

# **FCC Test Report**

FCC ID : XNAWSM02

Equipment : Nokia Sleep

Model No. : WSM02

Brand Name : NOKIA

Applicant : NOKIA TECHNOLOGIES (France)

Address : 2 rue Maurice Hartmann

92130 Issy-Les-Moulineaux

**France** 

Standard : 47 CFR FCC Part 15.247

Received Date : Sep. 28, 2017

Tested Date : Oct. 24, 2017 ~ Jan. 19, 2018

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: Approved by:

Along Chen / Assistant Manager Gary Chang / Manager

Taf Testing Laboratory

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Report No.: FR792802AC Report Version: Rev. 01

Jaminas Day 04



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## **Release Record**

Report No.	Version	Description	Issued Date
FR792802AC	Rev. 01	Initial issue	Jan. 31, 2018

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# **Summary of Test Results**

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.476MHz 33.93 (Margin -12.48dB) - AV	Pass
15.247(d)	Radiated Emissions	[dBuV/m at 3m]: 7311.00MHz	Pass
15.209	Natiated Effissions	52.99 (Margin -1.01dB) - AV	r ass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 22.53	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

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## 1 General Description

## 1.1 Information

## 1.1.1 Specification of the Equipment under Test (EUT)

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N <sub>TX</sub> )	Data Rate / MCS	
2400-2483.5	b	2412-2462	1-11 [11]	1	1-11 Mbps	
2400-2483.5	g	2412-2462	1-11 [11]	1	6-54 Mbps	
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	1	MCS 0-7	

Note 1: RF output power specifies that Maximum Peak Conducted Output Power.

### 1.1.2 Antenna Details

Ant. No.	Brand	Model	Туре	Connector	Gain (dBi)	Remarks
1	Broadcom	BCM9Fractal	PCB	N/A	2.8	

## 1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from AC adapter
i ower ouppry Type	ovac nom Ao adapter

#### 1.1.4 Accessories

	Accessories				
No.	Equipment	Description			
1	AC adapter	Brand: ABP Model: SWA06B-050-1000U Power Rating: I/P: 100-240Vac, 50-60Hz, 0.3A O/P: 5Vdc, 1000mA			

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Note 2: 802.11b uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.

Note 3: 802.11g/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.



## 1.1.5 Channel List

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

## 1.1.6 Test Tool and Duty Cycle

Test Tool	Tera Term, Version: 4.74					
	Mode	Duty cycle (%)	Duty factor (dB)			
Duty Cycle and Duty Footor	11b	99.66%	0.01			
Duty Cycle and Duty Factor	11g	94.18%	0.26			
	HT20	94.36%	0.25			

## 1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)	Power Set
11b	2412	17
11b	2437	17.5
11b	2462	17.5
11g	2412	16
11g	2437	16
11g	2462	15.5
HT20	2412	16
HT20	2437	16
HT20	2462	15.5

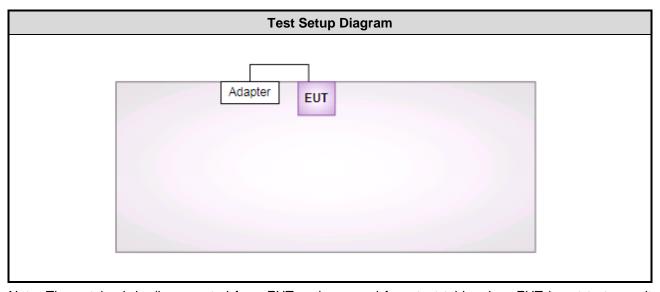
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## 1.2 Local Support Equipment List

	Support Equipment List						
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)		
1	Notebook	DELL	Latitude E6430	Doc			

## 1.3 Test Setup Chart



Note: The notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

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## 1.4 The Equipment List

Test Item	Conducted Emission						
Test Site	Conduction room 1 /	Conduction room 1 / (CO01-WS)					
Tested Date	Nov. 01, 2017						
Instrument	Manufacturer	Manufacturer Model No. Serial No. Calibration Date Calibration Until					
Receiver	R&S	ESR3	101657	Dec. 21, 2016	Dec. 20, 2017		
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 08, 2016	Nov. 07, 2017		
RF Cable-CON	EMC	EMC EMCCFD300-BM-BM-6000 50821 Dec. 20, 2016 Dec. 19, 2017					
Measurement Software	AUDIX e3 6.120210k NA NA						
Note: Calibration Interval of instruments listed above is one year.							

