

FCC Part 15C
Measurement and Test Report
For
Green Electronics, LLC

FCC ID: 2APPB-SPK5-16

FCC Rule(s):	<u>FCC Part 15C</u>
Product Description:	<u>RainMachine PRO</u>
Tested Model:	<u>SPK5-16</u>
Report No.:	<u>BSL18041055030001-ER-1</u>
Tested Date:	<u>Apr 20~28, 2018</u>
Issued Date:	<u>Apr 29, 2018</u>
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Green Electronics, LLC
Address of applicant: 47801 Fremont Blvd, Fremont, California, 94538 USA

Manufacturer: Green Electronics, LLC
Address of manufacturer: 47801 Fremont Blvd, Fremont, California, 94538 USA

General Description of EUT	
Product Name:	RainMachine PRO
Trade Name:	RainMachine
Model No.:	SPK5-16, SPK5-8
Rated Voltage:	AC 24V from AC/DC adapter
Adapter information:	Model: MKA-482400750 Input: AC120V, 50/60Hz, 0.3A Output: AC 24V, 0.75A
<i>Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model AMP-i50B, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power:	8.87dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	PIFA Antenna
Antenna Gain:	2dBi
Lowest Internal Frequency	32.768KHz

1.2 Test Standards

The following report is prepared on behalf of the SHEN ZHEN UYESEE TECHNOLOGY CO.,LTD in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v04 for digital transmission systems shall be performed also.

1.4 Test Facility

BSL Testing Co.,LTD.

NO. 24, ZH Park, Nantou, Shenzhen, 518000 China

Designation Number : CN1217

Test Firm Registration Number: 866035

Tel: 86- 755-26508703

Fax: 86- 755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	2412MHz, 2437MHz, 2462MHz
TM2	802.11g	2412MHz, 2437MHz, 2462MHz
TM3	802.11n-HT20	2412MHz, 2437MHz, 2462MHz
TM4	802.11n-HT40	2422MHz, 2437MHz, 2452MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

Accessories Equipment List and Details			
Description	Manufacturer	Model No.	Serial Number
/	/	/	/
/	/	/	/
Accessories Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With Core/Without Core
/	/	/	/
EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2017-10-21	2018-10-20
Spectrum Analyzer	R&S	FSP40	100550	2017-10-21	2018-10-20
Test Receiver	R&S	ESCI7	US47140102	2017-10-21	2018-10-20
Signal Generator	HP	83630B	3844A01028	2017-10-22	2018-10-21
Test Receiver	R&S	ESPI-3	100180	2017-10-21	2018-10-20
Amplifier	Agilent	8449B	4035A00116	2017-10-22	2018-10-21
Amplifier	HP	8447E	2945A02770	2017-10-22	2018-10-21
Signal Generator	IFR	2023A	202307/242	2017-10-22	2018-10-21
Broadband Antenna	SCHAFFNER	2774	2774	2017-10-17	2018-10-16
Biconical and log periodic antennas	ELECTRO-METRIC	EM-6917B-1	171	2017-10-17	2018-10-16
Horn Antenna	R&S	HF906	100253	2017-10-17	2018-10-16
Horn Antenna	EM	EM-6961	6462	2017-10-17	2018-10-16
LISN	R&S	ESH3-Z5	100196	2017-10-17	2018-10-16
LISN	COM-POWER	LI-115	02027	2017-10-17	2018-10-16
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2017-10-21	2018-10-20
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2017-10-21	2018-10-20

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	PASS
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	PASS
§15.205	Restricted Band of Operation	PASS
§ 15.207(a)	Conducted Emission	PASS
§ 15.247(e)	Power Spectral Density	PASS
§ 15.247(a)(2)	6 dB Bandwidth	PASS
§ 15.247(b)(3)	RF Output Power	PASS
§ 15.209(a)	Radiated Emission	PASS
§ 15.247(d)	Band Edge (Out of Band Emissions)	PASS

Note: PASS: applicable, N/A: not applicable.

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has a PIFA antenna, fulfill the requirement of this section.

5. Power Spectral Density

5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2 Test Procedure

According to the KDB 558074 D01 v04, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set VBW $\geq 3 \times \text{RBW}$.
- e) Detector = power averaging (RMS) or sample detector (when RMS not available).
- f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- g) Sweep time = auto couple.
- h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- i) Use the peak marker function to determine the maximum amplitude level.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

5.3 Environmental Conditions

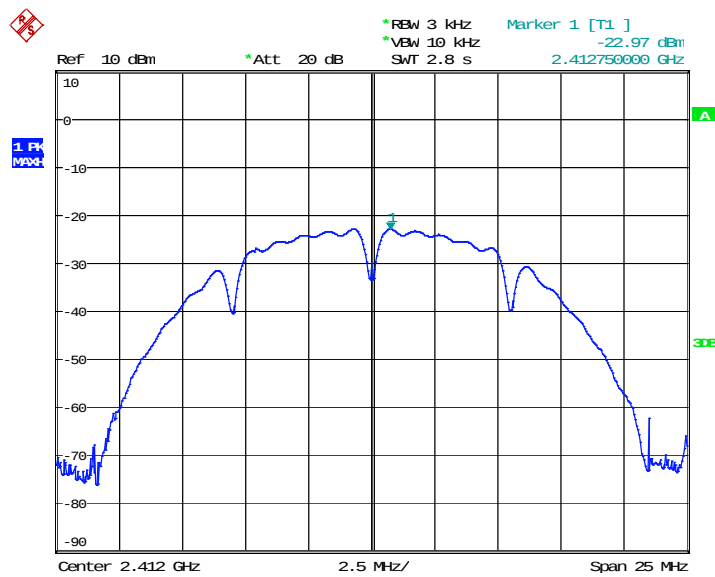
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-22.97	8
	2437	-23.17	8
	2462	-22.30	8
802.11g	2412	-26.62	8
	2437	-26.12	8
	2462	-25.22	8
802.11n HT20	2412	-26.82	8
	2437	-26.79	8
	2462	-26.64	8
802.11n HT40	2422	-27.47	8
	2437	-27.91	8
	2452	-26.34	8

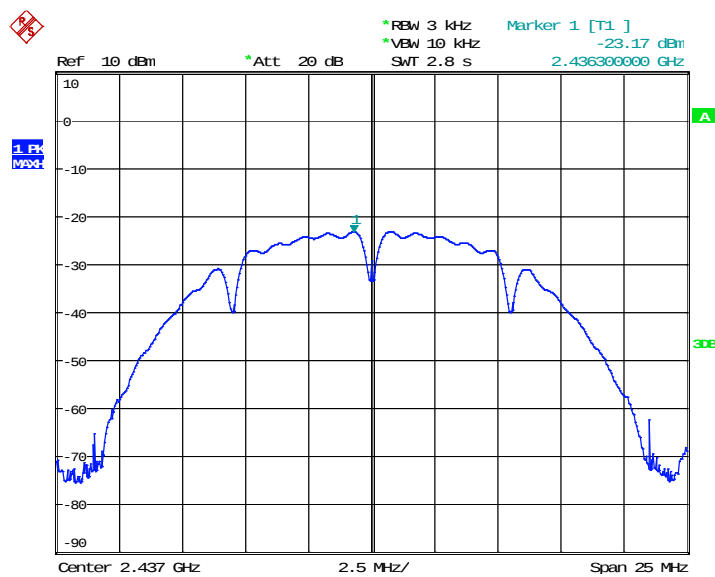
Please refer to the following test plots:

802.11b-Low Channel



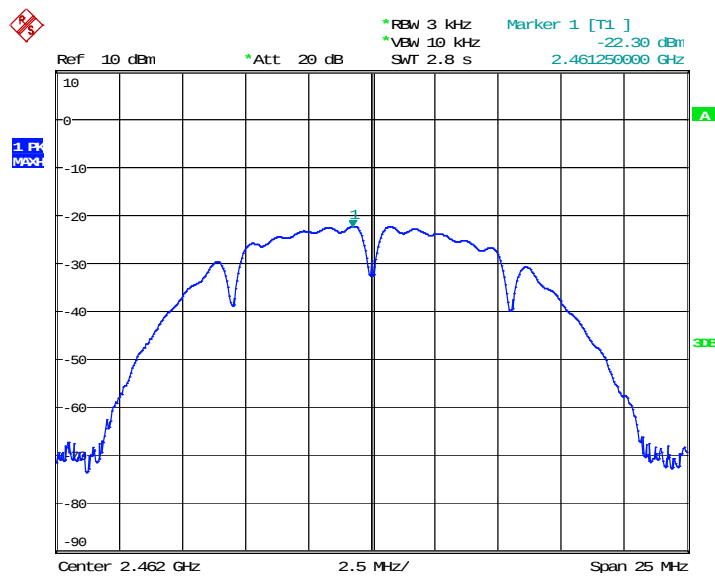
Date: 28.APR.2018 04:21:24

802.11b-Middle Channel



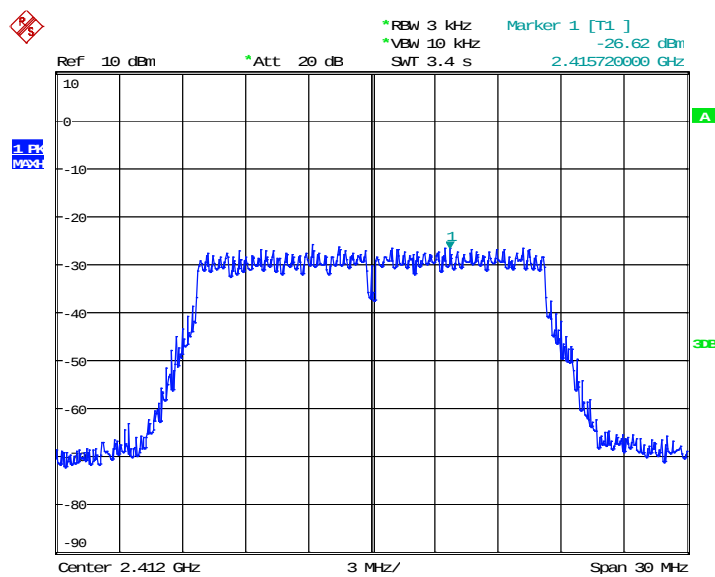
Date: 28.APR.2018 04:22:01

802.11b-High Channel



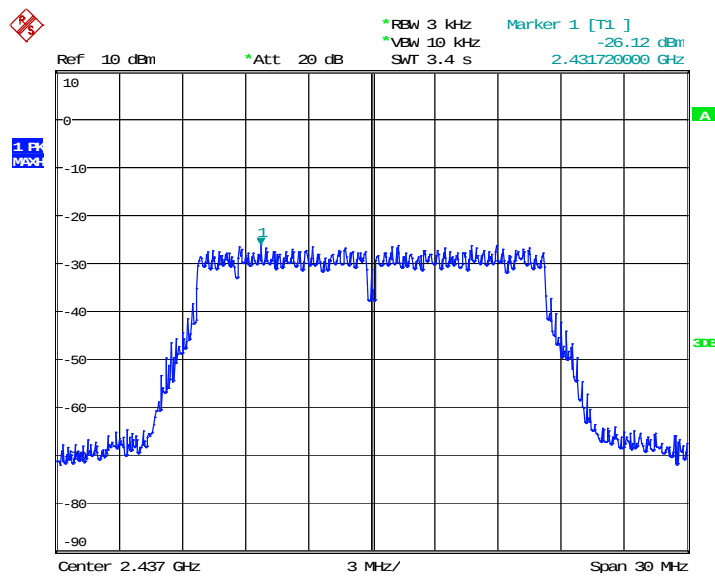
Date: 28.APR.2018 04:22:31

802.11g-Lows Channel



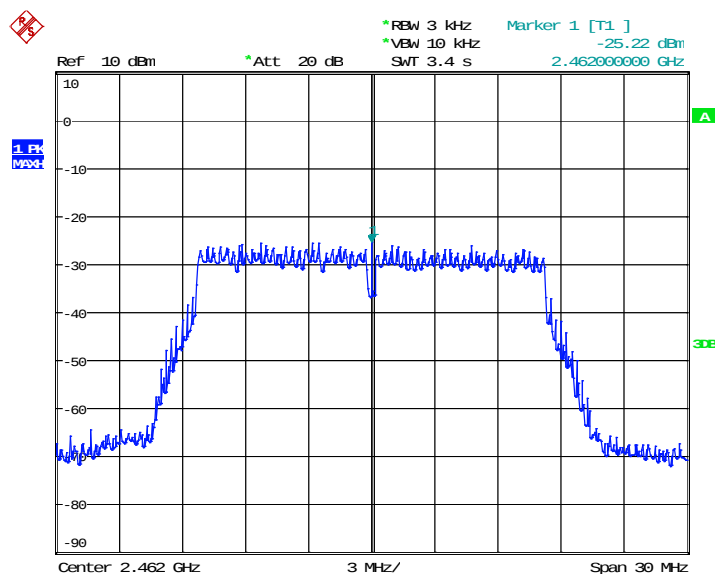
Date: 28.APR.2018 04:23:28

802.11g-Middle Channel



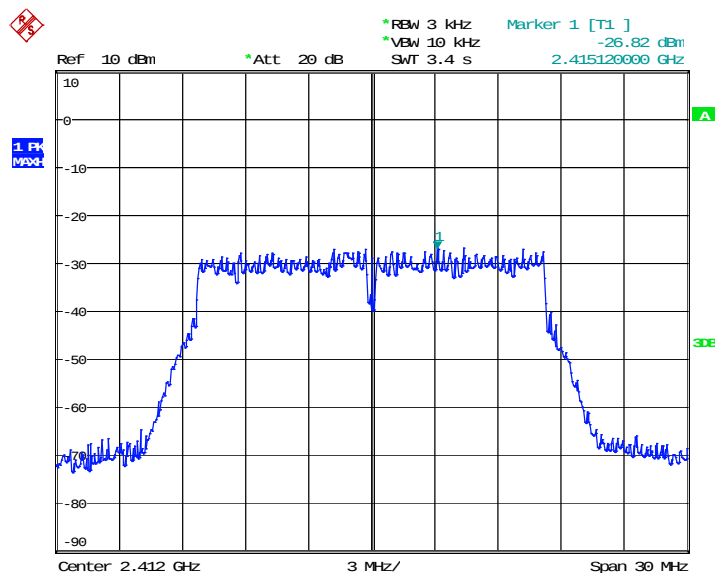
Date: 28.APR.2018 04:24:03

802.11g-High Channel



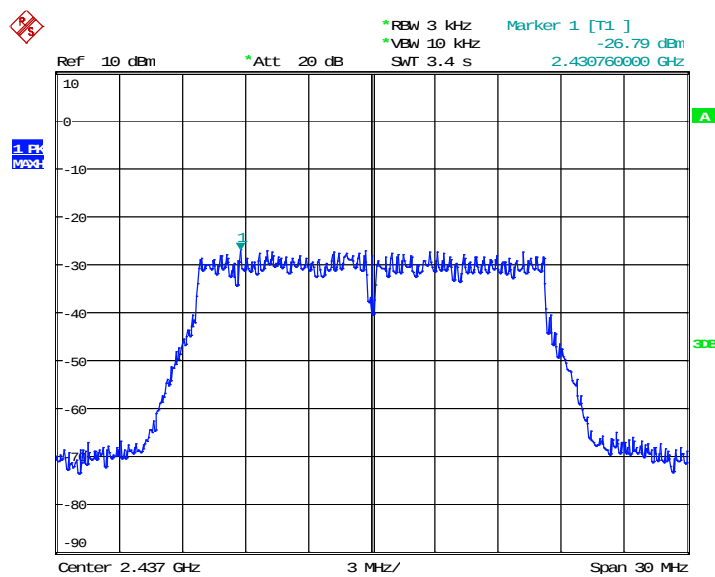
Date: 28.APR.2018 04:24:40

802.11n-HT20-Low Channel



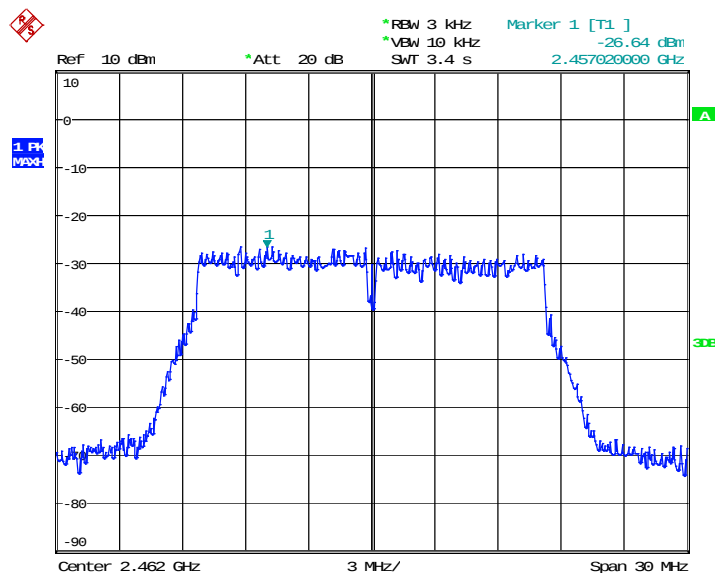
Date: 28.APR.2018 04:25:28

802.11n-HT20-Middle Channel



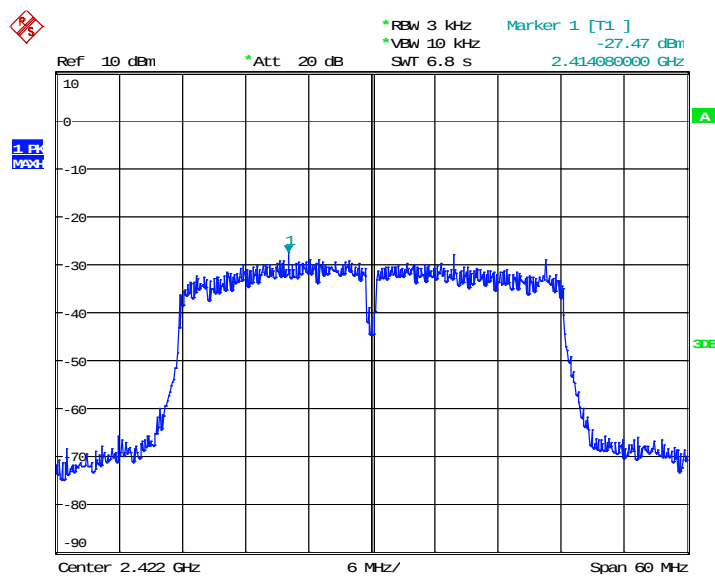
Date: 28.APR.2018 04:26:56

802.11n-HT20-High Channel



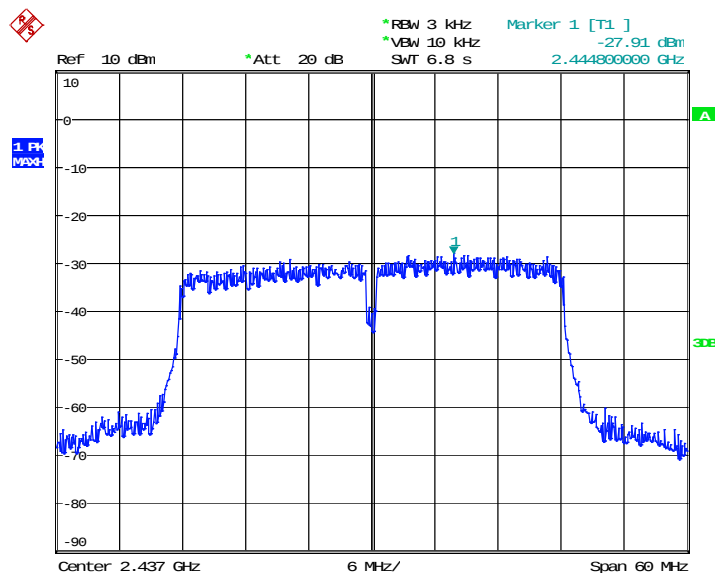
Date: 28.APR.2018 04:27:31

802.11n-HT40-Low Channel



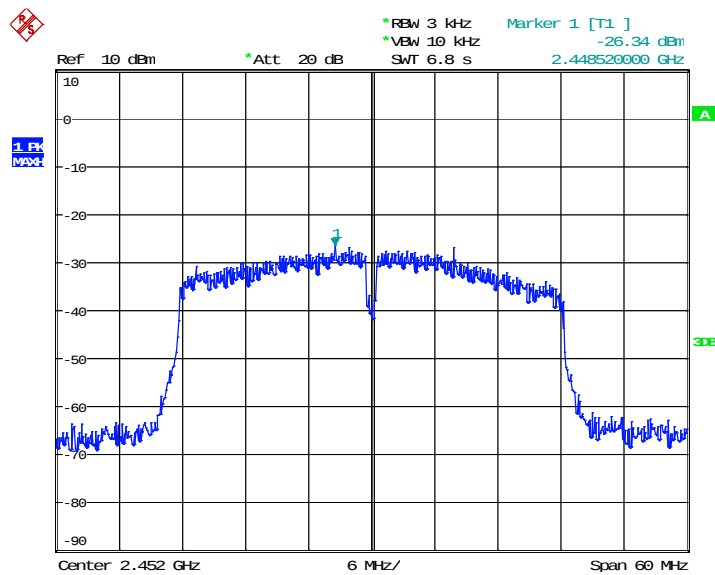
Date: 28.APR.2018 04:28:56

802.11n-HT40-Middle Channel



Date: 28.APR.2018 04:29:29

802.11n-HT40-High Channel



Date: 28.APR.2018 04:30:00

6. 6dB Bandwidth

6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2 Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to 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.

6.3 Environmental Conditions

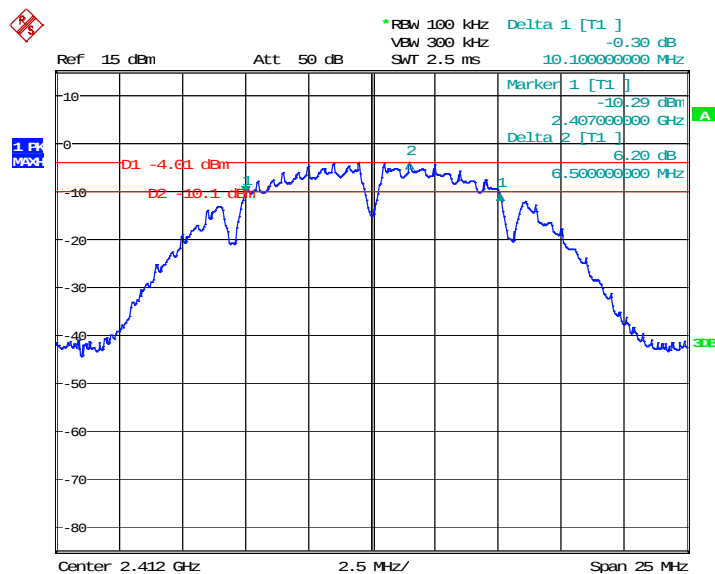
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b	2412	10.10	≥ 500
	2437	10.10	≥ 500
	2462	10.10	≥ 500
802.11g	2412	16.62	≥ 500
	2437	16.36	≥ 500
	2462	16.62	≥ 500
802.11n-HT20	2412	16.62	≥ 500
	2437	16.62	≥ 500
	2462	16.62	≥ 500
802.11n-HT40	2422	36.44	≥ 500
	2437	36.48	≥ 500
	2452	32.76	≥ 500

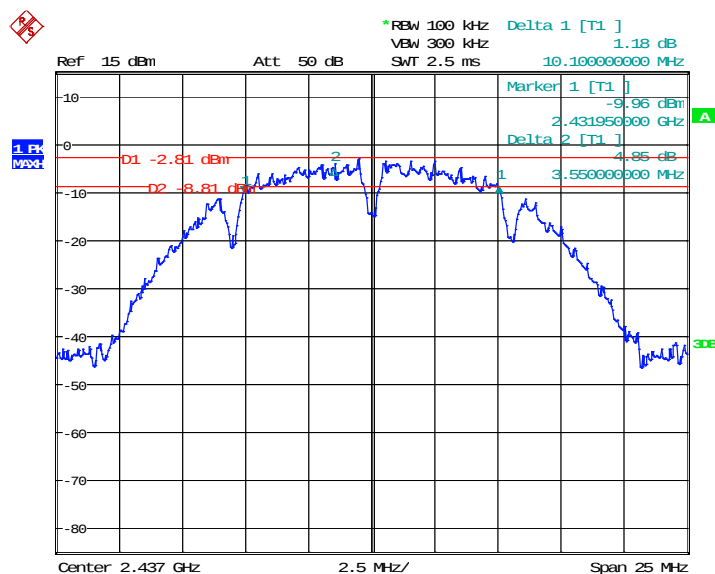
Please refer to the following test plots:

802.11b-Low Channel



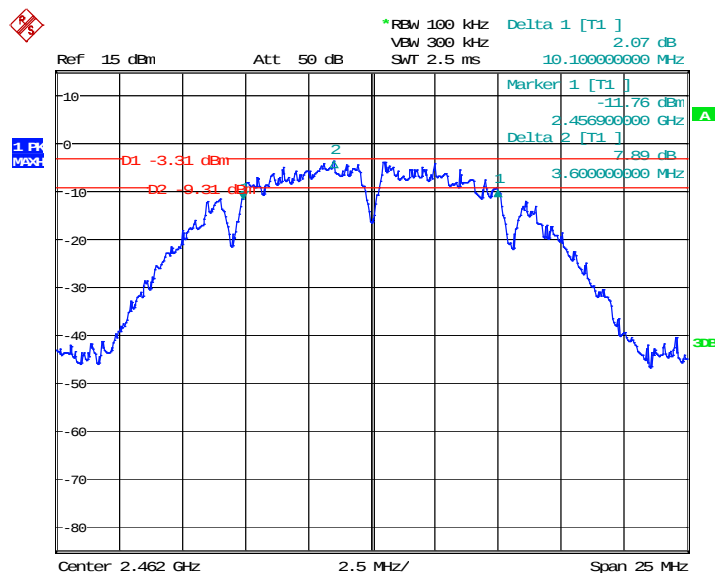
Date: 28.APR.2018 01:45:22

802.11b-Middle Channel



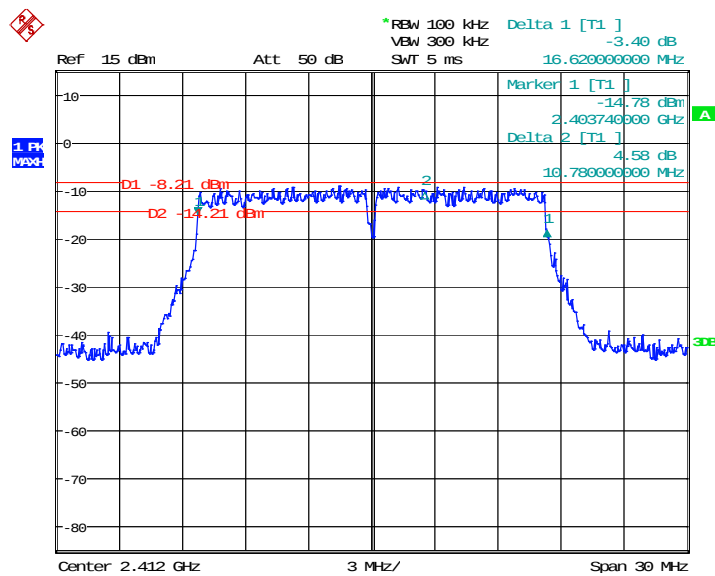
Date: 28.APR.2018 01:53:22

802.11b-High Channel



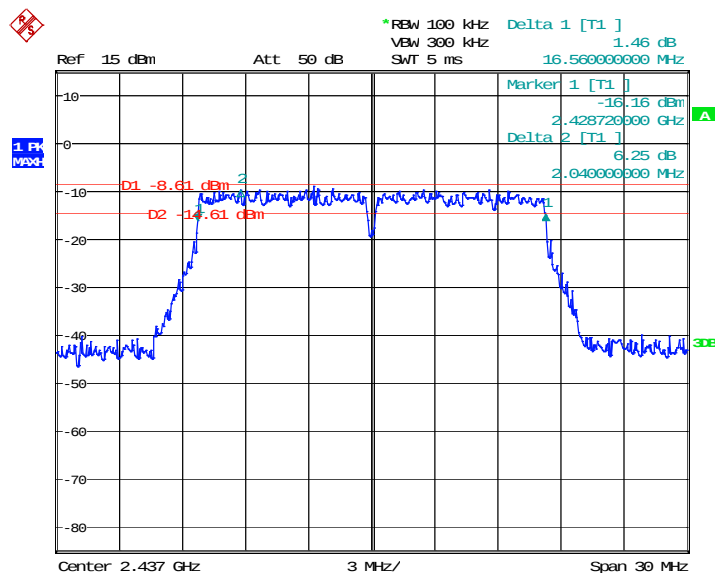
Date: 28.APR.2018 01:56:22

802.11g-Low Channel



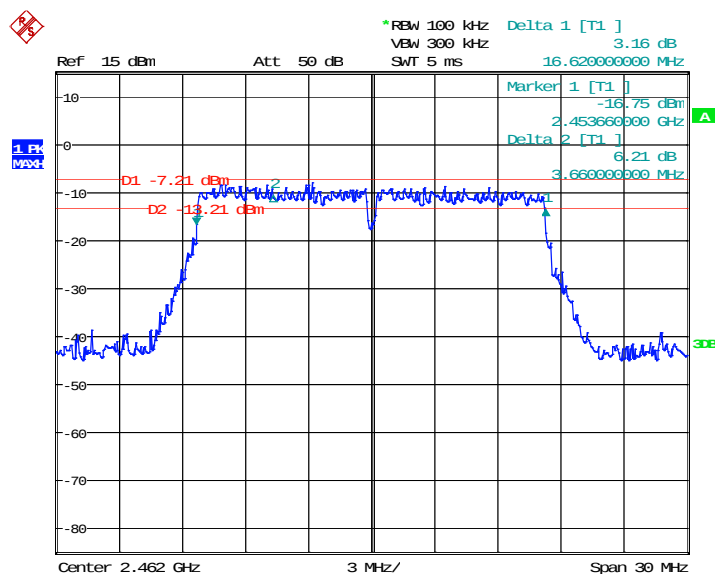
Date: 28.APR.2018 01:59:50

802.11g-Middle Channel



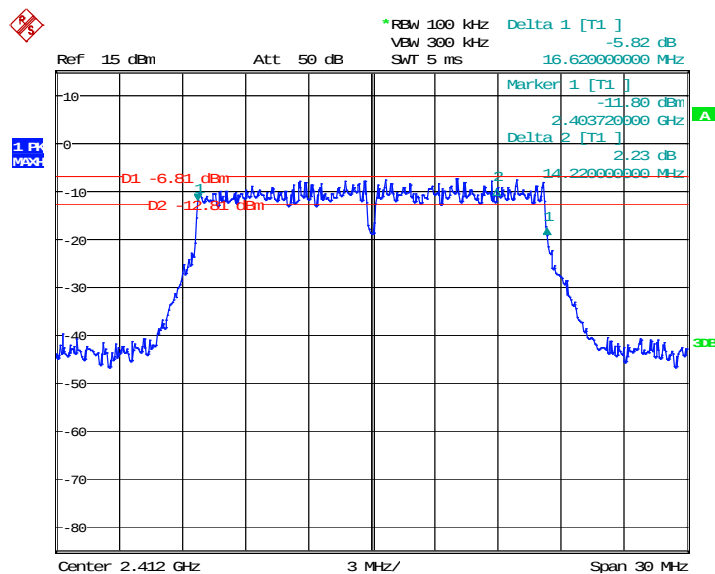
Date: 28.APR.2018 02:01:34

802.11g-High Channel



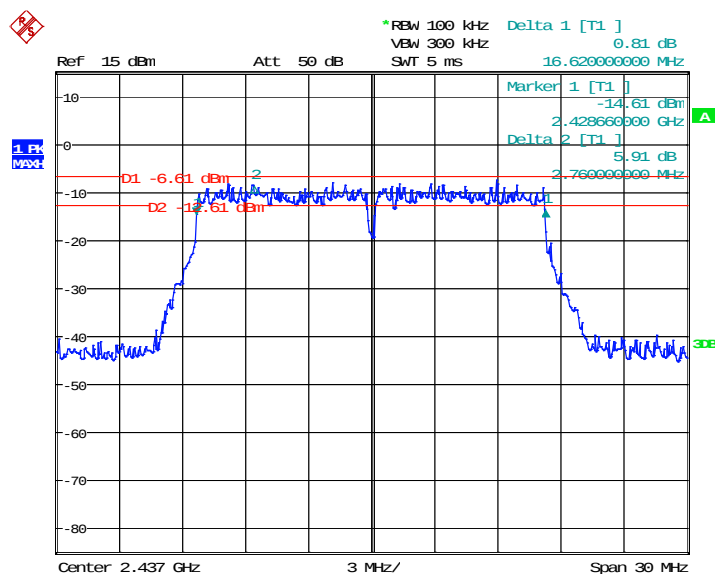
Date: 28.APR.2018 02:03:05

802.11n-HT20-Low Channel



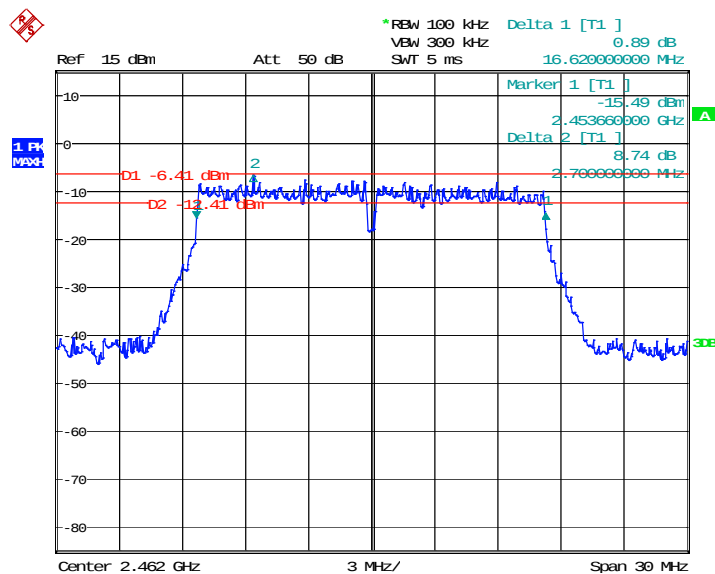
Date: 28.APR.2018 02:04:52

802.11n-HT20-Middle Channel



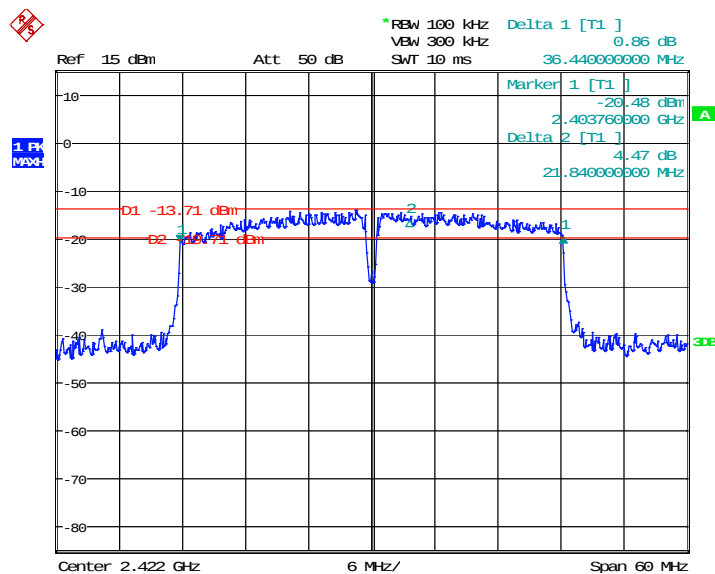
Date: 28.APR.2018 02:06:27

802.11n-HT20-High Channel



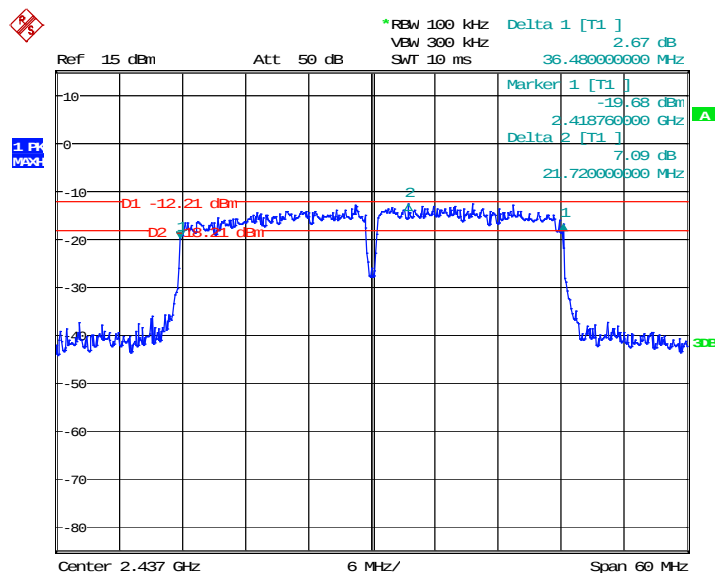
Date: 28.APR.2018 02:09:17

802.11n-HT40-Low Channel



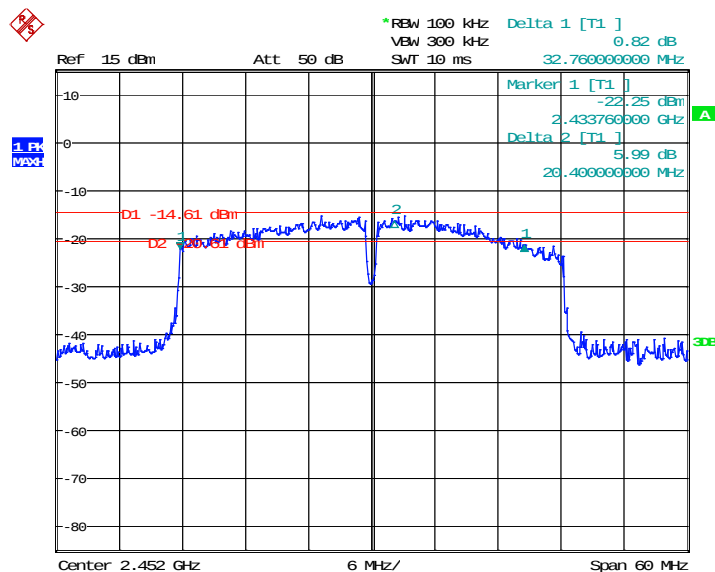
Date: 28.APR.2018 02:18:23

802.11n-HT40-Middle Channel



Date: 28.APR.2018 02:19:53

802.11n-HT40-High Channel



Date: 28.APR.2018 02:22:57

7. RF Output Power

7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

7.2 Test Procedure

According to the KDB-558074 D01 v04, 9.2.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1 MHz.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This gives bin-to-bin spacing $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
- e) Sweep time = auto.
- f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- g) If transmit duty cycle $< 98 \%$, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq 98 \%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run” .
- h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

7.3 Environmental Conditions

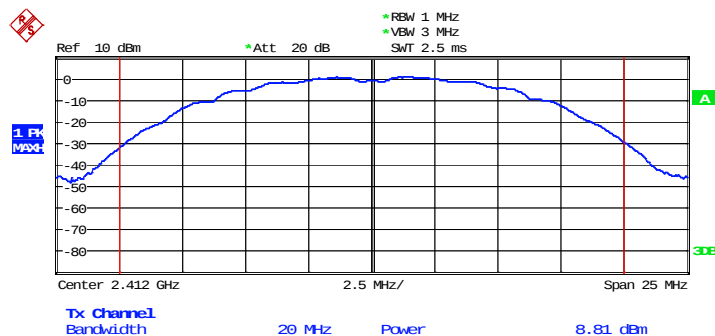
Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	8.81	7.60	1000
	2437	8.64	7.31	1000
	2462	8.87	7.71	1000
802.11g_54Mbps	2412	7.84	6.08	1000
	2437	7.72	5.92	1000
	2462	7.70	5.89	1000
802.11n HT20_MCS7	2412	7.81	6.04	1000
	2437	8.22	6.64	1000
	2462	7.38	5.47	1000
802.11n HT40_MCS7	2422	7.19	5.24	1000
	2437	7.38	5.47	1000
	2452	6.68	4.66	1000

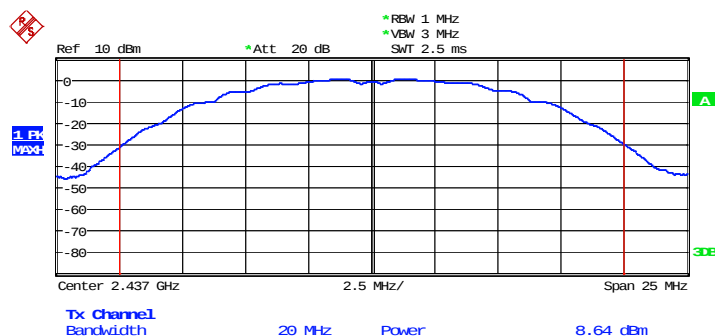
Please refer to the following test plots:

802.11b-11Mbps-Low Channel



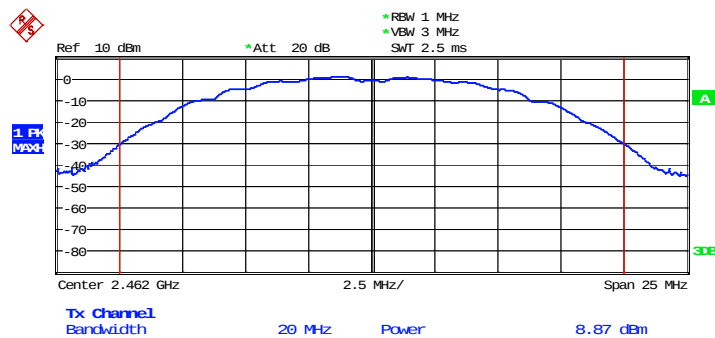
Date: 28.APR.2018 04:13:37

802.11b -11Mbps-Middle Channel



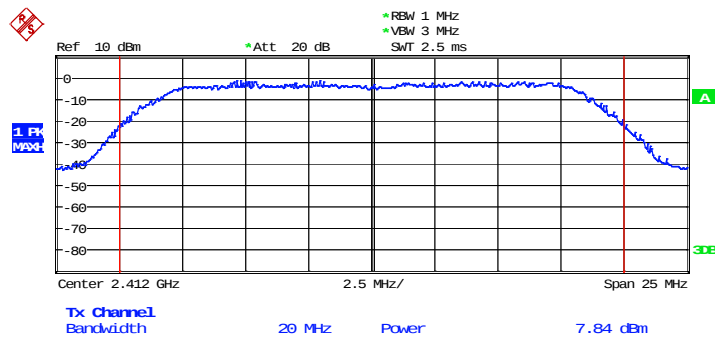
Date: 28.APR.2018 04:12:52

802.11b -11Mbps-High Channel



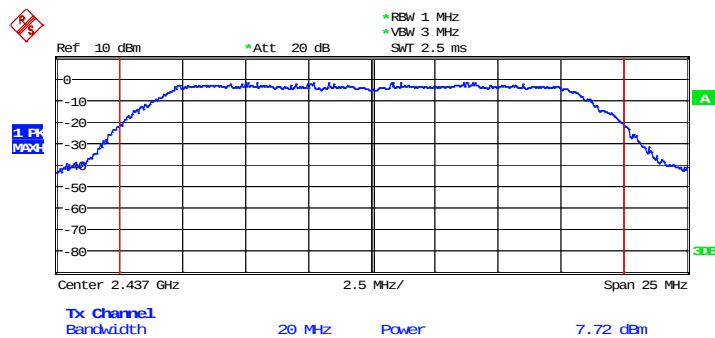
Date: 28.APR.2018 04:14:14

802.11g-54Mbps-Low Channel



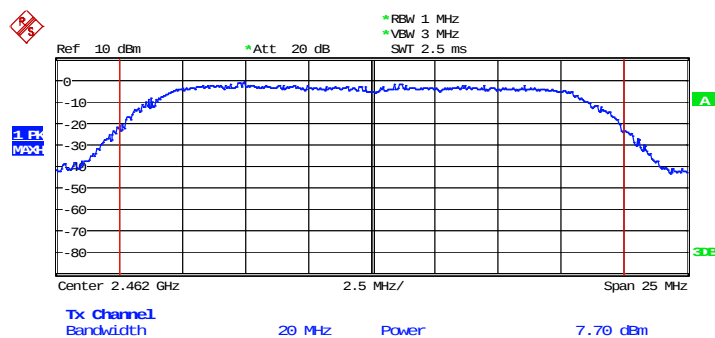
Date: 28.APR.2018 04:46:20

802.11g-54Mbps-Middle Channel



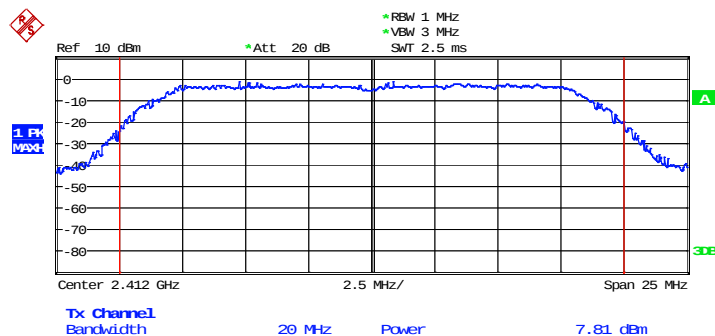
Date: 28.APR.2018 04:47:07

802.11g-54Mbps-High Channel



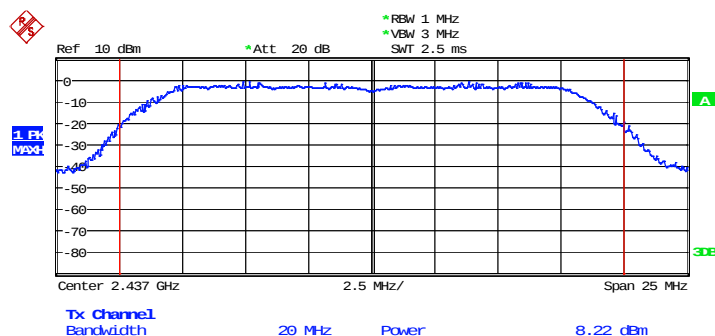
Date: 28.APR.2018 04:47:39

802.11n-HT20-MCS7-Low Channel



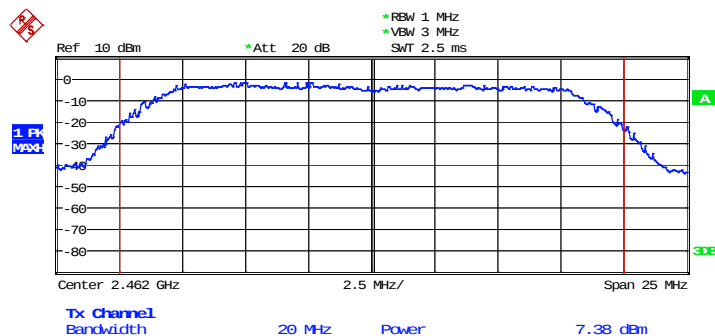
Date: 28.APR.2018 04:15:28

802.11n-HT20-MCS7-Middle Channel



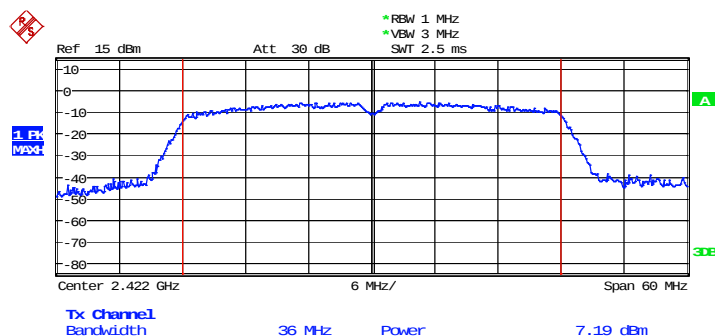
Date: 28.APR.2018 04:16:03

802.11n-HT20-MCS7-High Channel



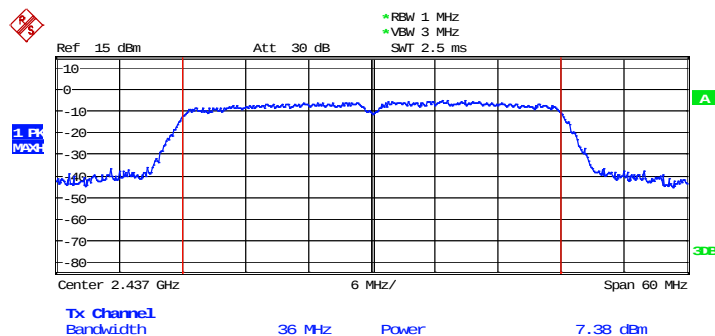
Date: 28.APR.2018 04:16:49

802.11n-HT40-MCS7-Low Channel



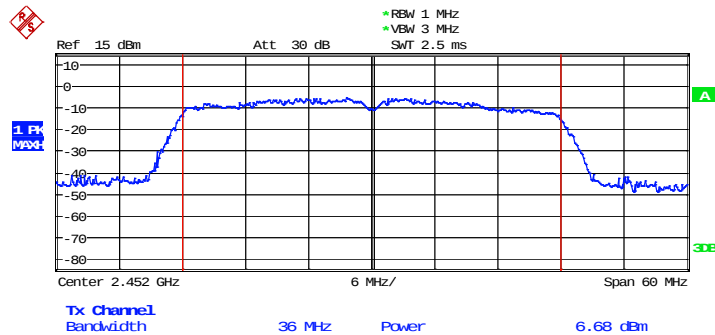
Date: 28.APR.2018 02:27:58

802.11n-HT40-MCS7-Middle Channel



Date: 28.APR.2018 02:43:32

802.11n-HT40-MCS7-High Channel



Date: 28.APR.2018 02:42:22

8. Field Strength of Spurious Emissions

8.1 Standard Applicable

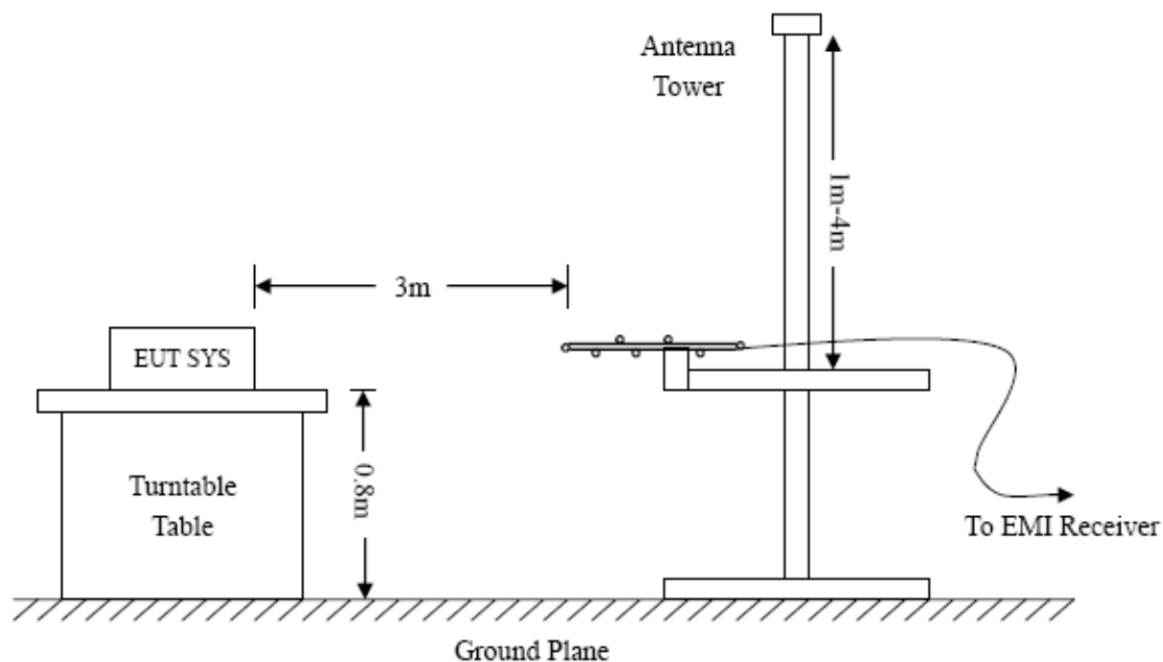
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

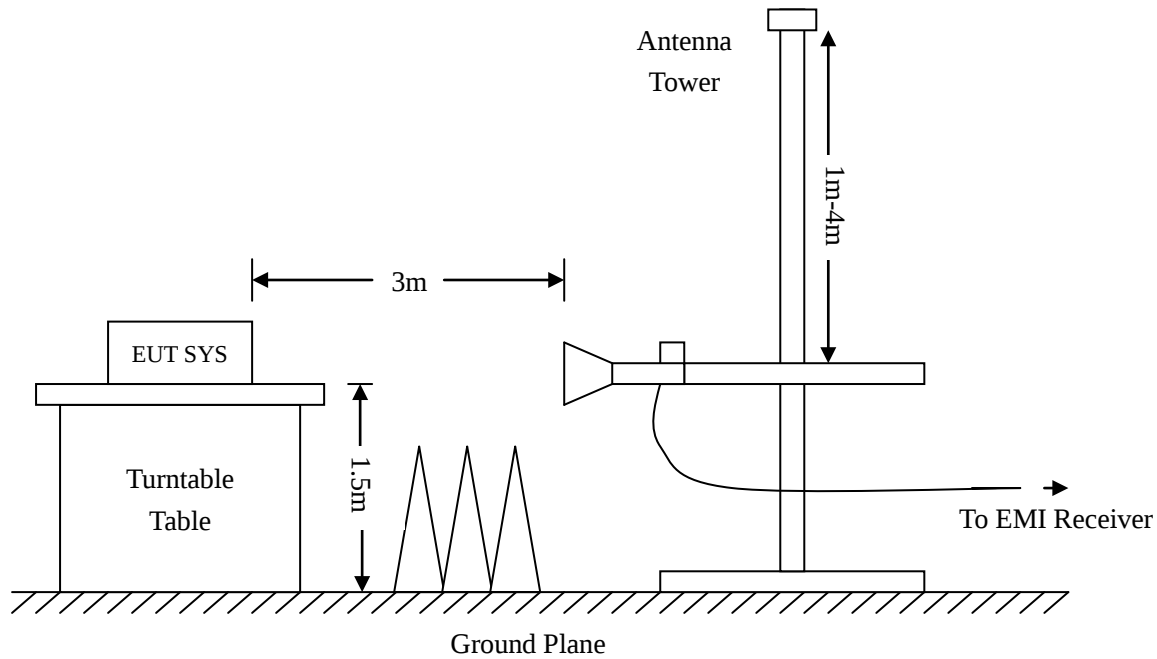
