RSS-GEN ISSUE 4, NOVEMBER 2014
RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Shandong USR IOT Technology Limited

Floor 11, Aosheng Building 1, Xinluo Street, Jinan, Shandong, China

IC: 23410-G806

Report Type:	**Product Type:**
Original Report	4G Router

Report Number:	RSZ171011002-08A
Report Date:	2017-12-18
Reviewed By:	Rocky Kang RF Engineer
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shandong USR IOT Technology Limited's* product, model number: *USR-G806* (*IC: 23410-G806)* or the "EUT" in this report was a *4G Router*, which was measured approximately: 110 mm (L) × 99 mm (W) × 30 mm (H), rated with input voltage: DC 12V from adapter.

Adapter Information:
Model: SOY-1200100US
Input: AC 100-240V, 50/60Hz, 0.3A
Output: DC 12V, 1.0 A

Notes: This series products model: USR-G800, USR-G807, USR-G808, USR-G781, USR-G805, USR-G809, USR-G786, USR-G788 and USR-G806 are electrically identical, and only are different for model name. Model USR-G806 was selected for fully testing, the detailed information can be referred to the declaration which was stated and guaranteed by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: 1702223 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2017-10-11.*

Objective

This report is prepared on behalf of *Shandong USR IOT Technology Limited* in accordance with RSS-247, Issue 2, February 2017 of the Innovation, science and Economic Development Canada.

Related Submittal(s)/Grant(s)

RSS-130 & RSS-132 & RSS-133& RSS-139 submissions with IC: 23410-G806.

Test Methodology

All tests and measurements indicated in this document were performed in accordance ANSI C63.10-2013 and RSS-Gen Issue 4, November 2014.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.5dB
RF conducted test with spectrum		±1.5dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3℃
Humidity		±6%
Supply voltages		±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 382179,the FCC Designation No. : CN5001.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g and 802.11n-HT20 mode, 13 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442	/	/

For 802.11b, 802.11g, 802.11n-HT20 mode, EUT was tested with Channel 1, 7 and 13

For 802.11n-HT40 mode, 9 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	6	2447
2	2427	7	2452
3	2432	8	2457
4	2437	9	2462
5	2442	/	/

EUT was tested with Channel 1, 5 and 9.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

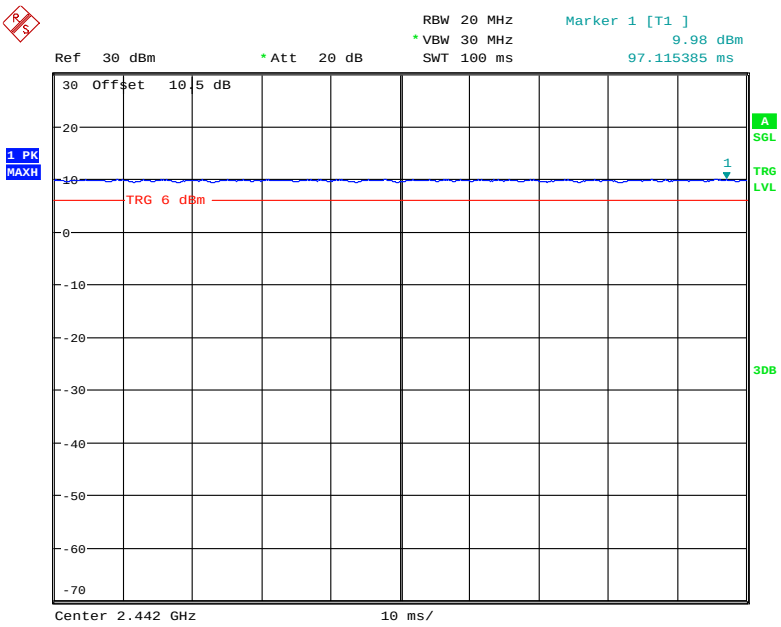
“Xshell5” and “QATool_Dbg.exe” was used for Wi-Fi test.

802.11b: Data rate: 1 Mbps, power level: 10
802.11g: Data rate: 6 Mbps, power level: 11
802.11n-HT20: Data rate: MCS0, power level: 11
802.11n-HT40: Data rate: MCS0, power level: 13

Pre-scan with all the data rates, the above data rate is the worst case for Wi-Fi test.

Duty cycle

802.11b mode



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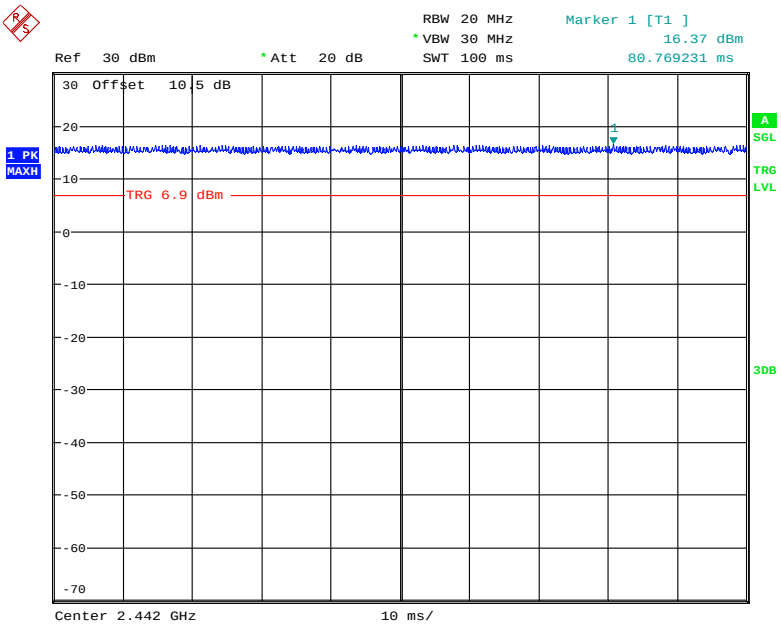
802.11g mode



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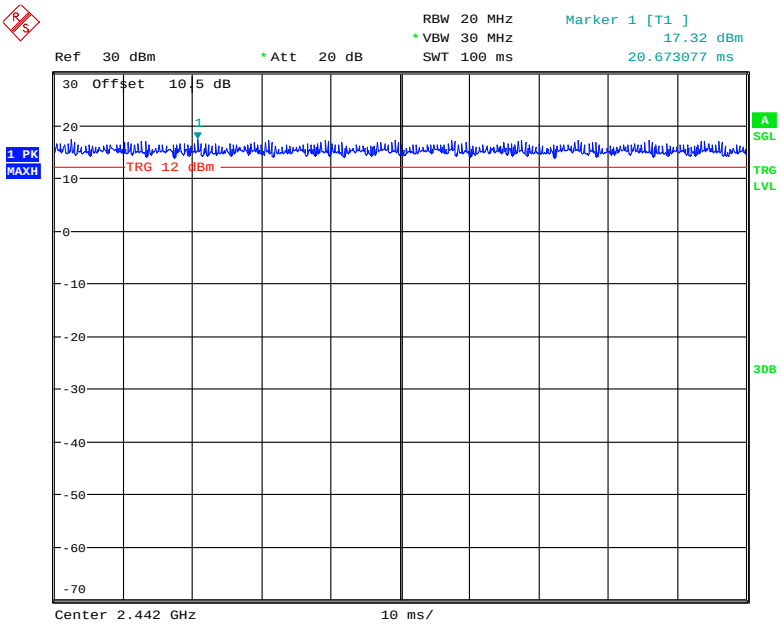
802.11n-HT20 Mode



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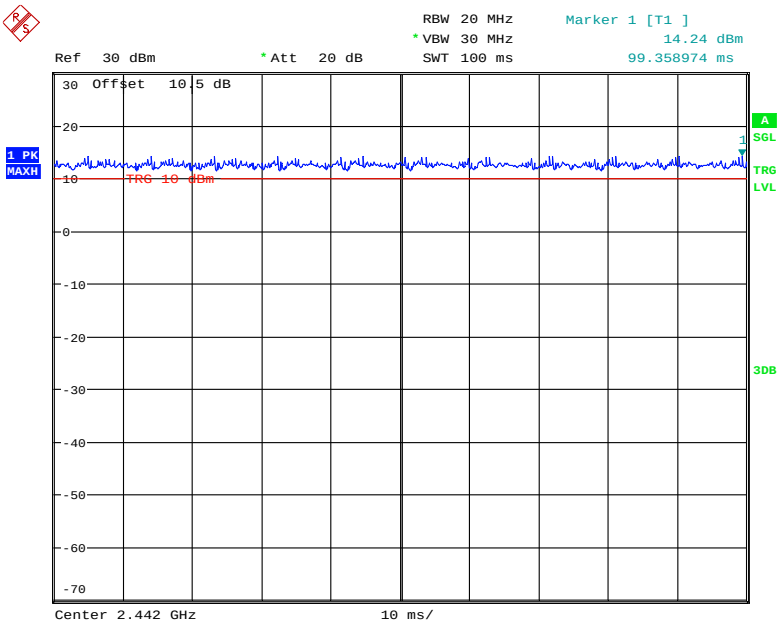
802.11n-HT40 Mode



Date: 15.DEC.2017 17:08:07

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/ Duty Cycle)
802.11b	100	-	-	10Hz	-
802.11g	100	-	-	10Hz	-
802.11n-HT20	100	-	-	10Hz	-
802.11n-HT40	100	-	-	10Hz	-

Support Equipment List and Details

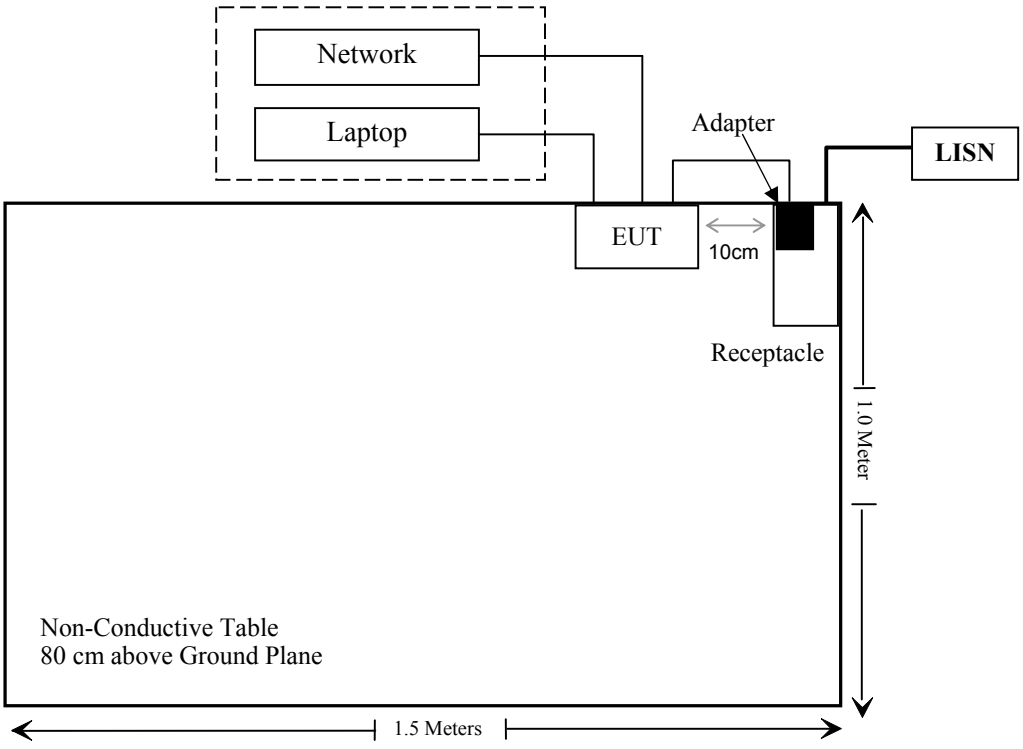
Manufacturer	Description	Model	Serial Number
Acer	Laptop	MS2376	NXMF7CN0013360957F6600

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-Shielding Detachable DC Cable	1.0	EUT	Adapter
Un-shielding Detachable RJ45 cable	1.5	EUT	Laptop
Un-shielding Detachable RJ45 cable	1.5	EUT	Network

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

RSS-247 & RSS-Gen Rules	Description of Test	Result
RSS-102 § 4	Exposure Limits	Compliance
RSS-Gen §8.3	Transmitter Antenna	Compliance
RSS-Gen §8.8	AC Power Line Conducted Emission	Compliance
RSS-Gen § 8.10 RSS-247 § 5.5	Unwanted Emission Frequencies and Restricted Bands and Out of Band Emissions	Compliance
RSS- Gen§6.6, RSS-247 § 5.2 (a)	99% Occupied Bandwidth & 6 dB Bandwidth Testing	Compliance
RSS-247 § 5.2 (b)	Peak Power Spectral Density	Compliance
RSS-247 § 5.4(d)	Peak output Power Measurement	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2017-08-04	2018-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2016-12-07	2017-12-07
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2017-11-19	2018-05-21
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2017-11-12	2018-05-12
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2017-04-24	2018-04-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-05-21	2018-05-21
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2014-12-17	2017-12-16
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2016-12-07	2017-12-07
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	1	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	2	2017-11-22	2018-05-22
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2014-12-29	2017-12-28
Ducommun Technologies	Pre-amplifier	ALN-22093530-01	991373-01	2017-08-03	2018-08-03
Sinoscite	Band Reject Filter	BSF2402-2480MN-0898-001	N/A	2017-05-21	2018-05-21
RF Conducted Test					
Agilent	P-Series Power Meter	N1912A	MY5000448	2016-12-05	2017-12-05
Agilent	Wideband Power Sensor	N1921A	MY54210016	2016-12-05	2017-12-05
WEINSCHEL	3dB Attenuator	N/A	N/A	2017-05-23	2018-11-22
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2016-12-05	2017-12-05
Ducommun technologies	RF Cable	RG-214	3	2017-11-22	2018-05-22

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

RSS-102 § 4 –EXPOSURE LIMITS

Applicable Standard

According to RSS-102 §4:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21×10^{-4} $f^{0.5}$	6.67×10^{-5} f	616000/$f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

According to RSS-102 clause 3.1.2

Compliance of devices with multiple transmitters capable of simultaneous transmission shall be assessed in accordance with the latest version of IEEE 1528. However, other recognized methods — such as the proceduresFootnote16published by the FCC proven to provide a conservative estimate of the SAR value — can also be used. Applicants shall include in the RF exposure technical brief all information relevant to the exact test methodology used.

Simultaneous transmitting consideration for PCB & WIFI:

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (m)	Power Density (W/m^2)	MPE Limit (W/m^2)
	(dBi)	(numeric)	(dBm)	(W)			
2412-2472 WIFI	3.0	2.00	15	0.032	0.2	0.127	5.37
1850-1910 WCDMA	3.5	2.24	23.5	0.224	0.2	0.999	4.48
1710-1755 WCDMA	3.5	2.24	23.5	0.224	0.2	0.999	4.24
824-849 WCDMA	3.5	2.24	23.5	0.224	0.2	0.999	2.58
1850-1910 LTE	3.5	2.24	24	0.251	0.2	1.119	4.48
1710-1755 LTE	3.5	2.24	24	0.251	0.2	1.119	4.24
699-716 LTE	3.5	2.24	24	0.251	0.2	1.119	2.30

Note：PCB Data comes from the PCB report.

Simultaneous transmitting consideration for PCB & WIFI:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 1.119/2.3+0.127/5.37=0.51 < 1.0$$

To maintain compliance with the RF exposure guidelines, place the equipment at least 20cm from nearby persons.

So the RF Exposure evaluation can be exempted.

