

FCC RF Test Report

APPLICANT	:	Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	:	Wi-Fi & Bluetooth Module
BRAND NAME	:	QUECTEL
MODEL NAME	:	FLM240D
FCC ID	:	XMR2023FLM240D
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Aug. 04, 2023 ~ Aug. 11, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



Sporton International Inc. (Kunshan) No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR371204B	Rev. 01	Initial issue of report	Aug. 23, 2023



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	\geq 0.5MHz	Pass	-
3.1	-	99% Bandwidth -		Report Only	-
3.2	15.247(b)	Power Output Measurement	\leq 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
0.4	45.047(-1)	Conducted Band Edges		Pass	-
3.4	15.247(d)	Conducted Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.06 dB at 2388.39 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 16.61 dB at 0.191 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.

2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1 General Description

1.1 Applicant

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233, China

1.2 Manufacturer

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233, China

1.3 Product Feature of Equipment Under Test

Product Feature			
Equipment	Wi-Fi & Bluetooth Module		
Brand Name	QUECTEL		
Model Name	FLM240D		
FCC ID	XMR2023FLM240D		
SN	Conducted: D1823H30R000027 Conduction: D1823H30R000022 Radiation: D1823H30R000014		
HW Version	R1.0		
SW Version	NA		
EUT Stage	Identical Prototype		

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

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification			
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz		
Maximum (Peak) Output Power to	802.11b : 18.58 dBm (0.0721 W)		
antenna	802.11g : 21.47 dBm (0.1403 W)		
	802.11n HT20 : 21.18 dBm (0.1312 W)		
	802.11b : 14.19MHz		
99% Occupied Bandwidth	802.11g : 17.53MHz		
	802.11n HT20 : 18.43MHz		
Antenna Type / Gain	PCB Antenna type with gain 3.58 dBi		
Town of Madulation	802.11b : DSSS (DBPSK / DQPSK / CCK)		
Type of Modulation	802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)		

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)				
	No. 1098, Pengxi North Road, Kunshan Economic Development Zone				
Test Site Location	Jiangsu Province 215300 People's Republic of China				
	TEL : +86-512-57900158				
	Sporton Site No.	FCC Designation No.	FCC Test Firm		
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.		
Test one NU.	CO01-KS 03CH05-KS TH01-KS	CN1257	314309		

1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	TH01-KS	SPORTON	FCC 15C-15E Test Tools Ver10.0_210607	10.0
2.	03CH05-KS	AUDIX	E3	210616
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	1	2412	7	2442
2400-2483.5 MHz	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

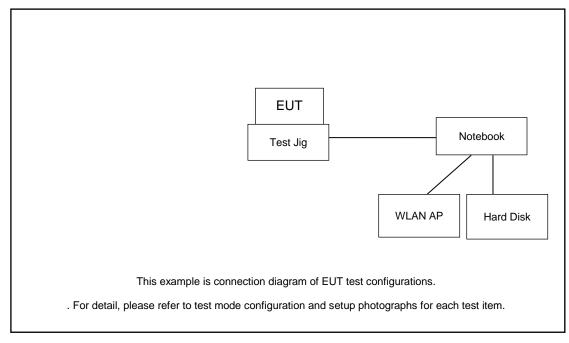
Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0

Test Cases				
AC				
Conducted	Mode 1 :WLAN Link(2.4G) + charging from test Jig			
Emission				

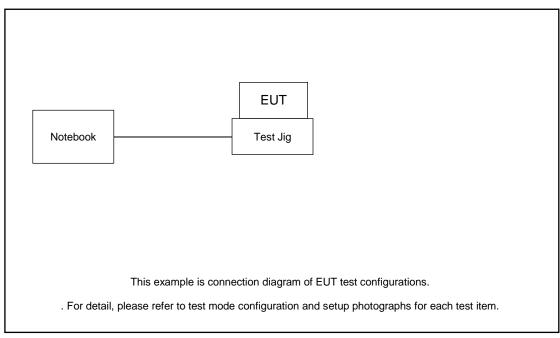


2.3 Connection Diagram of Test System

AC Conducted Emission:



Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
				QDS-BRCM1050I N/A		shielded cable DC
1.	Notebook	Longua	G480		O/P 1.8m ,	
1.	NOLEDOOK	Lenovo	G460	QDS-BRCM1050	IN/A	Unshielded AC I/P
						cable 1.8m
		Honor	HLY-W29RL	N//A		shielded cable DC
2.	Notebook					O/P 1.8m ,
Ζ.	NOLEDOOK		NLI-WZ9KL	IN/A	IN/A	Unshielded AC I/P
						cable 1.8m
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
4.	Hard Disk	Lenovo	F310	DoC	Shielded, 1.2m	N/A
5.	Test Jig	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss r.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5.50 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ = 5.50 (dB)



3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.8
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1%~5% of OBW and set the VBW is set to 3 times of the RBW.
- 6. Measure and record the results in the test report.

3.1.4 Test Setup



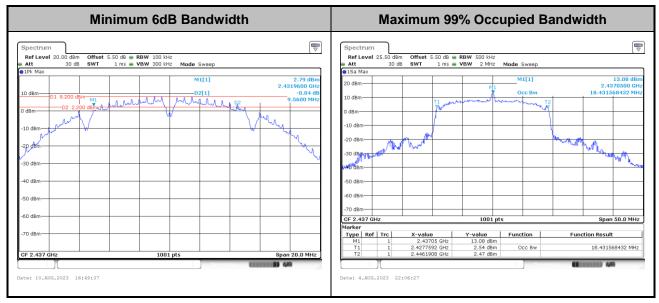
Spectrum Analyzer

EUT



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

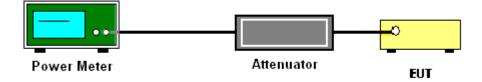
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

- The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

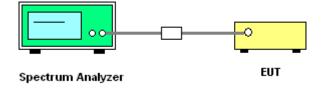
The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

- 1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
 Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.

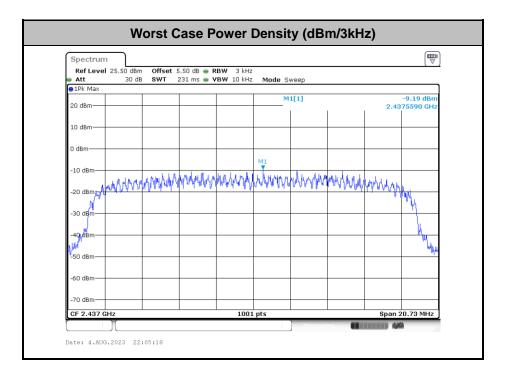


3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.





3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

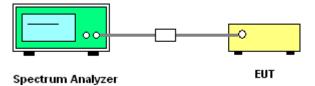
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

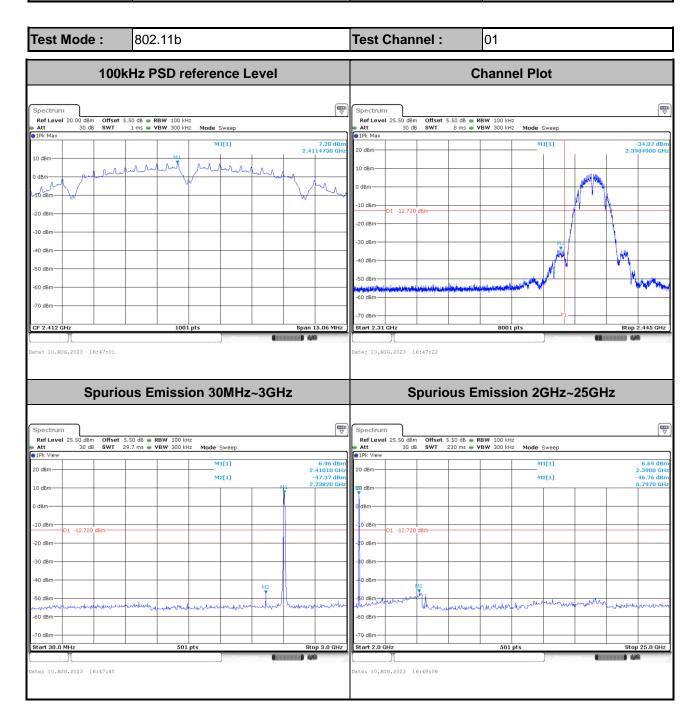
- 1. The testing follows ANSI C63.10-2013 clause 11.11
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



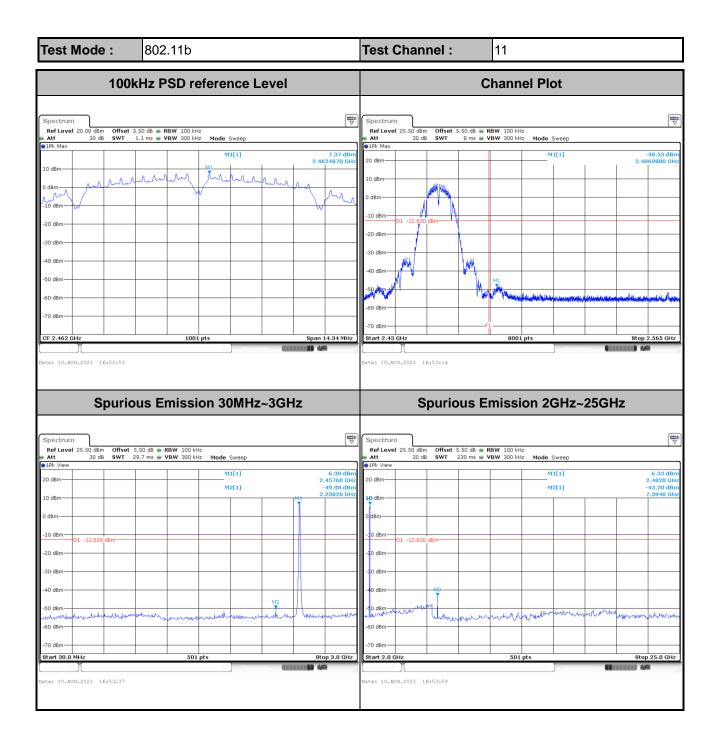
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer : Si	Smile Wang	Temperature :	23~25°C
		Relative Humidity :	41~42%