Test Item	Radiated Emission								
Test Site	966 chamber 3 / (03CH03-WS)								
Tested Date	Oct. 24 ~ Oct. 25, 2017								
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until				
Spectrum Analyzer	ROHDE&SCHWAR Z	FSV40	101486	Nov. 15, 2016	Nov. 14, 2017				
Receiver	Agilent	N9038A	MY53290044	Sep. 26, 2017	Sep. 25, 2018				
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 28, 2017	Apr. 27, 2018				
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 09, 2017	Feb. 08, 2018				
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Dec. 29, 2016	Dec. 28, 2017				
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017				
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017				
Preamplifier	EMC	EMC02325	980187	Sep. 04, 2017	Sep. 03, 2018				
Preamplifier	Agilent	83017A	MY53270014	Aug. 21, 2017	Aug. 20, 2018				
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018				
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 04, 2017	Feb. 03, 2018				
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 04, 2017	Feb. 03, 2018				
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 04, 2017	Feb. 03, 2018				
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800 -001	Feb. 04, 2017	Feb. 03, 2018				
LF cable-3M	EMC	EMC8D-NM-NM-300 0	131103	Feb. 04, 2017	Feb. 03, 2018				
LF cable-13M	EMC	EMC8D-NM-NM-130 00	131104	Feb. 04, 2017	Feb. 03, 2018				
Measurement Software	AUDIX e3 6.120210g NA NA								
Note: Calibration Inter	rval of instruments liste	d above is one year.							

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Test Item	RF Conducted							
Test Site	(TH01-WS)							
Tested Date	Nov. 10, 2017 ~ Jan.	19, 2018						
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until			
Spectrum Analyzer	R&S	FSV40	101063	Mar. 15, 2017	Mar. 14, 2018			
Power Meter	Anritsu	ML2495A	1241002	Oct. 16, 2017	Oct. 15, 2018			
Power Sensor	Anritsu	MA2411B	1207366	Oct. 16, 2017	Oct. 15, 2018			
AC POWER SOURCE	G.W .	APS-9102	EL920581	Jun. 03, 2017	Jun. 02, 2018			
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA			
Note: Calibration Inte	rval of instruments liste	d above is one year.		•				

### 1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247 ANSI C63.10-2013 FCC KDB 558074 D01 DTS Meas Guidance v04

## 1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty								
Parameters	Uncertainty							
Bandwidth	±34.134 Hz							
Conducted power	±0.808 dB							
Power density	±0.463 dB							
Conducted emission	±2.670 dB							
AC conducted emission	±2.90 dB							
Radiated emission ≤ 1GHz	±3.66 dB							
Radiated emission > 1GHz	±5.37 dB							

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# 2 Test Configuration

## 2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	23°C / 59%	Alex Tsai
Radiated Emissions	03CH03-WS	24-25°C / 64%	Aska Huang
RF Conducted	TH01-WS	22°C / 65%	Aska Huang

FCC Designation No.: TW2732
 FCC site registration No.: 181692
 IC site registration No.: 10807A-1

### 2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	HT20	2412	6 Mbps	
Radiated Emissions ≤1GHz	HT20	2412	6 Mbps	
Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	11b 11g HT20	2412 / 2437 / 2462 2412 / 2437 / 2462 2412 / 2437 / 2462	1 Mbps 6 Mbps MCS 0	

#### NOTE:

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<sup>1.</sup> The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.



## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit								
Frequency Emission (MHz) Quasi-Peak Average								
0.15-0.5 66 - 56 * 56 - 46 *								
0.5-5	56	46						
5-30 60 50								
Note 1: * Decreases with the logarithm of the frequency.								