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

Detector function = peak, AV

8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

8.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

8.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

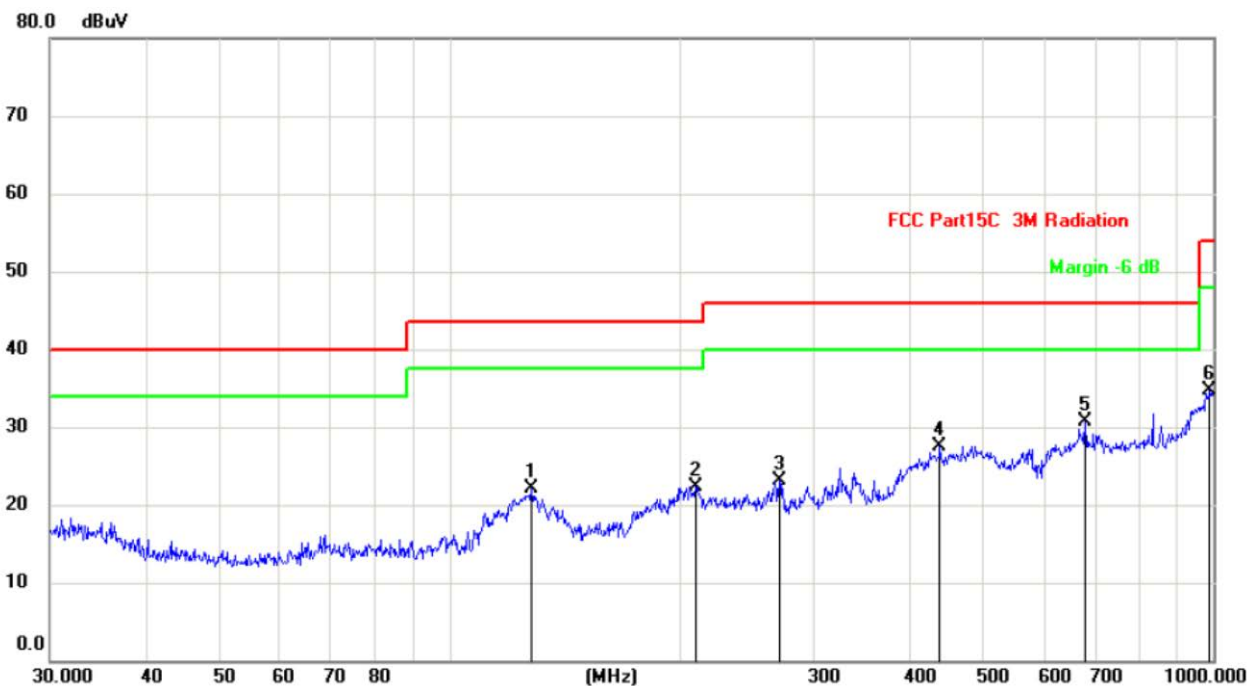
Note:

1. Worst-case radiated emission below 1GHz is 802.11b (CH Low) mode.
2. Worst-case radiated emission above 1GHz is 802.11g (CH Low, Middle, High) mode.

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

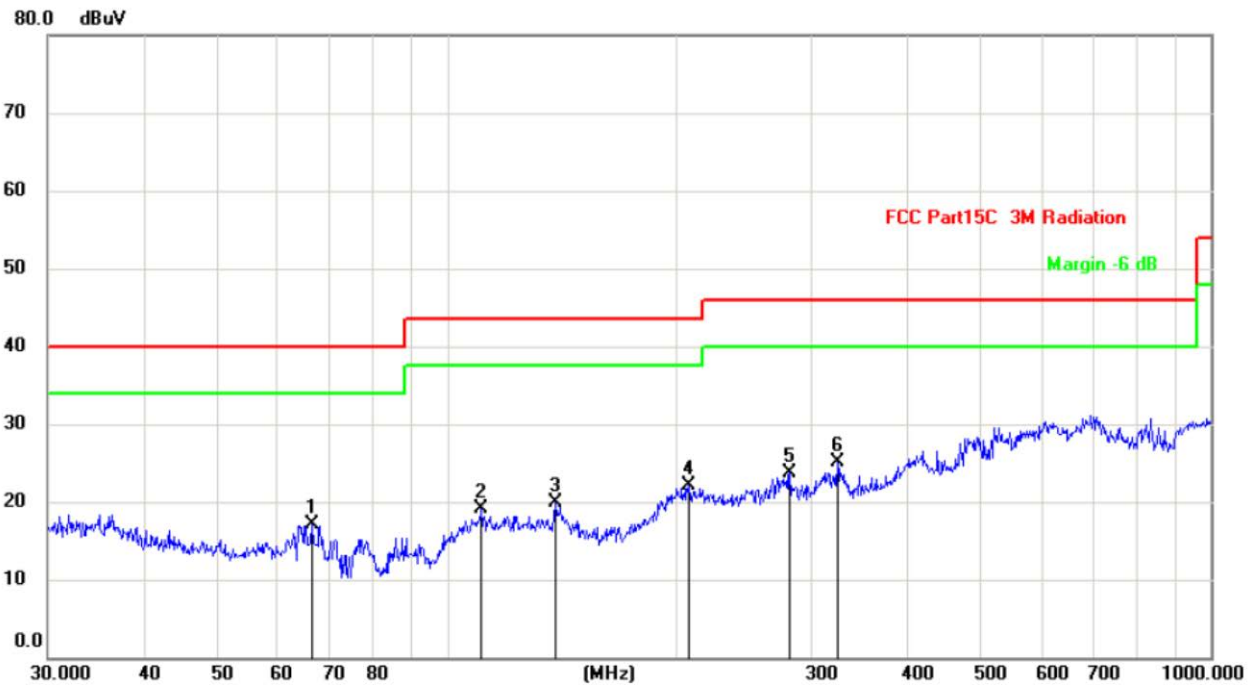
Operating Condition: 802.11b Transmitting Low Channel-2412MHz

Test Specification: Horizontal



No.	Mk.	Freq.	Measure- ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dBuV	dB	Detector	cm	degree
1		128.1129	22.06	43.50	-21.44	QP		
2		210.0482	22.37	43.50	-21.13	QP		
3		270.3747	23.14	46.00	-22.86	QP		
4		438.6553	27.45	46.00	-18.55	QP		
5	*	679.9600	30.75	46.00	-15.25	QP		
6		989.5354	34.79	54.00	-19.21	QP		

Test Specification: Vertical



No.	Mk.	Freq.	Measure- ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dBuV	dB	cm	degree	Comment
1		66.4989	17.14	40.00	-22.86	QP		
2		110.9570	19.06	43.50	-24.44	QP		
3		138.8735	19.92	43.50	-23.58	QP		
4		207.1226	22.02	43.50	-21.48	QP		
5		281.0074	23.75	46.00	-22.25	QP		
6	*	324.4560	25.10	46.00	-20.90	QP		

