.00	8.02
236.384	H	Z	QP	43.96	-3.00	40.96	46.00	5.04
2389.480	H	Z	PK	66.28	-2.20	64.08	74.00	9.92
2390.000	H	Z	AV	51.80	-2.20	49.60	54.00	4.40
3229.240	V	Y	PK	50.21	0.71	50.92	74.00	23.08
3229.370	V	Y	AV	46.24	0.71	46.95	54.00	7.05

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.426	H	Z	QP	41.74	-4.00	37.74	46.00	8.26
265.378	H	Z	QP	44.82	-3.00	41.82	46.00	4.18
3249.330	V	Y	PK	50.52	0.81	51.33	74.00	22.67
3249.360	V	Y	AV	45.16	0.81	45.97	54.00	8.03

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.430	H	Z	QP	41.60	-4.00	37.60	46.00	8.40
265.364	H	Z	QP	44.92	-3.00	41.92	46.00	4.08
2484.040	H	Z	PK	68.48	-2.39	66.09	74.00	7.91
2483.510	H	Z	AV	52.77	-2.39	50.38	54.00	3.62
3269.740	V	Y	PK	49.42	0.88	50.30	74.00	23.70
3269.700	V	Y	AV	44.27	0.88	45.15	54.00	8.85

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

7.6 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.247(d)

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

▣ RESULT PLOTS

AC Line Conducted Emissions (Graph)

Test Mode: 802.11b & 11Mbps & 2437MHz

Digital EMC

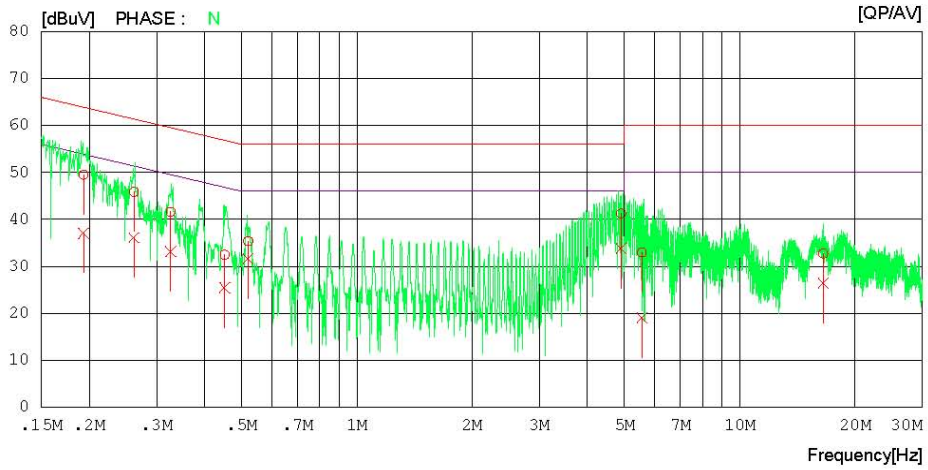
Results of Conducted Emission

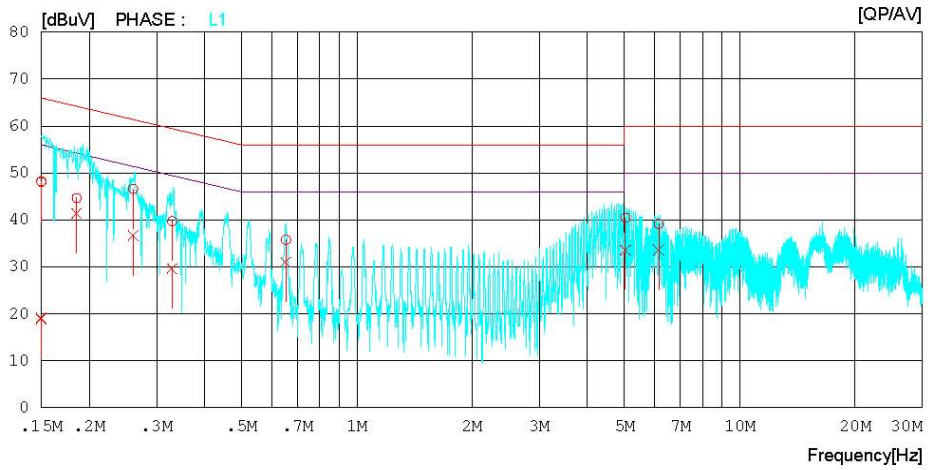
Digital EMC
Date : 2012-04-05

Model No.	:	TWFMKB304D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21 'C 37 % R.H.
Test Condition	:	802.11b	Operator	:	J.J.LEE