RSS-GEN §8.3 - TRANSMITTER ANTENNA

Applicable Standard

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

Antenna Connector Construction

The EUT has an external antenna arrangement, which with a non-standard jack and the antenna gain is 3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

RSS-GEN §8.8 - AC POWER LINE CONDUCTED EMISSIONS

Applicable Standard

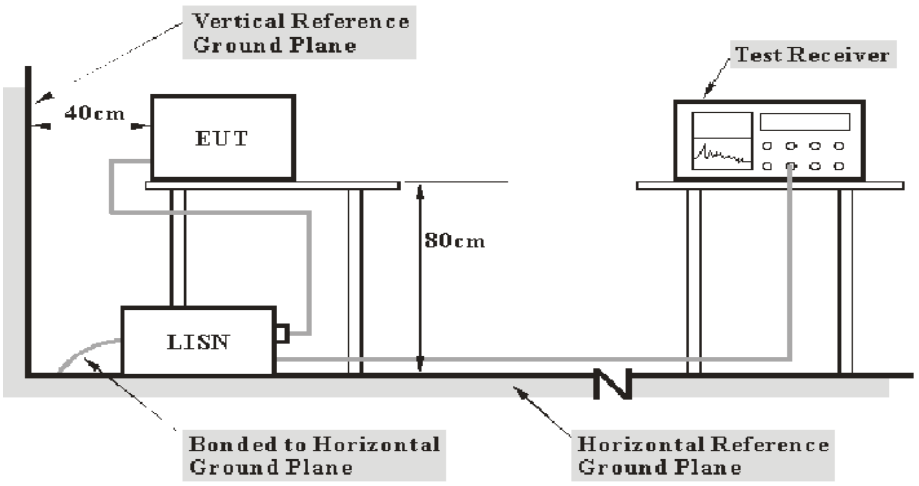
A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in the below table.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in below table. The more stringent limit applies at the frequency range boundaries.

Table 2 - AC Power Lines Conducted Emission Limits		
Frequency range (MHz)	Conducted limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Note: *Decreases with the logarithm of the frequency

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the RSS-247/RSS-Gen limits.

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

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Test Results Summary

According to the recorded data in following table, the EUT complied with the RSS-247/RSS-Gen,

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

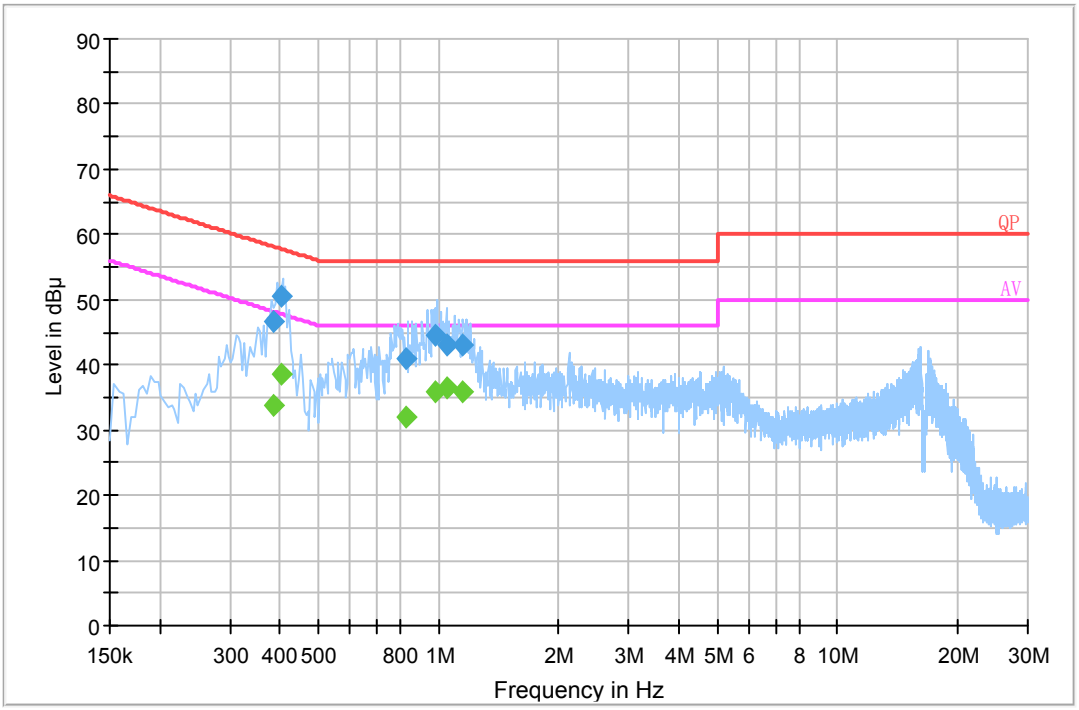
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Kobe Li on 2017-12-06.

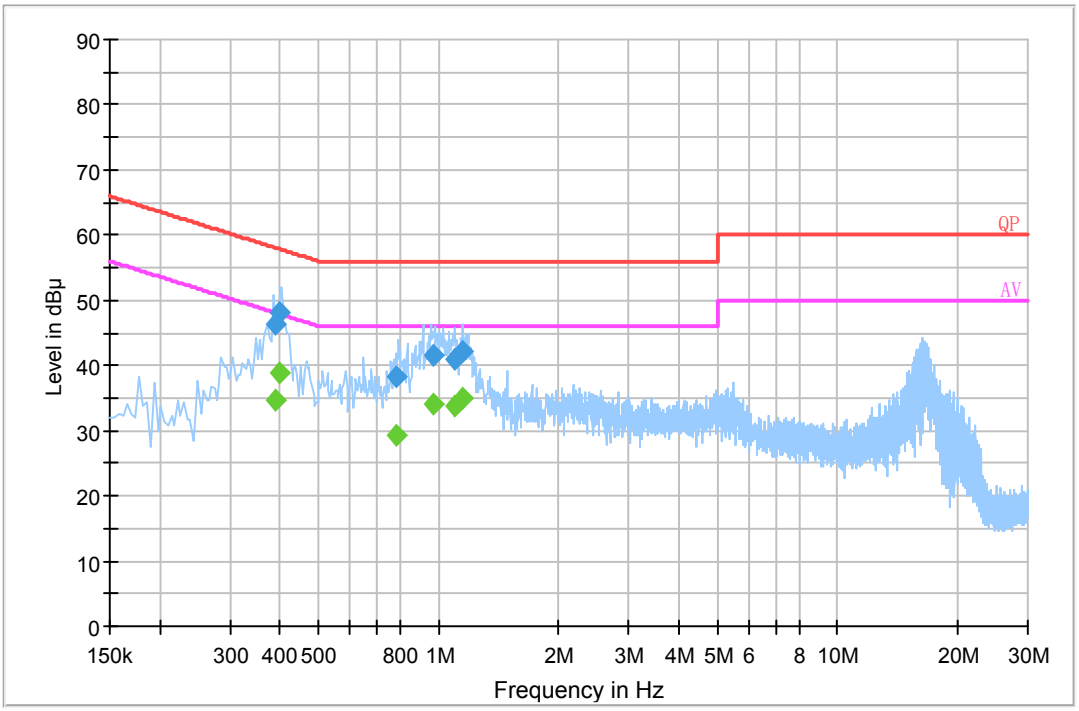
EUT operation mode: Transmitting

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.384270	46.6	20.2	58.2	11.6	QP
0.403910	50.6	20.2	57.8	7.2	QP
0.833430	41.0	20.0	56.0	15.0	QP
0.987090	44.6	20.1	56.0	11.4	QP
1.046310	42.9	20.1	56.0	13.1	QP
1.148750	42.9	20.1	56.0	13.1	QP
0.384270	33.8	20.2	48.2	14.4	Ave.
0.403910	38.7	20.2	47.8	9.1	Ave.
0.833430	32.0	20.0	46.0	14.0	Ave.
0.987090	35.9	20.1	46.0	10.1	Ave.
1.046310	36.4	20.1	46.0	9.6	Ave.
1.148750	35.8	20.1	46.0	10.2	Ave.

AC 120V/ 60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.391790	46.4	20.2	58.0	11.6	QP
0.399970	48.0	20.2	57.9	9.9	QP
0.782090	38.2	20.0	56.0	17.8	QP
0.971630	41.5	20.1	56.0	14.5	QP
1.101530	40.9	20.1	56.0	15.1	QP
1.152750	42.2	20.1	56.0	13.8	QP
0.391790	34.6	20.2	48.0	13.4	Ave.
0.399970	39.0	20.2	47.9	8.9	Ave.
0.782090	29.4	20.0	46.0	16.6	Ave.
0.971630	34.0	20.1	46.0	12.0	Ave.
1.101530	33.9	20.1	46.0	12.1	Ave.
1.152750	35.1	20.1	46.0	10.9	Ave.

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

RSS-GEN § 8.10 & RSS-247 § 5.5 – UNWANTED EMISSION FREQUENCIES AND RESTRICTED BANDS

Applicable Standard

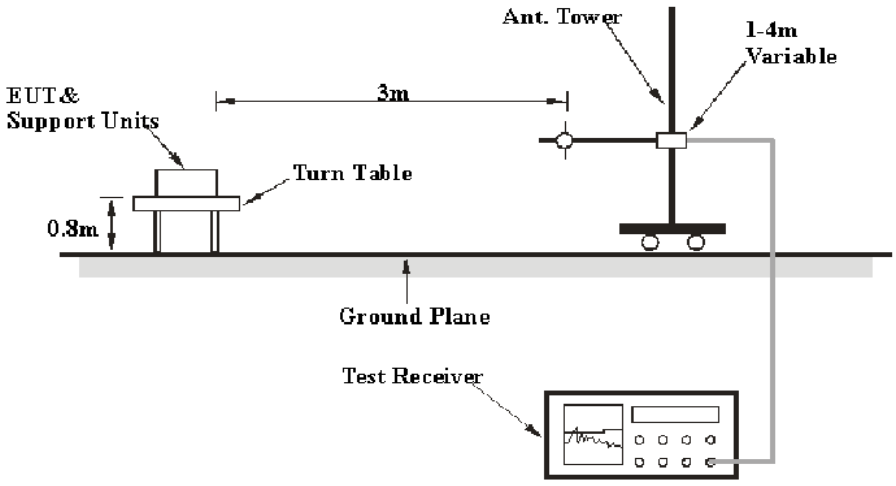
According to RSS-GEN § 8.10 & RSS-247 § 5.5

Restricted bands, identified in Table 6, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply: (a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287; (b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

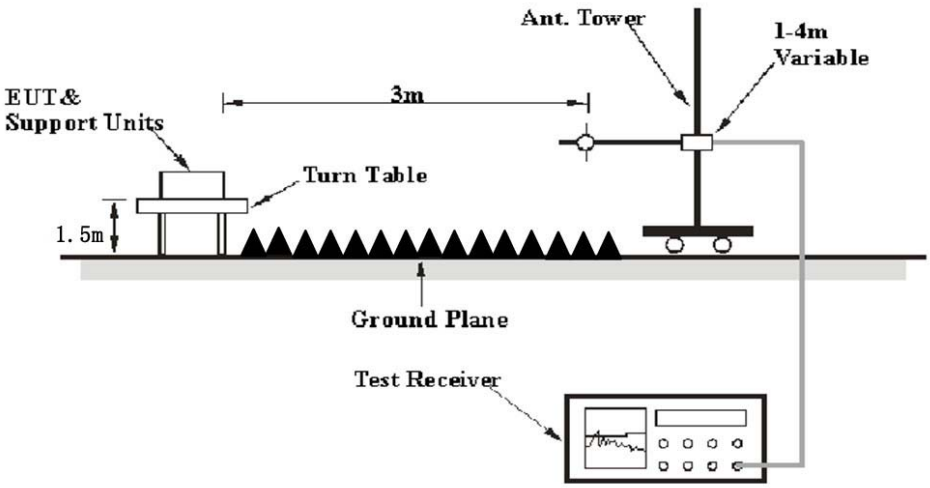
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the RSS-Gen. The specification used was the RSS-Gen limits.

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

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30MHz – 1000 MHz	100 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

Repeat above procedures until all measured frequencies were complete.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the RSS-247/RSS-Gen,

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

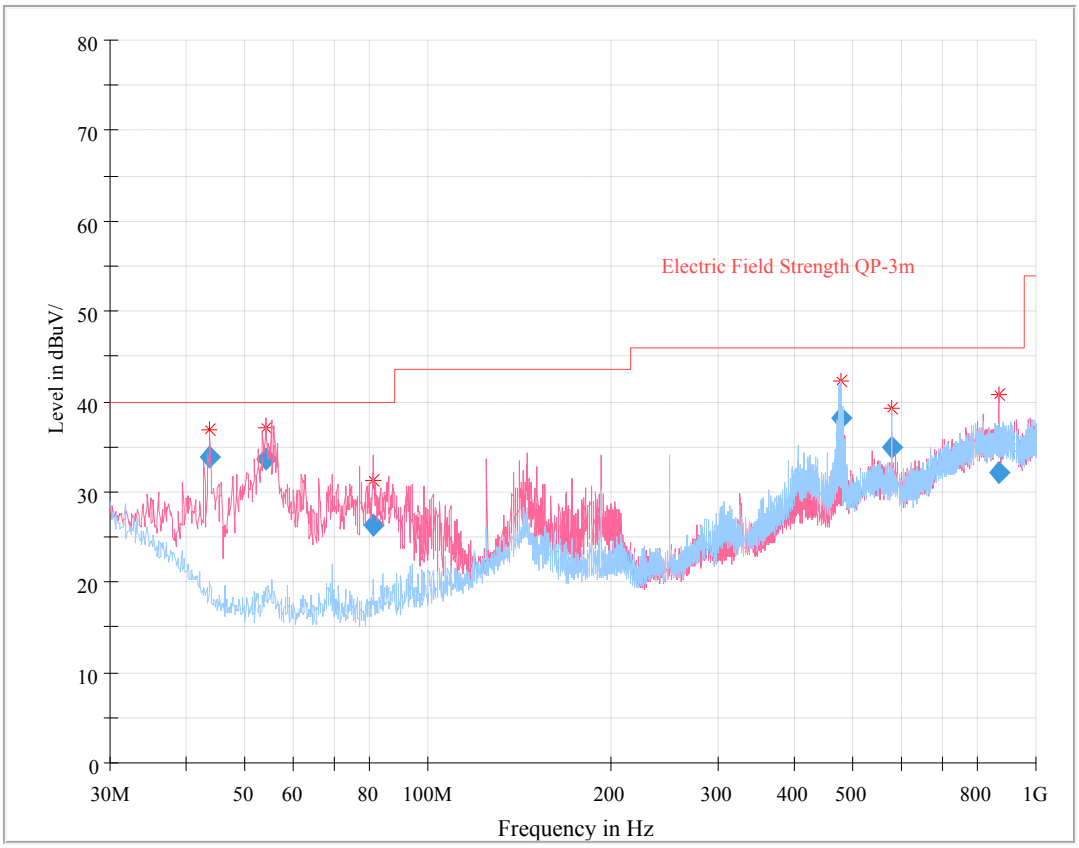
Temperature:	24~25 ℃
Relative Humidity:	48~50 %
ATM Pressure:	100.0~101.0 kPa

The testing was performed by Kobe Li from 2017-11-30 to 2017-12-03.

