

FCC - TEST REPORT

Report Number	68.960.17.06	8.01	Date of Issue:	October 19, 2017
Model	: HCl001			
Product Type	: Hive View			
Applicant	: Centrica Con	nected Home	e Harris	
Address	: Millstream, M	aidenhead R	Road, Windsor, Be	erkshire SL4 5GD United
	Kingdom			
Manufacturer	: Centrica Coni	nected Home	e Harris	
Address	: Millstream, M	aidenhead R	Road, Windsor, Be	erkshire SL4 5GD United
	Kingdom			
Test Result	■ Positive	□ Negati	ve	
Total pages including Appendices	: 40			

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Building 12&13, Zhiheng Wisdomland Business Park,

Nantou Checkpoint Road 2, Nanshan District,

Shenzhen City, 518052,

P. R. China

FCC Registration

514049

No.:

Telephone: 86 755 8828 6998 Fax: 86 755 8828 5299



3 Description of the Equipment Under Test

Product: Hive Active Camera

Model no.: HCI001

FCC ID: WJHHCI001

Brand Name: Hive

Options and accessories: NIL

Rating: 3.8V by Li-on battery or DC 5V by adapter

RF Transmission Frequency: 2412-2462MHz

No. of Operated Channel: 11

Modulation: DSSS, OFDM

Antenna Type: Internal Antenna

Antenna Gain: 3.0dBi

Description of the EUT: The Equipment Under Test (EUT) is Wireless Hive Active Camera

operated at 2.4GHz

Remark 1: The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



4 Summary of Test Standards

Test Standards				
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES			
10-1-2016 Edition	Subpart C - Intentional Radiators			

All the test methods were according to KDB558074 D01 DTS Measurement Guidance v04and ANSI C63.10 (2013).



5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C	•					
			Test Result			
Test Condition		Site	Pass	Fail	N/	
					Α	
§15.207	Conducted emission AC power port	Site 1				
§15.247 (b) (1)	Conducted peak output power	Site 1				
§15.247(a)(1)	20dB bandwidth					
§15.247(a)(1)	Carrier frequency separation					
§15.247(a)(1)(iii)	Number of hopping frequencies					
§15.247(a)(1)(iii)	Dwell Time					
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	Site 1				
§15.247(e)	Power spectral density	Site 1				
§15.247(d)	Spurious RF conducted emissions	Site 1				
§15.247(d)	Band edge	Site 1				
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	Site 1				
§15.203	Antenna requirement	See note 1				

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an Integrated antenna, which gain is 3.0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: WJHHCl001 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed
- ☐ Not Performed

The Equipment Under Test

- - Fulfills the general approval requirements.
- ☐ **Does not** fulfill the general approval requirements.

Sample Received Date: September 28, 2017

Testing Start Date: September 27, 2017

Testing End Date: October 10, 2017

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:

Prepared by:

John Zhi Section Manager

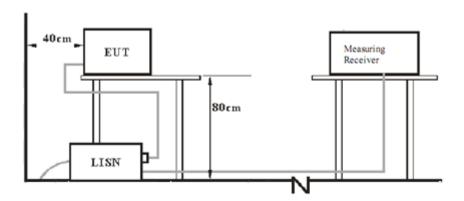
Johnshi

Moon Xiong Project Engineer



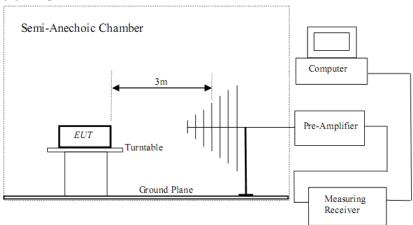
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

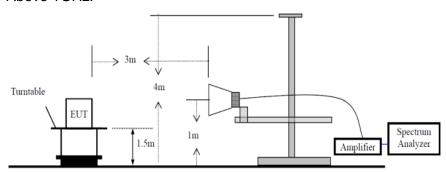


7.2 Radiated test setups

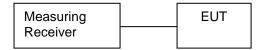
Below 1GHz:



Above 1GHz:



7.3 Conducted RF test setups





8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
		-	

The system was configured to non-hopping mode.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

Through pre-scan all kind of modulation and all kind of rates, find the 1Mbps of rate is the worst case of 802.11b; the 6Mbps of rate is the worst case of 802.11g; the 6.5Mbps of rate is the worst case of 802.11N20; only the worst case transmitter rate data mode in recorded in the report.