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (List)

Test Mode: 802.11b & 11Mbps & 2437MHz

Results of Conducted Emission

Digital EMC
Date : 2012-04-05

Model No.	: TWFMKB304D	Referrence No.	:	
Type	:	Power Supply	: 120 V 60 Hz	
Serial No.	: Identical prototype	Temp/Humi.	: 21 'C 37 % R.H.	
Test Condition	: 802.11b	Operator	: J.J.LEE	

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19344	49.3	36.8	0.2	49.5	37.0	63.9	53.9	14.4	16.9	N
2	0.26196	45.7	35.9	0.2	45.9	36.1	61.4	51.4	15.5	15.3	N
3	0.32644	41.4	32.9	0.2	41.6	33.1	59.5	49.5	17.9	16.4	N
4	0.45186	32.3	25.2	0.2	32.5	25.4	56.8	46.8	24.3	21.4	N
5	0.52038	35.2	31.4	0.2	35.4	31.6	56.0	46.0	20.6	14.4	N
6	4.90000	40.8	33.4	0.4	41.2	33.8	56.0	46.0	14.8	12.2	N
7	5.55700	32.5	18.6	0.4	32.9	19.0	60.0	50.0	27.1	31.0	N
8	16.52400	31.7	25.4	1.0	32.7	26.4	60.0	50.0	27.3	23.6	N
9	0.15001	47.9	18.9	0.3	48.2	19.2	66.0	56.0	17.8	36.8	L1
10	0.15001	47.8	18.6	0.3	48.1	18.9	66.0	56.0	17.9	37.1	L1
11	0.18539	44.5	41.2	0.2	44.7	41.4	64.2	54.2	19.5	12.8	L1
12	0.26079	46.4	36.4	0.2	46.6	36.6	61.4	51.4	14.8	14.8	L1
13	0.32950	39.6	29.4	0.2	39.8	29.6	59.5	49.5	19.7	19.9	L1
14	0.65333	35.6	30.8	0.2	35.8	31.0	56.0	46.0	20.2	15.0	L1
15	5.02950	40.1	33.2	0.4	40.5	33.6	60.0	50.0	19.5	16.4	L1
16	6.14200	38.7	33.3	0.4	39.1	33.7	60.0	50.0	20.9	16.3	L1

AC Line Conducted Emissions (Graph)