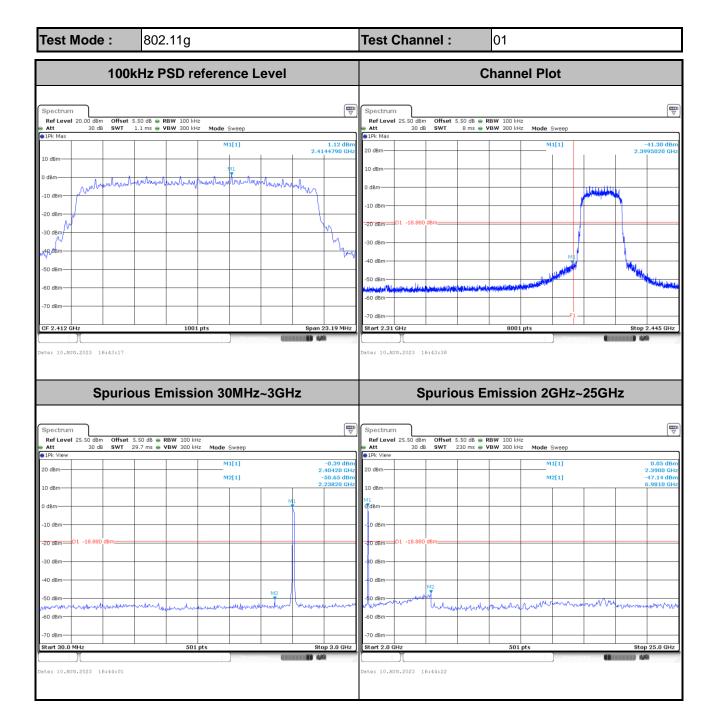




Test Mode :	802.11b	Test Channel : 06		
100	kHz PSD reference Level	Channel Plot		
10 dem	5.50 d8 • RBW 100 Hk2 1.1 ms • VBW 300 Hk2 Mode Sweep M1[1] 8.25 M1 2.4374870 M1 0.01 pts Spon 14.34 N			
Spurio	us Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz		
Spectrum RefLevel 25.50 dBm Offset Att 30 dB SWT :	5.50 dB ● RBW 100 kHz 9.7 ms ● VBW 300 kHz Mode Sweep	Image: Spectrum Image: Sp		
20 d8m	M1[1] 7.67 2.43980 M2[1] -50.05 M1 2.23820	BBm M1[1] 6.69 dBm GHz 20 dBm 2.4360 GHz BBm M2[1] -44.25 dBm GHz 7.3020 GHz 7.3020 GHz 0 dBm 0 dBm 1		
-10 dBm D1 -11.750 dBm -20 dBm -30 dBm -40 dBm	M2	-10 dBm 01 -11.750 dBm		
-50 d8m -00 d8m -70 d8m Start 30.0 MHz	501 pts Stop 3.0 (-50 d8m		
Date: 10.AUG.2023 16:51:02		Date: 10.AUG.2023 16:51:24		

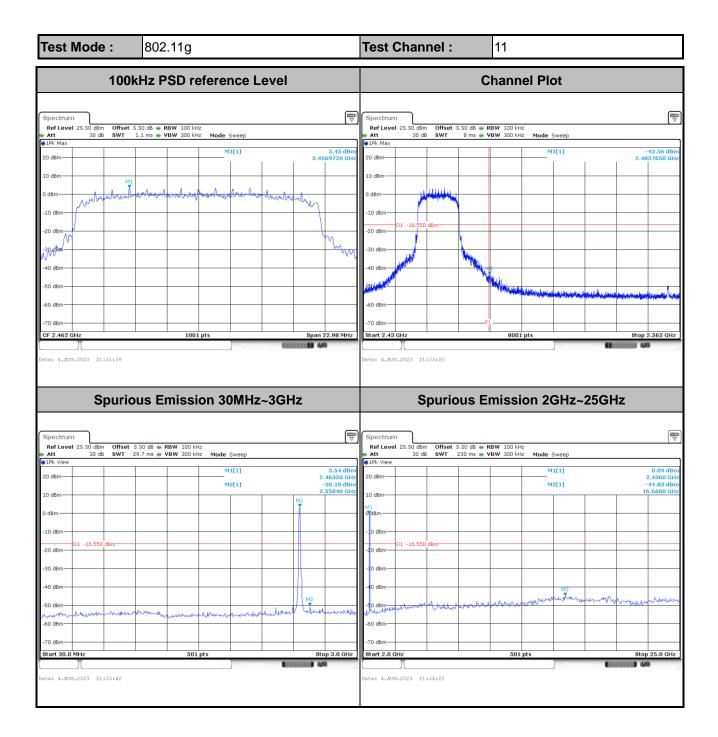




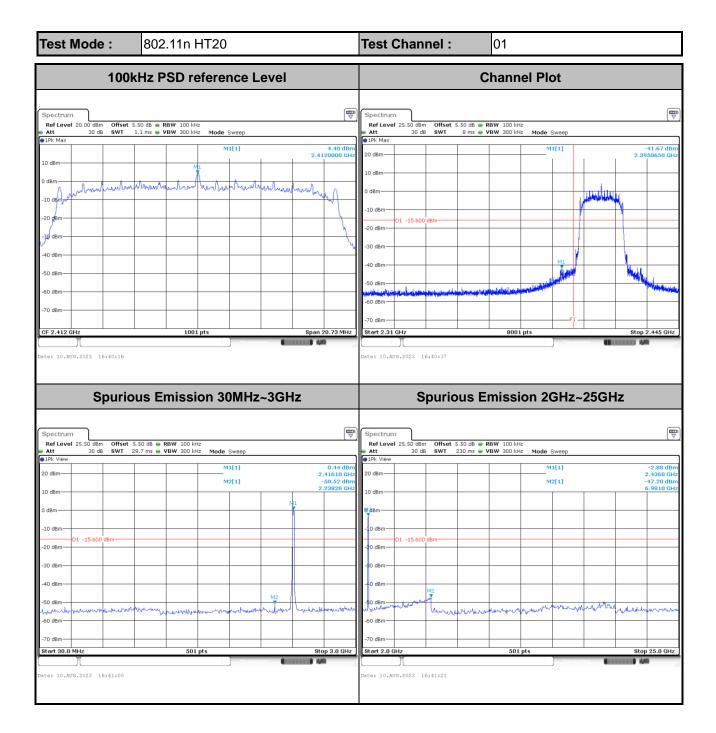




Test Mode :	802.11g	Test Channel : 06		
100	kHz PSD reference Level	Channel Plot		
Spectrum Ref Level 25.50 d8m Offset Att 30 d8 SWT 10 d8m	5.50 dB • RBW 100 HHz 1.1 ms • VBW 300 HHz Mode Sweep M1[1] 4.57 dl 4.57 dl 4.			
Spurio	ous Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz		
Att 30 dB SWT • 1Pk View • 0 dBm 10 dBm • 0 dBm • 0 dBm • 0 dBm -10 dBm • 0 1 -15.430 dBm • 0 dBm • 0 dBm -20 dBm • 0 1 -15.430 dBm • • • • • • • • • • • • •	5.50 db @ RBW 100 kHz 29.7 ms @ VBW 300 kHz Mode Sweep M1[1] 3.16 dt M2[1] -49.40 dt 2.85840 d 2.55840 d 2.55840 d 4.55840 d 4.558400 d 4.558400 d 4.558400 d 4.558400 d 4.558400 d 4.558400 d 4.558400 d 4.558600 d 4.5586000 d	22 dbm 2.4860 cHz 10 dbm M2[1] 10 dbm 15.8870 CHz 0 dbm 0 -10 dbm 0 -20 dbm 0 -30 dbm 0 -30 dbm 0 -0 dbm 0 -20 dbm 0 -30 dbm 0 -30 dbm 0 -70 dbm 0		
Start 30.0 MHz	501 pts Stop 3.0 GF	z) Stor 2.0 GHz Stop 25.0 GHz Date: 4.AUG.2023 21:30:23		