9 Technical Requirement

9.1 Conducted Emission

Test Method

- 1. The EUT was placed on a table, which is 0.8m above ground plane
- 2. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 3. Maximum procedure was performed to ensure EUT compliance
- 4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency	QP Limit	AV Limit
MHz	dΒμV	dΒμV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

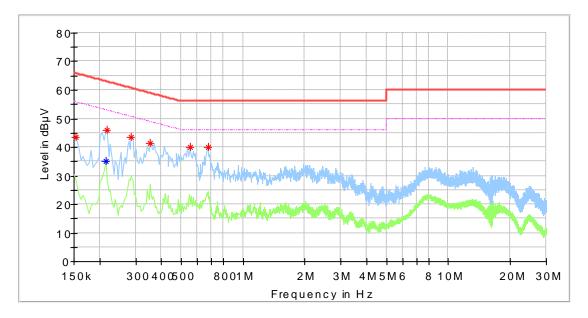


Product Type : Diagnostic Ultrasound System

M/N : HCl001

Operating Condition : Normal Working with WiFi Traffic

Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.154000	43.66		65.78	22.12	L1	10.2
0.214000		35.08	53.05	17.96	L1	10.2
0.218000	46.05		62.89	16.84	L1	10.2
0.286000	43.54		60.64	17.10	L1	10.2
0.354000	41.55		58.87	17.32	L1	10.3
0.550000	40.15		56.00	15.85	L1	10.2
0.674000	39.85		56.00	16.15	L1	10.2

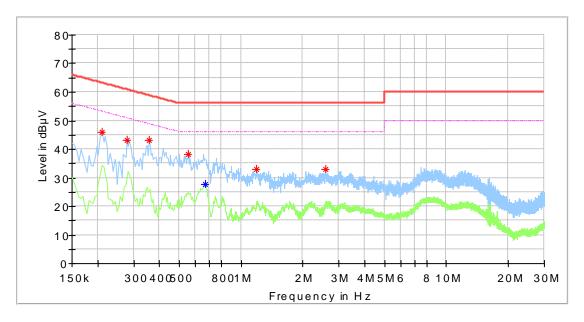


Product Type : Diagnostic Ultrasound System

M/N : HCl001

Operating Condition : Normal Working with WiFi Traffic

Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.210000	45.82		63.21	17.39	N	10.3
0.278000	43.11		60.88	17.76	N	10.3
0.358000	43.01		58.77	15.76	N	10.3
0.554000	38.08		56.00	17.92	N	10.4
0.670000		27.72	46.00	18.28	N	10.4
1.182000	32.88		56.00	23.12	N	10.4
2.586000	32.92		56.00	23.08	N	10.4



9.2 Conducted peak output power

Test Method

- Use the following spectrum analyzer settings:
 Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

According to §15.247 (b) (1) and RSS-210 A8.4, conducted peak output power limit as below:

Frequency Range	Limit	Limit
MHz	W	dBm
2400-2483.5	≤1	≤30



Conducted peak output power

802.11b modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low channel 2412MHz	15.16	30	Pass
Middle channel 2437MHz	14.90	30	Pass
High channel 2462MHz	14.82	30	Pass

802.11g modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low channel 2412MHz	14.32	30	Pass
Middle channel 2437MHz	14.25	30	Pass
High channel 2462MHz	14.53	30	Pass

802.11n-HT20 modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low channel 2412MHz	14.66	30	Pass
Middle channel 2437MHz	15.02	30	Pass
High channel 2462MHz	14.94	30	Pass

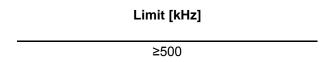


9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

- Use the following spectrum analyzer settings:
 RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
- 3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit



802.11b modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Result
Low channel 2412MHz	8.987	12.069	Pass
Middle channel 2437MHz	9.074	12.069	Pass
High channel 2462MHz	9.117	12.069	Pass

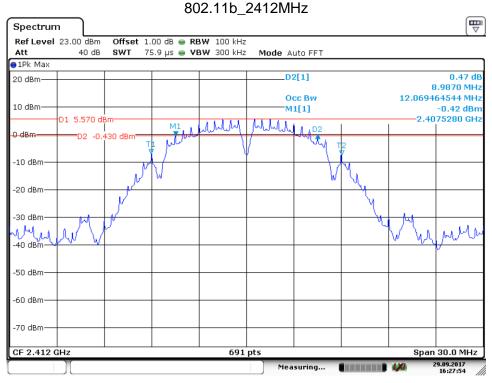
802.11g modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Result
Low channel 2412MHz	16.324	16.454	Pass
Middle channel 2437MHz	16.368	16.454	Pass
High channel 2462MHz	16.368	16.498	Pass