Test Mode: 802.11g & 54Mbps & 2437MHz

Digital EMC

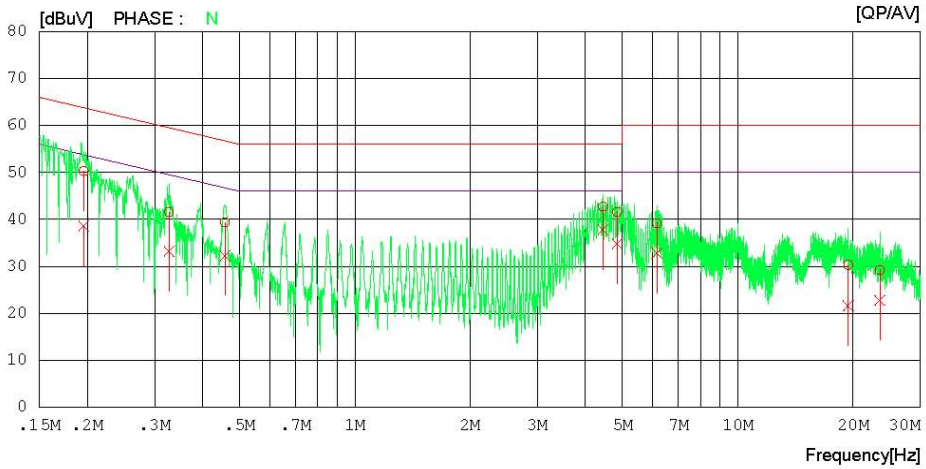
Results of Conducted Emission

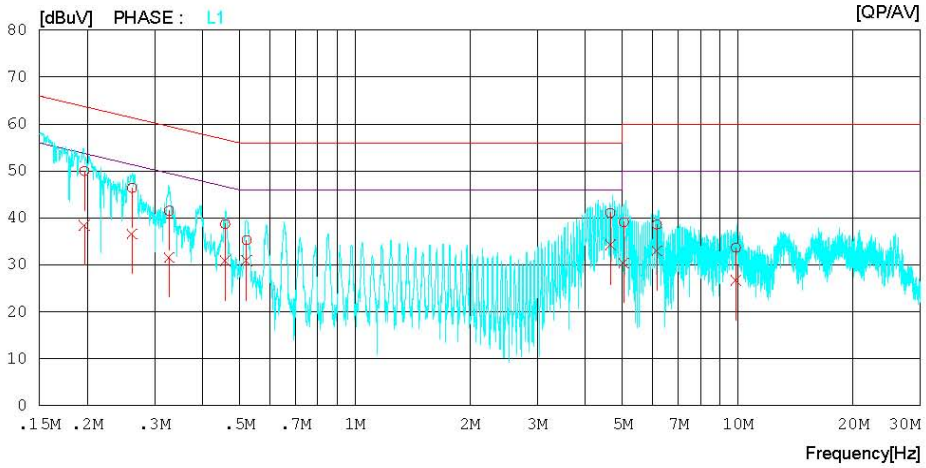
Digital EMC
Date : 2012-04-05

Model No.	:	TWFMKB304D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21 'C 37 % R.H.
Test Condition	:	802.11g	Operator	:	J.J.LEE

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (List)

Test Mode: 802.11g & 54Mbps & 2437MHz

Results of Conducted Emission

Digital EMC
Date : 2012-04-05

Model No.	: TWFMKB304D	Referrence No.	:
Type	:	Power Supply	: 120 V 60 Hz
Serial No.	: Identical prototype	Temp/Humi.	: 21 'C 37 % R.H.
Test Condition	: 802.11g	Operator	: J.J.LEE

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19593	50.1	38.4	0.2	50.3	38.6	63.8	53.8	13.5	15.2	N
2	0.32725	41.3	33.0	0.2	41.5	33.2	59.5	49.5	18.0	16.3	N
3	0.45830	39.2	32.0	0.2	39.4	32.2	56.7	46.7	17.3	14.5	N
4	4.44950	42.3	37.3	0.4	42.7	37.7	56.0	46.0	13.3	8.3	N
5	4.84500	41.2	34.4	0.4	41.6	34.8	56.0	46.0	14.4	11.2	N
6	6.15200	38.8	32.4	0.4	39.2	32.8	60.0	50.0	20.8	17.2	N
7	19.44200	29.2	20.5	1.1	30.3	21.6	60.0	50.0	29.7	28.4	N
8	23.49550	28.0	21.5	1.2	29.2	22.7	60.0	50.0	30.8	27.3	N
9	0.19664	49.8	38.2	0.2	50.0	38.4	63.8	53.8	13.8	15.4	L1
10	0.26189	46.2	36.4	0.2	46.4	36.6	61.4	51.4	15.0	14.8	L1
11	0.32751	41.3	31.4	0.2	41.5	31.6	59.5	49.5	18.0	17.9	L1
12	0.45849	38.5	30.7	0.2	38.7	30.9	56.7	46.7	18.0	15.8	L1
13	0.52138	35.1	30.7	0.2	35.3	30.9	56.0	46.0	20.7	15.1	L1
14	4.65000	40.7	33.9	0.4	41.1	34.3	56.0	46.0	14.9	11.7	L1
15	5.04350	38.7	30.0	0.4	39.1	30.4	60.0	50.0	20.9	19.6	L1
16	6.15300	38.2	32.6	0.4	38.6	33.0	60.0	50.0	21.4	17.0	L1
17	9.88700	33.1	26.1	0.6	33.7	26.7	60.0	50.0	26.3	23.3	L1