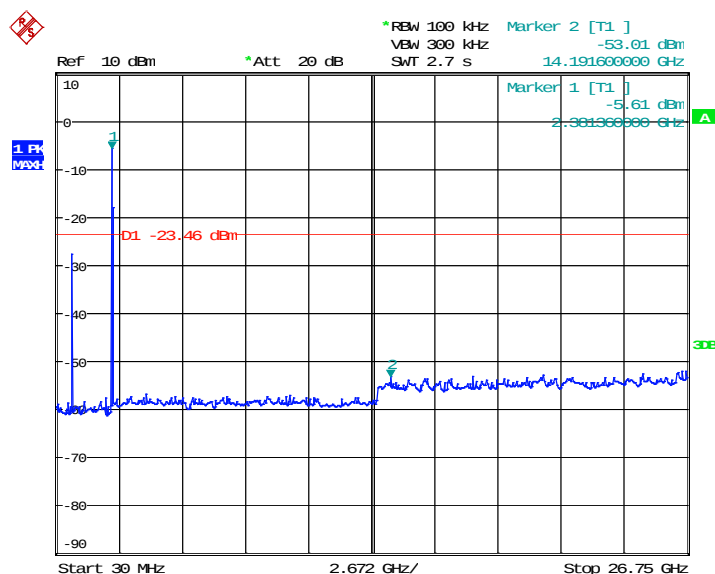
*Spurious Emissions Above 1GHz**Test Mode: 802.11b*

Frequency	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low channel-2412MHz					
4824.000	56.31	74	-17.69	H	PK
4824.000	49.25	54	-4.75	H	AV
7236.000	54.26	74	-19.74	H	PK
7236.000	48.63	54	-5.37	H	AV
4824.000	52.26	74	-21.74	V	PK
4824.000	45.78	54	-8.22	V	AV
7236.000	50.63	74	-23.37	V	PK
7236.000	42.36	54	-11.64	V	AV
Middle channel-2437MHz					
4874.000	57.63	74	-16.37	H	PK
4874.000	50.26	54	-3.74	H	AV
7311.000	55.26	74	-18.74	H	PK
7311.000	48.26	54	-5.74	H	AV
4874.000	54.29	74	-19.71	V	PK
4874.000	47.26	54	-6.74	V	AV
7311.000	52.36	74	-21.64	V	PK
7311.000	45.27	54	-8.73	V	AV
High channel-2462MHz					
4924.000	56.48	74	-17.52	H	PK
4924.000	48.65	54	-5.35	H	AV
7386.000	54.39	74	-19.61	H	PK
7386.000	46.23	54	-7.77	H	AV
4924.000	52.78	74	-21.22	V	PK
4924.000	44.27	54	-9.73	V	AV
7386.000	50.39	74	-23.61	V	PK
7386.000	42.75	54	-11.25	V	AV

Note:

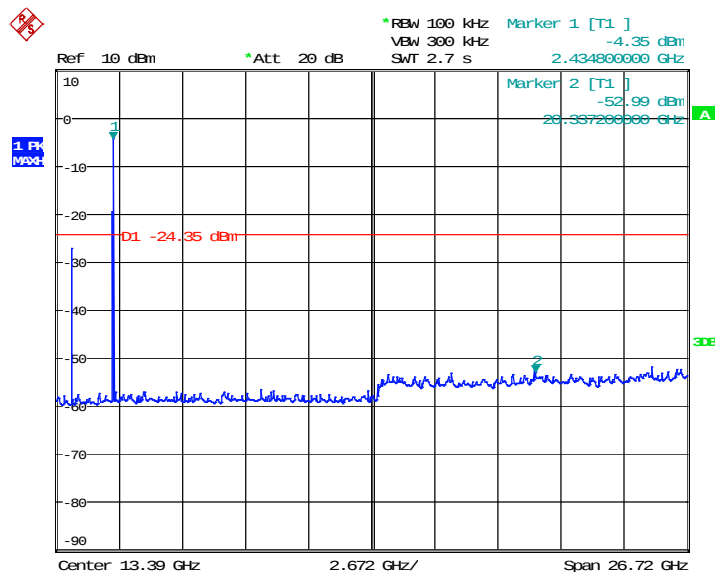
1. Calculation of result is: Result (dBm) = Reading (dBm) + Correction Factor (dB).
2. Correction Factor (dB)=Ant. Factor + Cable Loss – Ampl. Gain.
3. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Spurious (Conducted)
802.11b-Lowest
Lowest



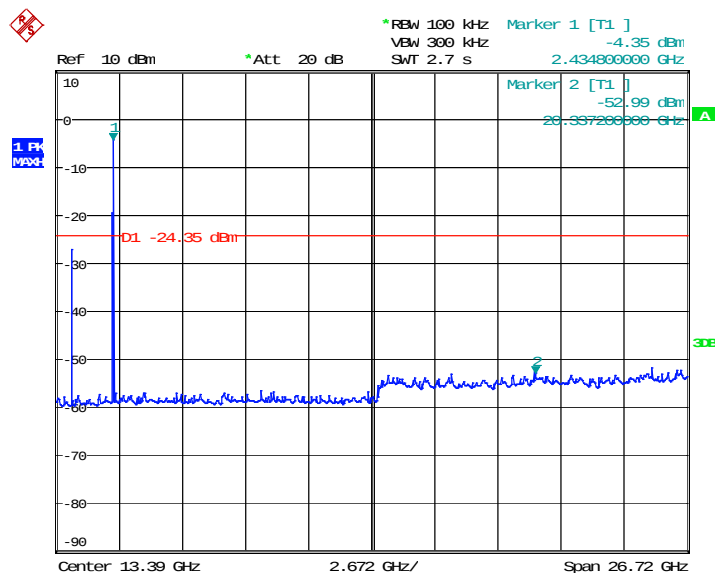
Date: 28.APR.2018 03:41:29

Middle



Date: 28.APR.2018 03:55:21

Highest

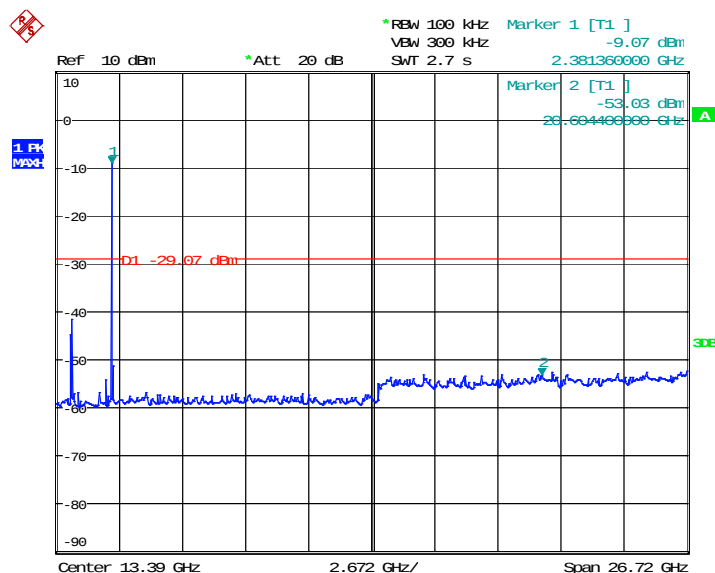


Date: 28.APR.2018 03:55:21

Spurious (Conducted)

