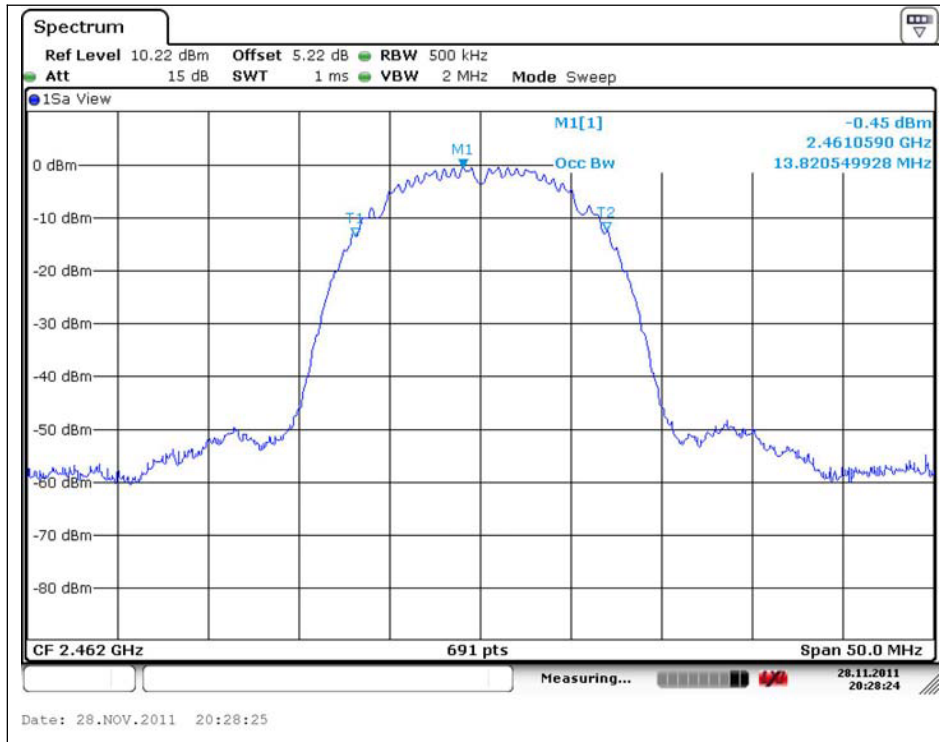
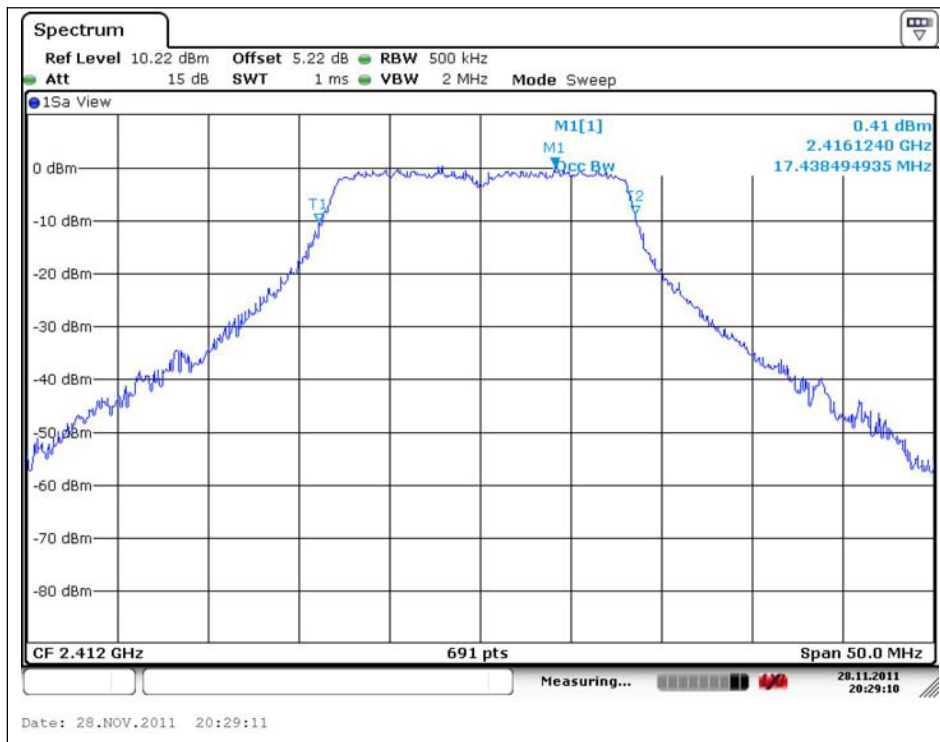


High Channel



OFDM : 802.11g

Low Channel



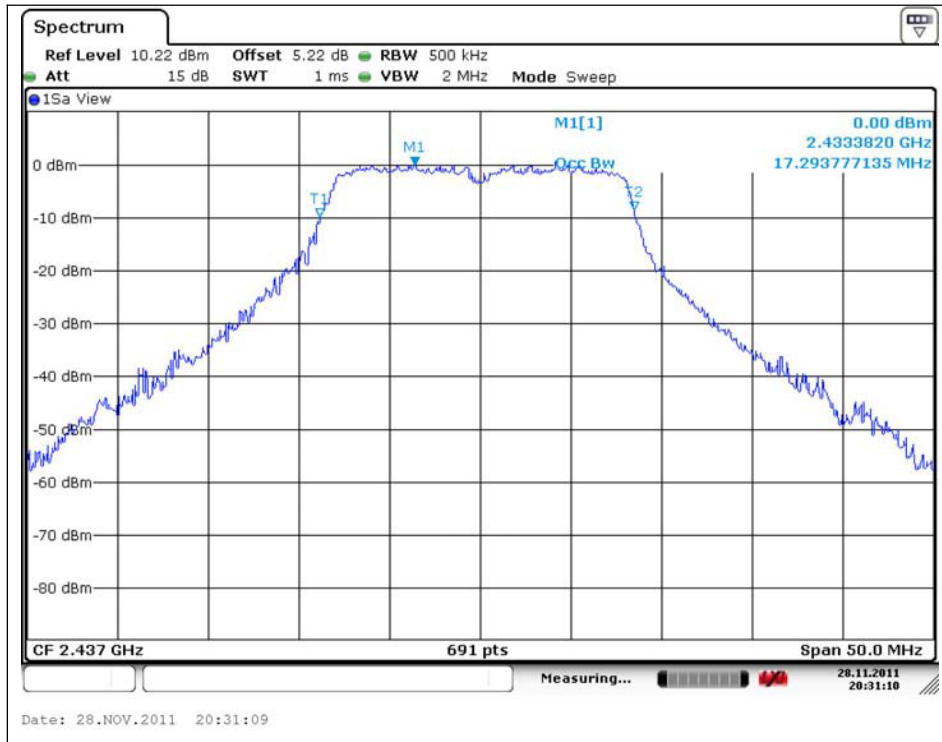
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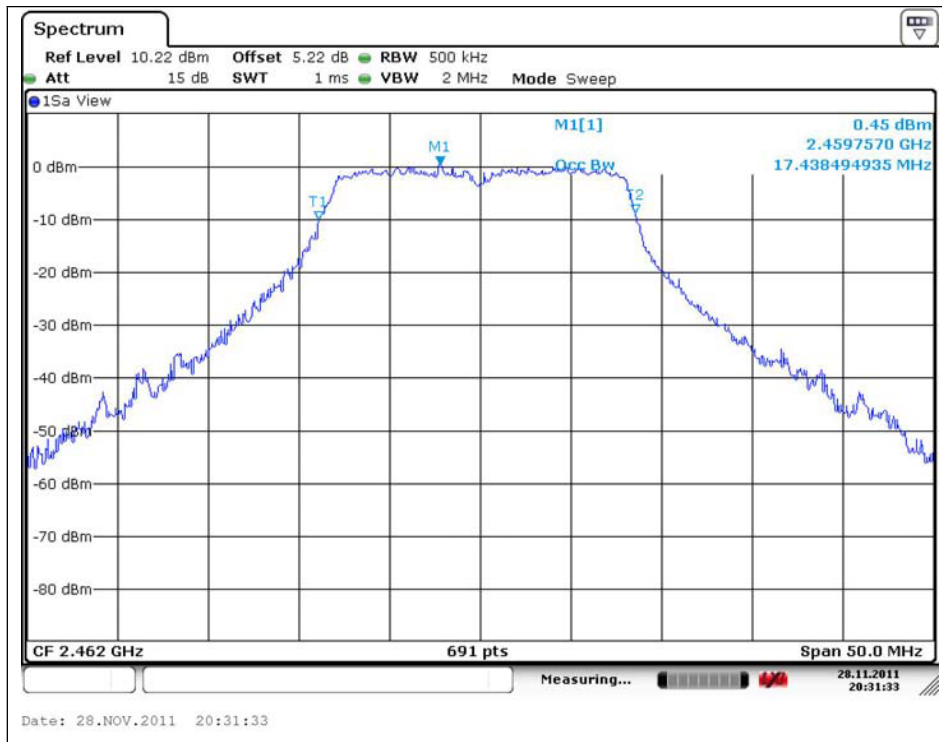
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Middle Channel