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n(HT20) & MCS 7 & 2437MHz

Digital EMC

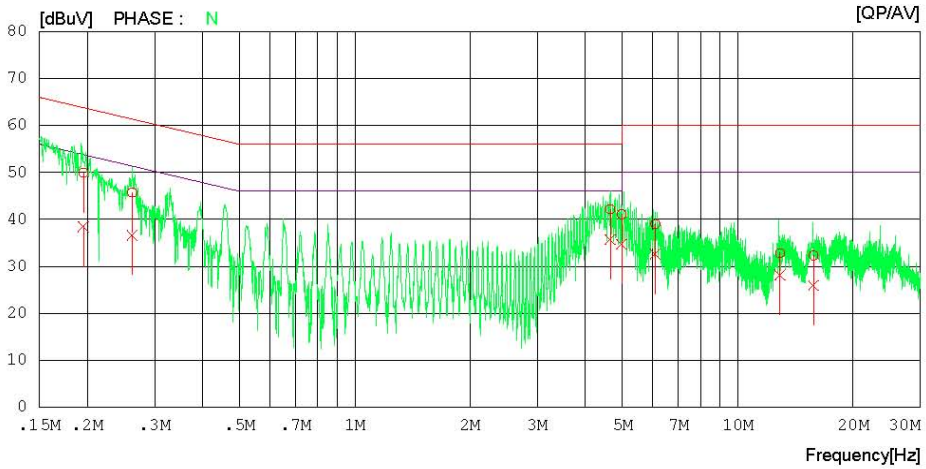
Results of Conducted Emission

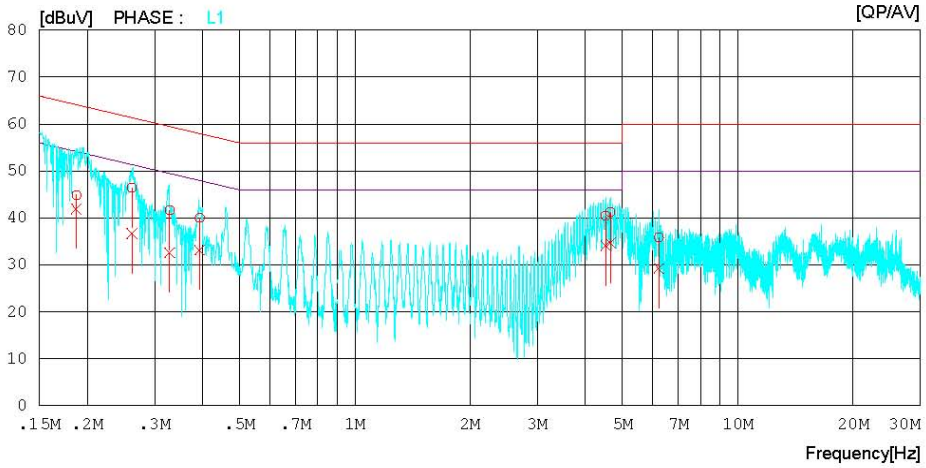
Digital EMC
Date : 2012-04-05

Model No.	:	TWFMKB304D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21 'C 37 % R.H.
Test Condition	:	802.11(HT20)	Operator	:	J.J.LEE

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (List)

Test Mode: 802.11n(HT20) & MCS 7 & 2437MHz

Results of Conducted Emission

Digital EMC
Date : 2012-04-05

Model No.	: TWFMKB304D	Referrence No.	:	
Type	:	Power Supply	: 120 V 60 Hz	
Serial No.	: Identical prototype	Temp/Humi.	: 21 'C 37 % R.H.	
Test Condition	: 802.11(HT20)	Operator	: J.J.LEE	