EUT operation mode: Transmitting

Worst case as below

30 MHz~1 GHz: (802.11n20 Mode, High channel)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
43.814000	33.89	111.0	V	227.0	-9.0	40.00	6.11
54.213375	33.64	100.0	V	241.0	-11.4	40.00	6.36
81.183375	26.37	108.0	V	0.0	-11.3	40.00	13.63
478.248250	38.27	107.0	H	239.0	1.8	46.00	7.73
579.981750	34.87	194.0	H	346.0	4.1	46.00	11.13
869.986000	32.14	107.0	V	283.0	9.3	46.00	13.86

30 MHz-25 GHz:

802.11b Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	RSS-247/RSS-Gen	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
Low Channel (2412 MHz)									
2412.00	64.63	PK	29	2.0	H	33.92	98.55	/	/
2412.00	58.51	Ave.	29	2.0	H	33.92	92.43	/	/
2412.00	67.26	PK	129	1.1	V	33.92	101.18	/	/
2412.00	61.51	Ave.	129	1.1	V	33.92	95.43	/	/
2325.23	26.73	PK	349	2.1	V	33.83	60.56	74	13.44
2325.23	13.79	Ave.	349	2.1	V	33.83	47.62	54	6.38
2486.55	27.35	PK	175	1.8	V	34.08	61.43	74	12.57
2486.55	13.88	Ave.	175	1.8	V	34.08	47.96	54	6.04
4824.00	44.13	PK	80	1.8	V	5.84	49.97	74	24.03
4824.00	30.29	Ave.	80	1.8	V	5.84	36.13	54	17.87

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	RSS-247/RSS-Gen	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2442MHz)									
2442.00	66.15	PK	215	1.5	H	33.92	100.07	/	/
2442.00	60.32	Ave.	215	1.5	H	33.92	94.24	/	/
2442.00	68.72	PK	144	2.5	V	33.92	102.64	/	/
2442.00	62.97	Ave.	144	2.5	V	33.92	96.89	/	/
4884.00	45.32	PK	131	1.3	V	6.21	51.53	74	22.47
4884.00	31.56	Ave.	131	1.3	V	6.21	37.77	54	16.23
High Channel (2472 MHz)									
2472.00	64.01	PK	298	2.5	H	34.08	98.09	/	/
2472.00	59.62	Ave.	298	2.5	H	34.08	93.70	/	/
2472.00	68.71	PK	222	2.4	V	34.08	102.79	/	/
2472.00	63.66	Ave.	222	2.4	V	34.08	97.74	/	/
2365.47	26.63	PK	335	1.6	V	33.92	60.55	74	13.45
2365.47	13.13	Ave.	335	1.6	V	33.92	47.05	54	6.95
2495.07	27.32	PK	326	1.4	V	34.08	61.40	74	12.60
2495.07	13.58	Ave.	326	1.4	V	34.08	47.66	54	6.34
4944.00	45.66	PK	89	1.8	V	6.21	51.87	74	22.13
4944.00	31.41	Ave.	89	1.8	V	6.21	37.62	54	16.38

802.11g Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	RSS-247/RSS-Gen	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412 MHz)									
2412.00	65.21	PK	115	2.5	H	33.92	99.13	/	/
2412.00	55.62	Ave.	115	2.5	H	33.92	89.54	/	/
2412.00	70.67	PK	4	2.0	V	33.92	104.59	/	/
2412.00	59.66	Ave.	4	2.0	V	33.92	93.58	/	/
2335.81	27.17	PK	60	1.3	V	33.83	61.00	74	13.00
2335.81	13.38	Ave.	60	1.3	V	33.83	47.21	54	6.79
2486.39	26.95	PK	198	1.6	V	34.08	61.03	74	12.97
2486.39	13.12	Ave.	198	1.6	V	34.08	47.20	54	6.80
4824.00	45.34	PK	45	2.1	V	5.84	51.18	74	22.82
4824.00	31.57	Ave.	45	2.1	V	5.84	37.41	54	16.59
Middle Channel (2442MHz)									
2442.00	66.74	PK	21	2.0	H	33.92	100.66	/	/
2442.00	55.62	Ave.	21	2.0	H	33.92	89.54	/	/
2442.00	69.22	PK	226	2.5	V	33.92	103.14	/	/
2442.00	60.07	Ave.	226	2.5	V	33.92	93.99	/	/
4884.00	44.72	PK	274	2.4	V	6.21	50.93	74	23.07
4884.00	30.83	Ave.	274	2.4	V	6.21	37.04	54	16.96
High Channel (2472 MHz)									
2472.00	64.59	PK	230	2.4	H	34.08	98.67	/	/
2472.00	51.48	Ave.	230	2.4	H	34.08	85.56	/	/
2472.00	68.67	PK	325	2.2	V	34.08	102.75	/	/
2472.00	57.75	Ave.	325	2.2	V	34.08	91.83	/	/
2326.51	27.21	PK	310	1.7	V	33.83	61.04	74	12.96
2326.51	13.46	Ave.	310	1.7	V	33.83	47.29	54	6.71
2483.56	27.85	PK	141	1.7	V	34.08	61.93	74	12.07
2483.56	14.83	Ave.	141	1.7	V	34.08	48.91	54	5.09
4944.00	43.52	PK	220	2.1	V	6.21	49.73	74	24.27
4944.00	29.38	Ave.	220	2.1	V	6.21	35.59	54	18.41

802.11n-HT20 Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	RSS-247/RSS-Gen	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412 MHz)									
2412.00	67.47	PK	229	2.5	H	33.92	101.39	/	/
2412.00	54.12	Ave.	229	2.5	H	33.92	88.04	/	/
2412.00	68.03	PK	103	1.9	V	33.92	101.95	/	/
2412.00	57.14	Ave.	103	1.9	V	33.92	91.06	/	/
2388.65	26.85	PK	5	2.1	V	33.92	60.77	74	13.23
2388.65	13.21	Ave.	5	2.1	V	33.92	47.13	54	6.87
2489.65	27.25	PK	164	2.1	V	34.08	61.33	74	12.67
2489.65	13.46	Ave.	164	2.1	V	34.08	47.54	54	6.46
4824.00	44.37	PK	145	1.6	V	5.84	50.21	74	23.79
4824.00	30.28	Ave.	145	1.6	V	5.84	36.12	54	17.88
Middle Channel (2442MHz)									
2442.00	65.61	PK	206	1.8	H	33.92	99.53	/	/
2442.00	53.17	Ave.	206	1.8	H	33.92	87.09	/	/
2442.00	67.76	PK	316	2.1	V	33.92	101.68	/	/
2442.00	55.72	Ave.	316	2.1	V	33.92	89.64	/	/
4884.00	44.81	PK	147	1.8	V	6.21	51.02	74	22.98
4884.00	30.54	Ave.	147	1.8	V	6.21	36.75	54	17.25
High Channel (2472 MHz)									
2472.00	64.33	PK	14	1.2	H	34.08	98.41	/	/
2472.00	54.58	Ave.	14	1.2	H	34.08	88.66	/	/
2472.00	69.22	PK	348	2.0	V	34.08	103.30	/	/
2472.00	57.35	Ave.	348	2.0	V	34.08	91.43	/	/
2352.16	26.78	PK	232	1.6	V	33.92	60.70	74	13.30
2352.16	13.05	Ave.	232	1.6	V	33.92	46.97	54	7.03
2484.02	32.56	PK	335	1.7	V	34.08	66.64	74	7.36
2484.02	16.89	Ave.	335	1.7	V	34.08	50.97	54	3.03
4944.00	42.58	PK	280	1.4	V	6.21	48.79	74	25.21
4944.00	28.66	Ave.	280	1.4	V	6.21	34.87	54	19.13

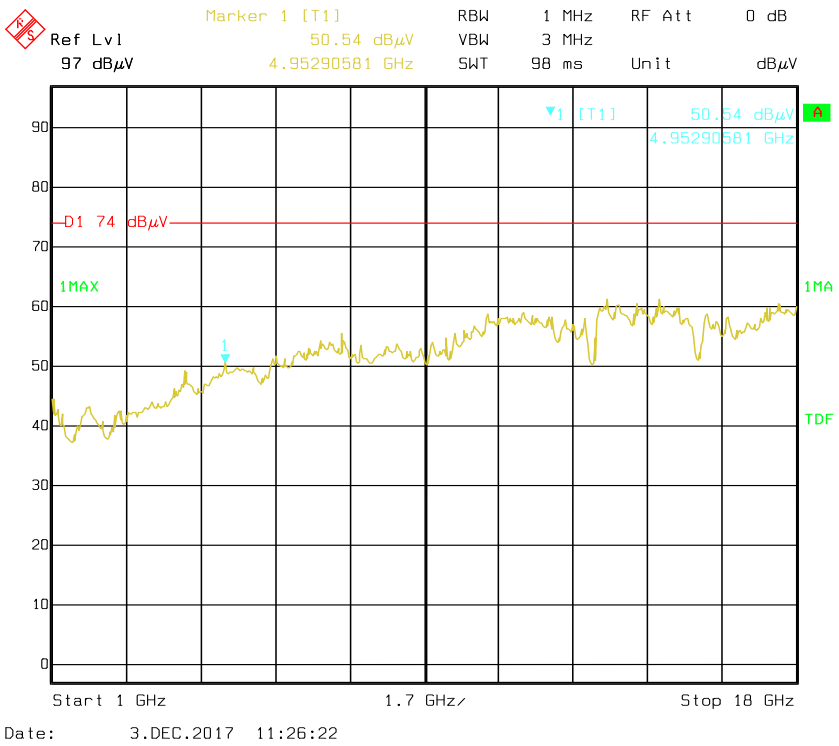
802.11n-HT40 Mode:

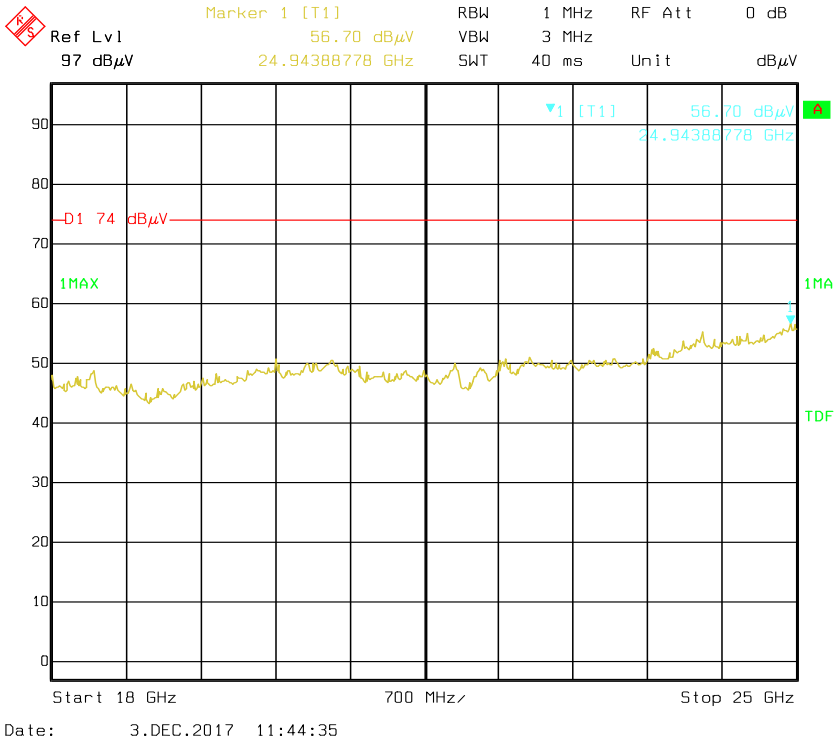
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	RSS-247/RSS-Gen	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2422 MHz)									
2422.00	65.83	PK	216	1.7	H	33.92	99.75	/	/
2422.00	53.61	Ave.	216	1.7	H	33.92	87.53	/	/
2422.00	71.05	PK	126	2.3	V	33.92	104.97	/	/
2422.00	60.24	Ave.	126	2.3	V	33.92	94.16	/	/
2389.19	31.64	PK	175	1.3	V	33.92	65.56	74	8.44
2389.19	16.01	Ave.	175	1.3	V	33.92	49.93	54	4.07
2488.64	27.33	PK	15	2.0	V	34.08	61.41	74	12.59
2488.64	13.54	Ave.	15	2.0	V	34.08	47.62	54	6.38
4844.00	43.58	PK	25	1.9	V	5.84	49.42	74	24.58
4844.00	29.51	Ave.	25	1.9	V	5.84	35.35	54	18.65
Middle Channel (2442MHz)									
2442.00	67.03	PK	207	1.2	H	33.92	100.95	/	/
2442.00	55.11	Ave.	207	1.2	H	33.92	89.03	/	/
2442.00	69.92	PK	278	1.9	V	33.92	103.84	/	/
2442.00	58.41	Ave.	278	1.9	V	33.92	92.33	/	/
4884.00	44.73	PK	321	2.2	V	6.21	50.94	74	23.06
4884.00	30.84	Ave.	321	2.2	V	6.21	37.05	54	16.95
High Channel (2462 MHz)									
2462.00	64.36	PK	214	1.5	H	34.08	98.44	/	/
2462.00	53.05	Ave.	214	1.5	H	34.08	87.13	/	/
2462.00	68.03	PK	7	2.1	V	34.08	102.11	/	/
2462.00	56.11	Ave.	7	2.1	V	34.08	90.19	/	/
2346.17	27.36	PK	129	1.5	V	33.83	61.19	74	12.81
2346.17	13.58	Ave.	129	1.5	V	33.83	47.41	54	6.59
2483.51	34.17	PK	339	1.8	V	34.08	68.25	74	5.75
2483.51	16.54	Ave.	338	1.1	V	34.08	50.62	54	3.38
4924.00	43.59	PK	195	1.3	V	6.21	49.80	74	24.20
4924.00	29.88	Ave.	195	1.3	V	6.21	36.09	54	17.91

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor
Margin = Limit - Corr. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