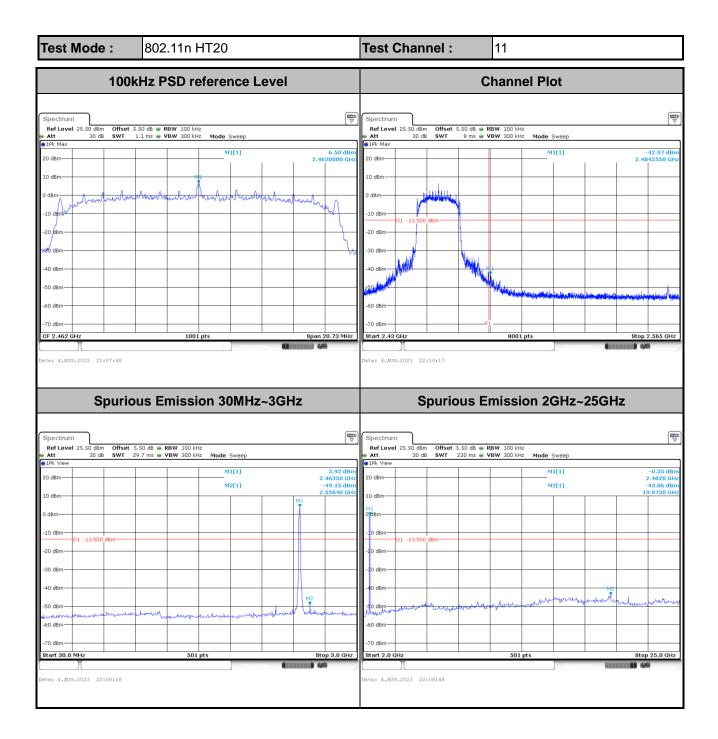








Test Mode :	802.11n HT20	Test Channel : 06		
100	kHz PSD reference Level	Channel Plot		
Spectrum Rof Level 25.50 dBm Offset 30 dB SWT 9 IPk Max 0 20 dBm 0 10 dBm 0 -10 dBm	5.0 dB & RBW 100 KHZ 1.1 ms & VBW 300 KHZ Mode Sweep M1[1] 7.42 dBM 2.4370000 GHZ 2.4370000 GHZ 4.4370000 GHZ 1.4370000 GHZ 1.437000 GHZ 1.43700 GHZ 1.437000 GHZ 1			
Spurio	ous Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz		
Spectrum Ref Level 25:50 dBm Offset Att 30 dB SWT 20 dBm	5.50 dB ● RBW 100 kHz 29.7 ms ● VBW 300 kHz M1[1] 7.65 dBm M2[1] -50.13 dBm M3[1] -50.13 dBm	Spectrum Image: Constraint of the second secon		
Date: 4.AUG.2023 22:05:58		Stort 2.0 GHz Stop 25.0 GHz Date: 4.AUG.2023 22:06:18		



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



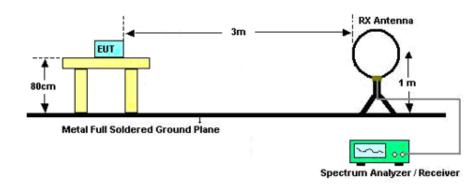
3.5.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement. For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

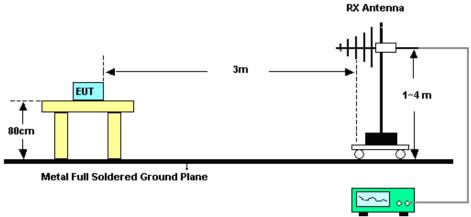


3.5.4 Test Setup

For radiated emissions below 30MHz

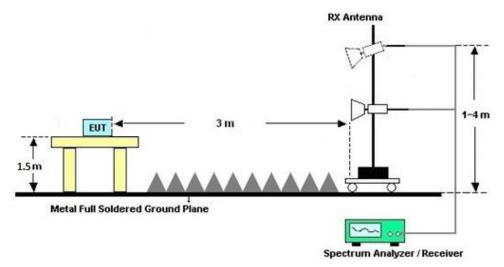


For radiated emissions from 30MHz to 1GHz



Spectrum Analyzer / Receiver





Sporton International Inc.(Kunshan) TEL : +86-512-57900158 FCC ID: XMR2023FLM240D



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

Frequency of Emission	Conducted Limit (dBµV)			
(MHz)	Quasi-Peak	Average		
0.15-0.5	66 to 56*	56 to 46*		
0.5-5	56	46		
5-30	60	50		

*Decreases with the logarithm of the frequency.

3.6.2 Measuring Instruments

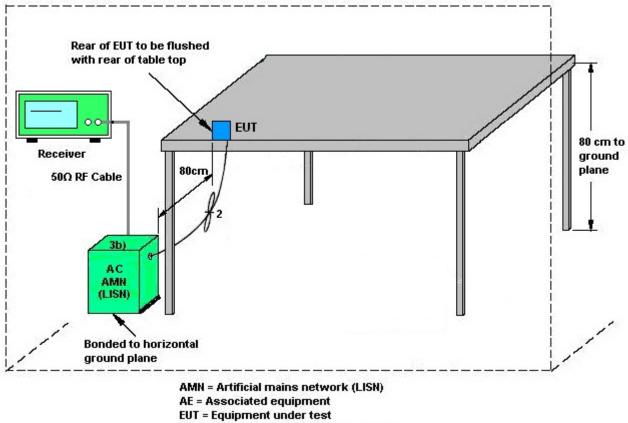
The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.



3.6.4 Test Setup



ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

Non-standard antenna connector is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Aug. 04, 2023~ Aug. 10, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 05, 2023	Aug. 04, 2023~ Aug. 10, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Aug. 04, 2023~ Aug. 10, 2023	Jan. 04, 2024	Conducted (TH01-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Aug. 11, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Aug. 11, 2023	Oct. 11, 2023	Conduction (CO01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;M ax 30dBm	Oct. 13, 2022	Aug. 08, 2023	Oct. 12, 2023	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44G,MAX 30dB	Mar. 24, 2023	Aug. 08, 2023	Mar. 23, 2024	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Aug. 08, 2023	Oct. 15, 2023	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Apr. 09, 2023	Aug. 08, 2023	Apr. 08, 2024	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 06, 2023	Aug. 08, 2023	Apr. 05, 2024	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 08, 2023	Aug. 08, 2023	Jan. 07, 2024	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 06, 2023	Aug. 08, 2023	Jul. 05, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060852	18~40GHz	Jan. 05, 2023	Aug. 08, 2023	Jan. 04, 2024	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 12, 2022	Aug. 08, 2023	Oct. 11, 2023	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 05, 2023	Aug. 08, 2023	Jan. 04, 2024	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Aug. 08, 2023	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Aug. 08, 2023	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Aug. 08, 2023	NCR	Radiation (03CH05-KS)

NCR: No Calibration Required



5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±2.26 dB
Occupied Channel Bandwidth	±0.001 %
Conducted Power Spectral Density	±0.88 dB

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence	2.94 dB
of 95% (U = 2Uc(y))	2.94 UB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	6 38 4P
of 95% (U = 2Uc(y))	6.28 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence	4.88 dB
of 95% (U = 2Uc(y))	4.00 UB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5.26 dB
of 95% (U = 2Uc(y))	5.20 UB

----- THE END ------



Appendix A. Conducted Test Results

Report Number : FR371204B

A1. Conducted Test Results

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2023/8/4~2023/8/10	Relative Humidity:	51~54	%

Report Number : FR371204B

<u>TEST RESULTS DATA</u> 6dB and 99% Occupied Bandwidth

2.4GHz Band Single Antenna										
Mod.	Mod. Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail		
					Ant1	Ant1				
11b	1Mbps	1	1	2412	14.09	10.04	0.50	Pass		
11b	1Mbps	1	6	2437	14.19	9.56	0.50	Pass		
11b	1Mbps	1	11	2462	14.14	9.56	0.50	Pass		
11g	6Mbps	1	1	2412	17.48	15.46	0.50	Pass		
11g	6Mbps	1	6	2437	17.53	15.34	0.50	Pass		
11g	6Mbps	1	11	2462	17.53	15.32	0.50	Pass		
HT20	MCS0	1	1	2412	18.43	13.82	0.50	Pass		
HT20	MCS0	1	6	2437	18.43	13.82	0.50	Pass		
HT20	MCS0	1	11	2462	18.43	13.82	0.50	Pass		

FR371204B

TEST RESULTS DATA Peak Output Power

					2.4GHz	Band Single An	tenna			
Mod.	Data Rate	N⊤x	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
				Ant1	Ant1	Ant1	Ant1	Ant1		
11b	1Mbps	1	1	2412	16.56	30.00	3.58	20.14	36.00	Pass
11b	1Mbps	1	6	2437	18.32	30.00	3.58	21.90	36.00	Pass
11b	1Mbps	1	11	2462	18.58	30.00	3.58	22.16	36.00	Pass
11g	6Mbps	1	1	2412	20.27	30.00	3.58	23.85	36.00	Pass
11g	6Mbps	1	6	2437	21.47	30.00	3.58	25.05	36.00	Pass
11g	6Mbps	1	11	2462	20.98	30.00	3.58	24.56	36.00	Pass
HT20	MCS0	1	1	2412	20.19	30.00	3.58	23.77	36.00	Pass
HT20	MCS0	1	6	2437	21.18	30.00	3.58	24.76	36.00	Pass
HT20	MCS0	1	11	2462	20.77	30.00	3.58	24.35	36.00	Pass

FR371204B

TEST RESULTS DATA Average Output Power

						2.4GHz Ba	and Single Anter	nna				
	Data			Freq.	Duty Factor	Average Conducted Power	Conducted Power	DG	EIRP Power	EIRP Power	Pass	
Mod.	Rate	NTX	CH.	(MHz)	(dB)	with duty factor (dBm)	Limit (dBm)	(dBi)	(dBm)	Limit (dBm)	/Fail	Setting
					Ant 1	Ant1	Ant1	Ant1	Ant1	Ant1		Ant 1
11b	1Mbps	1	1	2412	0.04	13.93	30.00	3.58	17.51	36.00	Pass	17.00
11b	1Mbps	1	6	2437	0.04	15.86	30.00	3.58	19.44	36.00	Pass	20.00
11b	1Mbps	1	11	2462	0.04	16.24	30.00	3.58	19.82	36.00	Pass	20.00
11g	6Mbps	1	1	2412	0.04	12.07	30.00	3.58	15.65	36.00	Pass	36.00
11g	6Mbps	1	6	2437	0.04	14.89	30.00	3.58	18.47	36.00	Pass	AUTO
11g	6Mbps	1	11	2462	0.04	14.21	30.00	3.58	17.79	36.00	Pass	AUTO
HT20	MCS0	1	1	2412	0.05	11.84	30.00	3.58	15.42	36.00	Pass	35.00
HT20	MCS0	1	6	2437	0.05	13.89	30.00	3.58	17.47	36.00	Pass	AUTO
HT20	MCS0	1	11	2462	0.05	13.16	30.00	3.58	16.74	36.00	Pass	AUTO

Remark : Power setting "AUTO " is the default.