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19544	49.7	38.2	0.2	49.9	38.4	63.8	53.8	13.9	15.4	N
2	0.26224	45.5	36.4	0.2	45.7	36.6	61.4	51.4	15.7	14.8	N
3	4.64800	41.7	35.3	0.4	42.1	35.7	56.0	46.0	13.9	10.3	N
4	4.97650	40.6	34.3	0.4	41.0	34.7	56.0	46.0	15.0	11.3	N
5	6.09150	38.6	32.2	0.4	39.0	32.6	60.0	50.0	21.0	17.4	N
6	12.89850	31.9	27.3	0.9	32.8	28.2	60.0	50.0	27.2	21.8	N
7	15.77950	31.3	24.9	1.0	32.3	25.9	60.0	50.0	27.7	24.1	N
8	0.18753	44.7	41.7	0.2	44.9	41.9	64.1	54.1	19.2	12.2	L1
9	0.26184	46.2	36.5	0.2	46.4	36.7	61.4	51.4	15.0	14.7	L1
10	0.32858	41.5	32.4	0.2	41.7	32.6	59.5	49.5	17.8	16.9	L1
11	0.39344	39.7	32.9	0.3	40.0	33.2	58.0	48.0	18.0	14.8	L1
12	4.52000	40.1	33.7	0.4	40.5	34.1	56.0	46.0	15.5	11.9	L1
13	4.64950	40.9	34.3	0.4	41.3	34.7	56.0	46.0	14.7	11.3	L1
14	6.22350	35.5	28.8	0.4	35.9	29.2	60.0	50.0	24.1	20.8	L1

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n(HT40) & MCS 7 & 2437MHz

Digital EMC

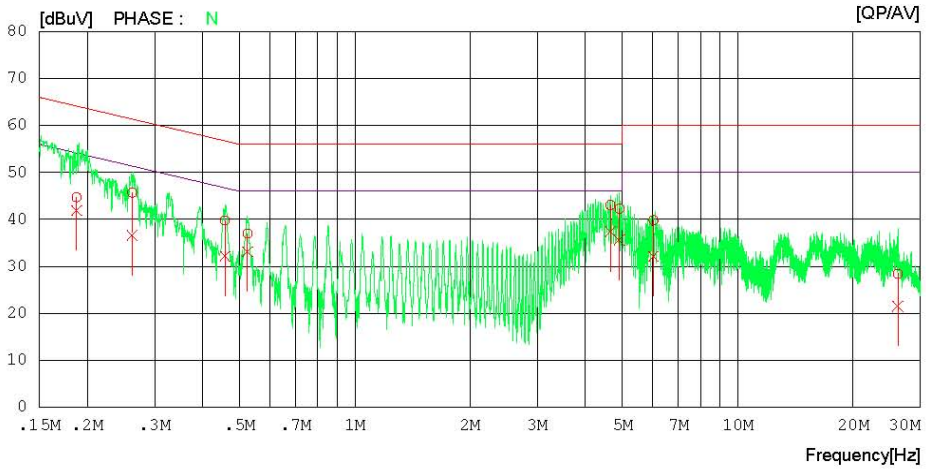
Results of Conducted Emission

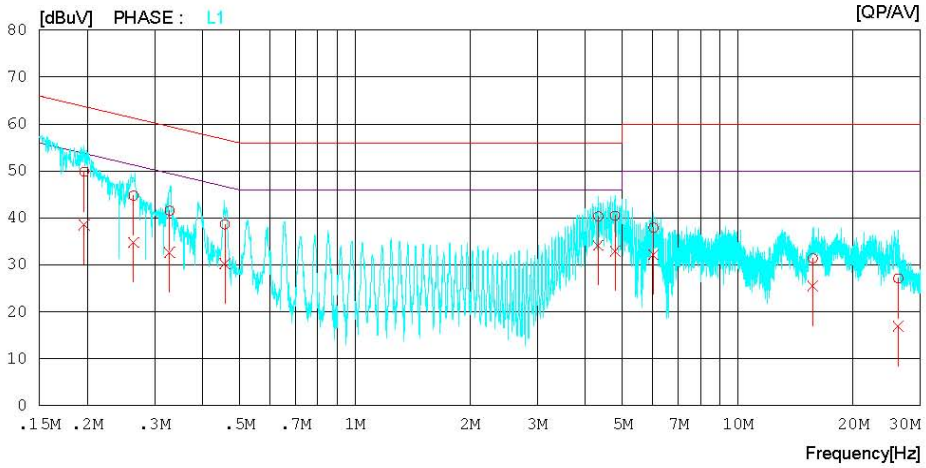
Digital EMC
Date : 2012-04-05

Model No.	:	TWFMKB304D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21 'C 37 % R.H.
Test Condition	:	802.11(HT40)	Operator	:	J.J.LEE

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (List)