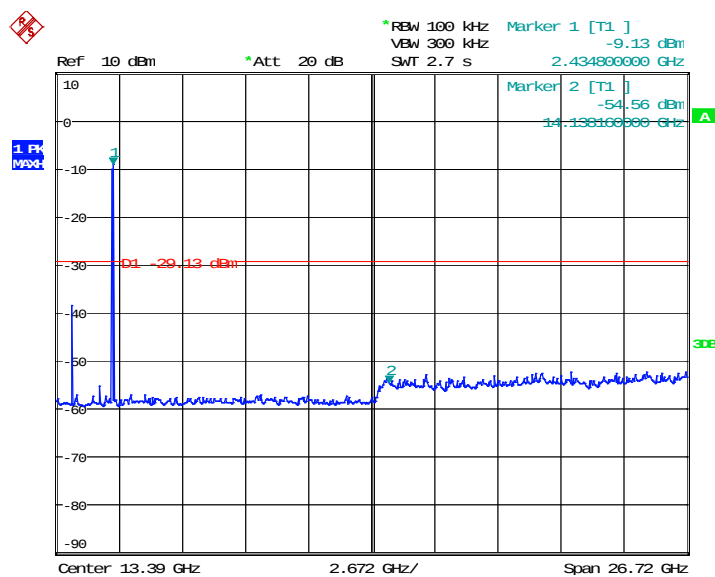
802.11g-Lowest

Lowest



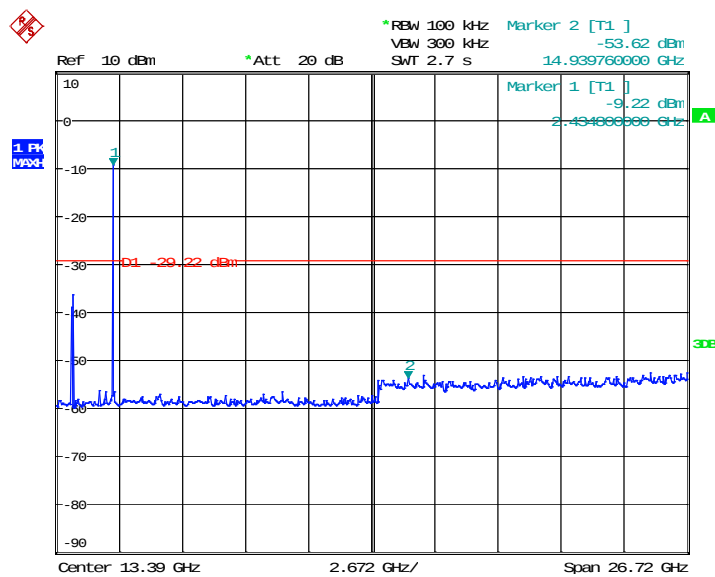
Date: 28.APR.2018 03:52:39

Middle



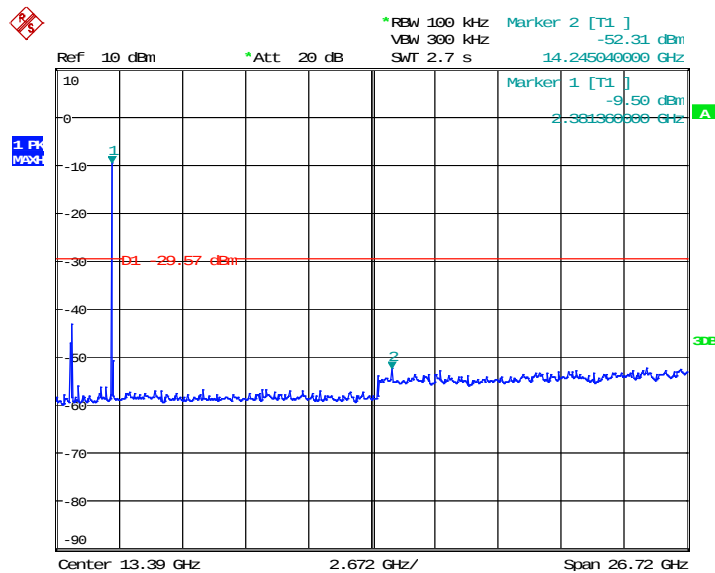
Date: 28.APR.2018 03:49:49

Highest



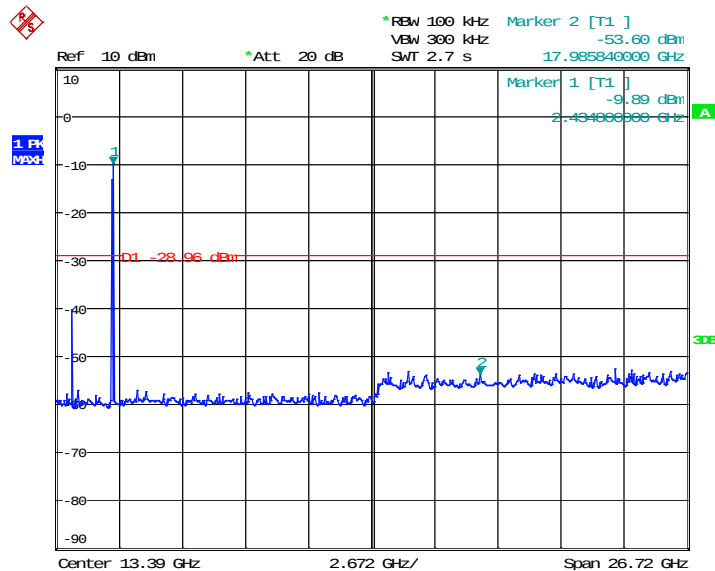
Date: 28.APR.2018 03:51:05

Spurious (Conducted)
802.11n-HT20-Lowest
Lowest



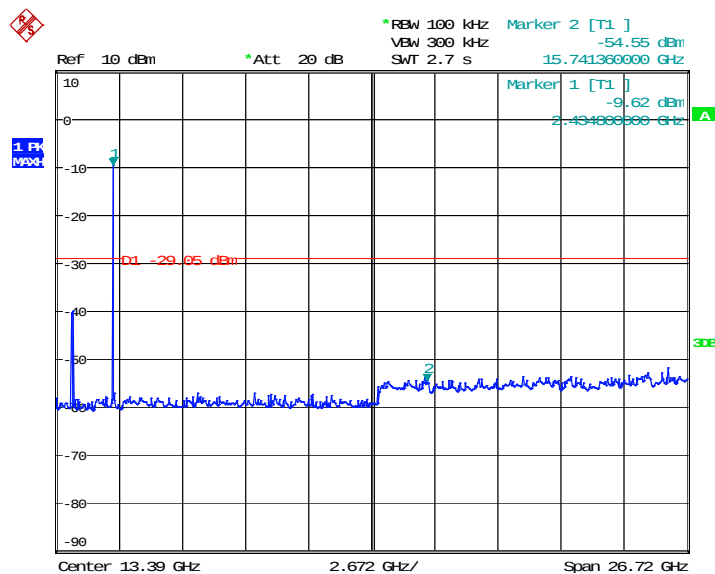
Date: 28.APR.2018 04:00:53

Middle



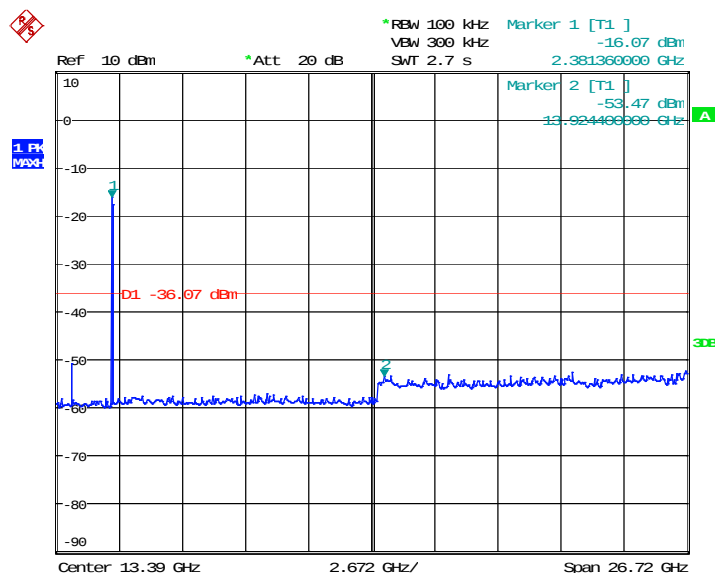
Date: 28.APR.2018 04:04:22

Highest



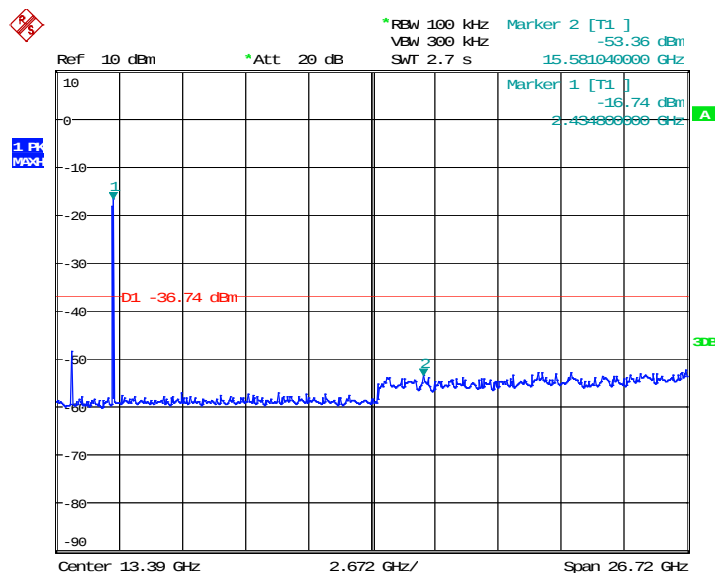
Date: 28.APR.2018 04:05:49

Spurious (Conducted)
802.11n-HT40-Lowest
Lowest



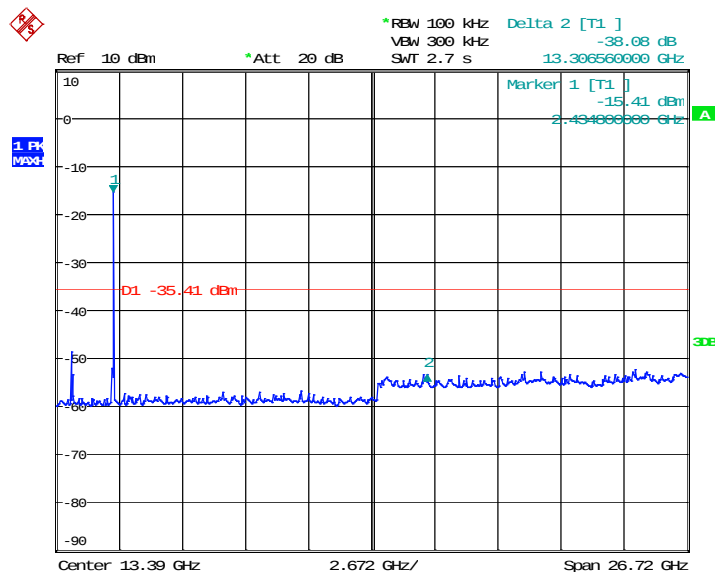
Date: 28.APR.2018 04:07:20

Middle



Date: 28.APR.2018 04:08:12

Highest



Date: 28.APR.2018 04:09:04

9. Out of Band Emissions

9.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

9.2 Test Procedure

According to the KDB 558074D01 v04, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak/average; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 v04, the conducted spurious emissions test method as follows:

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW $\geq$ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

9.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

802.11b- Bandedge (Radiated)

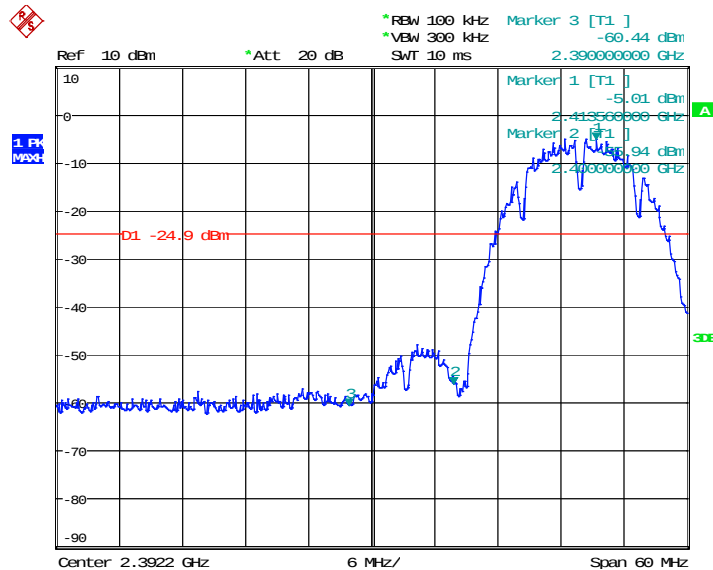
Note: we are pre-scan all modes, the worst data is 802.11b mode.

Channel	Freq.(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dB)	Detector
	2400	58.34	74	-15.66	Peak
LOW	2400	46.21	54	-7.79	Average
	2483.5	57.16	74	-16.84	Peak
HIGH	2483.5	44.59	54	-9.41	Average

Bandedge (Conducted)