Report Number : FR371204B

<u>TEST RESULTS DATA</u> <u>Peak Power Spectral Density</u>

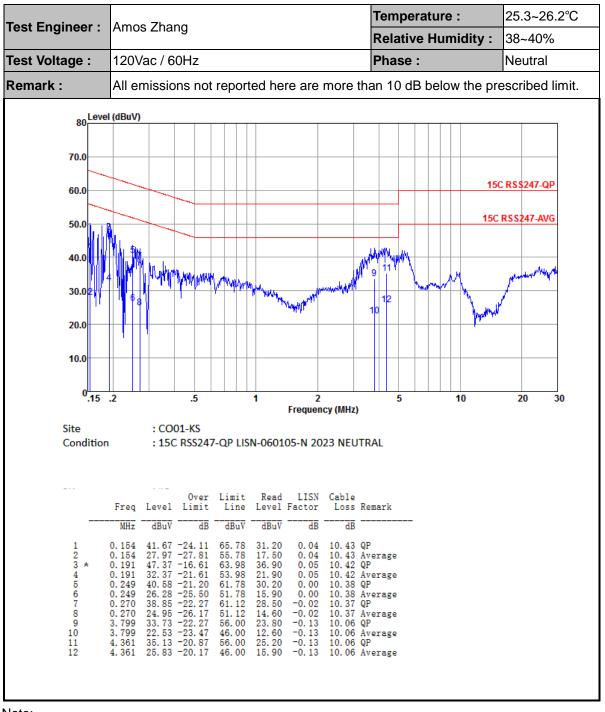
					2.4GHz Band S	ingle Antenn	а		
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)	DG (dBi)	Peak PSD Limit (dBm/3kHz)	Pass/Fail	
					Ant1	Ant1	Ant1		
11b	1Mbps	1	1	2412	-14.85	3.58	8.00	Pass	
11b	1Mbps	1	6	2437	-14.15	3.58	8.00	Pass	
11b	1Mbps	1	11	2462	-15.17	3.58	8.00	Pass	
11g	6Mbps	1	1	2412	-20.65	3.58	8.00	Pass	
11g	6Mbps	1	6	2437	-9.29	3.58	8.00	Pass	
11g	6Mbps	1	11	2462	-10.13	3.58	8.00	Pass	
HT20	MCS0	1	1	2412	-21.38	3.58	8.00	Pass	
HT20	MCS0	1	6	2437	-9.19	3.58	8.00	Pass	
HT20	MCS0	1	11	2462	-10.18	3.58	8.00	Pass	



Appendix B. AC Conducted Emission Test Results

Toot Engineer .	Amoo Zhong		Temperature :	25.3~26.2°C
Test Engineer :	Amos Zhang		Relative Humi	dity: 38~40%
Test Voltage :	120Vac / 60Hz		Phase :	Line
Remark :	All emissions no	t reported here are i	more than 10 dB below	the prescribed limit.
Leve	l (dBuV)			
80				
70.0				
60.0				15C RS\$247-QP
				450 000047 000
50.0				15C RSS247-AVG
40.0			- Marine -	
	M Manana		when it is a start of the second of the seco	monor
30.0	H F I VI MM	MMMMM and and Marked Marked	10 12	W month
20.0		. It is him water to	••••••••••	· · · · · · · · · · · · · · · · · · ·
10.0				
10.0				
0 <mark>.15</mark>	.2 .5	1 2 Frequenc	5 10	0 20 30
Site	: CO01-KS	riequein	.y (wnz)	
Condition		7-QP LISN-060105-L 202	3 LINE	
	Over Freq Level Limit	Limit Read LISN Line Level Factor	Cable Loss Remark	
	MHz dBuV dB		dB	
1 2 3 *		55.78 17.50 0.05	10.43 QP 10.43 Average	
3 × 4 5	0. 188 45. 66 -18. 45 0. 188 32. 06 -22. 05 0. 248 39. 22 -22. 60	54.11 21.61 0.03	10.42 QP 10.42 Average 10.38 QP	
6 7	0.248 24.92 -26.90 3.661 35.15 -20.85	51.82 14.50 0.04 56.00 25.19 -0.10	10.38 Average 10.06 QP	
8 9 10	4.006 34.54 -21.46	46.00 11.59 -0.10 56.00 24.59 -0.11 46.00 14.29 -0.11	10.06 QP	
11 12	5.139 33.12 -26.88	60.00 23.20 -0.14 50.00 13.60 -0.14	10.06 QP	





Note:

- 1. Level(dB μ V) = Read Level(dB μ V) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over Limit(dB) = Level(dB μ V) Limit Line(dB μ V)



Appendix C Radiated Spurious Emission Test Data

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	1	802.11b	01	2412	1Mbps	-	-
Mode 2	2400-2483.5	1	802.11b	06	2437	1Mbps	-	-
Mode 3	2400-2483.5	1	802.11b	11	2462	1Mbps	-	-
Mode 4	2400-2483.5	1	802.11g	01	2412	6Mbps	-	-
Mode 5	2400-2483.5	1	802.11g	06	2437	6Mbps	-	-
Mode 6	2400-2483.5	1	802.11g	11	2462	6Mbps	-	-
Mode 7	2400-2483.5	1	802.11n HT20	01	2412	MCS0	-	-
Mode 8	2400-2483.5	1	802.11n HT20	06	2437	MCS0	-	-
Mode 9	2400-2483.5	1	802.11n HT20	11	2462	MCS0	-	-
Mode 10	2400-2483.5	1	802.11b	01	2412	1Mbps	-	LF

Summary of each worse mode

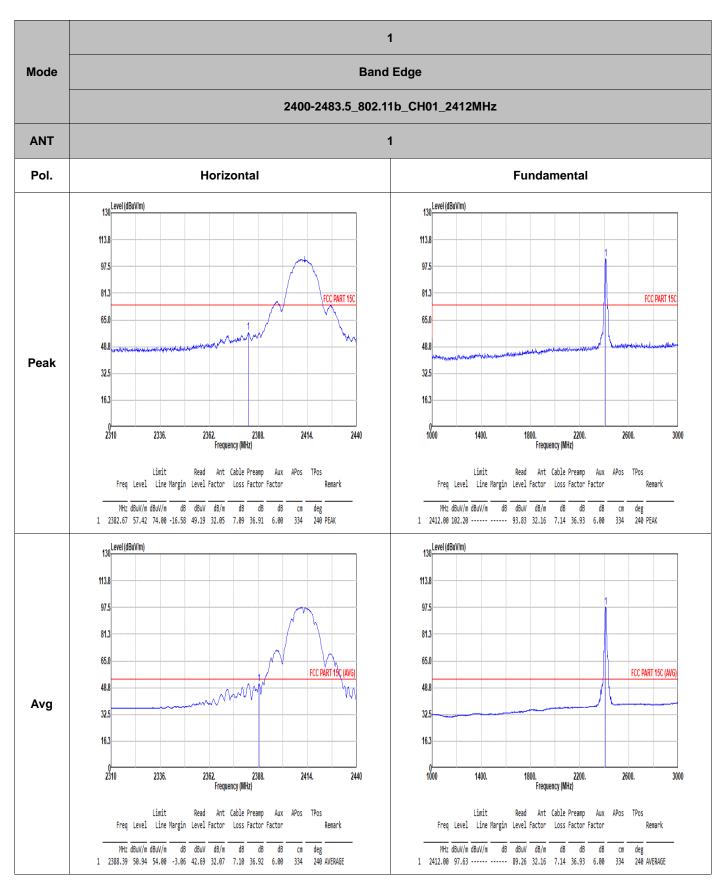
Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	802.11b	01	2388.39	50.94	54.00	-3.06	Н	AVERAGE	Pass	Band Edge
1	802.11b	01	7237.50	54.53	73.32	-21.79	Н	Peak	Pass	Harmonic
2	802.11b	06	-	-	-	-	-	-	-	Band Edge
2	802.11b	06	7311.00	50.77	54.00	-3.23	V	AVERAGE	Pass	Harmonic
3	802.11b	11	2483.56	47.66	54.00	-6.34	Н	AVERAGE	Pass	Band Edge
3	802.11b	11	7386.00	50.72	54.00	-3.28	V	AVERAGE	Pass	Harmonic
4	802.11g	01	2389.95	50.53	54.00	-3.47	Н	AVERAGE	Pass	Band Edge
4	802.11g	01	4824.00	40.64	74.00	-33.36	V	PEAK	Pass	Harmonic
5	802.11g	06	-	-	-	-	-	-	-	Band Edge
5	802.11g	06	7311.00	42.49	54.00	-11.51	V	AVERAGE	Pass	Harmonic
6	802.11g	11	2483.50	49.98	54.00	-4.02	Н	AVERAGE	Pass	Band Edge