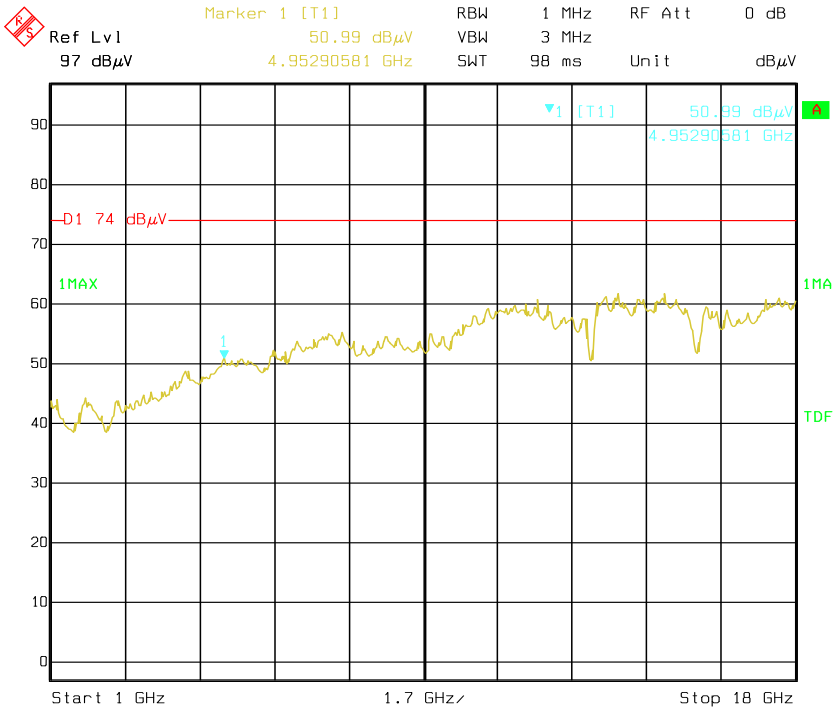
Pre-scan with 802.11n20 Mode 2472 MHz

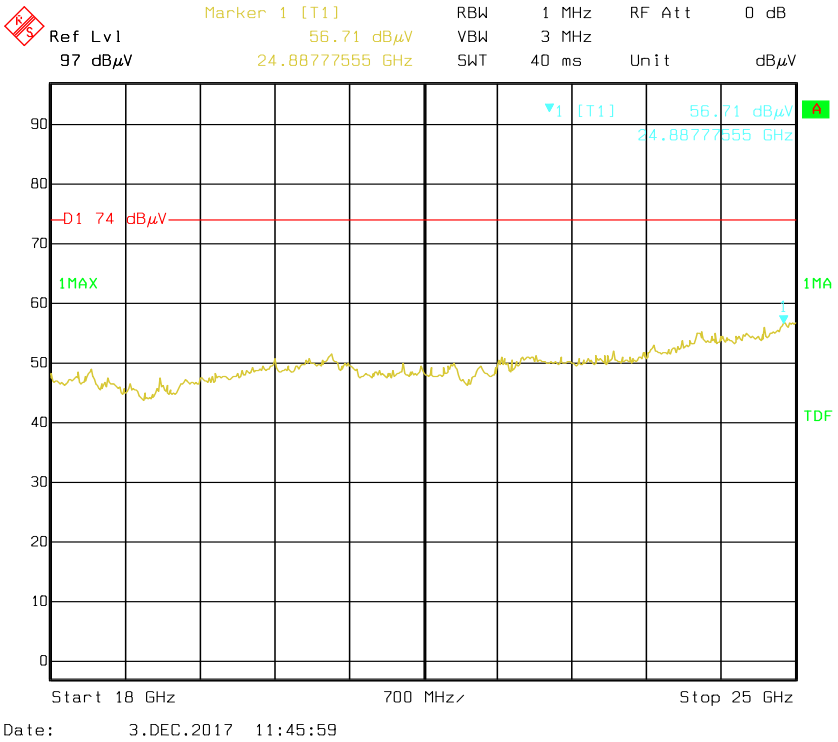
Horizontal



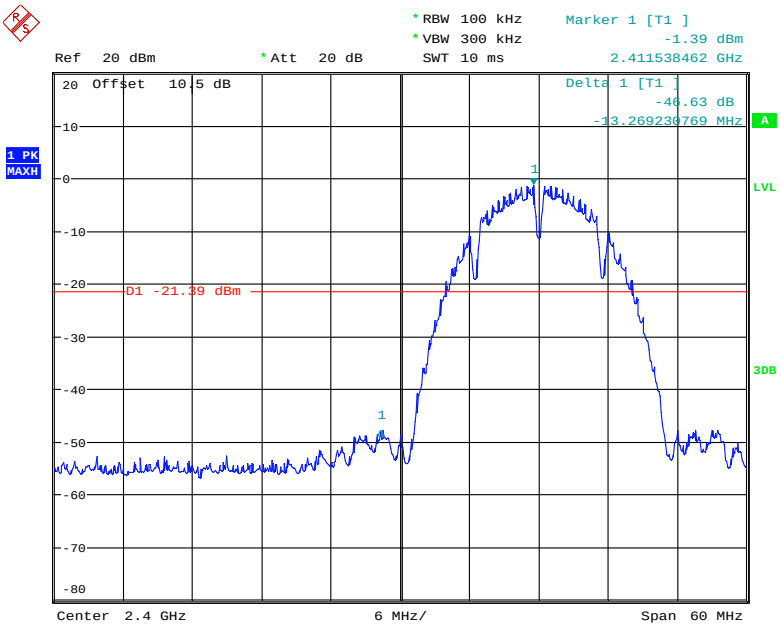


Vertical


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
50.99 dBµV
VBW 3 MHz
97 dBµV
4.95290581 GHz
SWT 98 ms
Unit dBµV
1 [T1] 50.99 dBµV
4.95290581 GHz
A
D1 74 dBµV
1MAX
1MA
TDF
Start 1 GHz
1.7 GHz/
Stop 18 GHz
Date: 3.DEC.2017 11:24:37

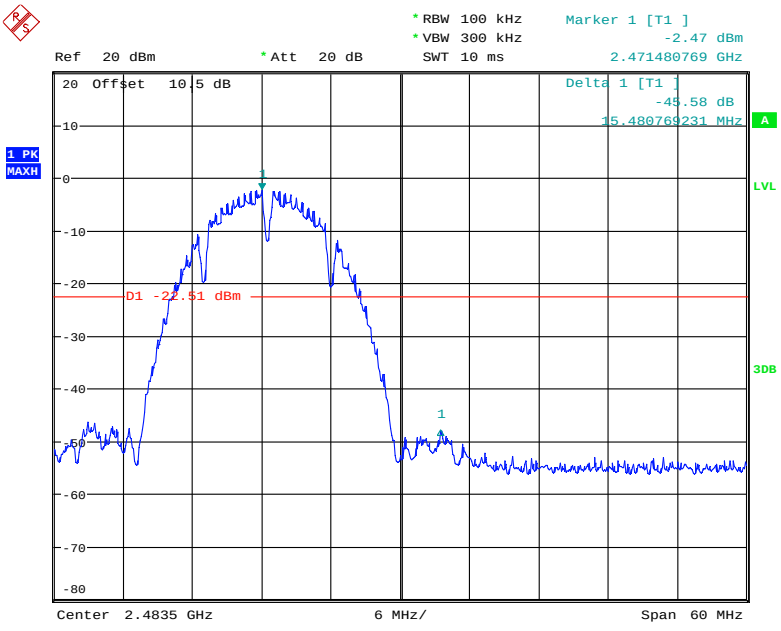

Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
56.71 dBµV
VBW 3 MHz
97 dBµV
24.88777555 GHz
SWT 40 ms
Unit dBµV
1 [T1] 56.71 dBµV
24.88777555 GHz
A
D1 74 dBµV
1MAX
1MA
TDF
Start 18 GHz
700 MHz/
Stop 25 GHz
Date: 3.DEC.2017 11:45:59

802.11b: Band Edge, Left Side



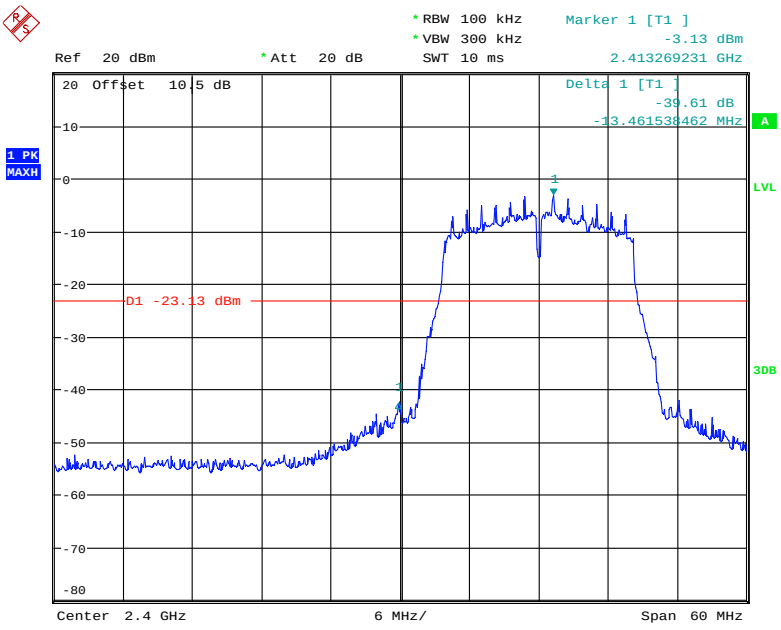
Date: 30.NOV.2017 22:08:29

802.11b: Band Edge, Right Side



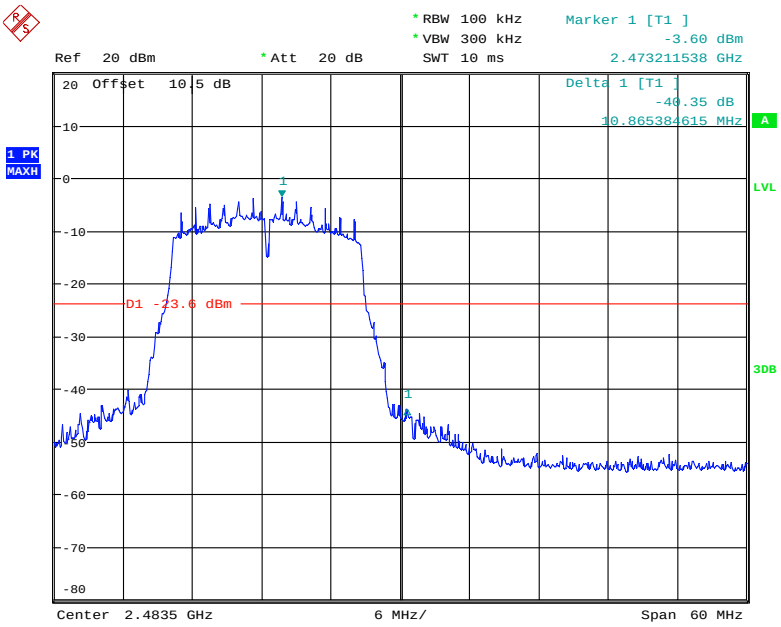
Date: 30.NOV.2017 22:07:54

802.11g: Band Edge, Left Side



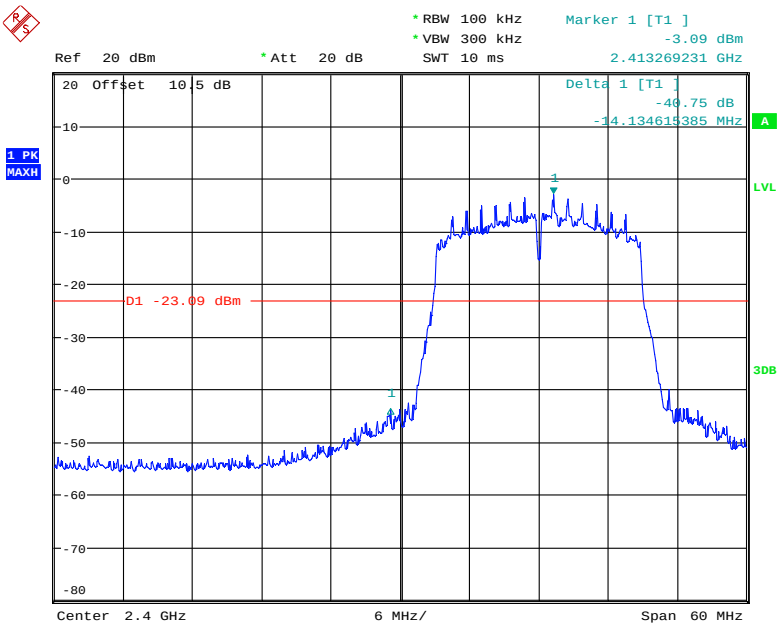
Date: 30.NOV.2017 22:06:45

802.11g: Band Edge, Right Side



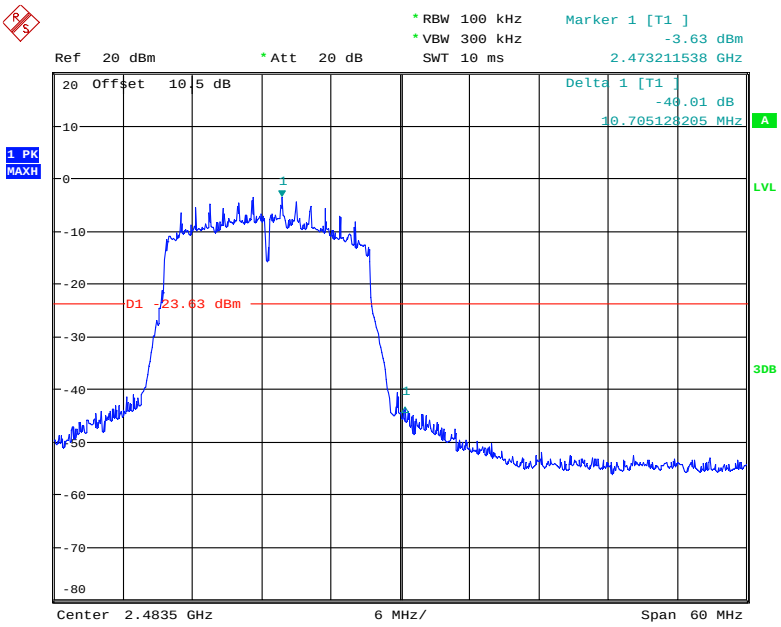
Date: 30.NOV.2017 22:07:20

802.11n-HT20: Band Edge, Left Side



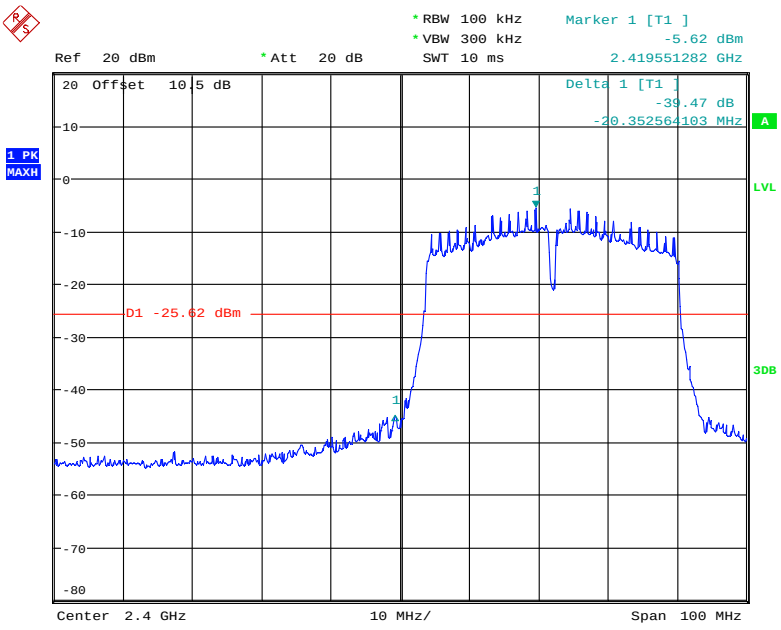
Date: 30.NOV.2017 22:06:06

802.11n-HT20: Band Edge, Right Side



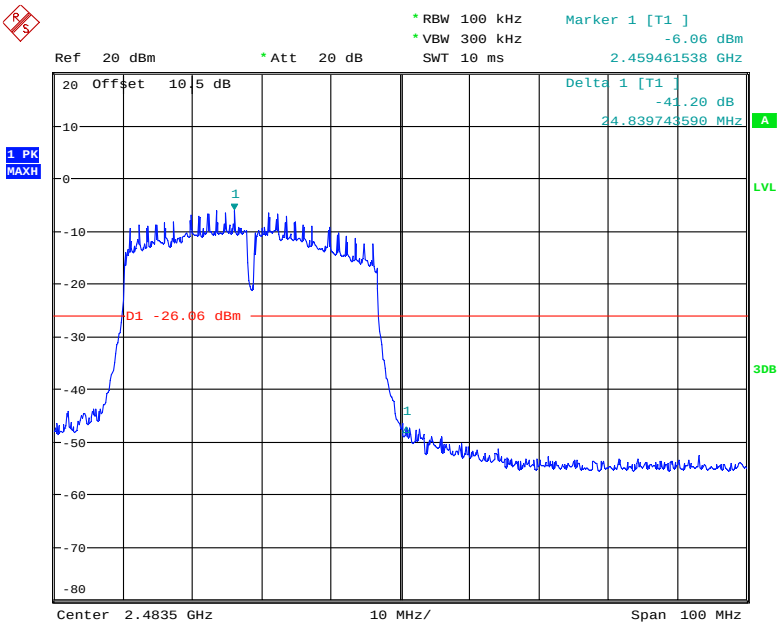
Date: 30.NOV.2017 22:05:20

802.11n-HT40: Band Edge, Left Side



Date: 30.NOV.2017 22:03:40

802.11n-HT40: Band Edge, Right Side



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RSS-GEN § 6.6 & RSS-247 § 5.2 (a) – 99% OCCUPIED BANDWIDTH & 20 dB EMISSON BANDWIDTH

Standard Applicable

According to RSS-GEN § 6.6 & RSS-247 §5.1 (a)

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz:

The minimum -6 dB bandwidth shall be at least 500 kHz.