High Channel



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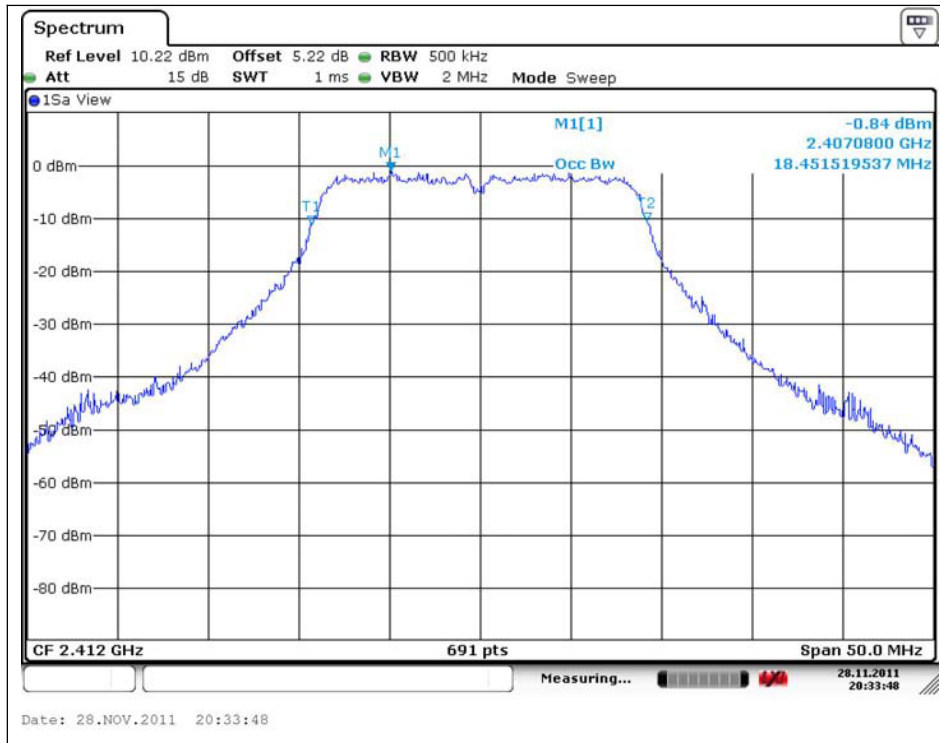
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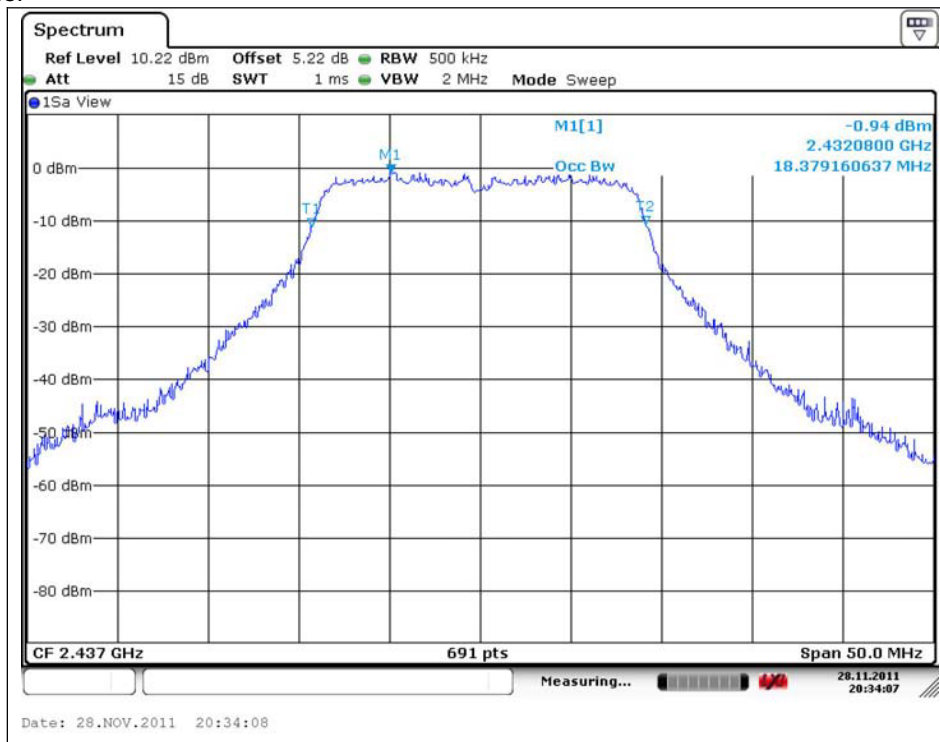
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OFDM : 802.11n

Low Channel



Middle Channel



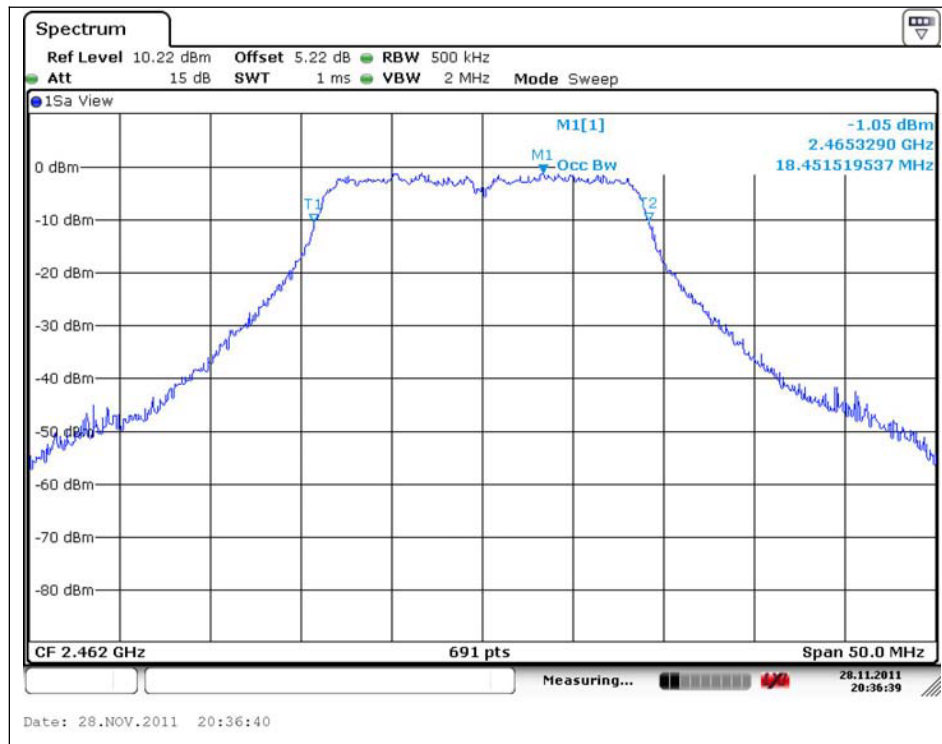
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High Channel