802.11n-HT20 modulation Test Result

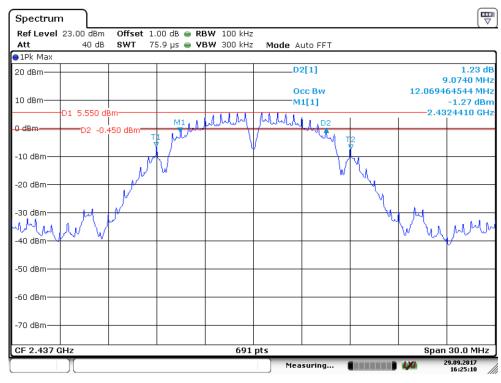
Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Result
Low channel 2412MHz	17.540	17.670	Pass
Middle channel 2437MHz	17.583	17.713	Pass
High channel 2462MHz	17.496	17.713	Pass





Date: 29.SEP.2017 16:27:54

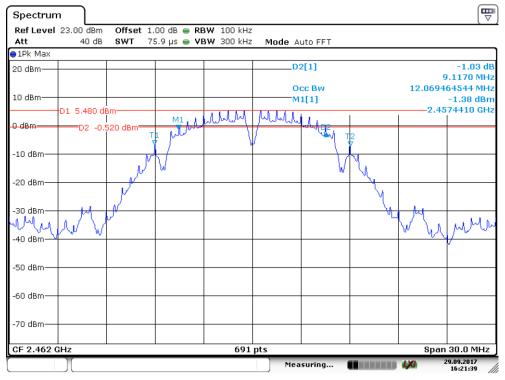
802.11b_2437MHz



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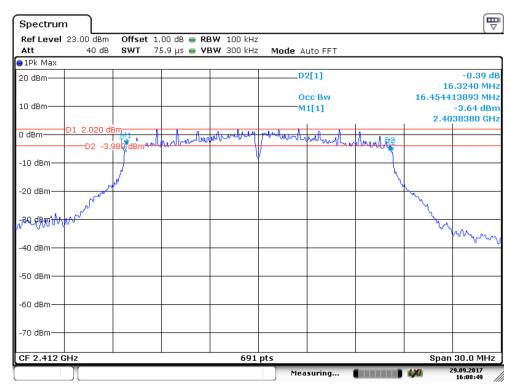


802.11b_2462MHz



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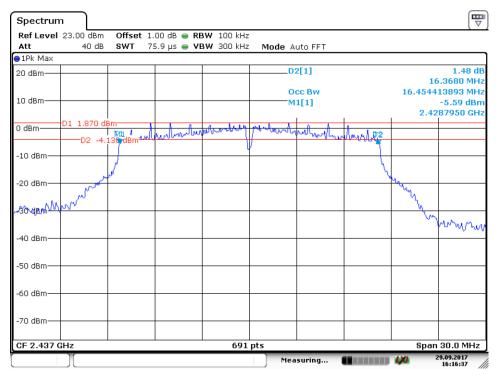
802.11g_2412MHz



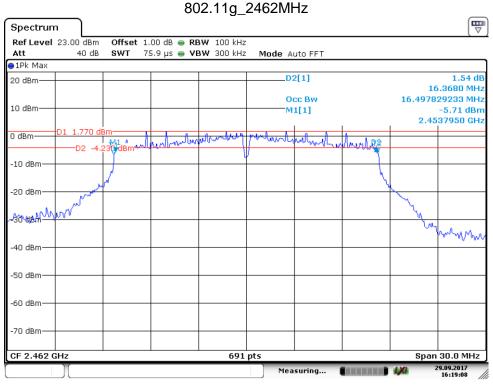
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802.11g_2437MHz