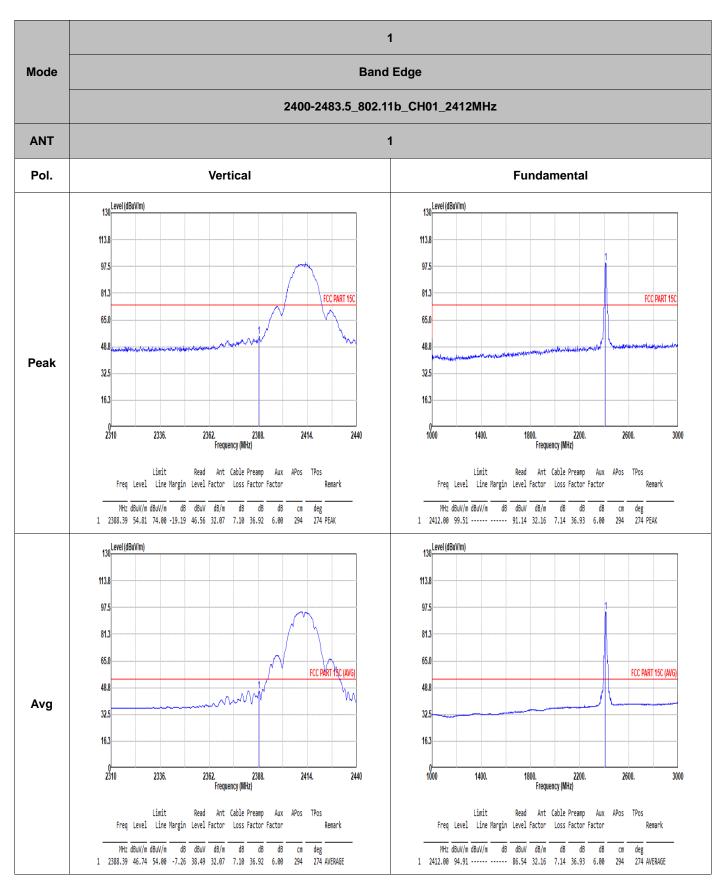
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
6	802.11g	11	7386.00	41.54	54.00	-12.46	V	AVERAGE	Pass	Harmonic
7	802.11n HT20	01	2389.95	50.66	54.00	-3.34	Н	AVERAGE	Pass	Band Edge
7	802.11n HT20	01	4824.00	40.56	74.00	-33.44	V	PEAK	Pass	Harmonic
8	802.11n HT20	06	-	-	-	-	-	-	-	Band Edge
8	802.11n HT20	06	7306.50	49.00	74.00	-25.00	V	PEAK	Pass	Harmonic
9	802.11n HT20	11	2483.50	47.83	54.00	-6.17	Н	AVERAGE	Pass	Band Edge
9	802.11n HT20	11	7386.00	46.60	74.00	-27.40	Н	PEAK	Pass	Harmonic
10	802.11b	01	73.65	26.20	40.00	-13.80	V	PEAK	Pass	LF



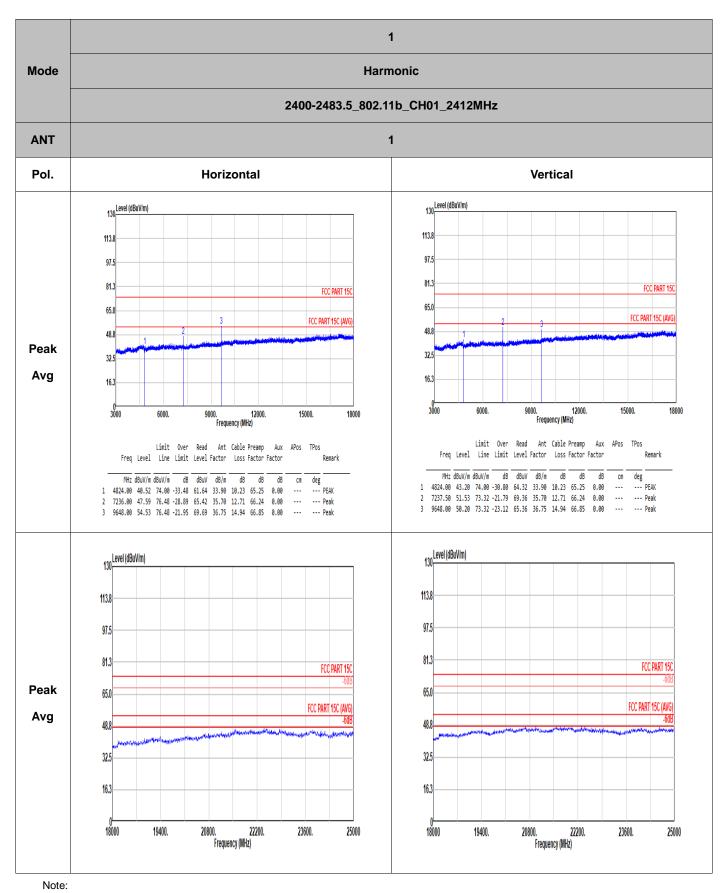






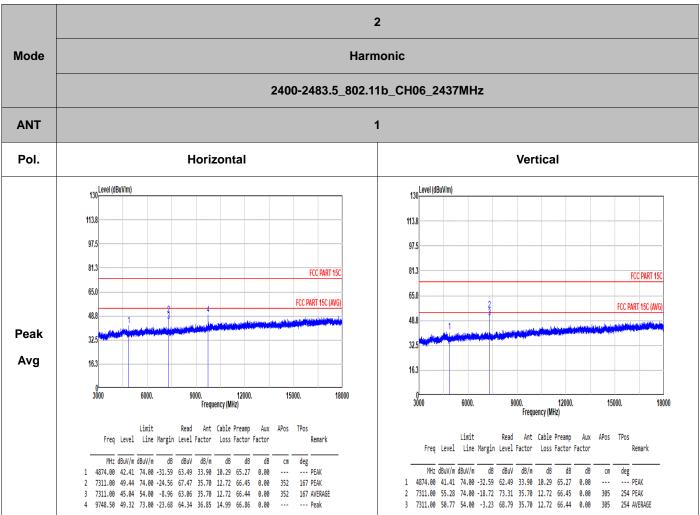
C4 of C24



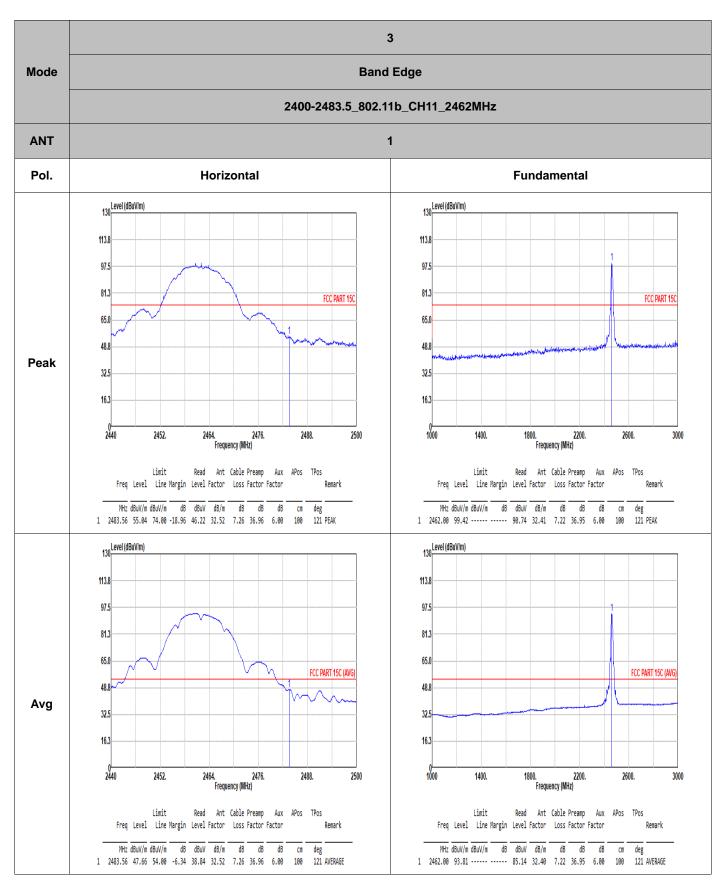




- 1. The non-restricted frequency which limit is 100kHz-PSD down 20dB
- 2. Only the worst case has assessed 18G ~25GHz to test.