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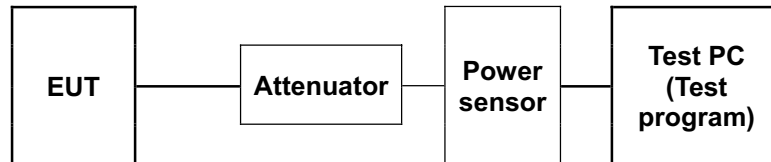
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5. Maximum Peak Output Power Measurement

5.1. Test Setup



5.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 MHz, 2 400 ~2 483.5 MHz, and 5 725 ~ 5 850 MHz band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

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

5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to power sensor.
3. Adjust the period of operating transmission in test program in order to use power sensor and then measure average power and peak power about each data rate of WLAN at the appropriate frequencies.
4. Record in the test report.

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5.4. Test Results

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

Operation Mode	Channel	Channel Frequency (MHz)	Attenuator + Cable offset (dB)	Peak Power Output (dB m)	Peak Power Limit (dB m)
DSSS (802.11b)	Low	2 412	5.98	12.11	30
	Middle	2 437		12.21	30
	High	2 462		12.01	30
OFDM (802.11g)	Low	2 412		17.64	30
	Middle	2 437		17.88	30
	High	2 462		17.75	30
OFDM (802.11n)	Low	2 412		16.82	30
	Middle	2 437		17.03	30
	High	2 462		17.00	30

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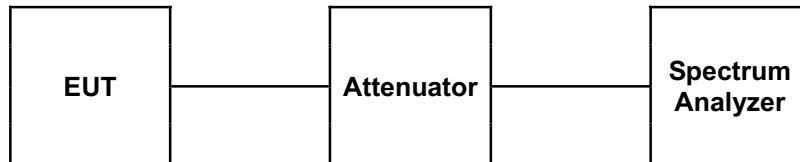
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6. POWER SPECTRAL DENSITY MEASUREMENT

6.1. Test Setup



6.2. Limit

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

6.3. Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3 kHz, VBW = 10 kHz, Span = 300 kHz and Sweep = 100 s.
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

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6.4. Test Results

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

Operation Mode	Frequency	Final RF Power Level in 3 kHz BW (dB m)	Maximum Limit (dB m)
DSSS (802.11b)	2 412 MHz	-18.72	8
	2 437 MHz	-18.80	8
	2 462 MHz	-18.17	8
OFDM (802.11g)	2 412 MHz	-19.33	8
	2 437 MHz	-18.45	8
	2 462 MHz	-19.99	8
OFDM (802.11n)	2 412 MHz	-19.11	8
	2 437 MHz	-19.84	8
	2 462 MHz	-18.32	8

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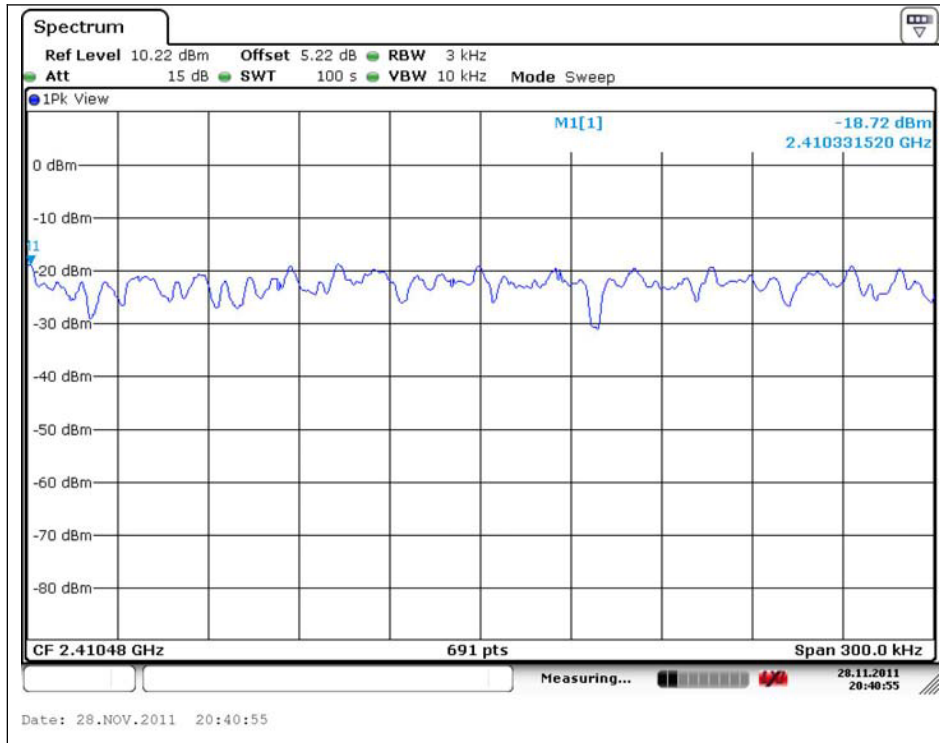
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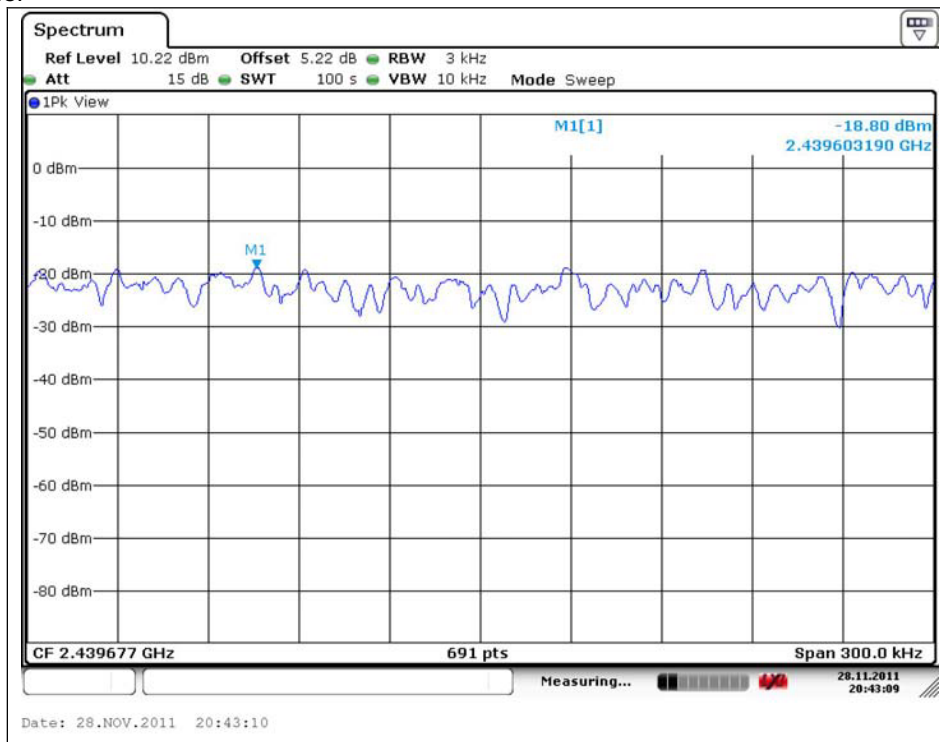
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DSSS : 802.11b