#### 3.1.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V / 60Hz.

#### 3.1.3 Test Setup



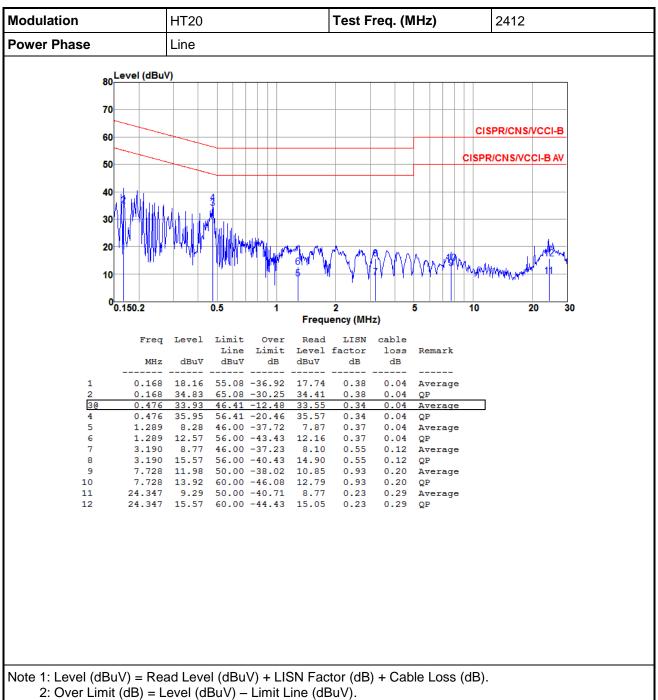
Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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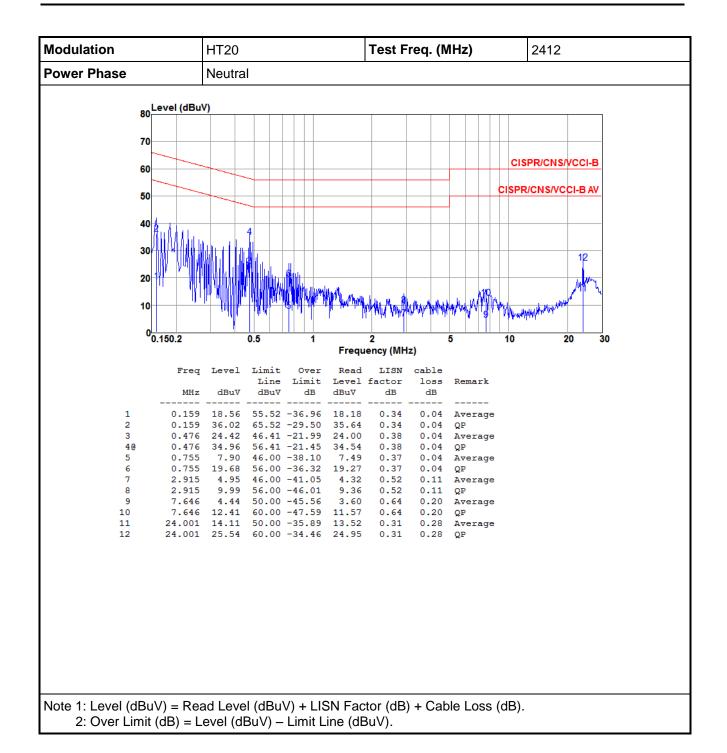


#### **Test Result of Conducted Emissions** 3.1.4



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## 3.2 6dB and Occupied Bandwidth

#### 3.2.1 Limit of 6dB Bandwidth

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

#### 3.2.2 Test Procedures

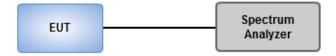
#### 6dB Bandwidth

- 1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
- Detector = Peak, Trace mode = max hold.
- 3. Sweep = auto couple, Allow the trace to stabilize.
- 4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

### **Occupied Bandwidth**

- 1. Set resolution bandwidth (RBW) = 1 MHz, Video bandwidth = 3 MHz.
- 2. Detector = Sample, Trace mode = max hold.
- 3 Sweep = auto couple, Allow the trace to stabilize.
- 4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