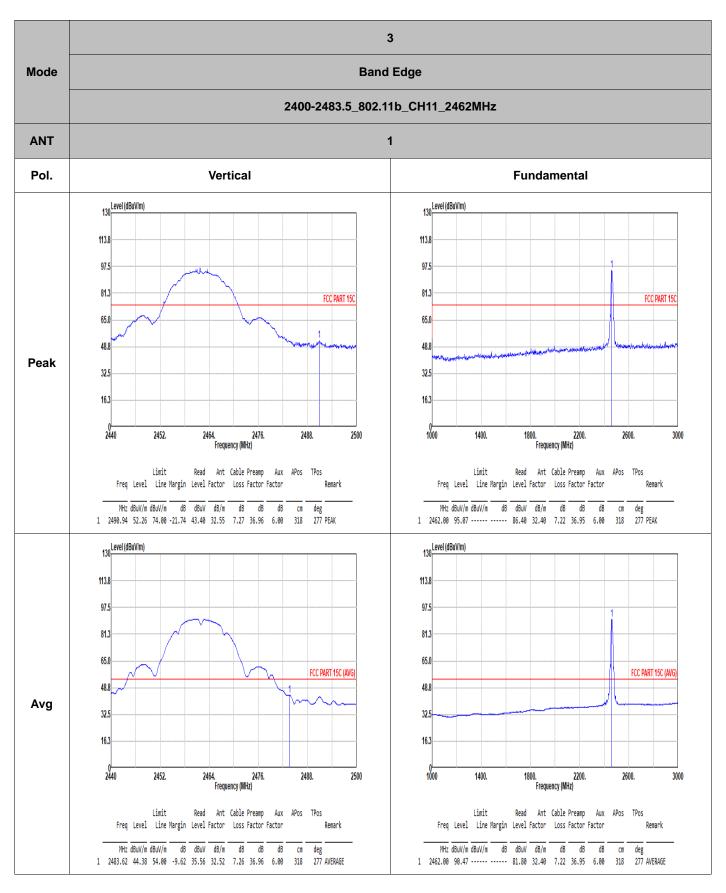




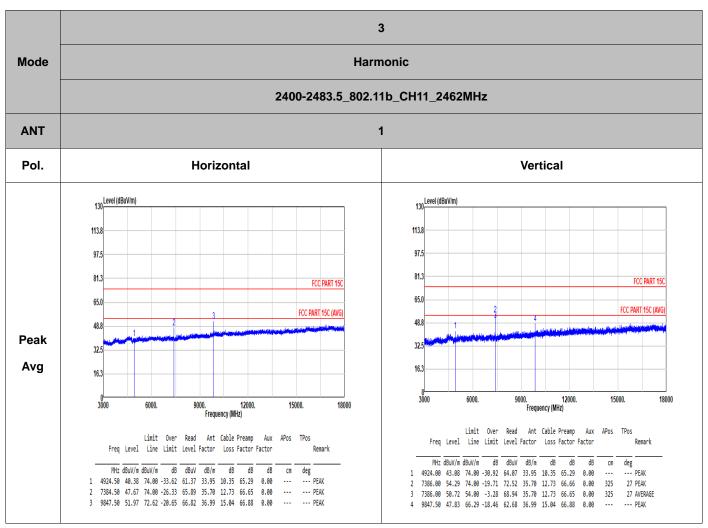


C7 of C24



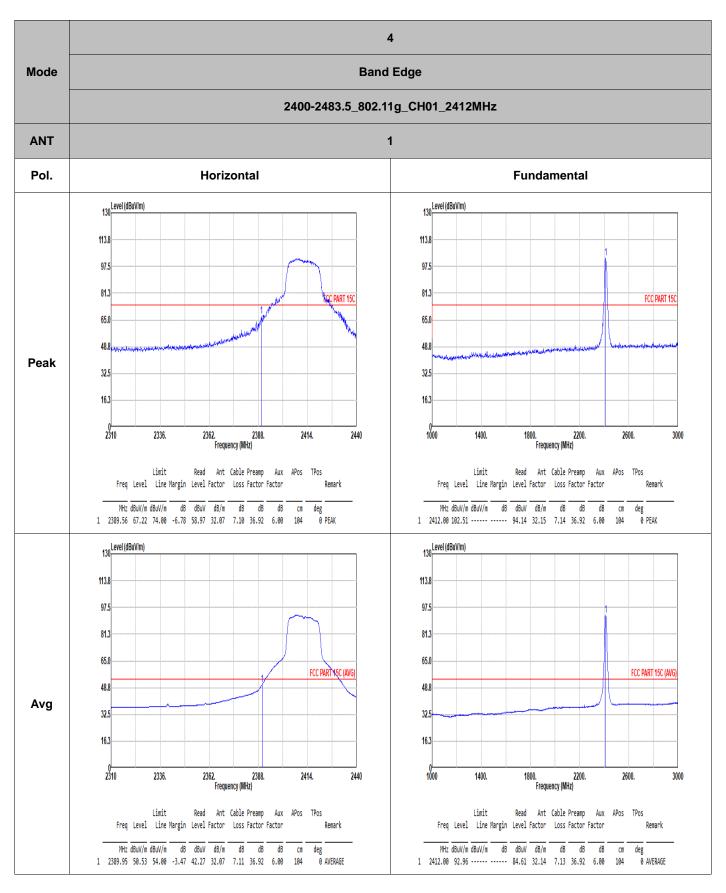




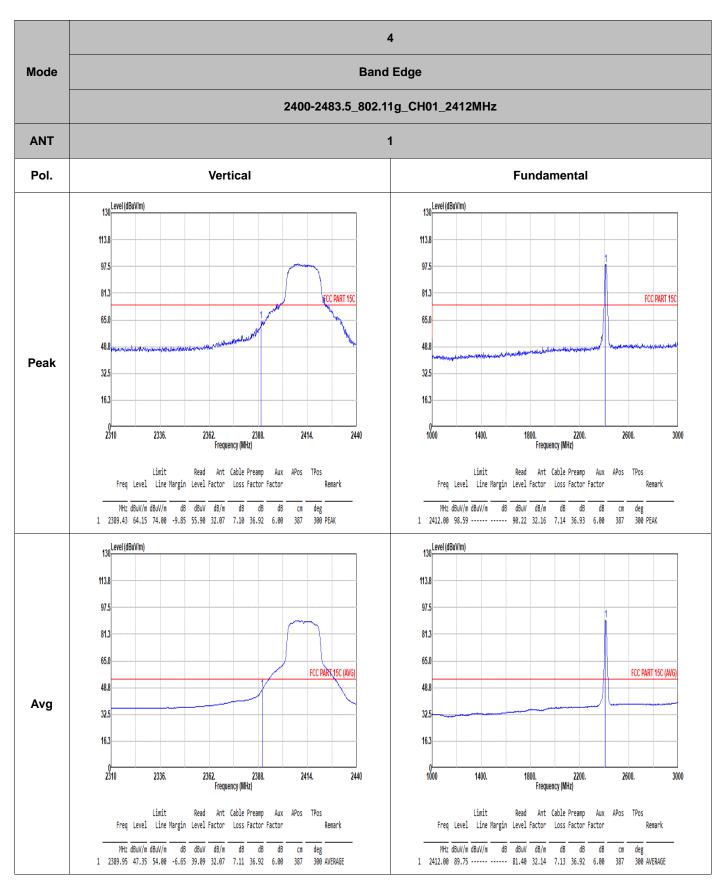


Note: The non-restricted frequency which limit is 100kHz-PSD down 20dB



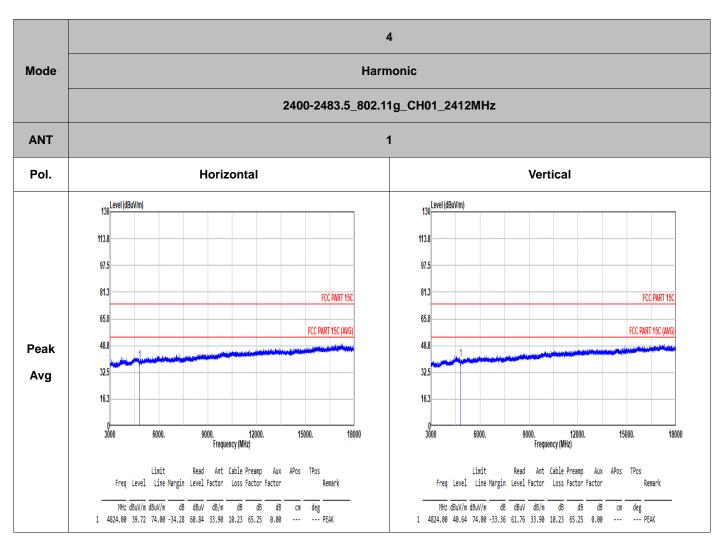




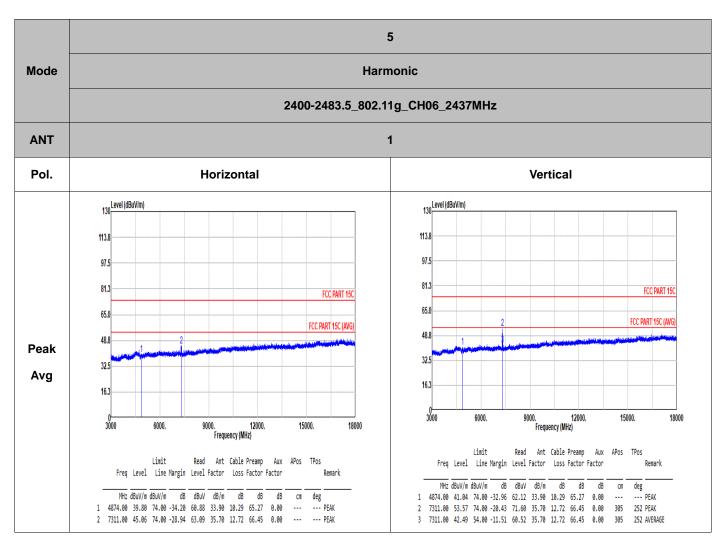


C11 of C24

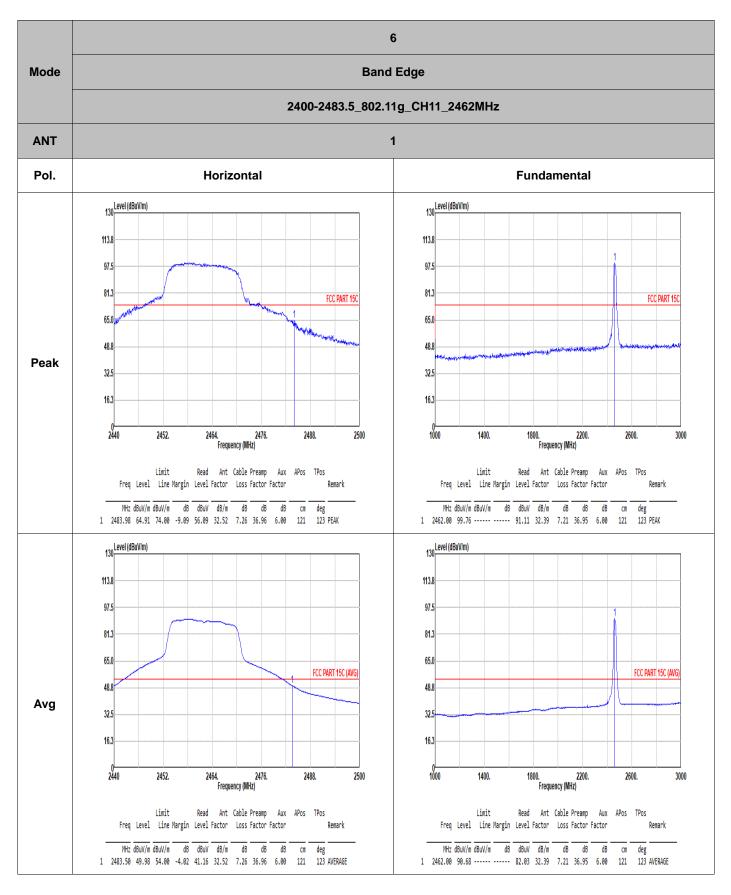




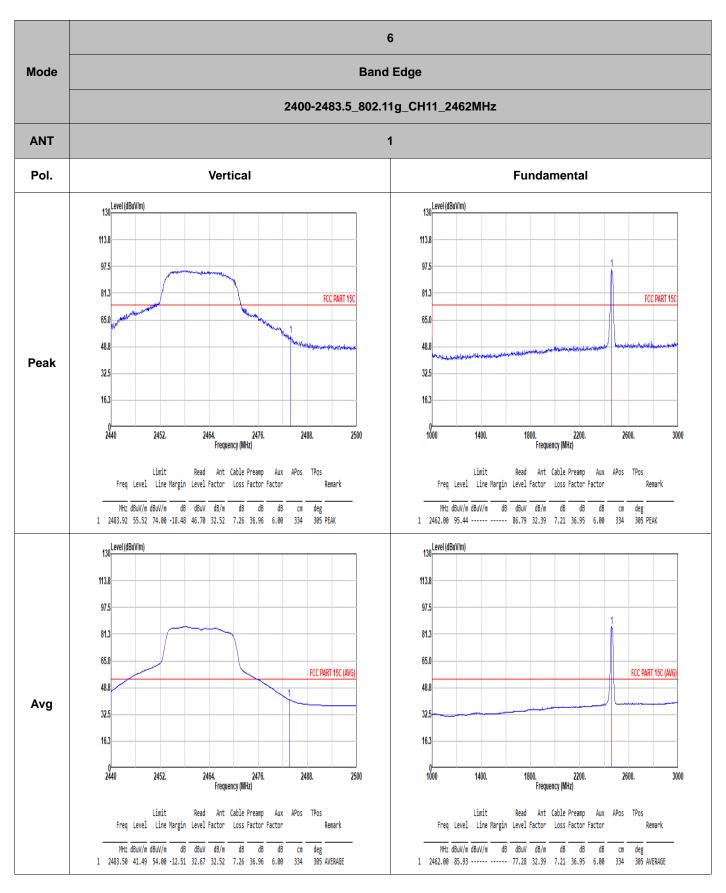




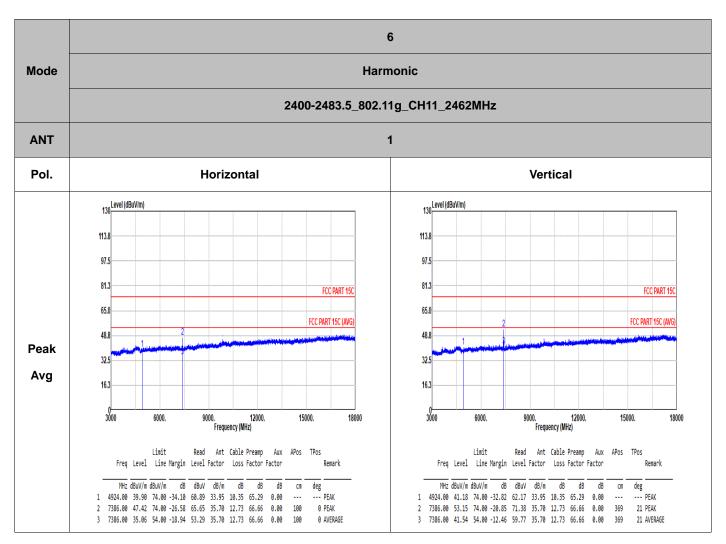




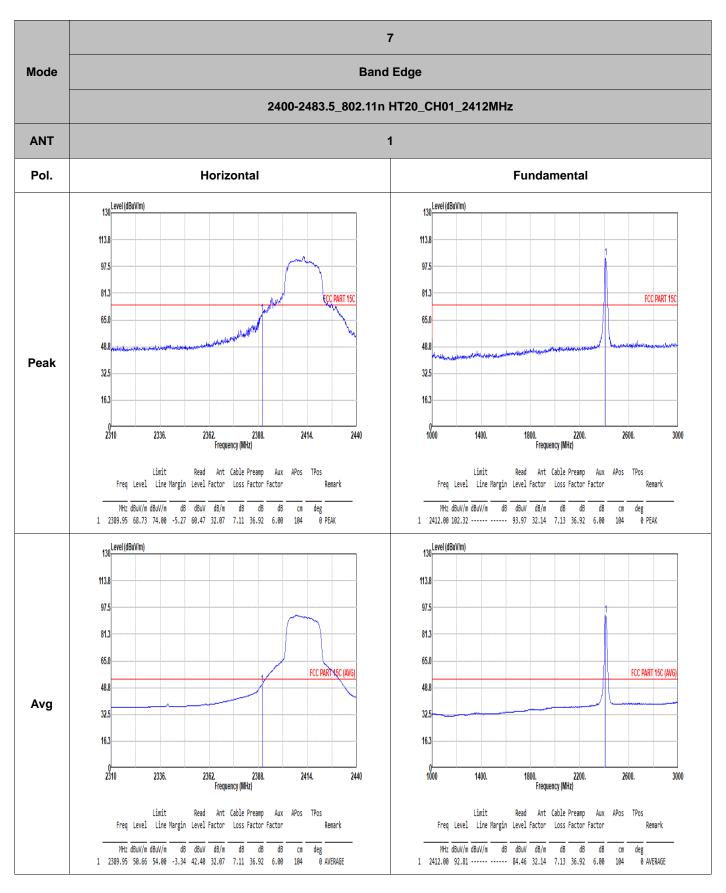




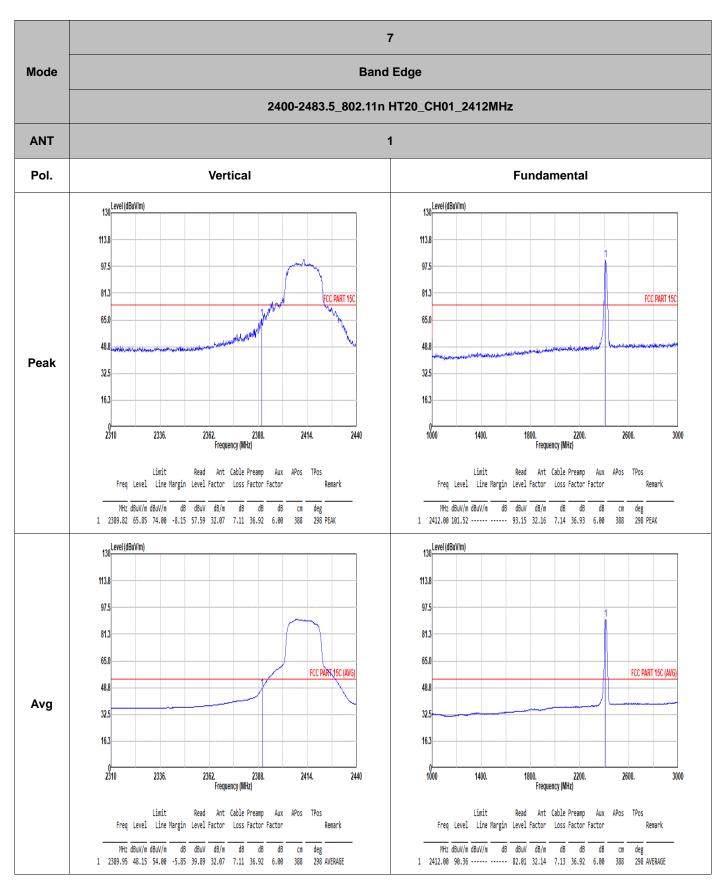




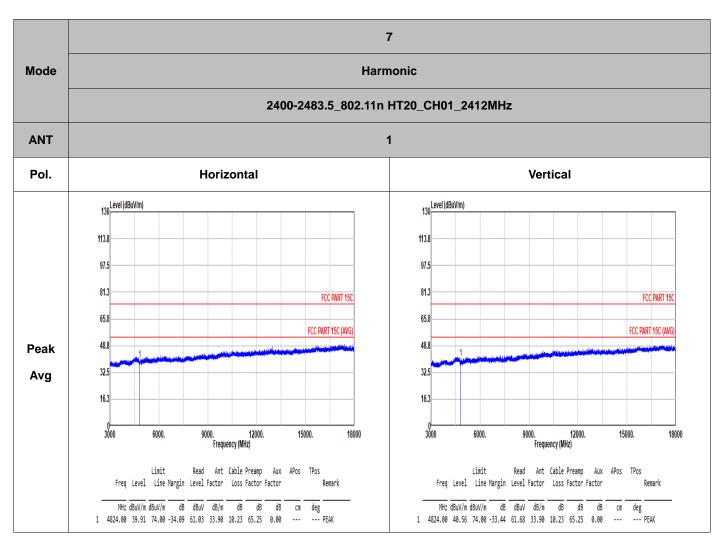