Low Channel



Middle Channel



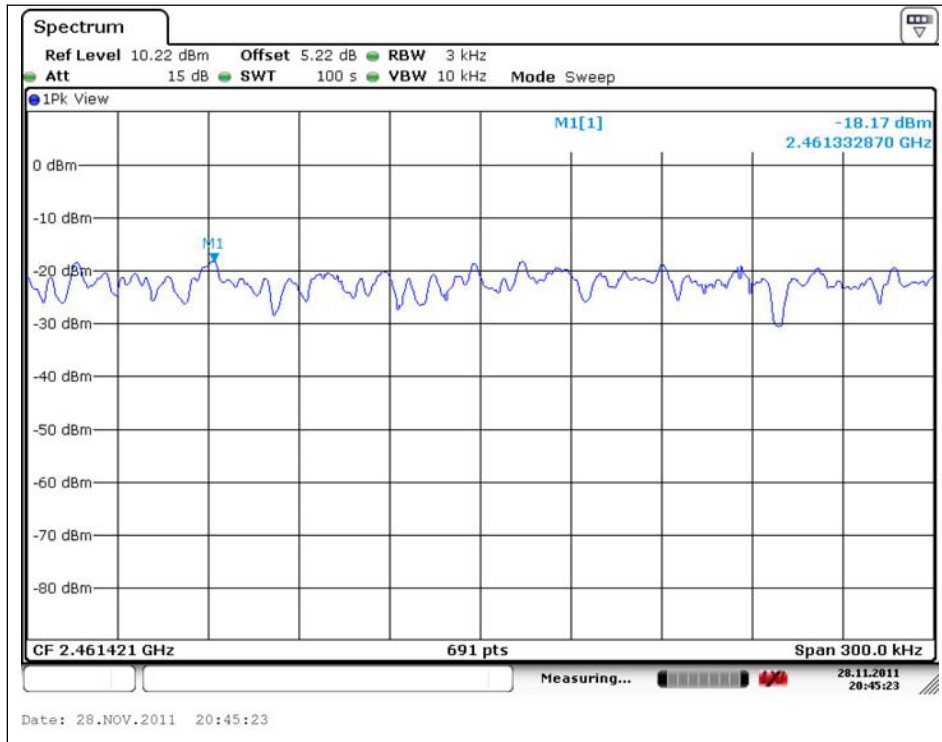
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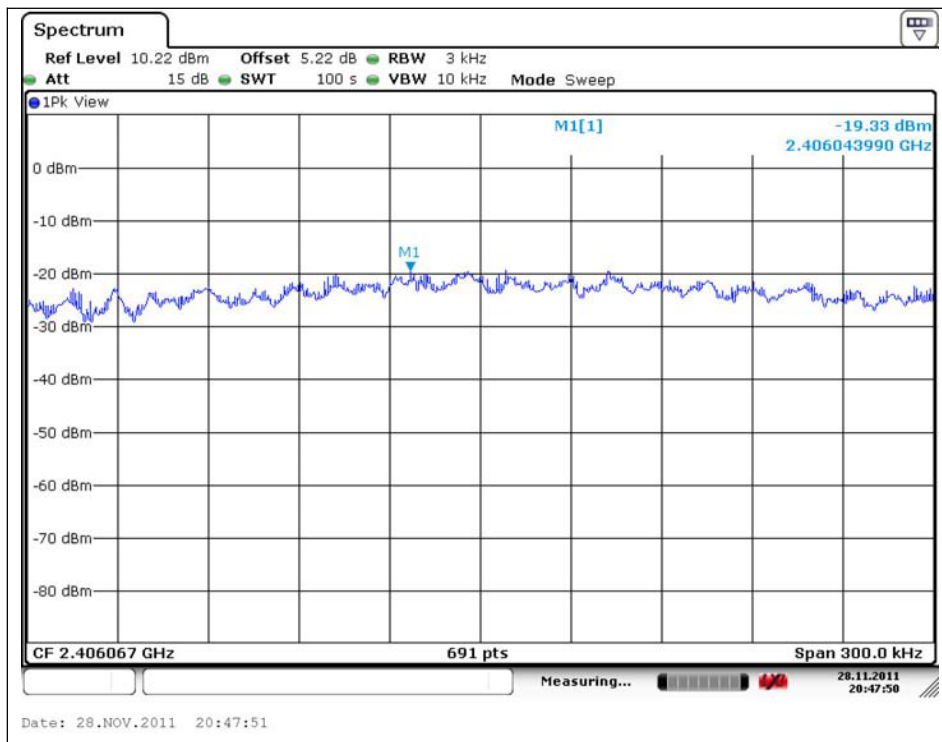
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High Channel