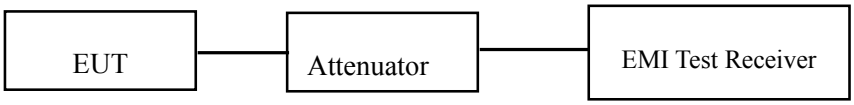
Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of two frequencies that indicated 99% Bandwidth & 6 dB bandwidth.

4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Kobe Li on 2017-11-30.

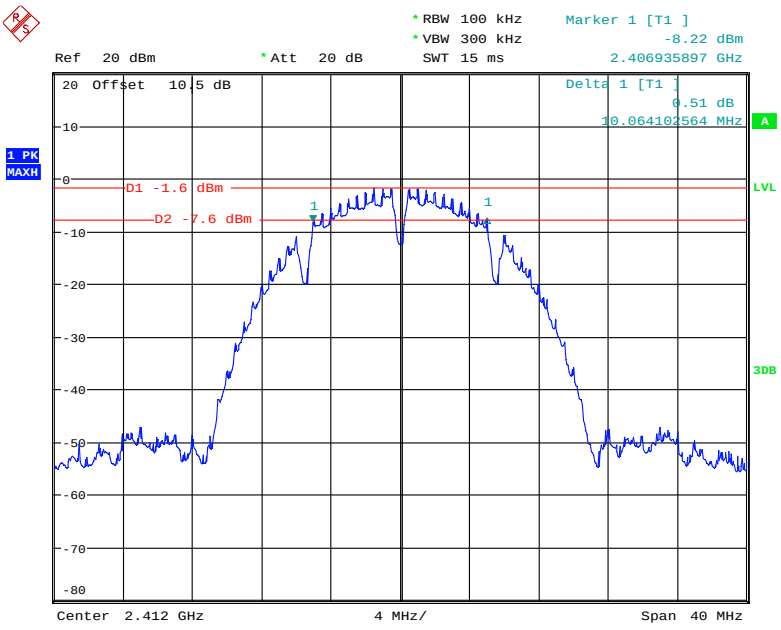
EUT operation mode: Transmitting

Test Result: Pass.

Please refer to the following tables and plots.

Channel	Frequency (MHz)	6dB bandwidth (MHz)	99% OBW (MHz)	Limited (kHz)
802.11b mode				
Low	2412	10.06	14.17	≥500
Middle	2442	9.68	14.23	≥500
High	2472	9.74	14.17	≥500
802.11g mode				
Low	2412	15.26	16.47	≥500
Middle	2442	15.26	16.47	≥500
High	2472	15.19	16.54	≥500
802.11n-HT20 mode				
Low	2412	15.26	17.5	≥500
Middle	2442	15.26	17.5	≥500
High	2472	15.19	17.5	≥500
802.11n-HT40 mode				
Low	2422	35.38	35.9	≥500
Middle	2442	35.26	35.9	≥500
High	2462	35.13	35.9	≥500

6 dB Bandwidth, 802.11b Low Channel



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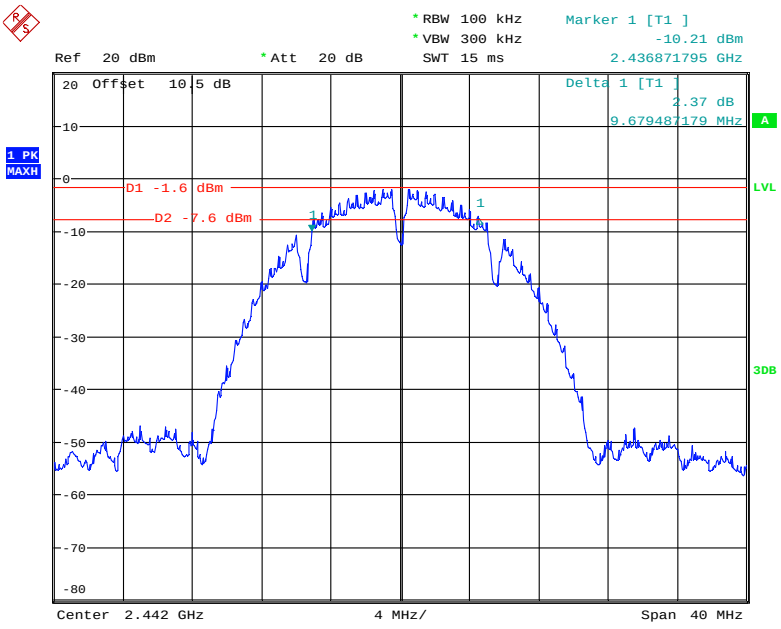
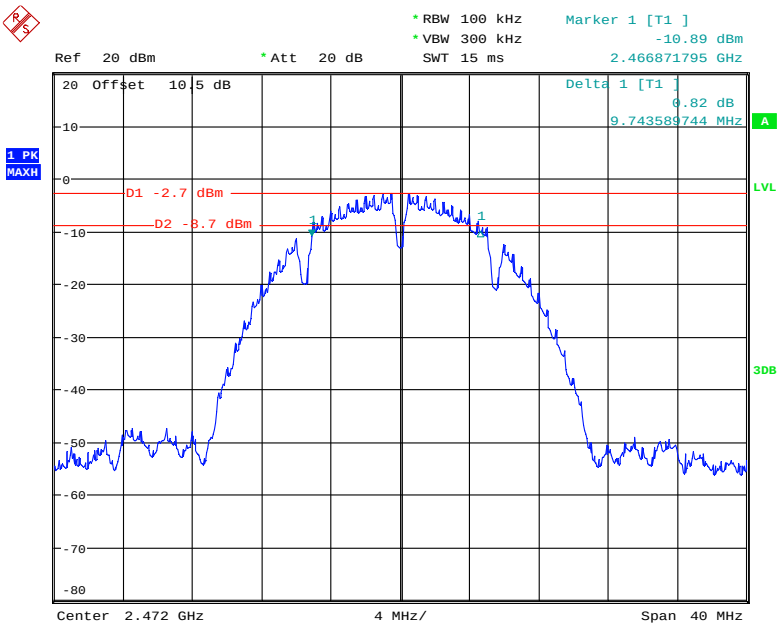
6 dB Bandwidth, 802.11b Middle Channel