#### 3.2.3 Test Setup

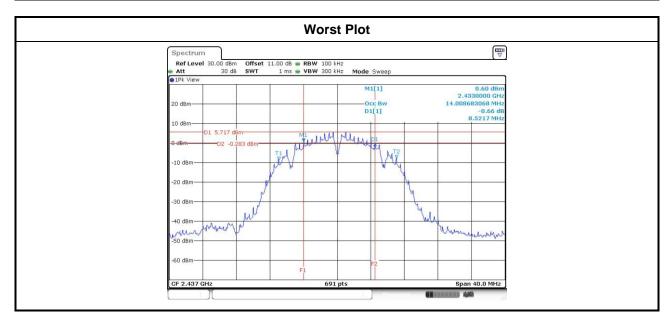


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## 3.2.4 Test Result of 6dB and Occupied Bandwidth

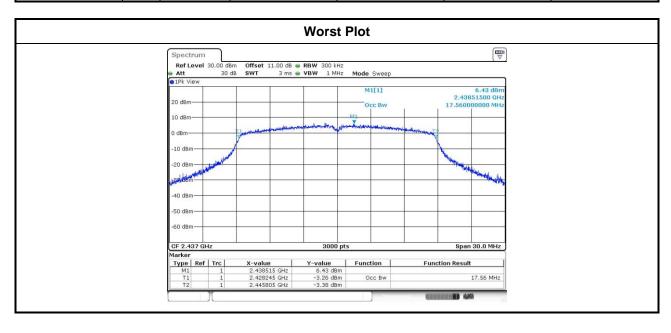
Modulation	N	Erog (MUz)			Limit (kHz)		
Mode	N <sub>TX</sub>	Freq. (MHz)	Chain 0	Chain 1	Chain 2	Chain 3	LIIIII (KHZ)
11b	1	2412	8.99				500
11b	1	2437	8.52				500
11b	1	2462	8.58				500
11g	1	2412	15.07				500
11g	1	2437	15.13				500
11g	1	2462	14.38				500
HT20	1	2412	15.13				500
HT20	1	2437	15.30				500
HT20	1	2462	15.07				500



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Modulation	N.	Freq.		99% Occupied E	Bandwidth (MHz)	
Mode	N <sub>TX</sub>	(MHz)	Chain 0	Chain 1	Chain 2	Chain 3
11b	1	2412	13.99			
11b	1	2437	13.98			
11b	1	2462	13.98			
11g	1	2412	16.47			
11g	1	2437	16.48			
11g	1	2462	16.46			
HT20	1	2412	17.56			
HT20	1	2437	17.56			
HT20	1	2462	17.55			



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## 3.3 RF Output Power

### 3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

Antenna gain <= 6dBi, no any corresponding reduction is in output power limit.

Antenna gain > 6dBi

Non Fixed, point to point operations.
The conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB

Fixed, point to point operations
Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point Operations, maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations, no any corresponding reduction is in transmitter peak output power

#### 3.3.2 Test Procedures

Maximum Peak Conducted Output Power

#### 

- 1. Set RBW = 1MHz, VBW = 3MHz, Detector = Peak.
- 2. Sweep time = auto, Trace mode = max hold, Allow trace to fully stabilize.
- 3. Use the spectrum analyzer channel power measurement function with the band limits set equal to the DTS bandwidth edges.

#### Nower meter

- A broadband Peak RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.
- Maximum Conducted Output Power (For reference only)

#### Nower meter

 A broadband Average RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

### 3.3.3 Test Setup



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## 3.3.4 Test Result of Maximum Output Power

		Peak conducted Output Power (dBm)							Amt		FIDD	
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Chain 0	Chain 1	Chain 2	Chain 3	Total Power (mW)	Total Power (dBm)	Limit (dBm)	Ant. Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)
11b	1	2412	16.75				47.315	16.75	30.00	2.80	19.55	36.00
11b	1	2437	16.96				49.659	16.96	30.00	2.80	19.76	36.00
11b	1	2462	17.25				53.088	17.25	30.00	2.80	20.05	36.00
11g	1	2412	22.48				177.011	22.48	30.00	2.80	25.28	36.00
11g	1	2437	22.41				174.181	22.41	30.00	2.80	25.21	36.00
11g	1	2462	22.12				162.930	22.12	30.00	2.80	24.92	36.00
HT20	1	2412	22.53				179.061	22.53	30.00	2.80	25.33	36.00
HT20	1	2437	22.46				176.198	22.46	30.00	2.80	25.26	36.00
HT20	1	2462	22.03				159.588	22.03	30.00	2.80	24.83	36.00