OFDM : 802.11g

Low Channel



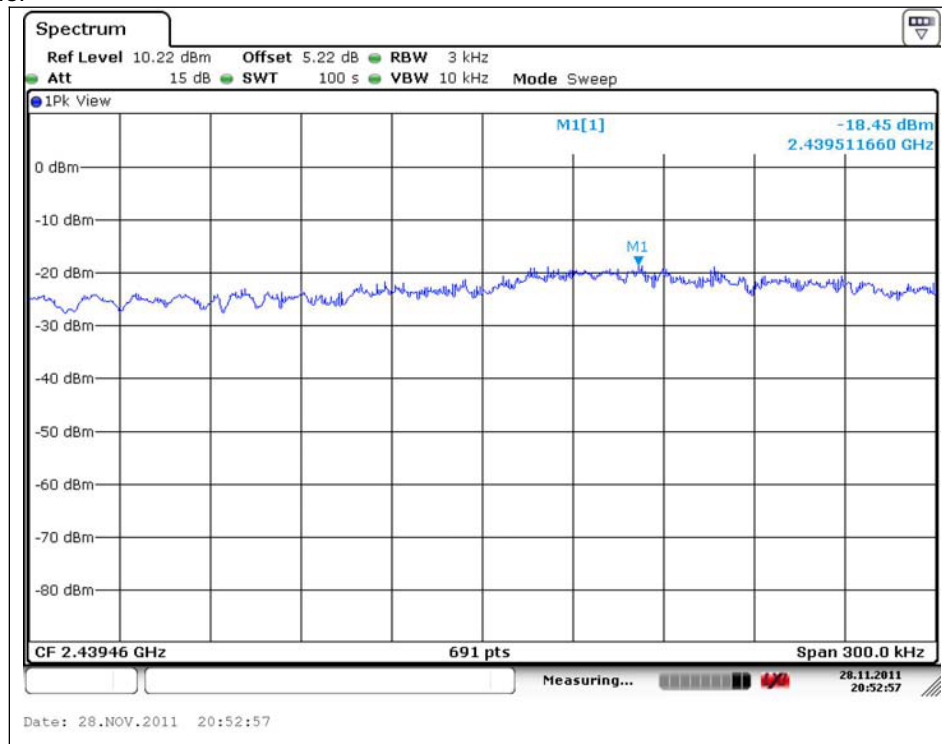
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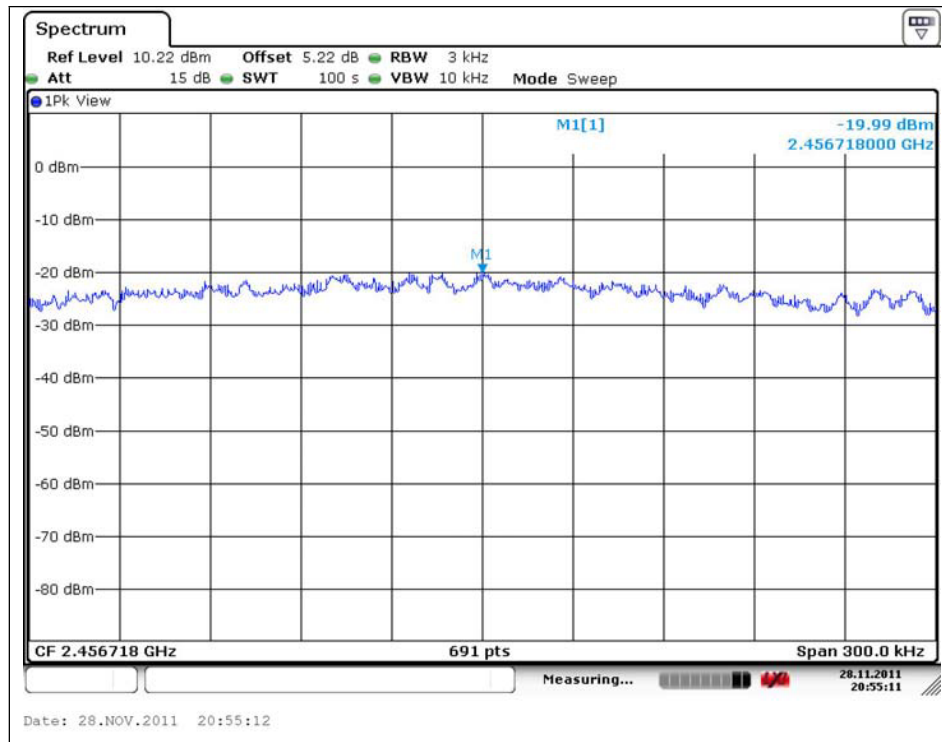
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Middle Channel



High Channel



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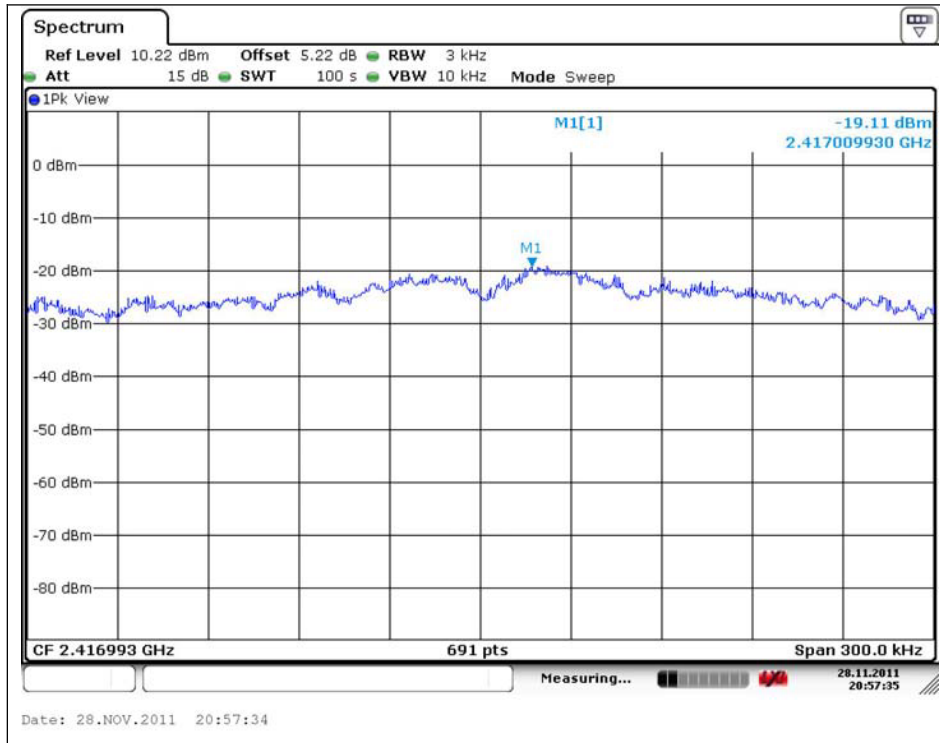
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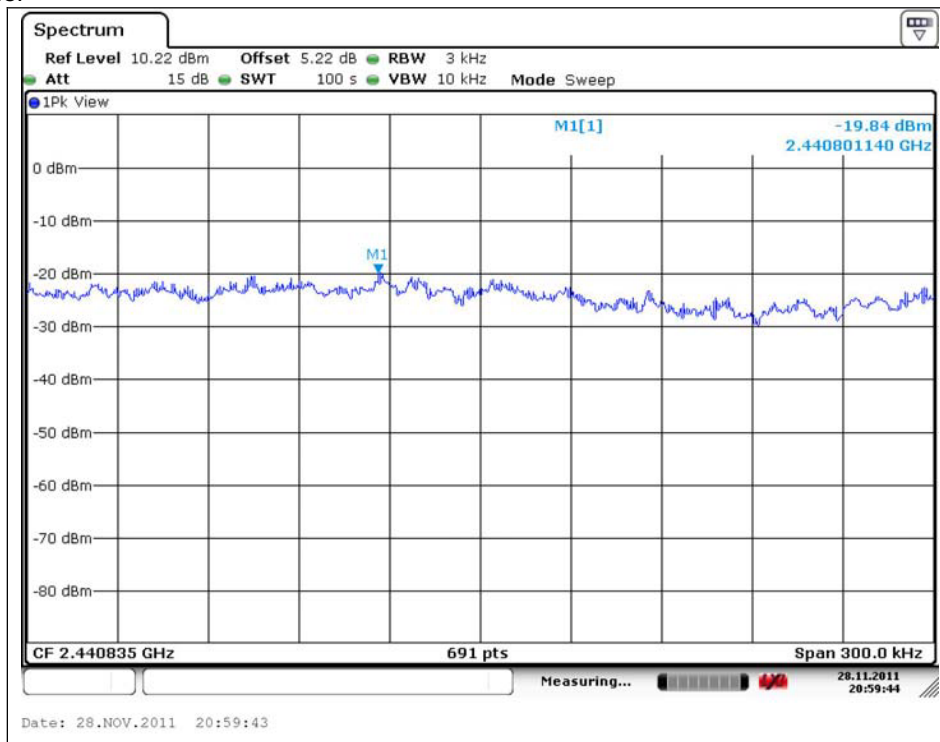
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DSSS : 802.11n