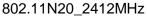


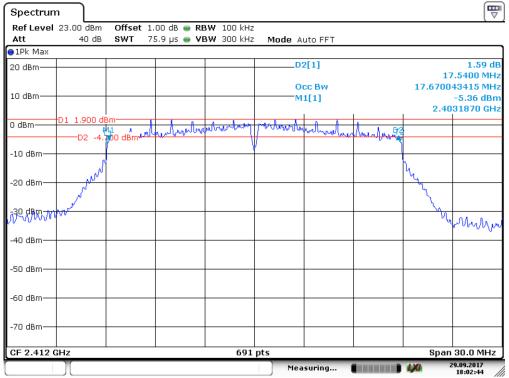
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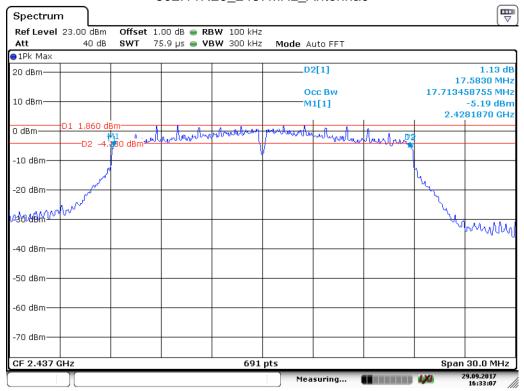






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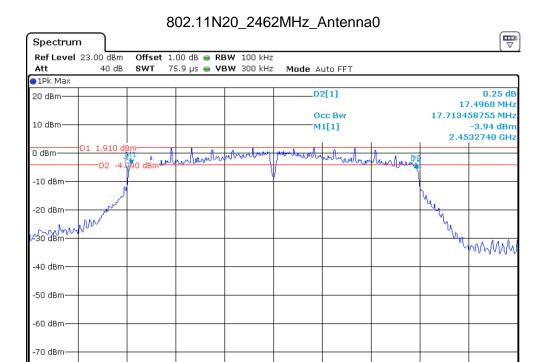
802.11N20_2437MHz_Antenna0



Date: 29.SEP.2017 16:33:08



Span 30.0 MHz



691 pts

Date: 29.SEP.2017 16:04:56

CF 2.462 GHz



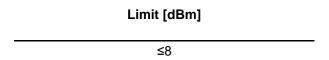
9.4 Power spectral density

Test Method

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

- Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
- 2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- 3. Repeat above procedures until other frequencies measured were completed.

Limit



802.11b modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-6.87	8	Pass
Middle channel 2437MHz	-7.81	8	Pass
High channel 2462MHz	-8.25	8	Pass

802.11g modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-9.57	8	Pass
Middle channel 2437MHz	-9.68	8	Pass
High channel 2462MHz	-9.67	8	Pass

802.11n-HT20 modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-10.01	8	Pass
Middle channel 2437MHz	-10.05	8	Pass
High channel 2462MHz	-9.78	8	Pass



9.5 Spurious RF conducted emissions

Test Method

- Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

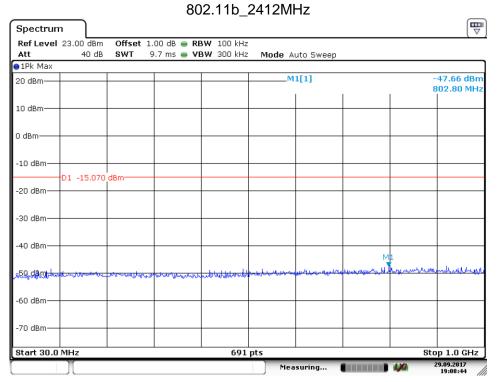
Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

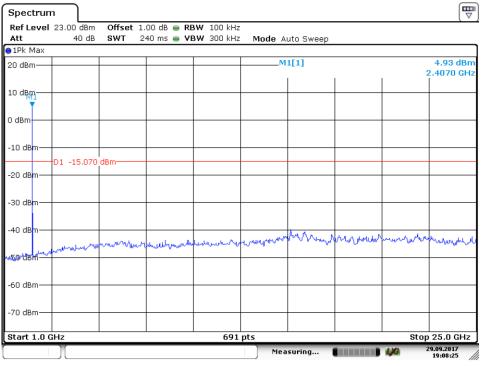


Spurious RF conducted emissions

All modulation test result is listed in the report.