Modulation		Freq.	Condi	Conducted (Average) Output Power (dBm)				Total	Limit
Mode	N <sub>TX</sub>	(MHz)	Chain 0	Chain 1	Chain 2	Chain 3	Power (mW)	Power (dBm)	(dBm)
11b	1	2412	14.39				27.479	14.39	
11b	1	2437	14.66				29.242	14.66	
11b	1	2462	14.92				31.046	14.92	
11g	1	2412	14.25				26.607	14.25	
11g	1	2437	14.21				26.363	14.21	
11g	1	2462	14.09				25.645	14.09	
HT20	1	2412	14.21				26.363	14.21	
HT20	1	2437	14.18				26.182	14.18	
HT20	1	2462	14.03				25.293	14.03	

Note: Conducted average output power is for reference only.

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## 3.4 Power Spectral Density

### 3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

#### 3.4.2 Test Procedures

- Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
  - Set the RBW = 3kHz, VBW = 10kHz.
  - Detector = Peak, Sweep time = auto couple.
  - 3. Trace mode = max hold, allow trace to fully stabilize.
  - 4. Use the peak marker function to determine the maximum amplitude level.
- Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.
  - Set the RBW = 100kHz, VBW = 300 kHz.
  - 2. Detector = RMS, Sweep time = auto couple.
  - 3. Set the sweep time to: ≥ 10 x (number of measurement points in sweep) x (maximum data rate per stream).
  - 4. Perform the measurement over a single sweep.
  - 5. Use the peak marker function to determine the maximum amplitude level.

### 3.4.3 Test Setup

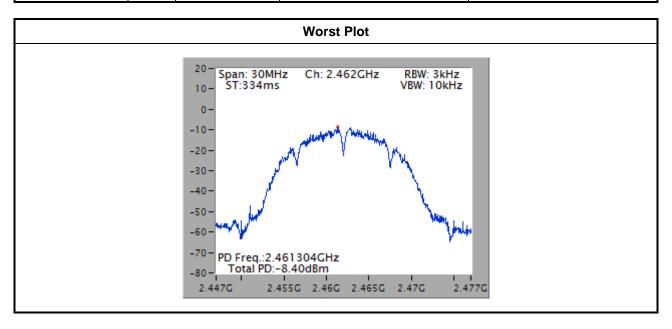


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## 3.4.4 Test Result of Power Spectral Density

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
11b	1	2412	-9.36	8.00
11b	1	2437	-8.74	8.00
11b	1	2462	-8.40	8.00
11g	1	2412	-11.69	8.00
11g	1	2437	-11.37	8.00
11g	1	2462	-11.24	8.00
HT20	1	2412	-11.97	8.00
HT20	1	2437	-11.05	8.00
HT20	1	2462	-11.53	8.00



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## 3.5 Unwanted Emissions into Restricted Frequency Bands

### 3.5.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit										
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)							
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300							
0.490~1.705	24000/F(kHz)	33.8 - 23	30							
1.705~30.0	30	29	30							
30~88	100	40	3							
88~216	150	43.5	3							
216~960	200	46	3							
Above 960	500	54	3							

#### Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2:** 

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

#### 3.5.2 Test Procedures

- 1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

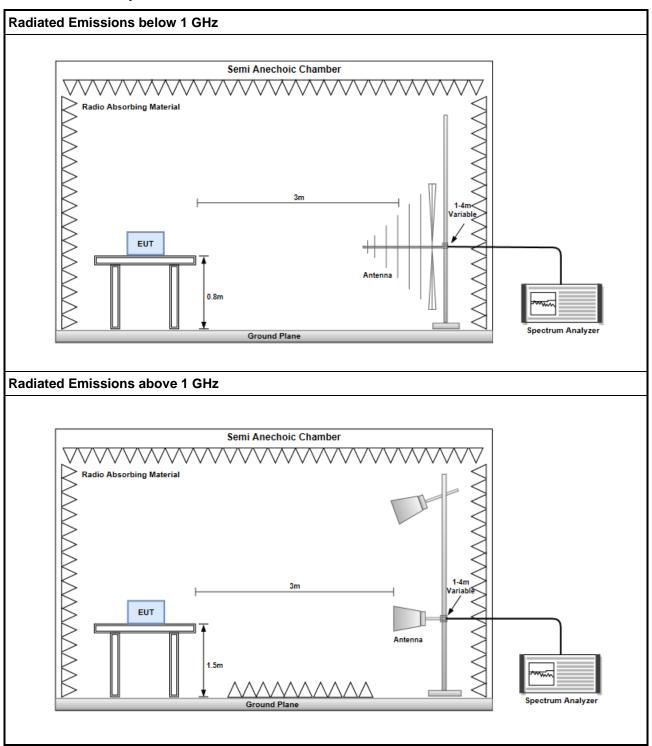
#### Note:

- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

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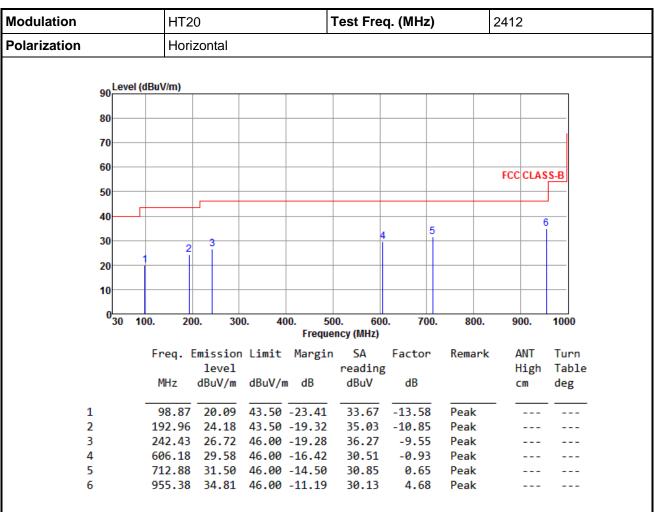
## 3.5.3 Test Setup



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### 3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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<b>Modulation</b>		HT20	)		-	Test Fre	q. (MHz)		2412	2412	
Polarization		Verti	cal		1						
Leve	el (dBuV	//m)									
90	ci (dDd v	<del>,,,,</del>									
80											
70											
60									FCC CLA	ee D	
50									TCCCLA	33-6	
30										_	
40										6	
30 1					1	5					
		2	3		Ī						
20											
10										+	
0											
030	100.	200	). 30	0. 4		00. 60 ency (MHz)	0. 700.	800.	900.	1000	
	En	oa F	mission	limi+	Margin		Factor	Remark	ANT	Turn	
	- ''	cq. L	level	LIMIT	Hai gili	reading		iteliai k	High		
	М	Hz	dBuV/m	dBuV/ı	n dB	dBuV	dB		cm	deg	
1			27.95		-12.05	36.50	-8.55	Peak			
2 3		2.96 2.43			-20.43 -24.34	33.92 31.21	-10.85 -9.55	Peak Peak			
4		6.66	25.72		-24.34	31.13	-9.55 -5.41	Peak			
5		0.29			-16.58	31.20	-1.78	Peak			

4.68

Peak

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

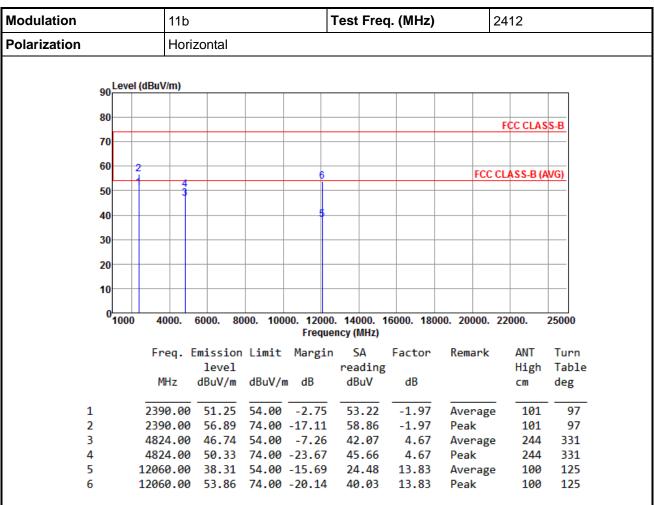
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