Low Channel



Middle Channel



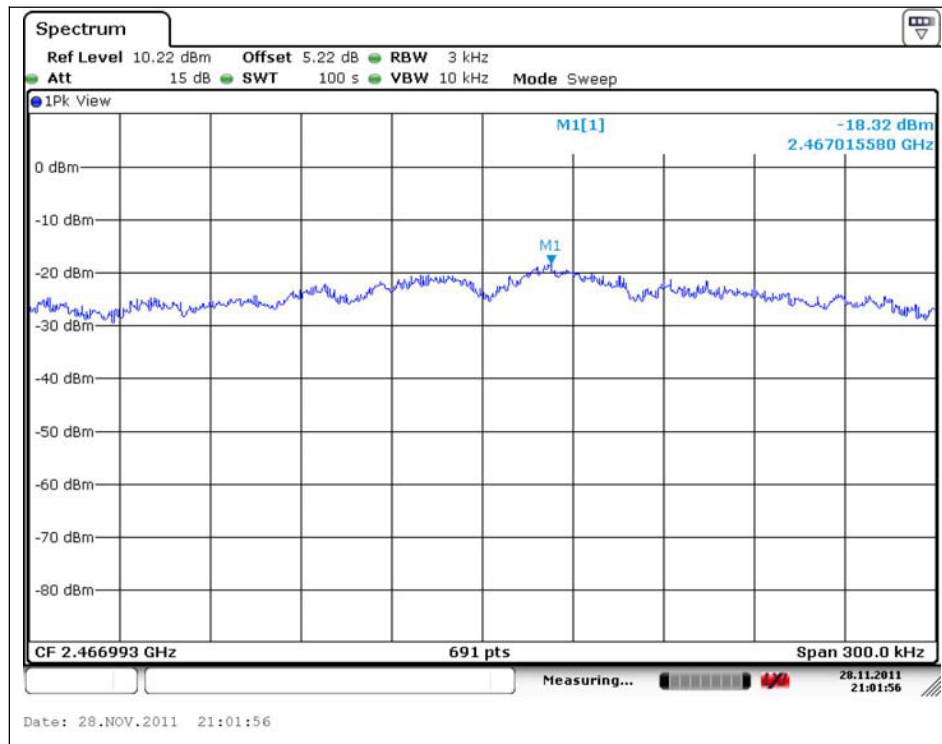
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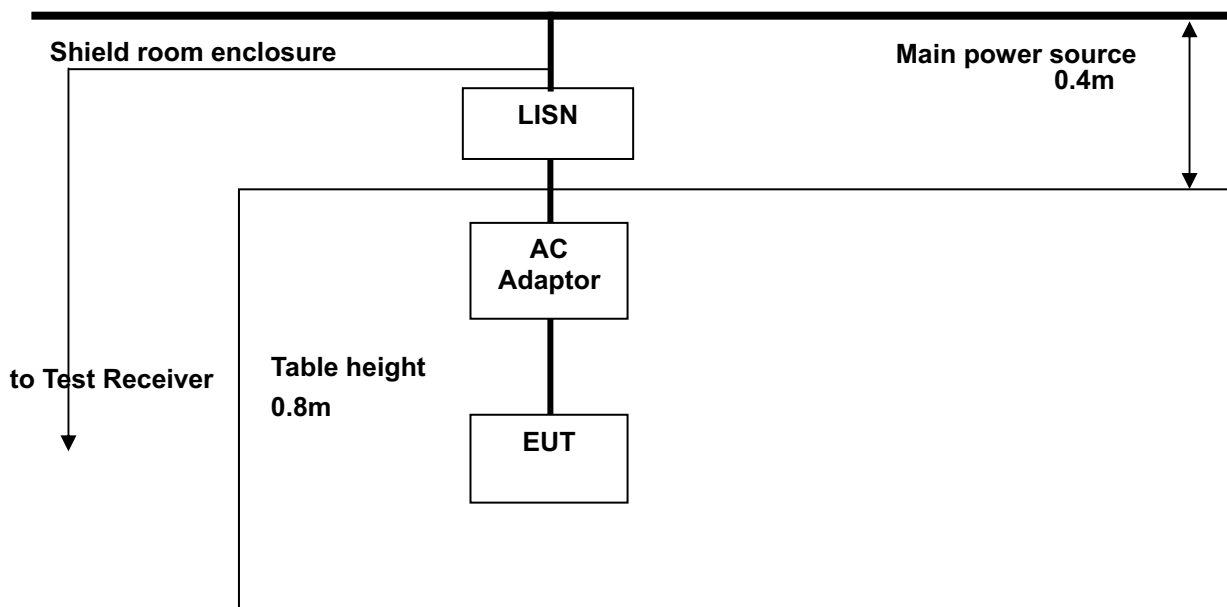
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7. Transmitter AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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7.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m × 3.6m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W) × 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.

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7.4. Test Results (Worst case configuration_11g mode)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dB μ V)		LINE	LIMIT(dB μ V)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	53.10	39.30	H	63.61	53.61	10.51	14.31
0.29	44.40	28.30	H	60.52	50.52	16.12	22.22
0.41	42.20	29.30	H	57.75	47.75	15.55	18.45
2.16	35.00	25.30	H	56.00	46.00	21.00	20.70
5.98	27.70	19.20	H	60.00	50.00	32.30	30.80
8.38	28.50	20.00	H	60.00	50.00	31.50	30.00
0.20	53.20	39.70	N	63.61	53.61	10.41	13.91
0.29	44.60	28.20	N	60.52	50.52	15.92	22.32
0.41	41.80	28.90	N	57.75	47.75	15.95	18.85
0.60	33.00	21.00	N	56.00	46.00	23.00	25.00
2.56	31.20	22.00	N	56.00	46.00	24.80	24.00
5.50	29.30	21.50	N	60.00	50.00	30.70	28.50

Note ;

Line (H) : Hot

Line (N) : Neutral

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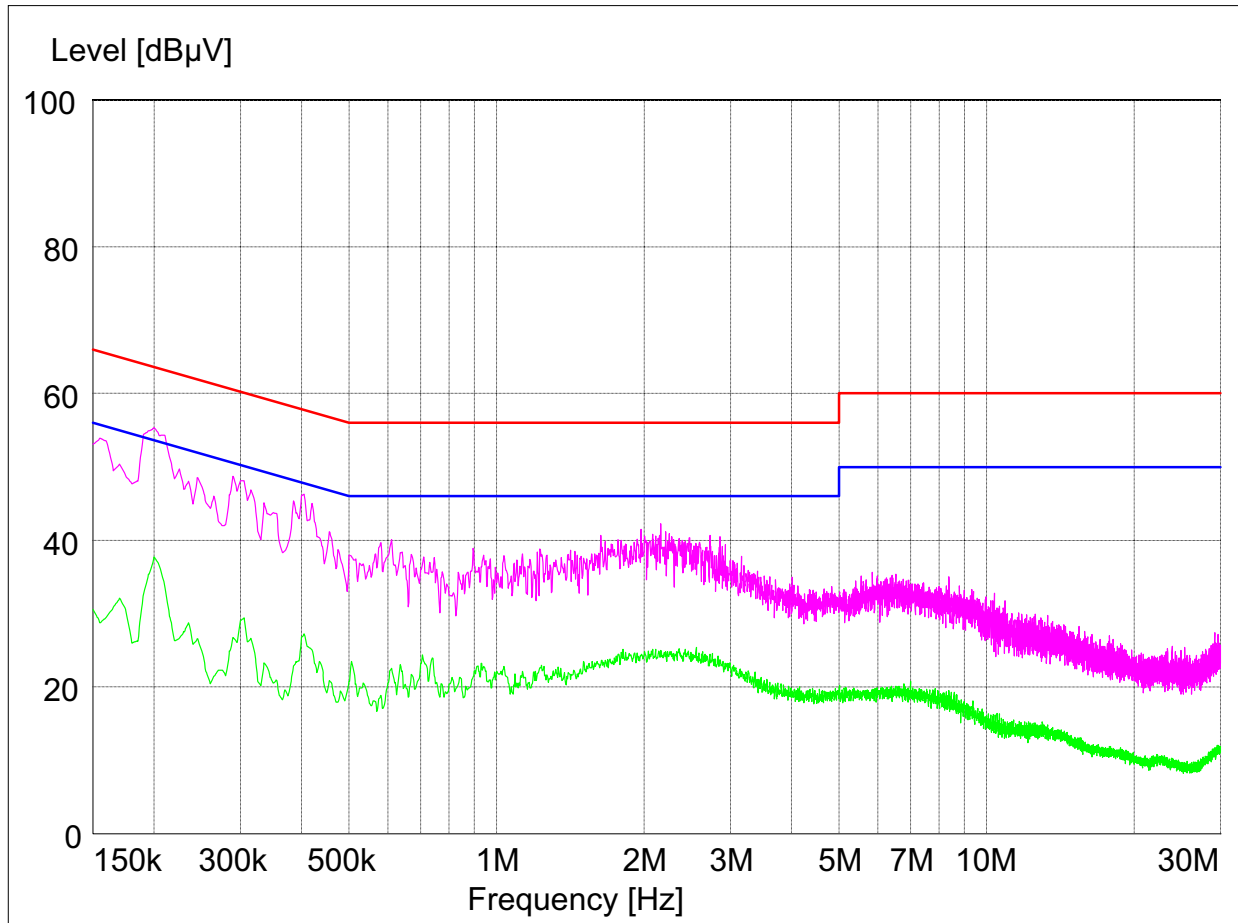
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Plot of Conducted Power line