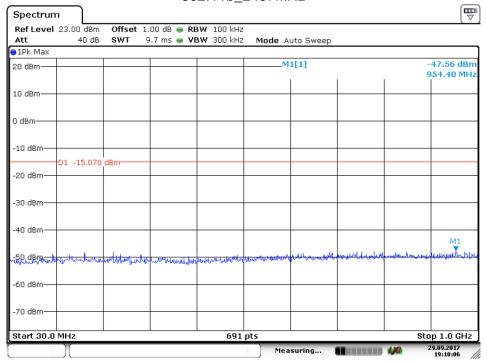
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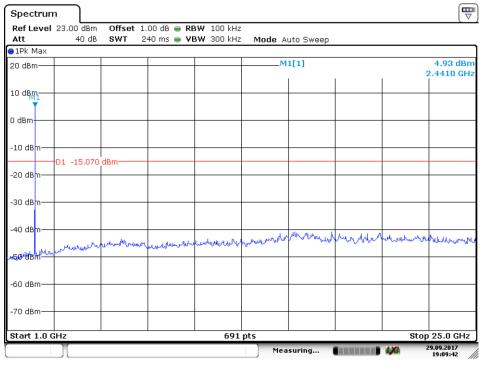
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802.11b_2437MHz

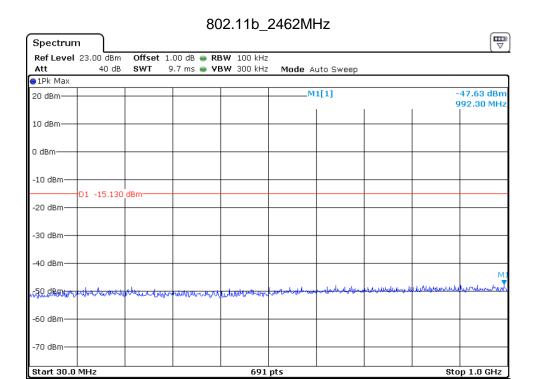


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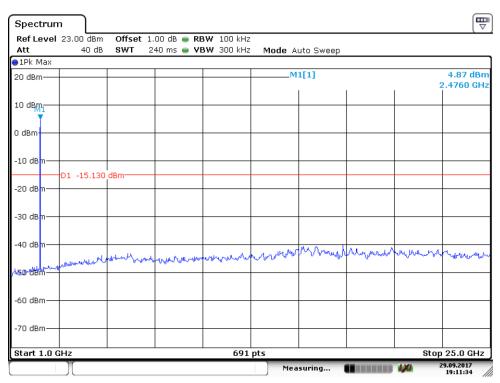
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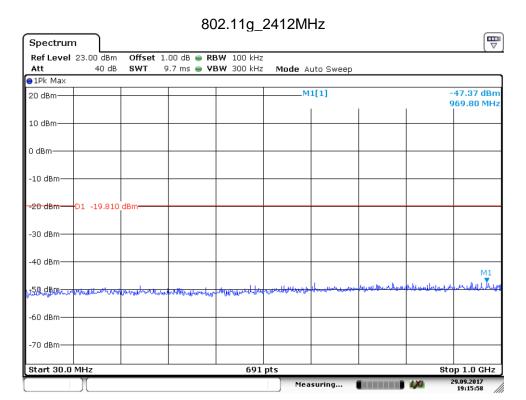
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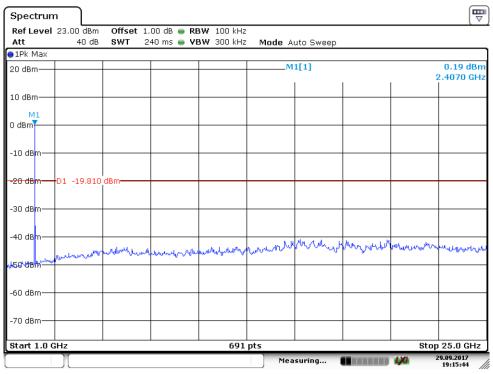


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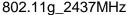


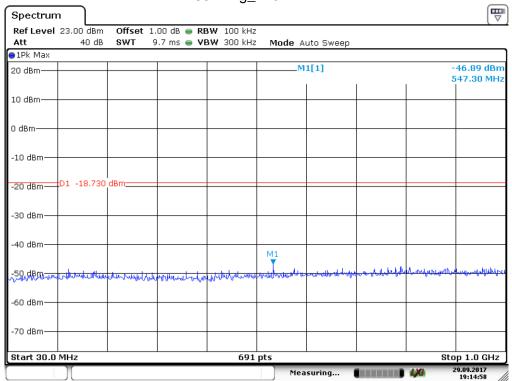
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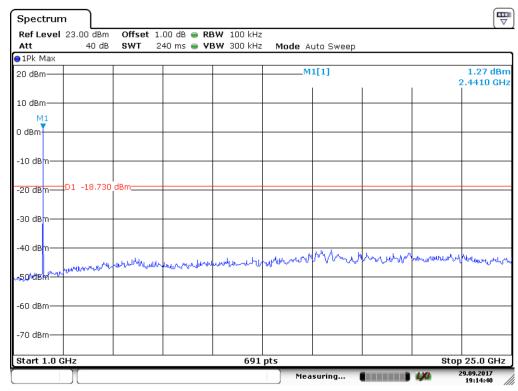
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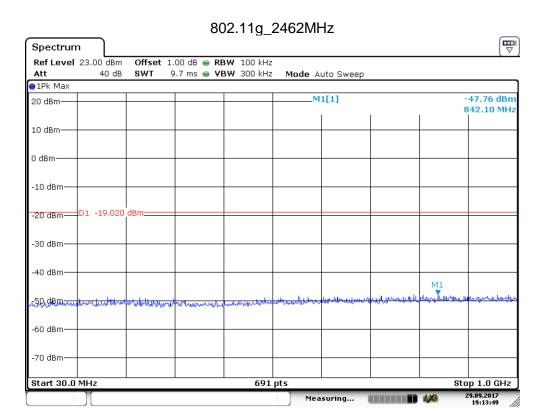