955.38 37.49 46.00 -8.51 32.81

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## 3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11b



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

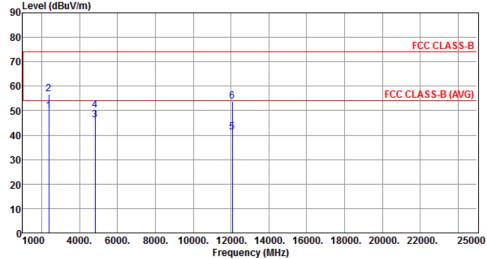
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

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Modulation 11b		Test Freq. (MHz)	2412		
Polarization	Vertical				
90 Level (dBu	V/m)				

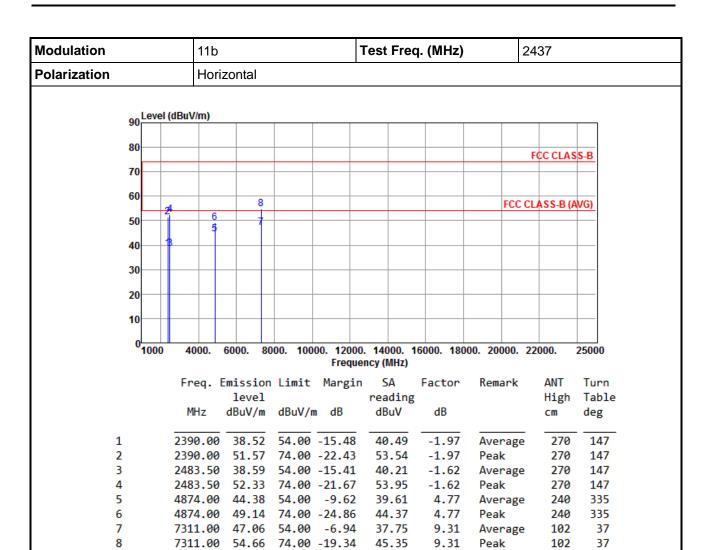


	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	49.81	54.00	-4.19	51.78	-1.97	Average	216	78
2	2390.00	56.74	74.00	-17.26	58.71	-1.97	Peak	216	78
3	4824.00	46.07	54.00	-7.93	41.40	4.67	Average	295	263
4	4824.00	50.00	74.00	-24.00	45.33	4.67	Peak	295	263
5	12060.00	41.14	54.00	-12.86	27.31	13.83	Average	100	150
6	12060.00	53.90	74.00	-20.10	40.07	13.83	Peak	100	150

\*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation		11b	)		-	Test Fred	ą. (MHz)	2	437	
Polarization		Ver	tical		1			•		
	90 Leve	el (dBuV/m)								
	80								FCC CLAS	S-B
	70									
	60		8							
	••	4	7					FCC C	LASS-B (A	WG)
	50	6								
	40	3								
	40									
	30									
	20									
	10									
	0 1000	0 4000.	6000. 80	000. 100	00 42000	14000 4	6000 400	00. 20000. 2	22000	25000
	1000	4000.	0000. 0	JUU. 100		ency (MHz)	0000. 160	00. 20000. 2	22000.	25000
		Freq.	Emission	Limit	Margin	s SA	Factor	Remark	ANT	Turn
			level			reading			High	Table
		MHz	dBuV/m	dBuV/ı	m dB	dBuV	dB		CM	deg
	1	2390.00	39.03	54.00	-14.97	41.00	-1.97	Average	216	77
	2	2390.00			-23.22	52.75	-1.97	Peak	216	77
	3	2483.56	39.14		-14.86	40.76	-1.62	Average	216	77
	4		51.58			53.20	-1.62	Peak	216	77
!	5	4874.00	44.97	54.00	-9.03	40.20	4.77	Average	328	253