Test mode : (Hot)



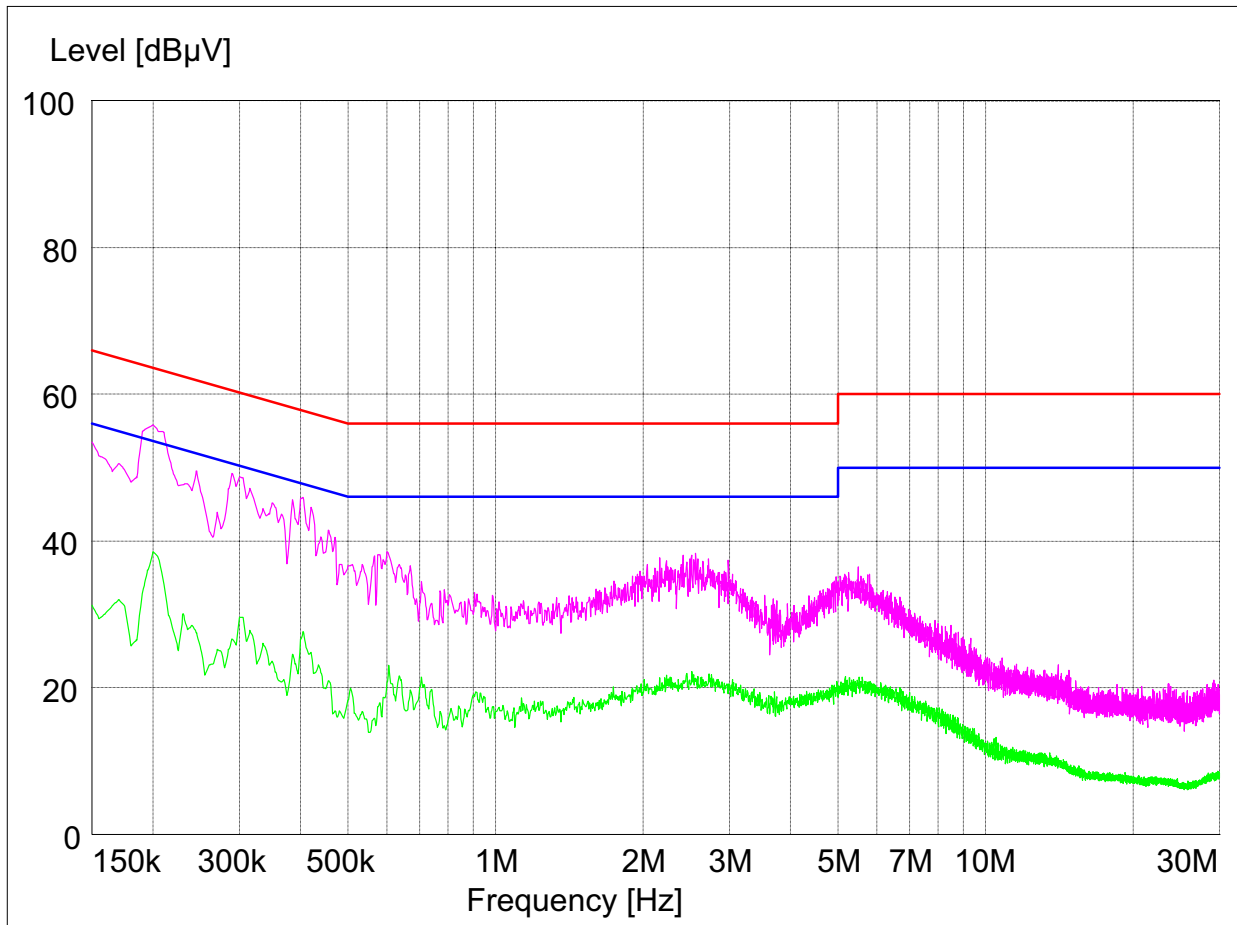
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Test mode : (Neutral)



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8. Receiver AC Power Line Conducted Emission

8.1. Test Setup- Same as clause 7.1.

8.2. Limit

According to §15.107(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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8.3. Test Procedures- Same as clause 7.3.

8.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line;
Addition,

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dB μ V)		LINE	LIMIT(dB μ V)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	53.20	39.30	H	63.61	53.61	10.41	14.31
0.29	44.50	28.10	H	60.52	50.52	16.02	22.42
0.41	42.30	29.10	H	57.75	47.75	15.45	18.65
2.07	34.20	24.80	H	56.00	46.00	21.80	21.20
2.42	34.20	25.50	H	56.00	46.00	21.80	20.50
6.67	27.90	19.70	H	60.00	50.00	32.10	30.30
0.20	53.00	38.80	N	63.61	53.61	10.61	14.81
0.29	43.80	28.20	N	60.52	50.52	16.72	22.32
0.41	40.30	28.00	N	57.75	47.75	17.45	19.75
0.61	33.70	22.30	N	56.00	46.00	22.30	23.70
2.56	30.50	21.40	N	56.00	46.00	25.50	24.60
5.32	28.80	20.00	N	60.00	50.00	31.20	30.00

Note ;