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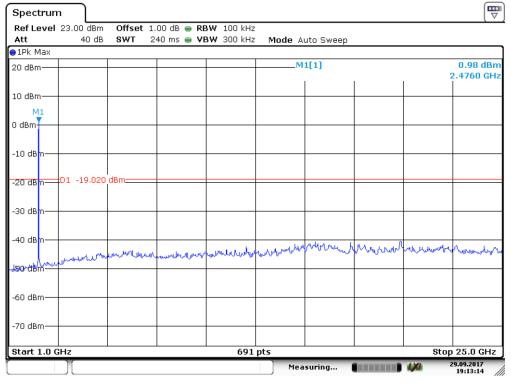


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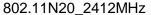


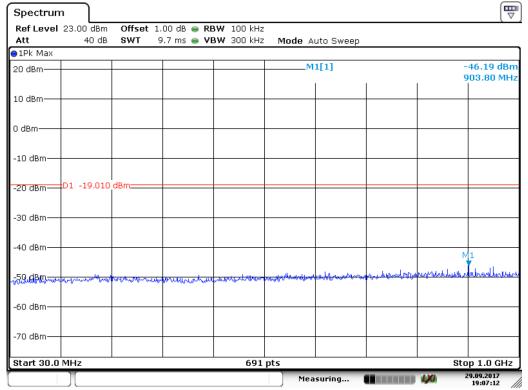
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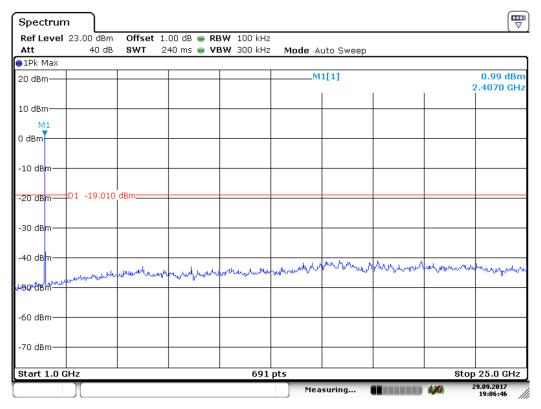
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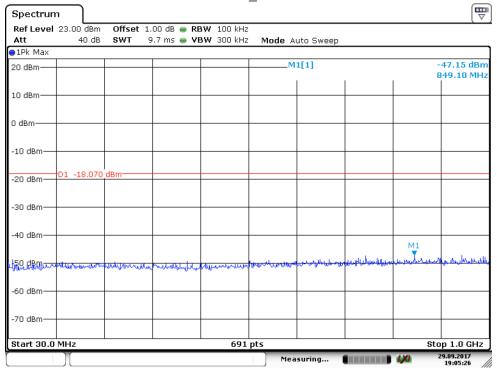
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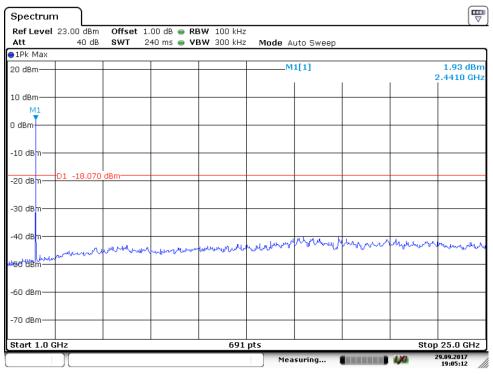
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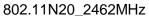