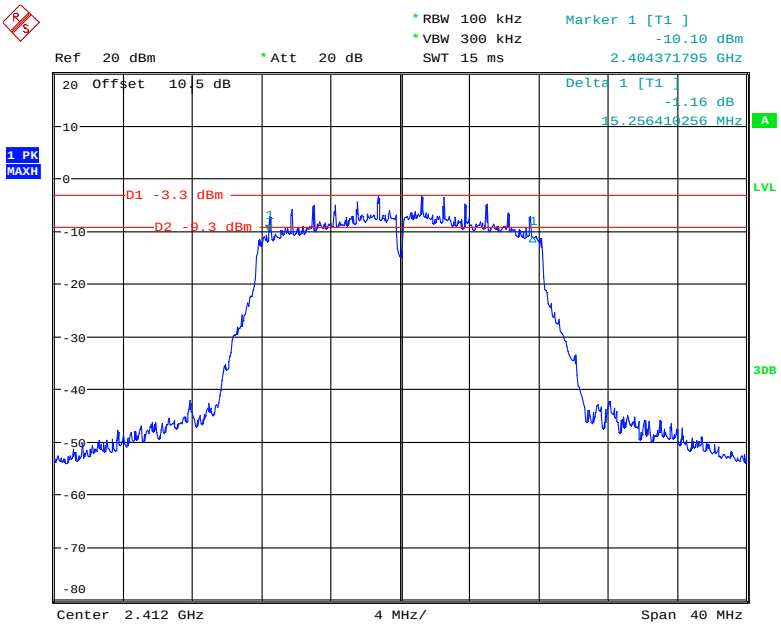
Date: 30.NOV.2017 21:47:38

6 dB Bandwidth, 802.11b High Channel



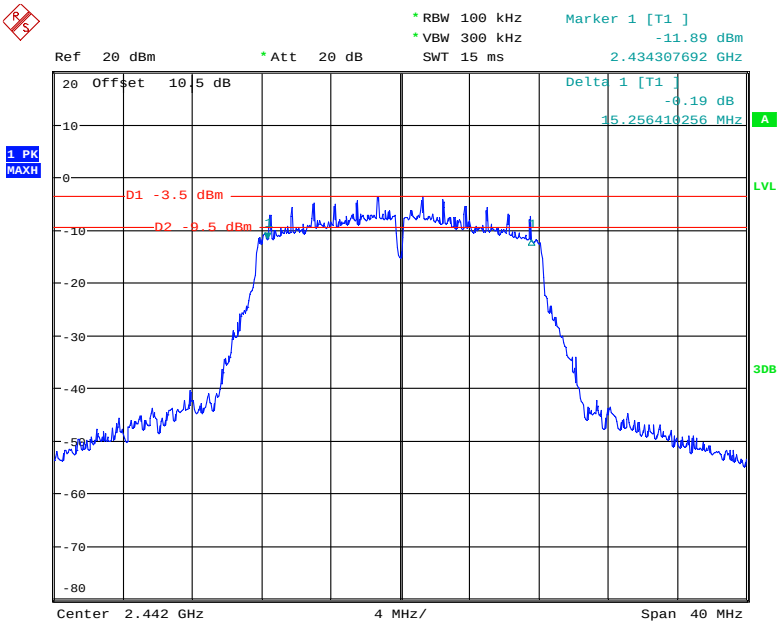
Date: 30.NOV.2017 21:48:23

6 dB Bandwidth, 802.11g Low Channel



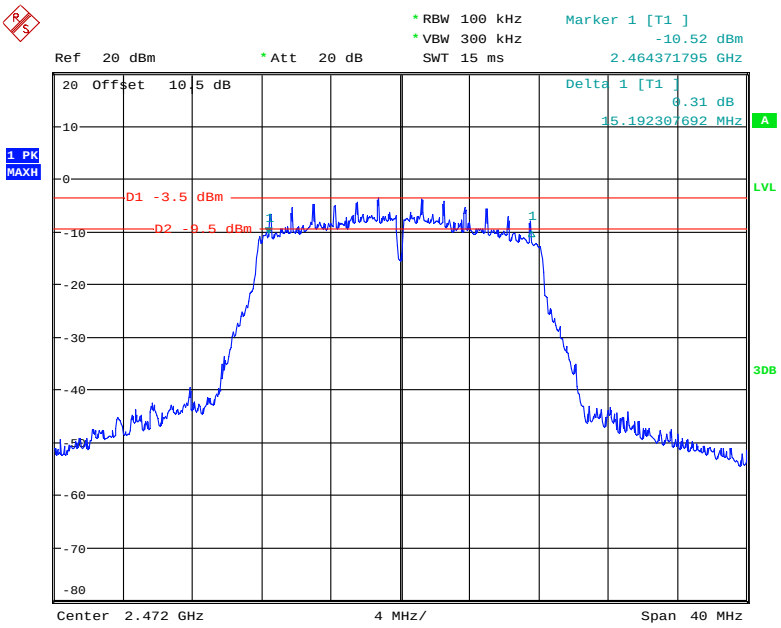
Date: 30.NOV.2017 21:45:32

6 dB Bandwidth, 802.11g Middle Channel



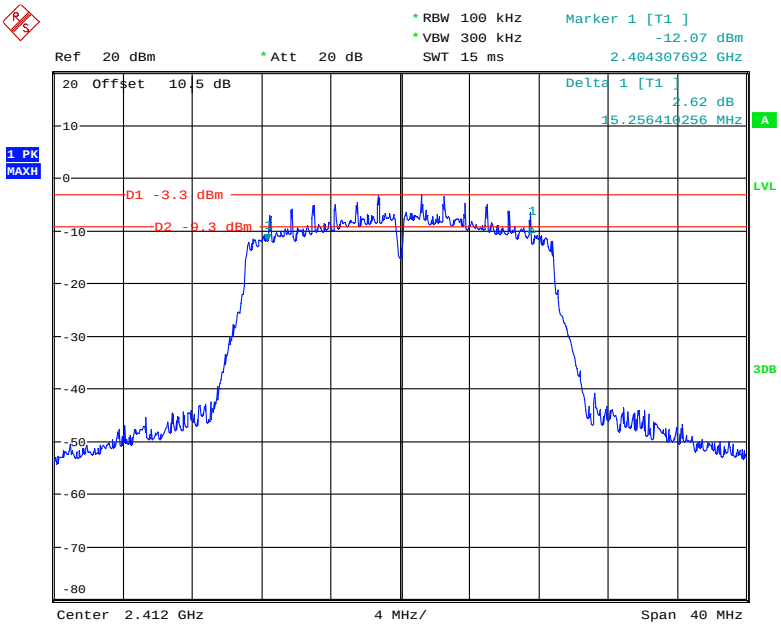
Date: 30.NOV.2017 21:44:55

6 dB Bandwidth, 802.11g High Channel



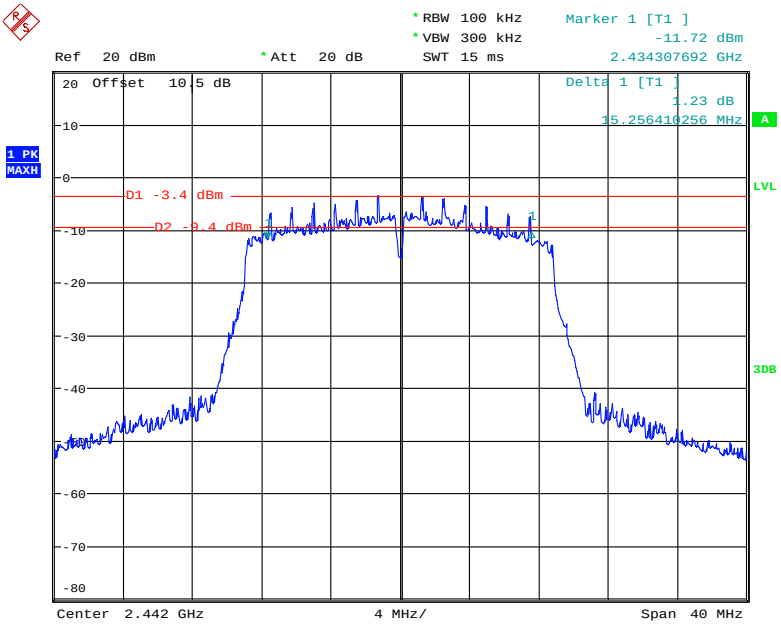
Date: 30.NOV.2017 21:44:23

6 dB Bandwidth, 802.11n-HT20 Low Channel



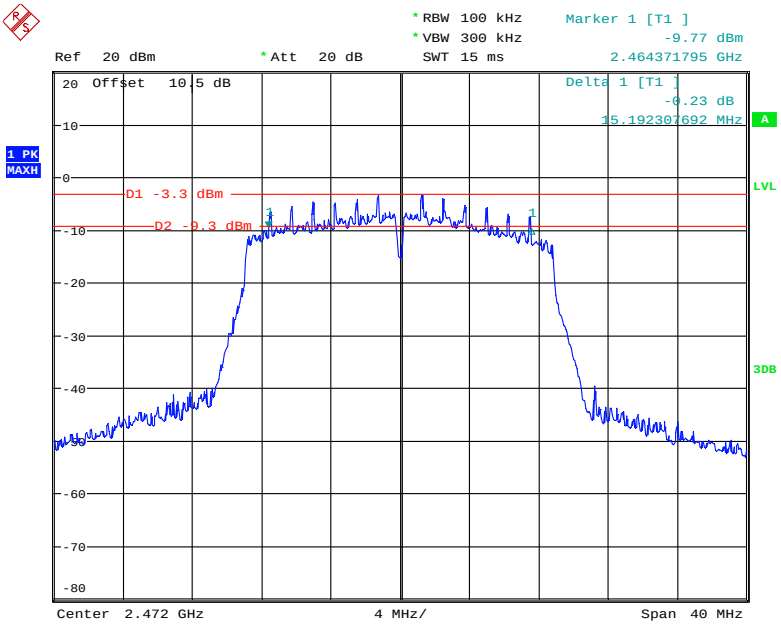
Date: 30.NOV.2017 21:40:20

6 dB Bandwidth, 802.11n-HT20 Middle Channel



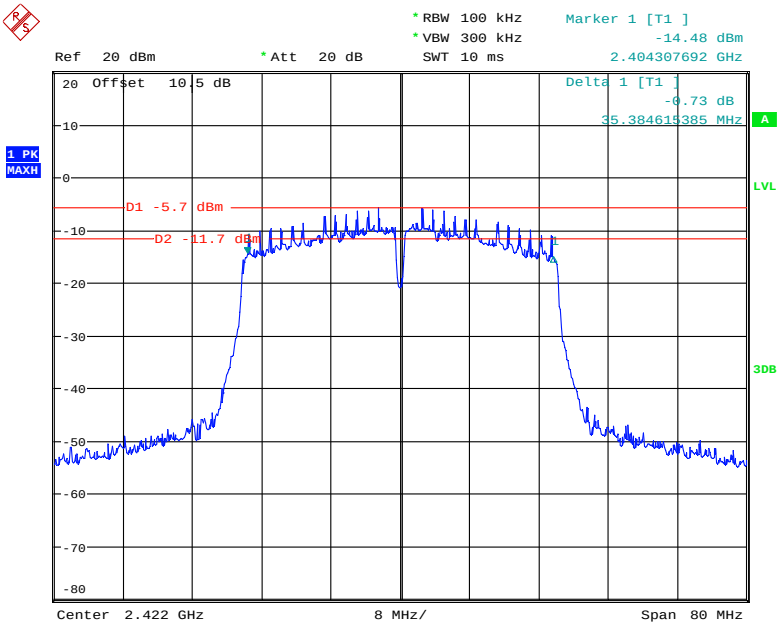
Date: 30.NOV.2017 21:39:36

6 dB Bandwidth, 802.11n-HT20 High Channel



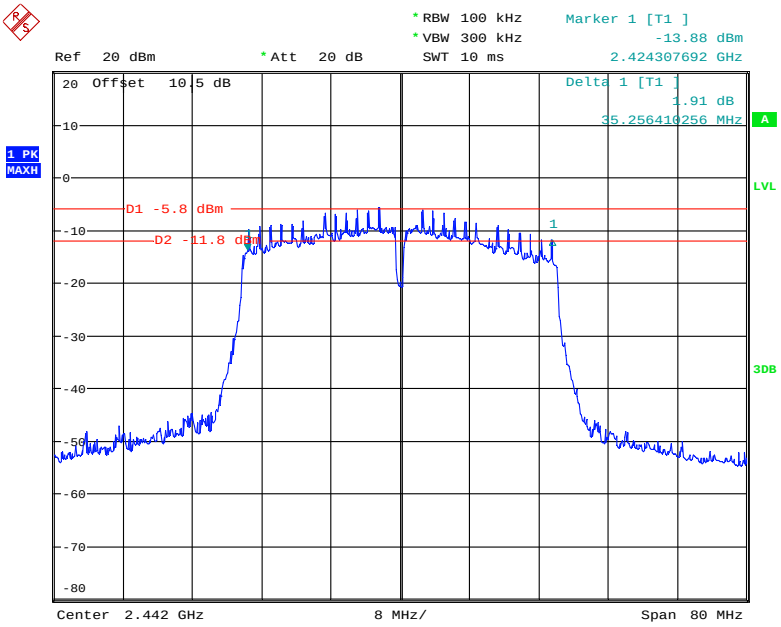
Date: 30.NOV.2017 21:38:44

6 dB Bandwidth, 802.11n-HT40 Low Channel



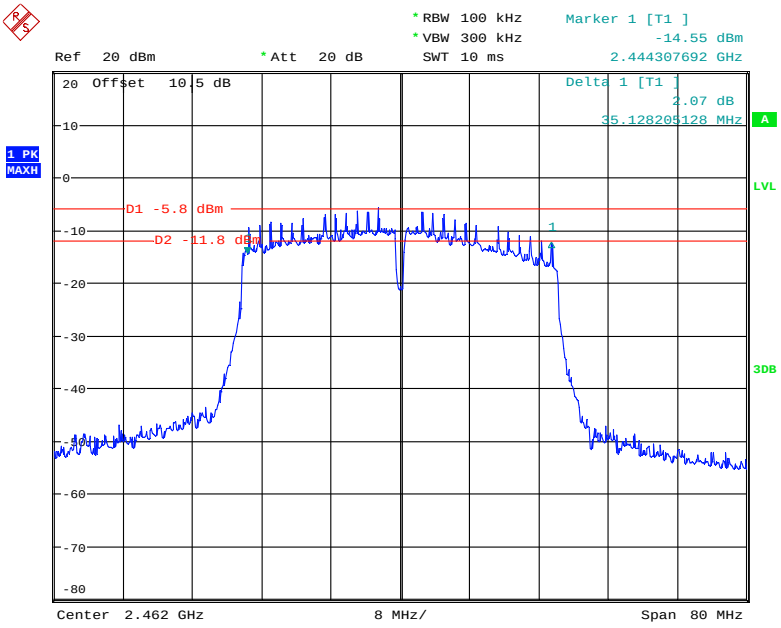
Date: 30.NOV.2017 21:42:00

6 dB Bandwidth, 802.11n-HT40 Middle Channel



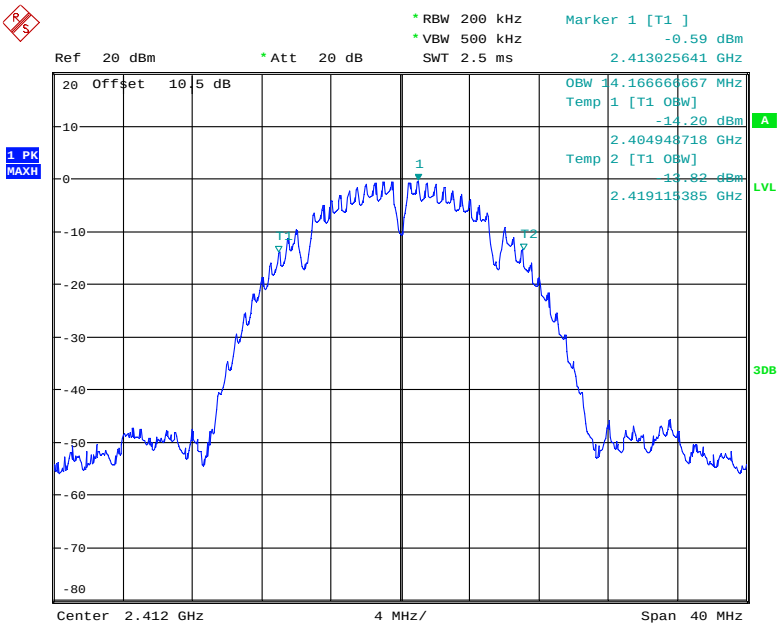
Date: 30.NOV.2017 21:42:50

6 dB Bandwidth, 802.11n-HT40 High Channel



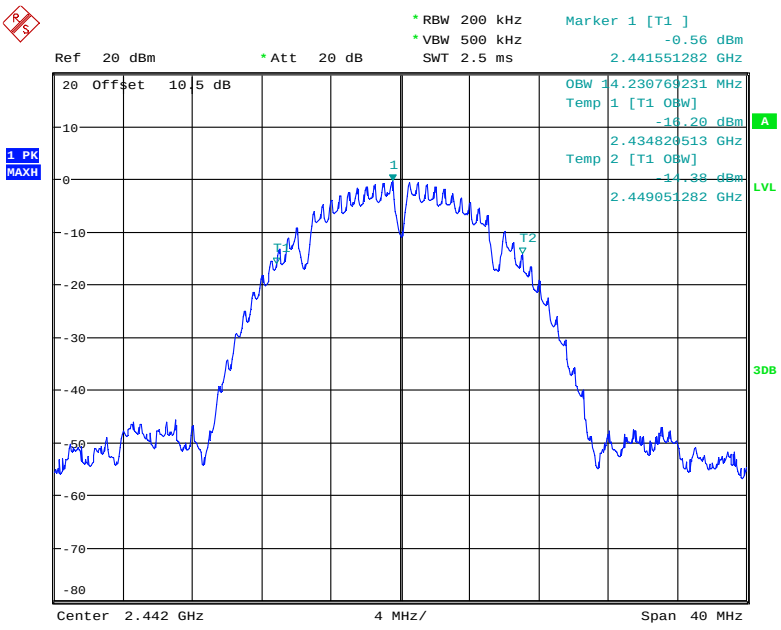
Date: 30.NOV.2017 21:43:19

99% Bandwidth, 802.11b Low Channel



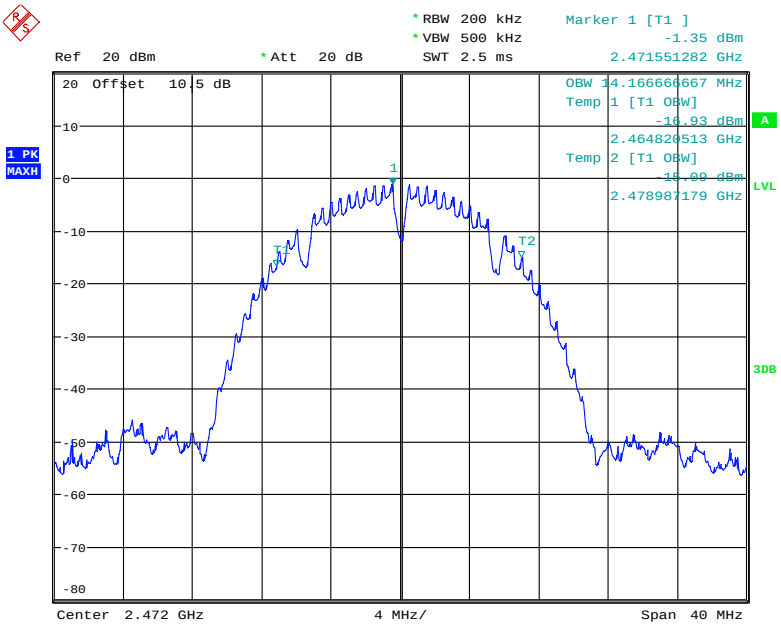
Date: 30.NOV.2017 21:49:46

99% Bandwidth, 802.11b Middle Channel



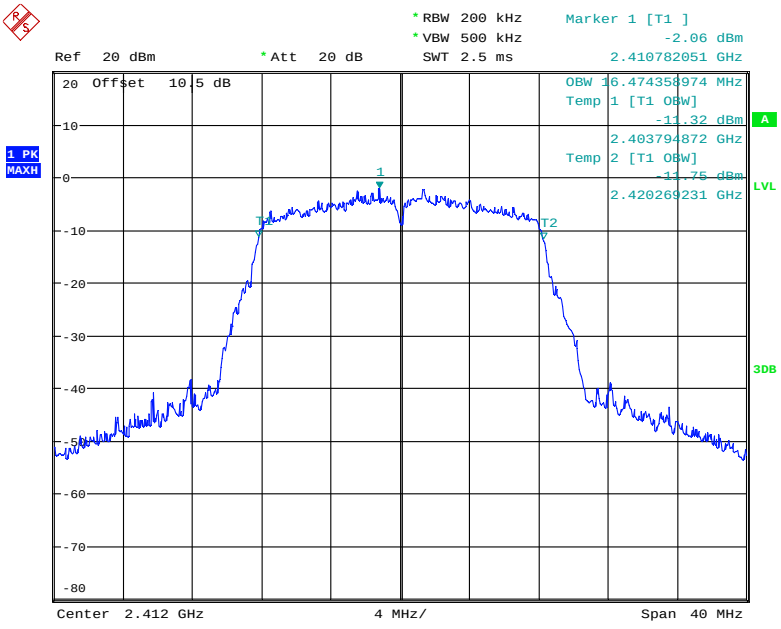
Date: 30.NOV.2017 21:49:27

99% Bandwidth, 802.11b High Channel



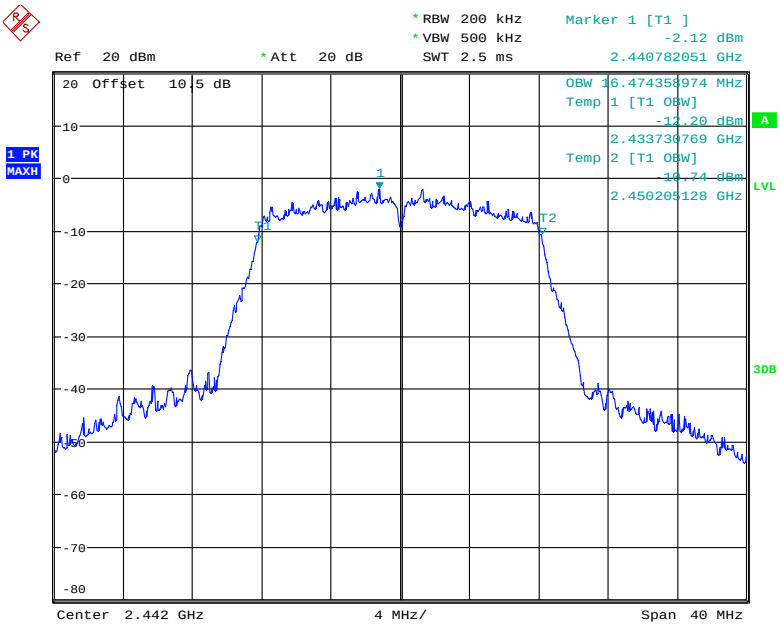
Date: 30.NOV.2017 21:49:02

99% Bandwidth, 802.11g Low Channel