Line (H) : Hot

Line (N) : Neutral

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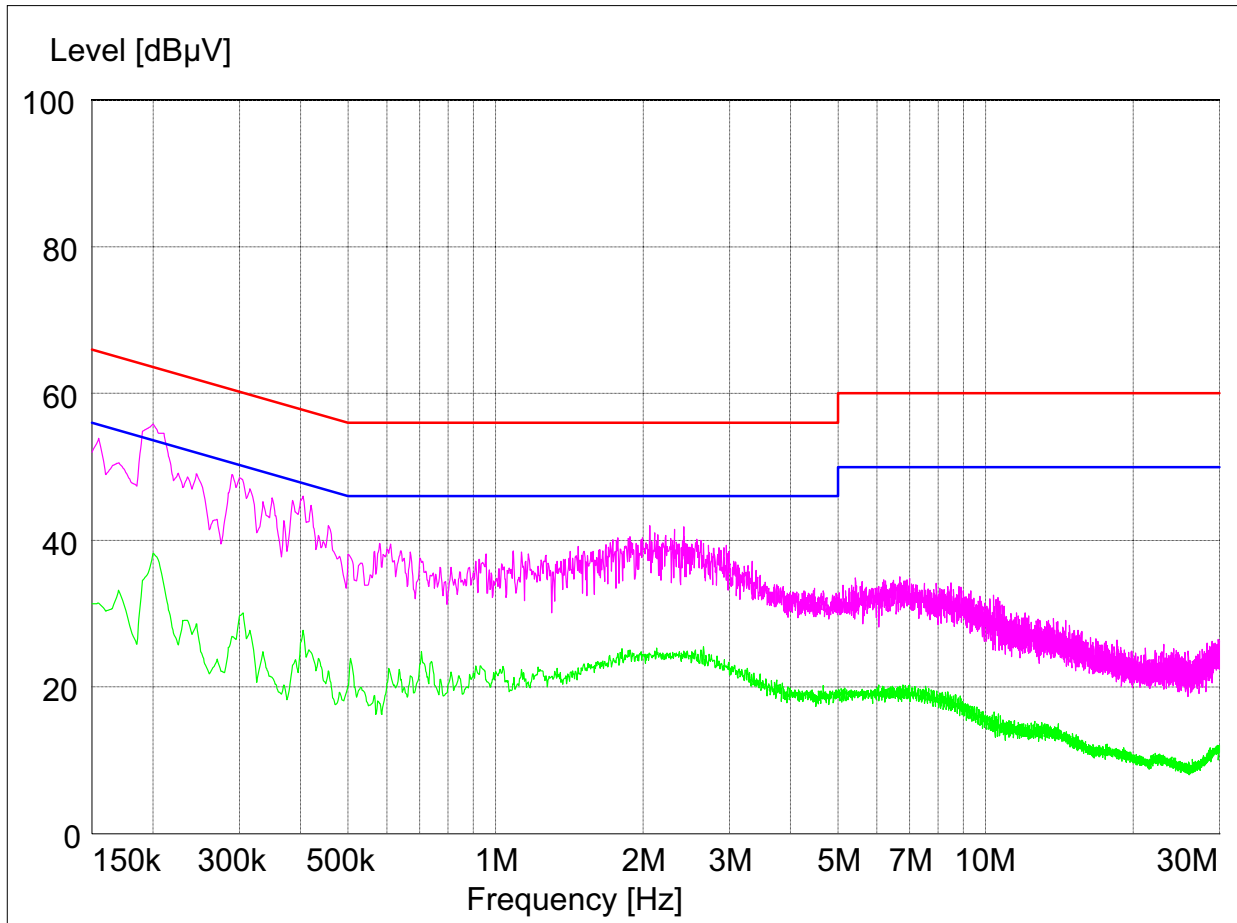
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Plot of Conducted Power line

Test mode : (Hot)



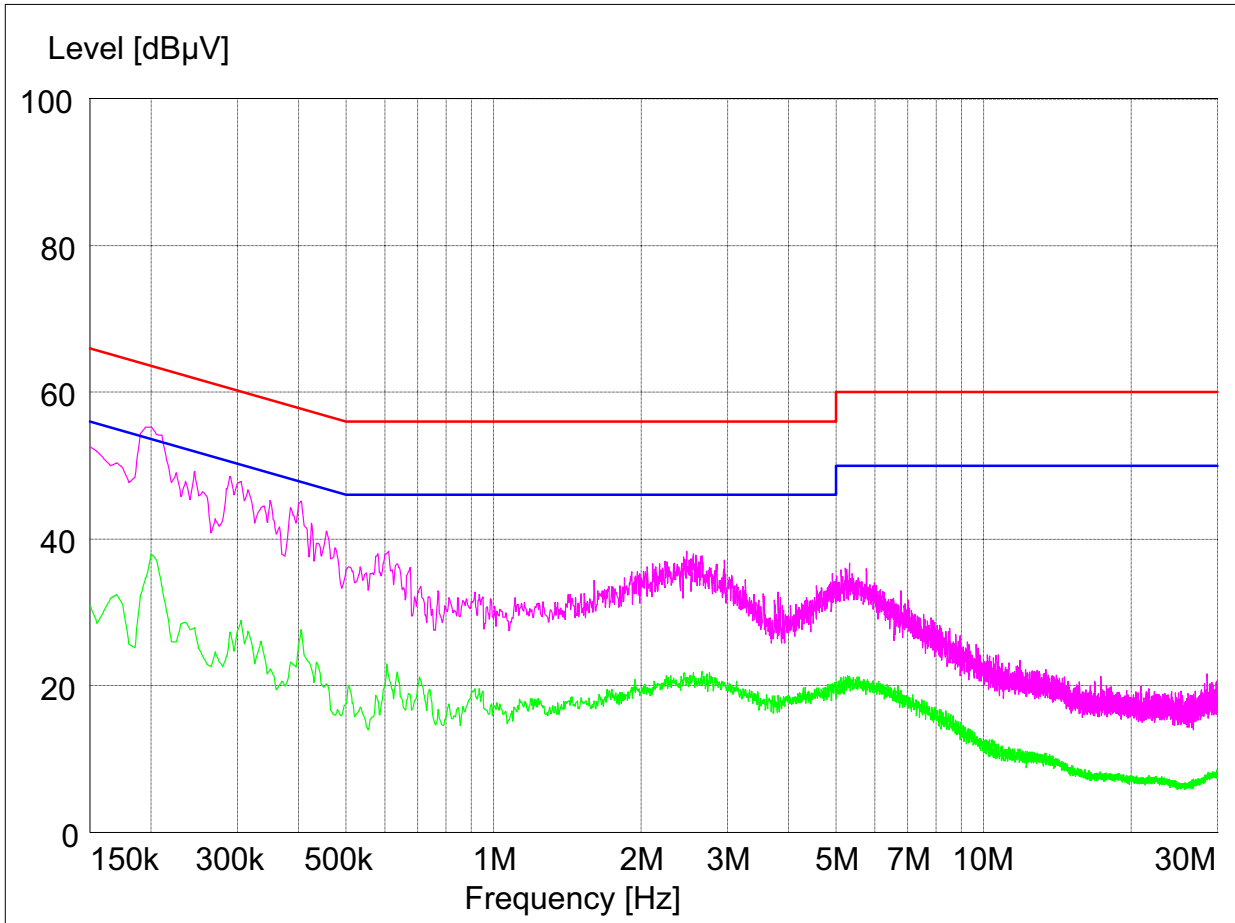
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Test mode : (Neutral)



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9. Antenna Requirement

9.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

9.2. Antenna Connected Construction

Antenna used in this product is Integral type (FPCB Antenna) gain of -0.96 dBi.

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10. RF Exposure Evaluation

10.1 Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500	--	--	F/1500	6
<u>1 500 – 100 000</u>	--	--	<u>1</u>	<u>30</u>

10.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

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10.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

10.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

DSSS : 802.11b

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	2 412	9.30	-0.96	0.001 357	1
Middle	2 437	9.40	-0.96	0.001 389	1
High	2 462	9.20	-0.96	0.001 327	1

OFDM : 802.11g

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	2 412	8.40	-0.96	0.001 103	1
Middle	2 437	8.57	-0.96	0.001 147	1
High	2 462	8.52	-0.96	0.001 134	1

OFDM : 802.11n

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	2 412	7.36	-0.96	0.000 868	1
Middle	2 437	7.50	-0.96	0.000 897	1
High	2 462	7.48	-0.96	0.000 893	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm².

Because the average output power is lower than 60/f(GHz), SAR evaluation is not required per KDB 447498

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