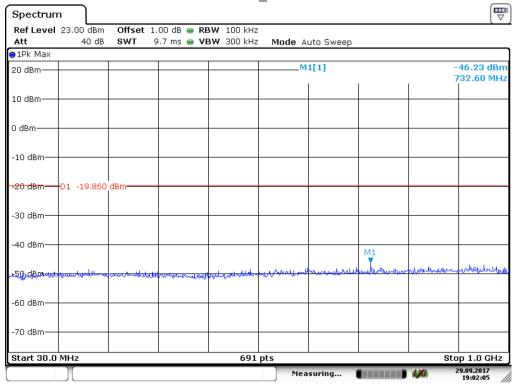
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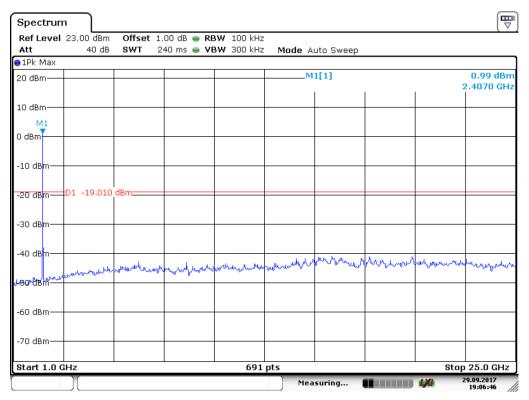
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Date: 29.SEP.2017 19:02:05



Date: 29.SEP.2017 19:06:46



9.6 Band edge testing

Test Method

- 1 Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

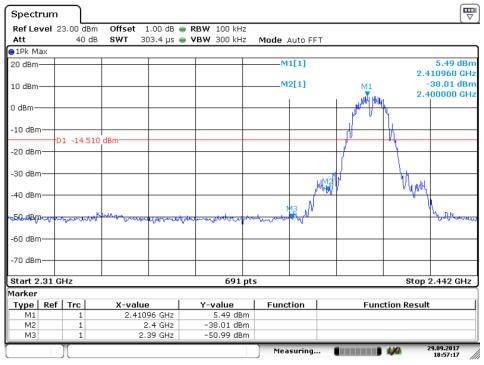
According to §15.247(d), in any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains 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. 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) (see Section 15.205(c)).



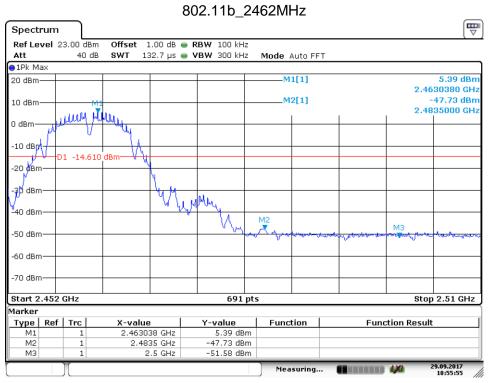
Band edge testing

Test Result:

802.11b_2412MHz

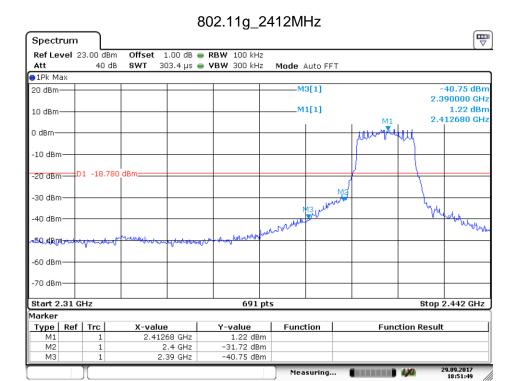


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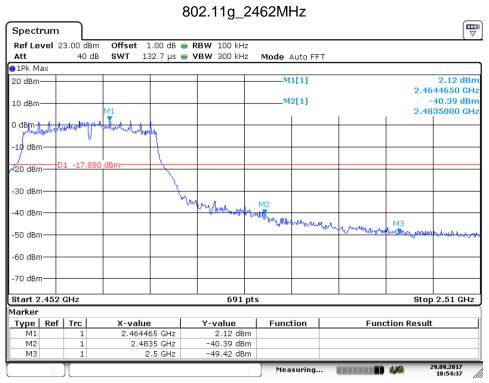