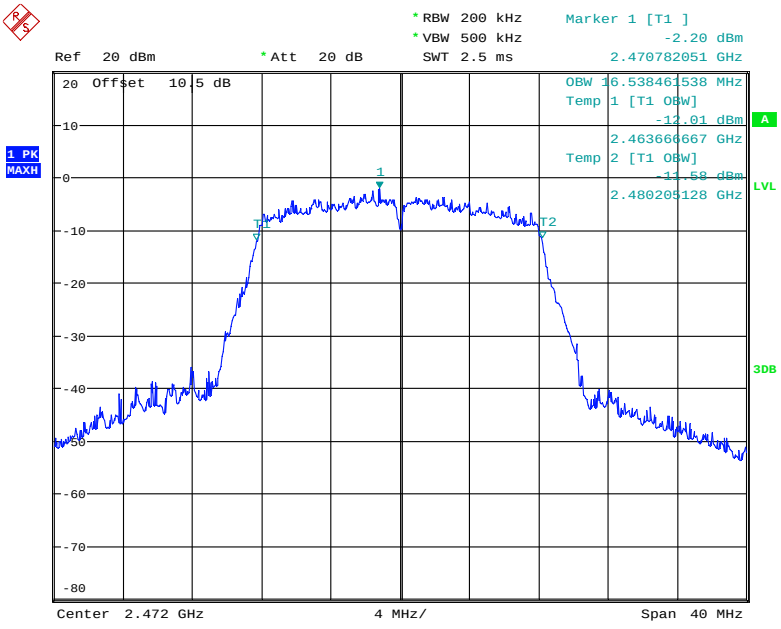
Date: 30.NOV.2017 21:50:10

99% Bandwidth, 802.11g Middle Channel



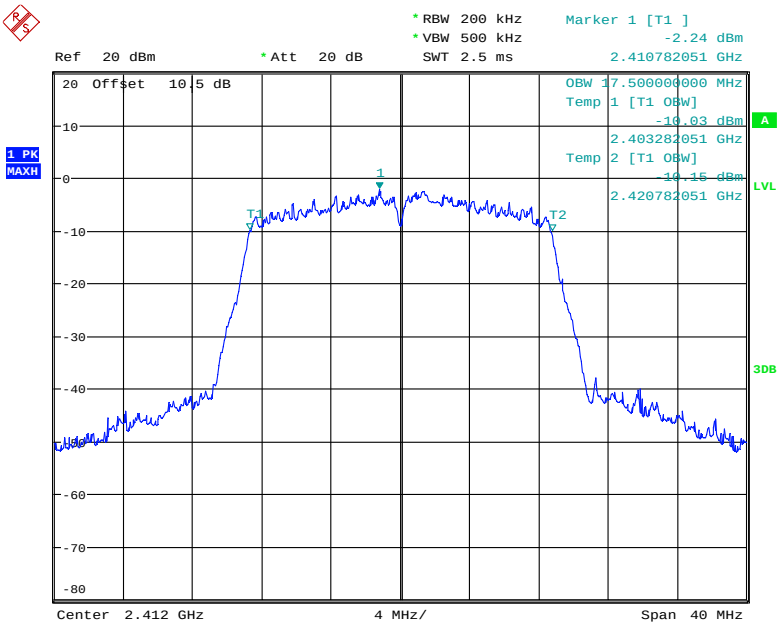
Date: 30.NOV.2017 21:50:40

99% Bandwidth, 802.11g High Channel



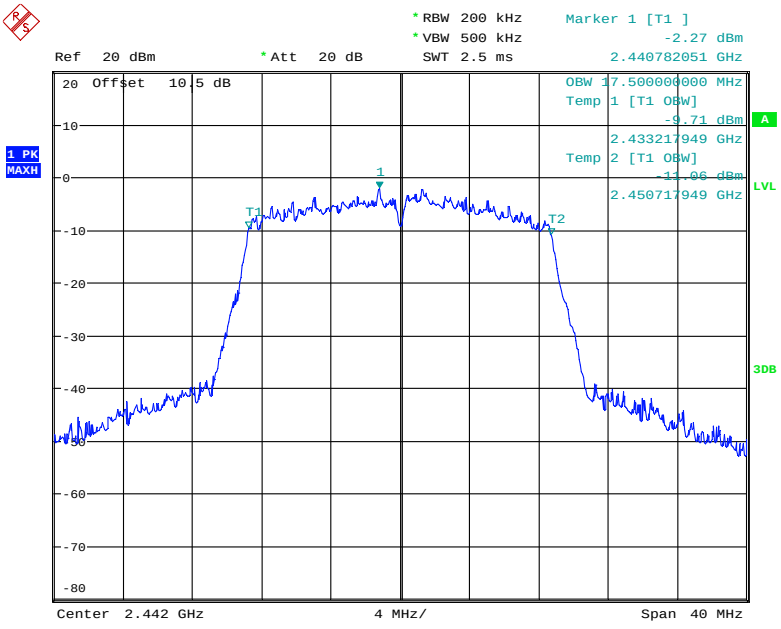
Date: 30.NOV.2017 21:53:27

99% Bandwidth, 802.11n-HT20 Low Channel



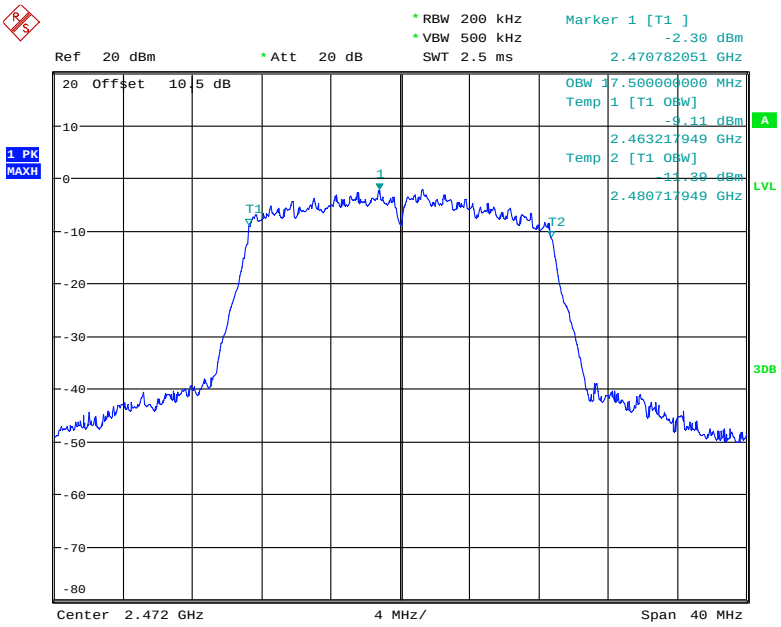
Date: 30.NOV.2017 21:56:06

99% Bandwidth, 802.11n-HT20 Middle Channel



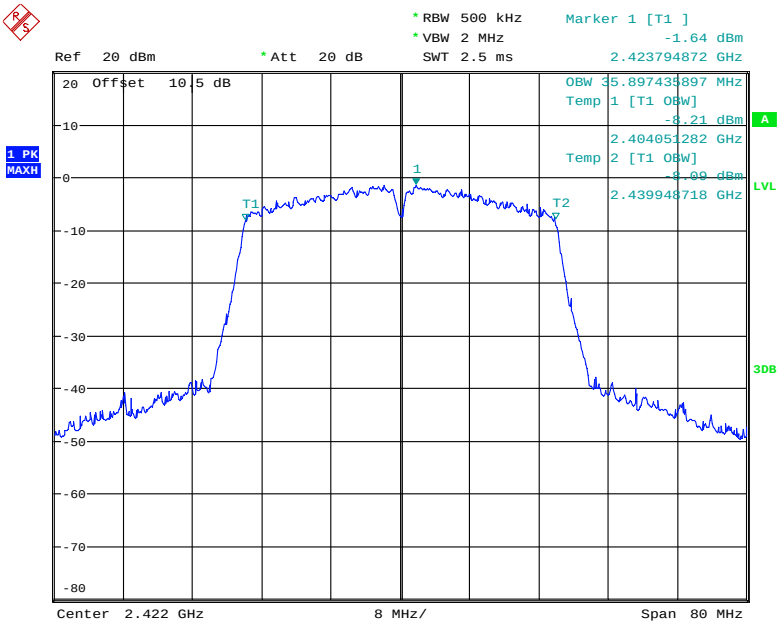
Date: 30.NOV.2017 21:55:35

99% Bandwidth, 802.11n-HT20 High Channel



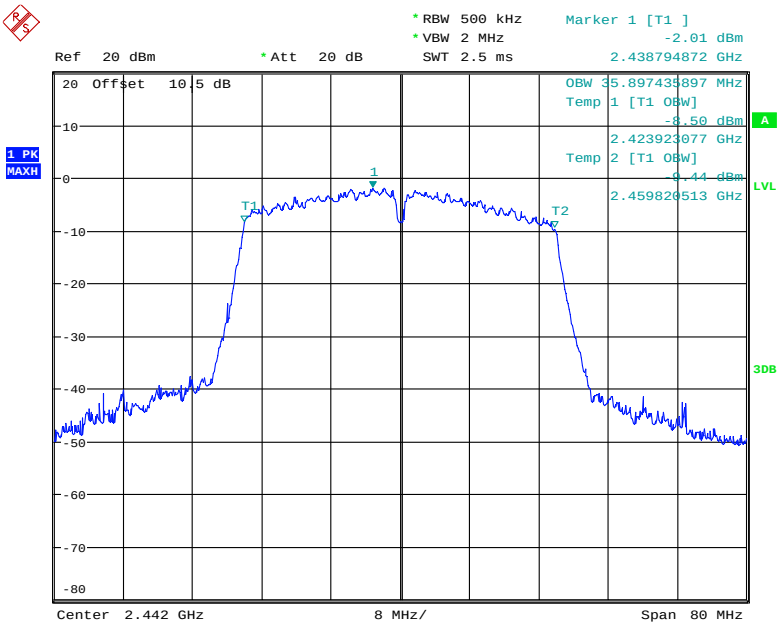
Date: 30.NOV.2017 21:55:06

99% Bandwidth, 802.11n-HT40 Low Channel



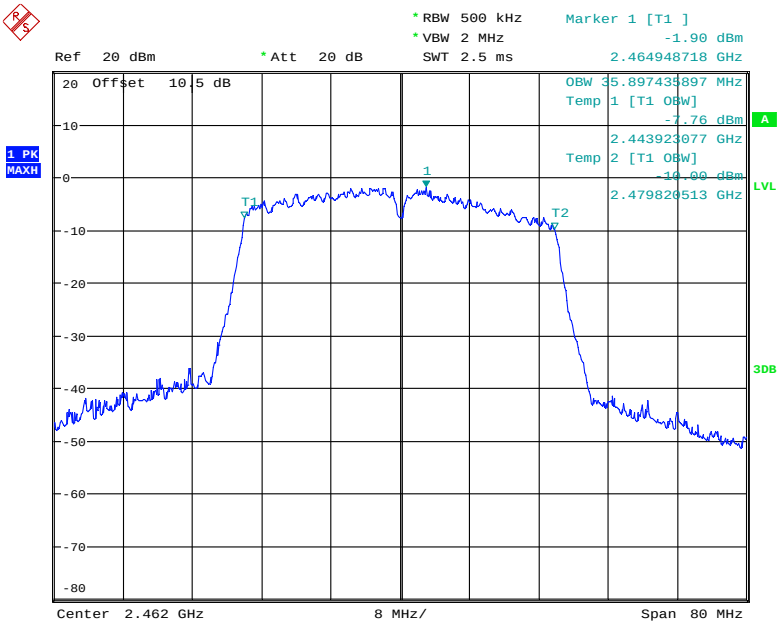
Date: 30.NOV.2017 21:59:52

99% Bandwidth, 802.11n-HT40 Middle Channel



Date: 30.NOV.2017 21:58:35

99% Bandwidth, 802.11n-HT40 High Channel



Date: 30.NOV.2017 21:58:14

RSS-247 §5.2 (b) – POWER SPECTRAL DENSITY

Applicable Standard

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Kobe Li on 2017-11-30.

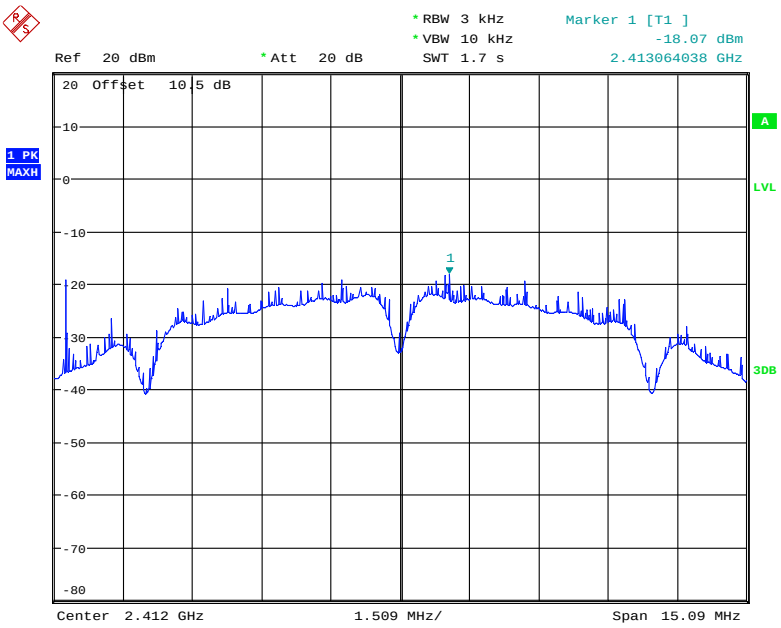
EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following table and plots:

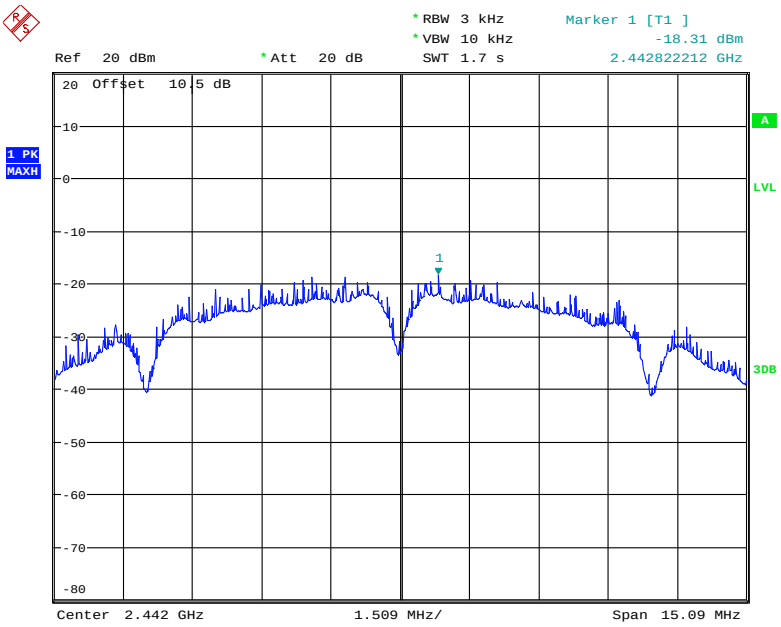
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-18.07	≤8
Middle	2442	-18.31	≤8
High	2472	-18.00	≤8
802.11g mode			
Low	2412	-20.19	≤8
Middle	2442	-19.34	≤8
High	2472	-20.30	≤8
802.11n-HT20 mode			
Low	2412	-19.93	≤8
Middle	2442	-18.91	≤8
High	2472	-20.01	≤8
802.11n-HT40 mode			
Low	2422	-22.24	≤8
Middle	2442	-21.30	≤8
High	2462	-20.65	≤8