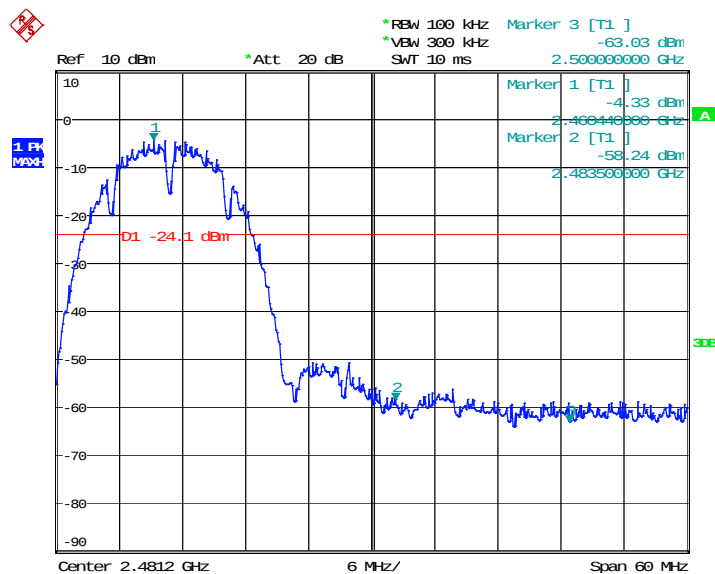
802.11b-Lowest

Lowest



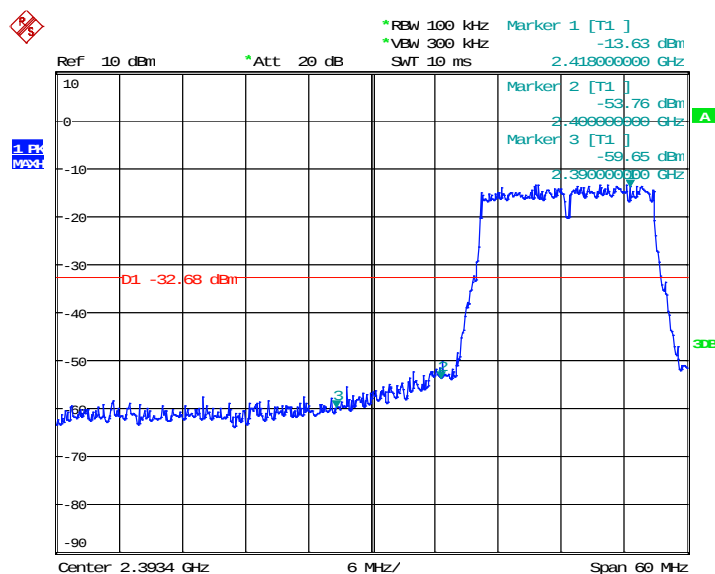
Date: 28.APR.2018 04:32:16

Highest



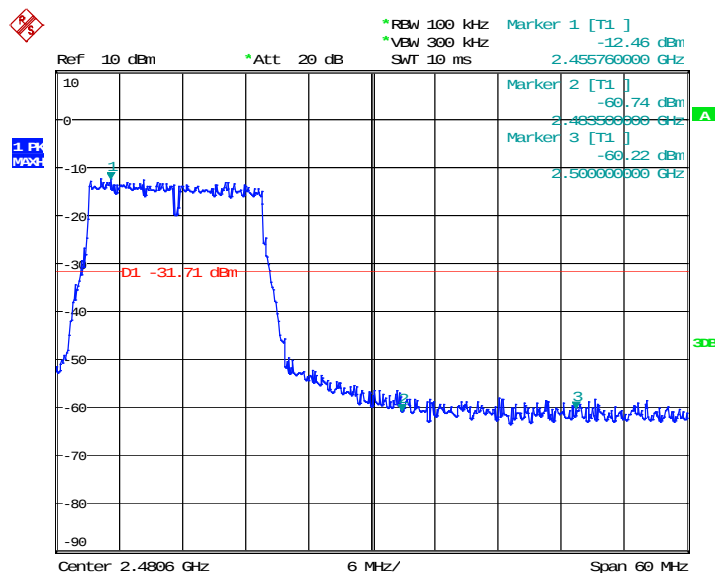
Date: 28.APR.2018 04:33:20

802.11g-Lowest



Date: 28.APR.2018 04:37:50

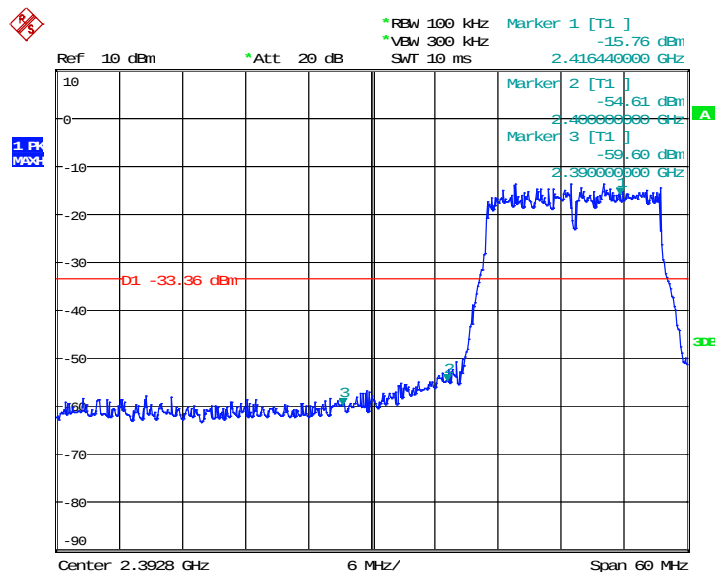
Highest



Date: 28.APR.2018 04:38:53

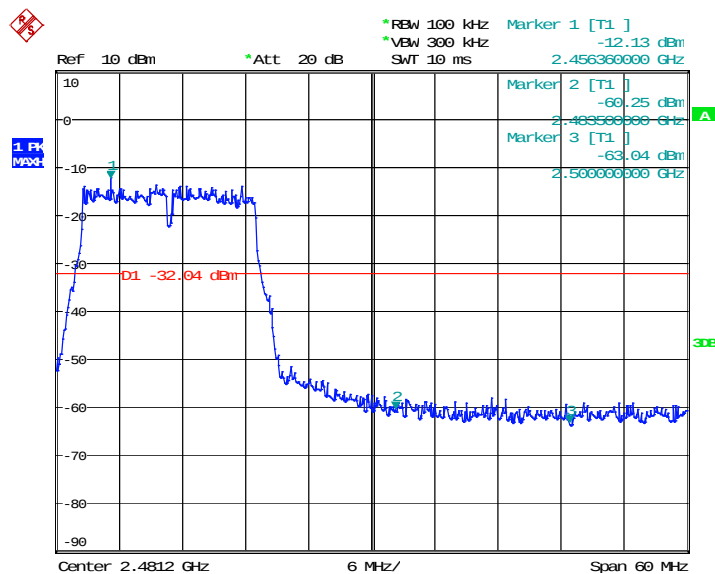
802.11n-HT20-Lowest

Lowest



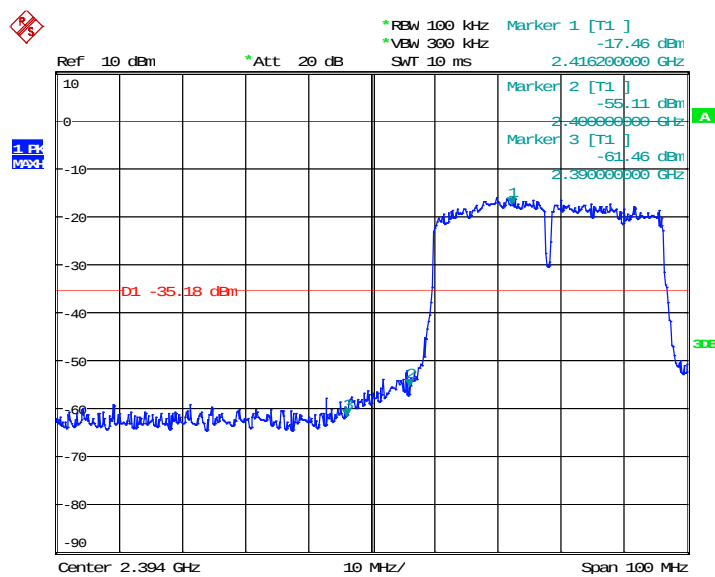
Date: 28.APR.2018 04:39:56

Highest



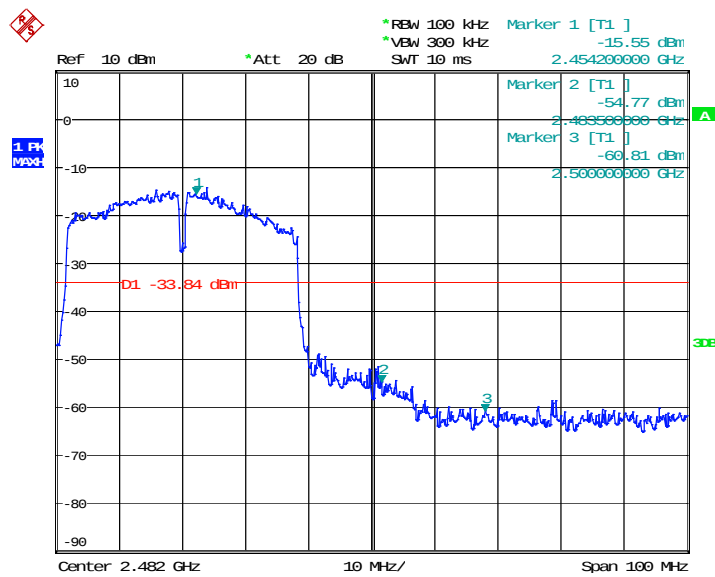
Date: 28.APR.2018 04:41:02

802.11n-HT40-Lowest



Date: 28.APR.2018 04:42:33

Highest



Date: 28.APR.2018 04:43:27

10. Conducted Emissions

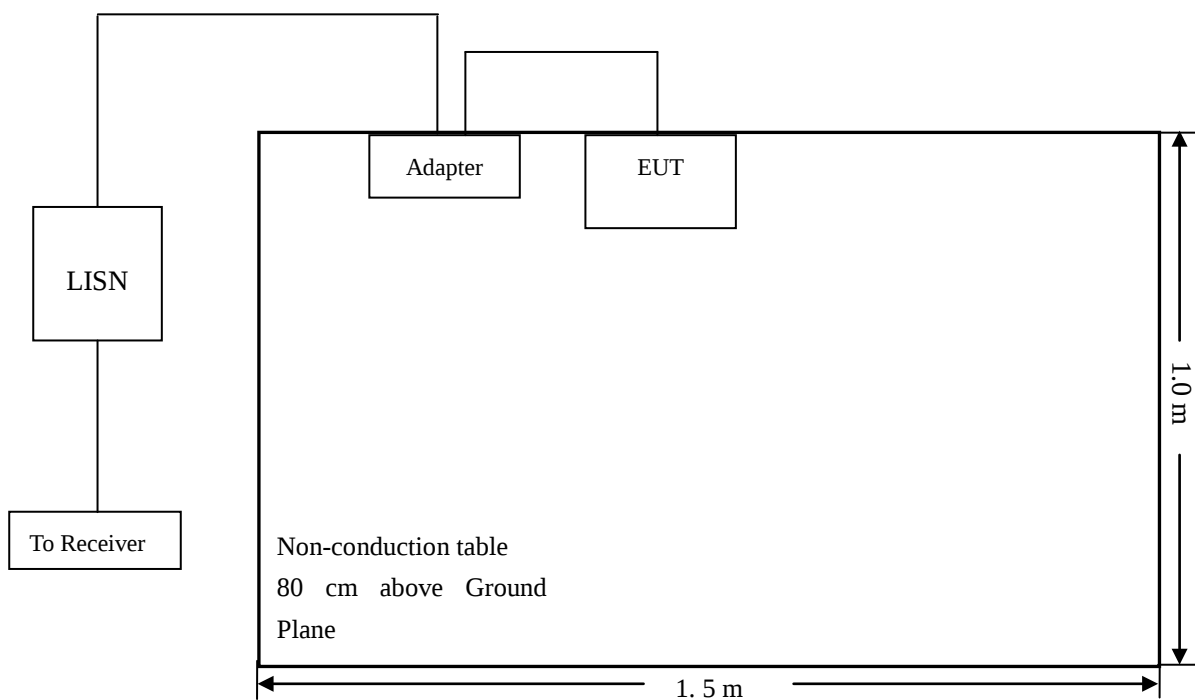
10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

10.2 Basic Test Setup Block Diagram



10.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device.

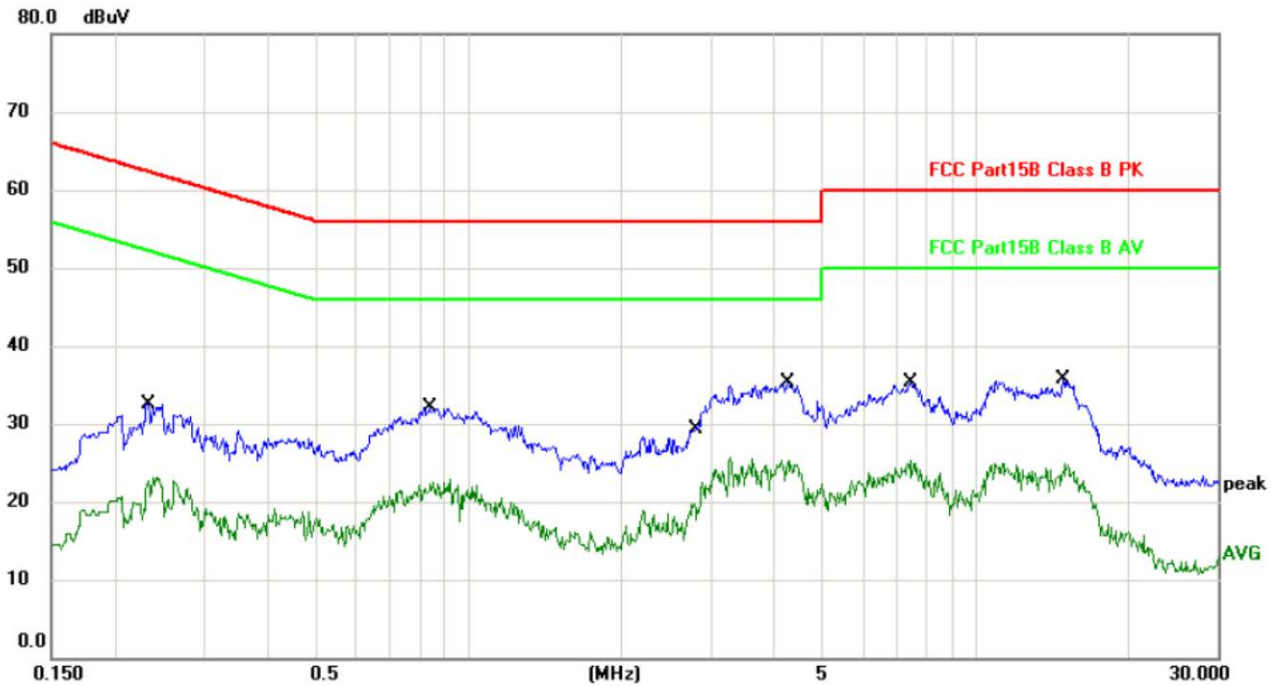
10.6 Conducted Emissions Test Data

Note: we are pre-scan all modes, the worst data is 802.11n HT20(Low) mode.

Plot of Conducted Emissions Test Data: 802.11n HT20(Low)Test Specification: *Neutral*

No.	Mk.	Measure-ment		Limit	Over	Detector	Comment
		Freq.					
		MHz	dBuV	dBuV	dB		
1		0.2467	32.30	61.86	-29.56	QP	
2		0.2467	18.95	51.86	-32.91	AVG	
3		0.3790	27.82	58.30	-30.48	QP	
4		0.3790	17.30	48.30	-31.00	AVG	
5		1.0300	33.02	56.00	-22.98	QP	
6		1.0300	19.65	46.00	-26.35	AVG	
7	*	4.1258	37.46	56.00	-18.54	QP	
8		4.1258	23.07	46.00	-22.93	AVG	
9		6.6859	36.16	60.00	-23.84	QP	
10		6.6859	23.57	50.00	-26.43	AVG	
11		12.2577	38.92	60.00	-21.08	QP	
12		12.2577	25.23	50.00	-24.77	AVG	

Test Specification: Live



No.	Mk.	Freq.	Measure- ment	Limit	Over	Detector
		MHz	dBuV	dBuV	dB	
1		0.2340	32.52	62.30	-29.78	QP
2		0.2340	18.58	52.30	-33.72	AVG
3		0.8379	32.06	56.00	-23.94	QP
4		0.8379	20.23	46.00	-25.77	AVG
5		2.7659	29.09	56.00	-26.91	QP
6		2.7659	19.61	46.00	-26.39	AVG
7	*	4.2538	35.28	56.00	-20.72	QP
8		4.2538	20.00	46.00	-26.00	AVG
9		7.4698	35.31	60.00	-24.69	QP
10		7.4698	20.69	50.00	-29.31	AVG
11		14.8818	35.71	60.00	-24.29	QP
12		14.8818	14.74	50.00	-35.26	AVG

***** END OF REPORT *****