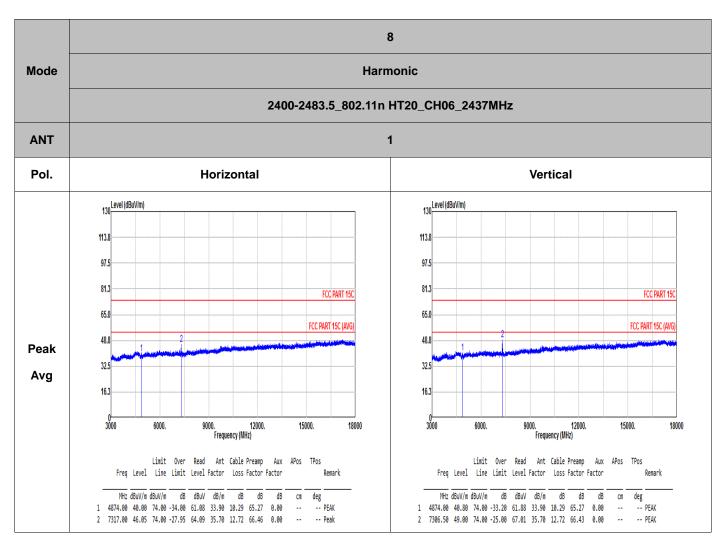




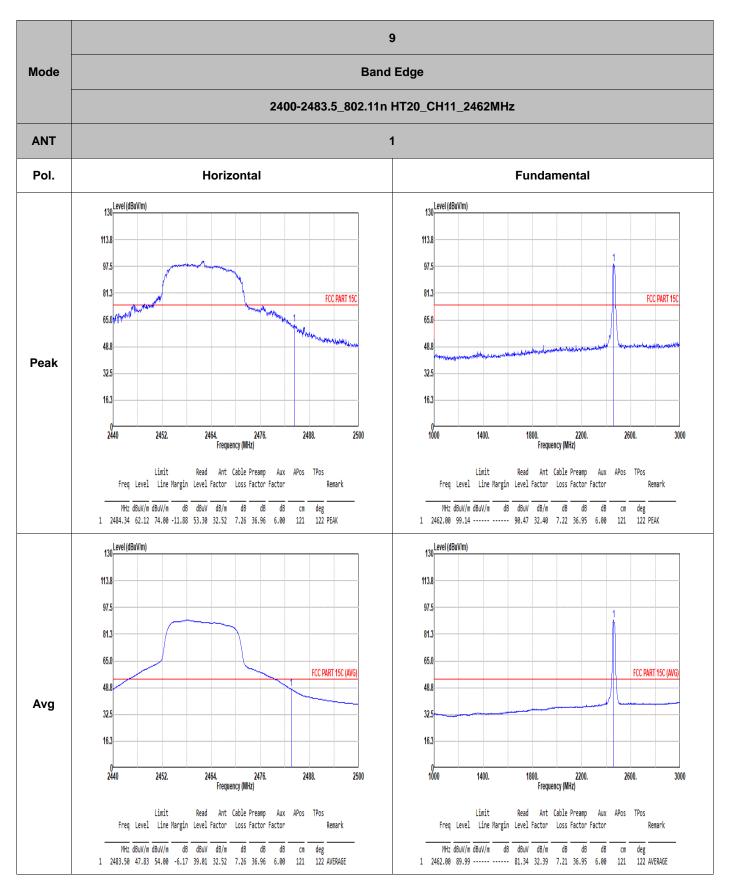






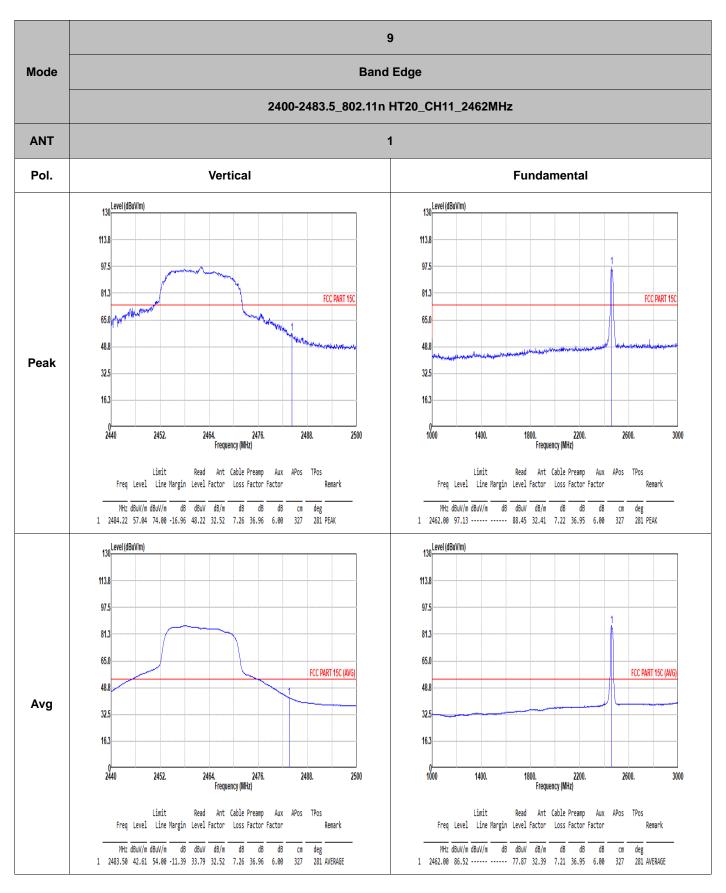






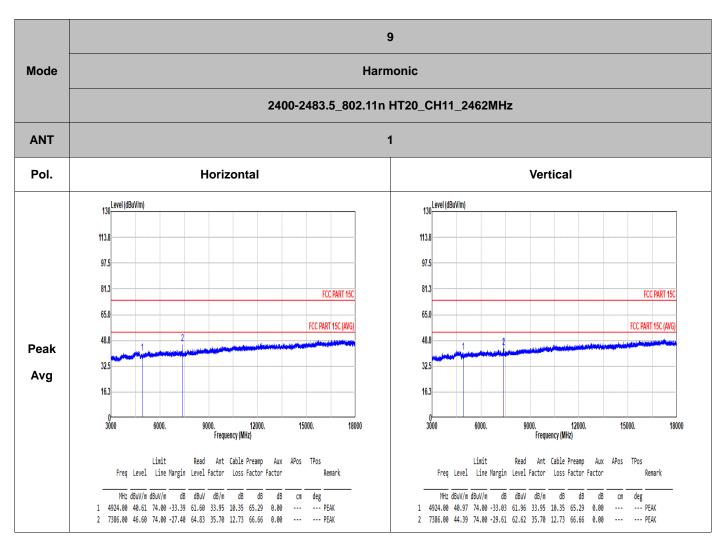
C21 of C24



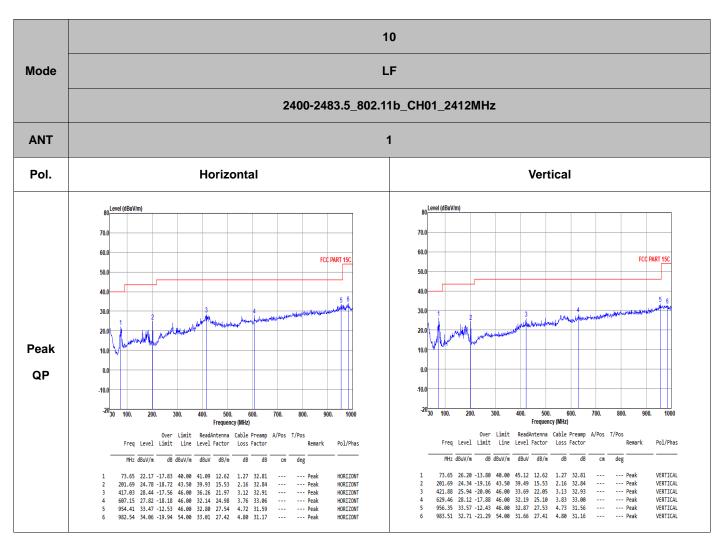


C22 of C24







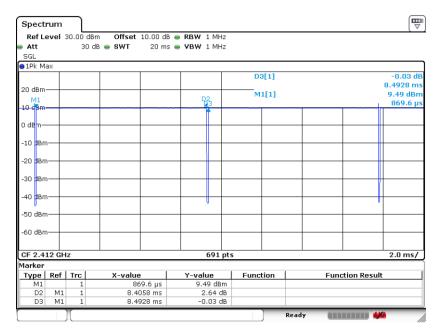




Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	98.98	-	-	10Hz
802.11g	98.97	-	-	10Hz
802.11n HT20	98.89	-	-	10Hz







802.11g

	um											[₩
Ref Le	vel 3	30.00	dBm Offset	10.00 dB	😑 RBW 1 MHz	:						(-
Att		30	idB 👄 SWT	5 ms	👄 VBW 1 MHz							
SGL												
1Pk Ma	х											
						D3	8[1	1				0.34 dB
20 dBm—												0580 ms
to abiii						M	1[1	L]				.28 dBm
10 dBm—	_										3	04.35 µs
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1 N				1		· ·		[
-10 dBm-												
-20 dBm-												
20 000												
-30 dBm-	+									_		
											- II.	
-40 dBm-	-		-									
								I				
-50 dBm-	+											
-60 dBm-												
-oo ubiii-												
05 0 11												0.0
CF 2.41	2 GH	Z			691 p	its	_				50	0.0 µs/
1arker	n (T 1	×			1 5 1		- 1	-	nction Re		
Type M1	Ref	1	X-valu	e 4.35 µs	Y-value -6.28 dBn				Fu	riction Re	suit	
D2	M1	1		913 ms	-0.28 UBI							
D3	M1	1		058 ms	0.34 di							
								Read			-	

802.11n HT20