Power Spectral Density, 802.11b Low Channel



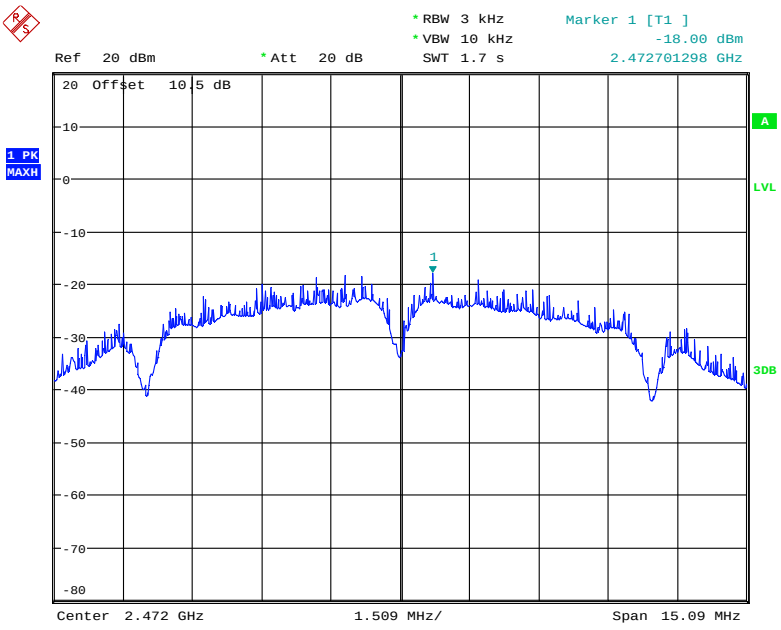
Date: 30.NOV.2017 22:15:11

Power Spectral Density, 802.11b Middle Channel



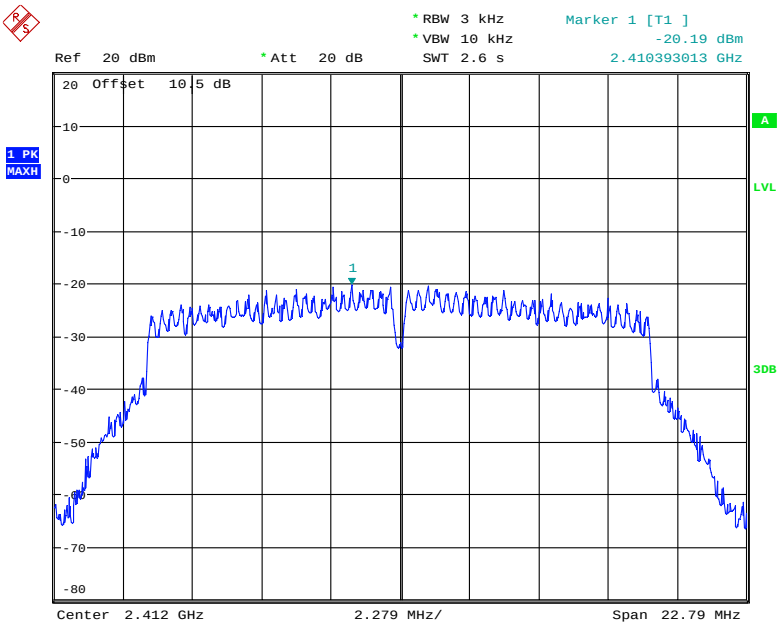
Date: 30.NOV.2017 22:16:07

Power Spectral Density, 802.11b High Channel



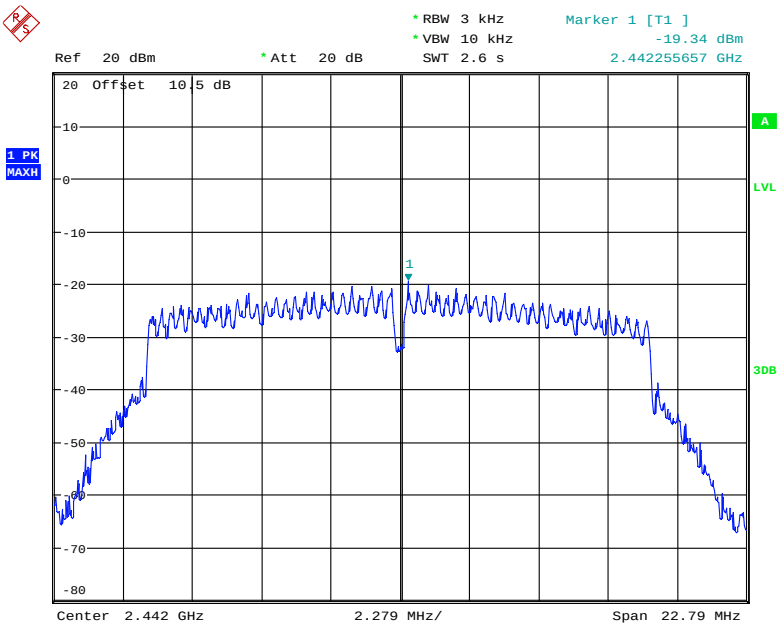
Date: 30.NOV.2017 22:16:28

Power Spectral Density, 802.11g Low Channel



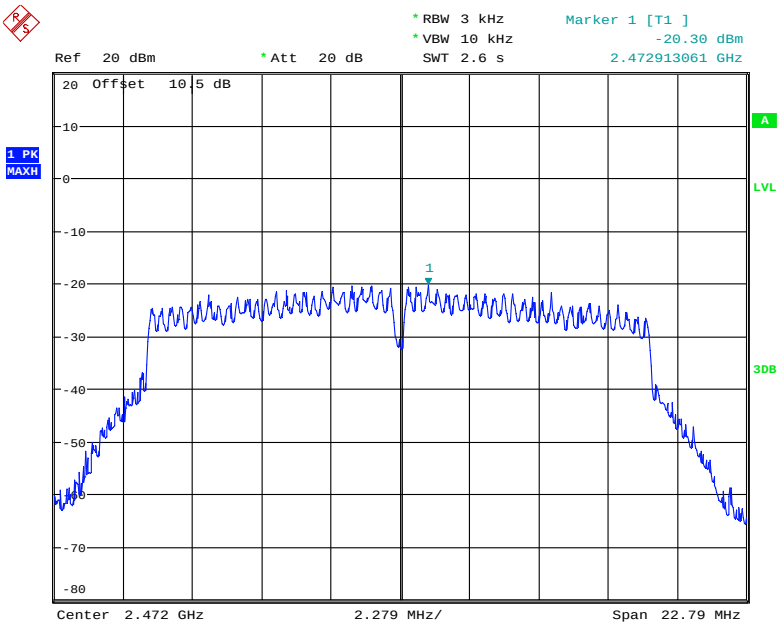
Date: 30.NOV.2017 22:13:57

Power Spectral Density, 802.11g Middle Channel



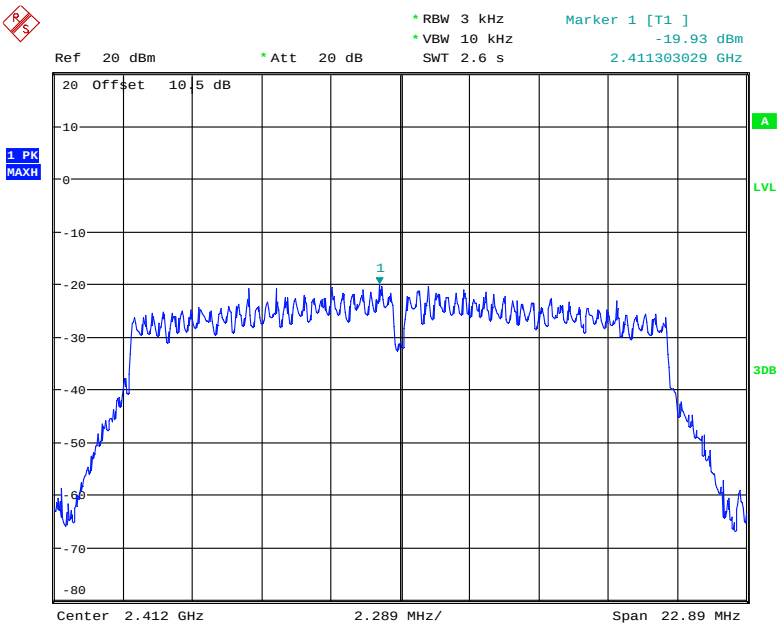
Date: 30.NOV.2017 22:13:31

Power Spectral Density, 802.11g High Channel



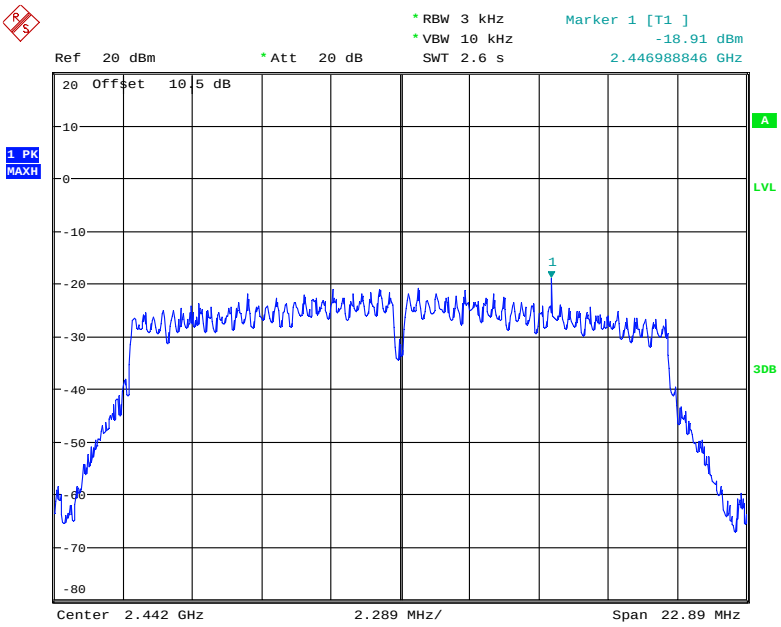
Date: 30.NOV.2017 22:13:14

Power Spectral Density, 802.11n-HT20 Low Channel



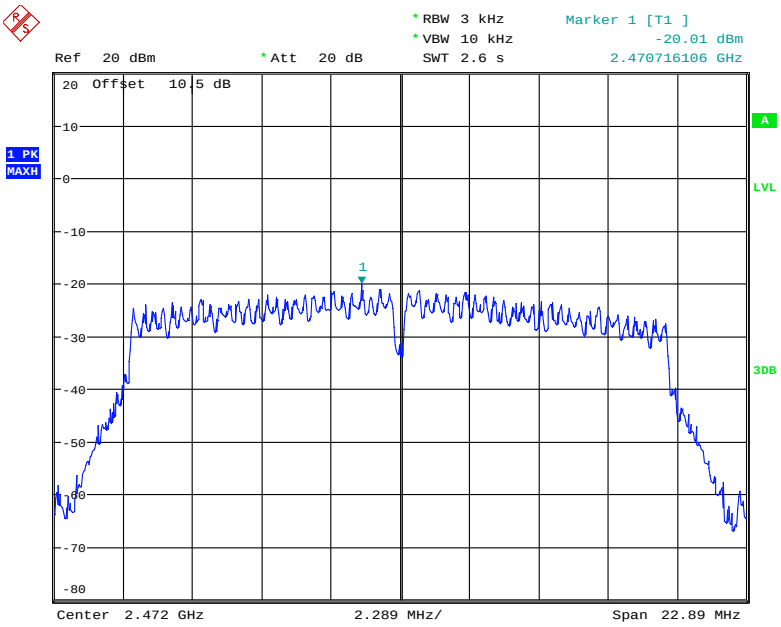
Date: 30.NOV.2017 22:17:50

Power Spectral Density, 802.11n-HT20 Middle Channel



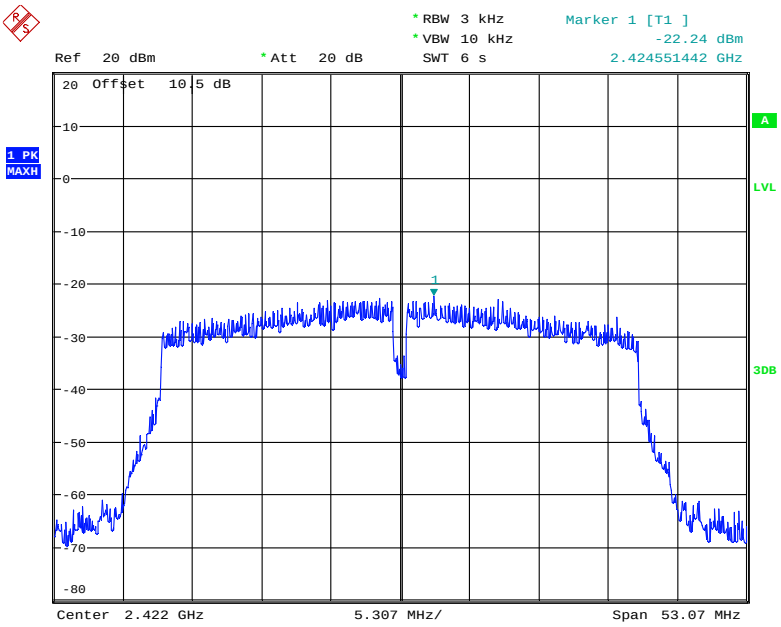
Date: 30.NOV.2017 22:17:30

Power Spectral Density, 802.11n-HT20 High Channel



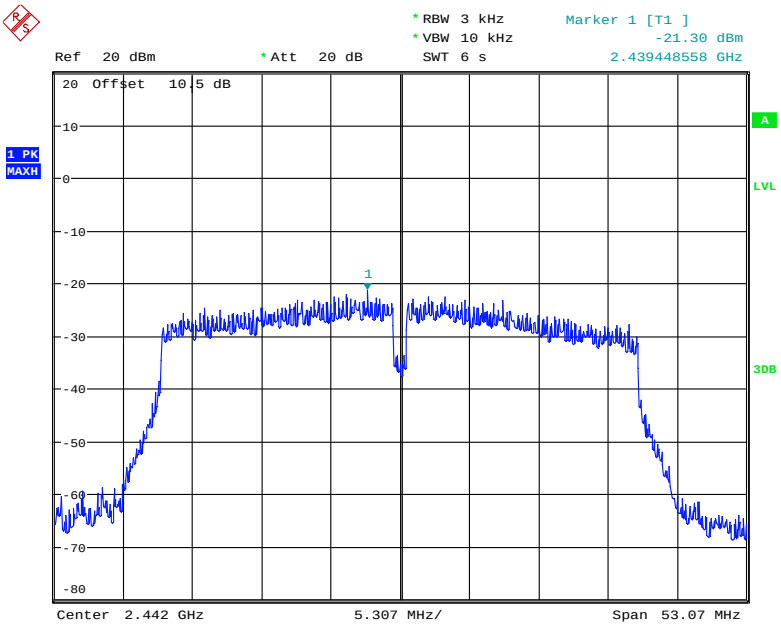
Date: 30.NOV.2017 22:17:10

Power Spectral Density, 802.11n-HT40 Low Channel



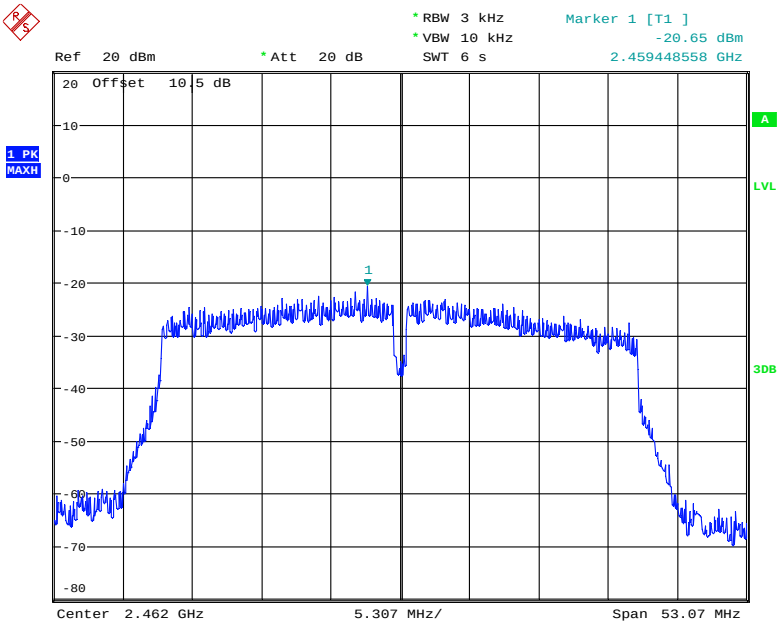
Date: 30.NOV.2017 22:28:36

Power Spectral Density, 802.11n-HT40 Middle Channel



Date: 30.NOV.2017 22:29:28

Power Spectral Density, 802.11n-HT40 High Channel



Date: 30.NOV.2017 22:30:27

RSS-247 §5.4 (d) - PEAK OUTPUT POWER MEASUREMENT

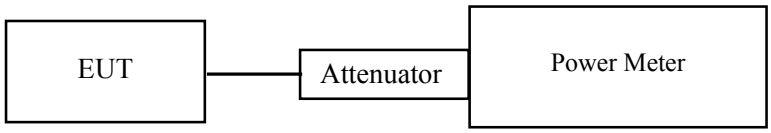
Applicable Standard

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Kobe Li on 2017-11-30.

Test Result: Compliance

EUT operation mode: Transmitting

Wi-Fi mode

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)
802.11b			
Low	2412	11.18	30
Middle	2442	10.94	30
High	2472	10.02	30
802.11g			
Low	2412	14.27	30
Middle	2442	13.95	30
High	2472	13.91	30
802.11n-HT20			
Low	2412	14.56	30
Middle	2442	14.32	30
High	2472	14.26	30
802.11n-HT40			
Low	2422	14.52	30
Middle	2442	14.31	30
High	2462	14.38	30

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