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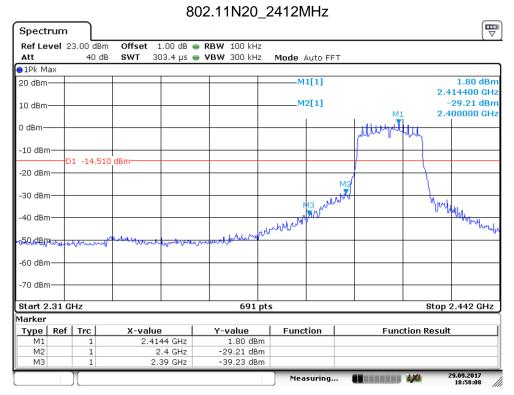


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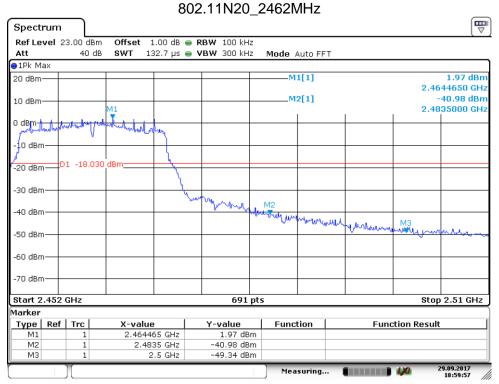


Date: 29.SEP.2017 18:54:37





Date: 29.SEP.2017 18:58:08



Date: 29.SEP.2017 18:59:57



9.7 Spurious radiated emissions for transmitter

Test Method

- 1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2. The EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
- 5. Use the following spectrum analyzer settings According to C63.10: For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold. For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.



Limit

According to part 15.247(d), the radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (802.11B mode) test result is listed in the report.

Transmitting spurious emission test result as below:

802.11B Modulation 2412MHzTest Result

Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	dBuV/m		dBμV/m	dB		
79.793333	33.44	Horizontal	40.00	6.56	QP	Pass
202.713889	37.63	Horizontal	43.50	5.87	QP	Pass
540.004444	40.81	Horizontal	46.00	5.19	QP	Pass
828.040556	41.42	Horizontal	46.00	4.58	QP	Pass
75.212778	34.24	Vertical	40.00	5.76	QP	Pass
81.302222	35.33	Vertical	40.00	4.67	QP	Pass
218.341667	36.61	Vertical	46.00	9.39	QP	Pass
324.017778	37.09	Vertical	46.00	8.91	QP	Pass
10310.156250	42.74	Horizontal	74.00	31.26	PK	Pass
16758.750000	48.99	Horizontal	74.00	25.01	PK	Pass
*8757.187500	42.14	Vertical	74.00	31.86	PK	Pass
16190.156250	48.73	Vertical	74.00	25.27	PK	Pass

802.11B Modulation 2437MHz Test Result

Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	dBuV/m		dBμV/m	dB		
11129.531250	43.07	Horizontal	74.00	30.93	PK	Pass
*15007.500000	48.02	Horizontal	74.00	25.98	PK	Pass
8074.687500	41.86	Vertical	74.00	32.14	PK	Pass
13598.906250	45.56	Vertical	74.00	28.44	PK	Pass

802.11B Modulation 2462MHz Test Result

Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	dBuV/m		dBμV/m	dB		
*7498.125000	39.58	Horizontal	74.00	34.42	PK	Pass
15797.343750	47.90	Horizontal	74.00	26.10	PK	Pass
11132.343750	43.62	Vertical	74.00	30.38	PK	Pass
15009.375000	47.46	Vertical	74.00	26.54	PK	Pass

Remark:

- (1) Above 1GHz Corrector factor= Antenna Factor +Cable Loss Amp. factor
- (2) Below 1GHz Corrector factor= Antenna Factor +Cable Loss
- (3) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (4) We test all modes and only the worst case for each bandwidth recorded in the report.
- (5) Testing is carried out with frequency rang 9KHz to 26GHz, which below 30MHz and data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.



10 Test Equipment List

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
С	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-14
	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
	Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
RE	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
	Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-14
	Attenuator	Agilent	8491A	MY39264334	2018-7-14
	3m Semi-anechoic chamber	TDK	9X6X6		2020-7-7
	Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge



11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items	Extended Uncertainty
Uncertainty for Radiated Emission in	Horizontal: 4.99dB;
3m chamber 30MHz-1000MHz	Vertical: 4.97dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.96dB; Vertical: 4.95dB;
Uncertainty for Conducted RF test	Power level test involved: 2.06dB Frequency test involved: 1.16×10 ⁻⁷