Test Mode: 802.11n(HT40) & MCS 7 & 2437MHz

Results of Conducted Emission

Digital EMC
Date : 2012-04-05

Model No.	: TWFMKB304D	Referrence No.	:	
Type	:	Power Supply	: 120 V 60 Hz	
Serial No.	: Identical prototype	Temp/Humi.	: 21 'C 37 % R.H.	
Test Condition	: 802.11(HT40)	Operator	: J.J.LEE	

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18768	44.5	41.7	0.2	44.7	41.9	64.1	54.1	19.4	12.2	N
2	0.26214	45.5	36.4	0.2	45.7	36.6	61.4	51.4	15.7	14.8	N
3	0.45841	39.5	32.0	0.2	39.7	32.2	56.7	46.7	17.0	14.5	N
4	0.52430	36.8	32.9	0.2	37.0	33.1	56.0	46.0	19.0	12.9	N
5	4.65050	42.6	37.0	0.4	43.0	37.4	56.0	46.0	13.0	8.6	N
6	4.91150	41.9	35.2	0.4	42.3	35.6	56.0	46.0	13.7	10.4	N
7	6.02450	39.4	31.7	0.4	39.8	32.1	60.0	50.0	20.2	17.9	N
8	26.19450	27.1	20.2	1.3	28.4	21.5	60.0	50.0	31.6	28.5	N
9	0.19658	49.7	38.3	0.2	49.9	38.5	63.8	53.8	13.9	15.3	L1
10	0.26450	44.6	34.6	0.2	44.8	34.8	61.3	51.3	16.5	16.5	L1
11	0.32850	41.3	32.5	0.2	41.5	32.7	59.5	49.5	18.0	16.8	L1
12	0.45786	38.4	30.1	0.2	38.6	30.3	56.7	46.7	18.1	16.4	L1
13	4.32150	39.9	33.8	0.4	40.3	34.2	56.0	46.0	15.7	11.8	L1
14	4.78400	40.1	32.5	0.4	40.5	32.9	56.0	46.0	15.5	13.1	L1
15	6.02350	37.5	31.8	0.4	37.9	32.2	60.0	50.0	22.1	17.8	L1
16	15.71450	30.4	24.6	1.0	31.4	25.6	60.0	50.0	28.6	24.4	L1
17	26.27650	25.8	15.6	1.3	27.1	16.9	60.0	50.0	32.9	33.1	L1

8. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
Spectrum Analyzer	Rohde Schwarz	FSQ26	12/01/09	13/01/09	200445
Spectrum Analyzer	Agilent	N9020A	12/01/09	13/01/09	MY49100833
Digital Multimeter	H.P	34401A	12/03/05	13/03/05	3146A13475, US36122178
Signal Generator	Rohde Schwarz	SMR20	12/03/05	13/03/05	101251
Vector Signal Generator	Rohde Schwarz	SMJ100A	12/01/09	13/01/09	100148
Virtual Power Meter(S/W)	Rohde Schwarz	R&S Power Viewer Plus	-	-	V 4.1.0
Power SENSOR	Rohde Schwarz	NRP-Z81	11/06/04	12/06/04	1137.9009.02-101001-EA
Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-2
DC Power Supply	HP	6622A	12/03/05	13/03/05	3448A03760
High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A	10/07/07	12/07/07	590
BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
HORN ANT	ETS	3115	12/02/20	13/02/20	6419
HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
Amplifier (22dB)	H.P	8447E	12/01/09	13/01/09	2945A02865
Amplifier (25dB)	Agilent	8447D	12/03/05	13/03/05	2944A10144
Amplifier (30dB)	Agilent	8449B	12/03/05	13/03/05	3008A01590
Attenuator(10dB)	WEINSCHEL	23-10-34	12/01/09	13/01/09	BP4386
EMI TEST RECEIVER	R&S	ESU	12/03/05	13/03/05	100014
Spectrum Analyzer(CE)	H.P	8591E	12/01/09	13/01/09	3649A05889
LISN	Kyoritsu	KNW-407	11/07/02	12/07/02	8-317-8
LISN	Kyoritsu	KNW-242	12/03/05	13/03/05	8-654-15
CVCF	NF Electronic	4420	12/01/09	13/01/09	304935/337980
50 ohm Terminator	HME	CT-01	11/07/02	12/07/02	N/A
RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	12/03/05	13/03/05	4N-170-3