44.72

43.68

48.79

4.77

9.31

9.31

Peak

Peak

Average

328

225

225

253

269

269

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

4874.00

7311.00

49.49

52.99

7311.00 58.10 74.00 -15.90

74.00 -24.51

54.00 -1.01

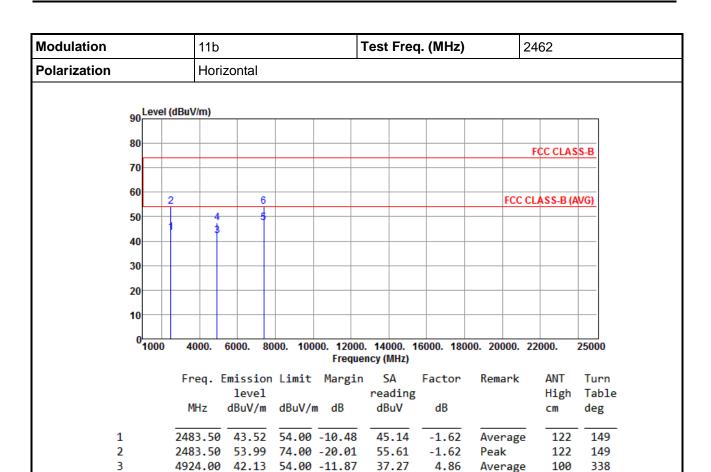
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4

5

6



74.00 -26.54

54.00 -6.48

42.60

37.94

44.70

4.86

9.58

9.58

Peak

Peak

Average

100

100

100

338

37

37

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB) \*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

4924.00 47.46

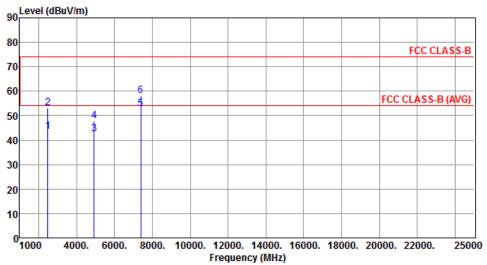
7386.00 47.52

7386.00 54.28 74.00 -19.72

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Modulation	•	11b		Test	Freq.	(MHz)	24	62		
Polarization	\	Vertical								
90 <mark>L</mark>	evel (dBuV/r	m)								



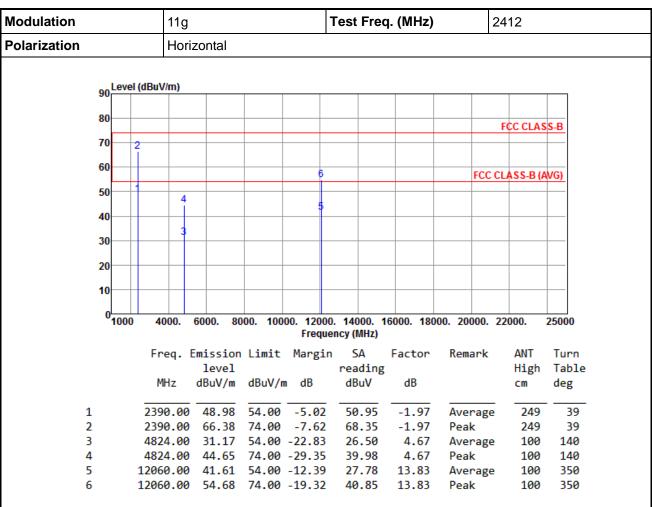
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	43.41	54.00	-10.59	45.03	-1.62	Average	216	75
2	2483.50	53.27	74.00	-20.73	54.89	-1.62	Peak	216	75
3	4924.00	42.52	54.00	-11.48	37.66	4.86	Average	100	244
4	4924.00	47.90	74.00	-26.10	43.04	4.86	Peak	100	244
5	7386.00	52.96	54.00	-1.04	43.38	9.58	Average	206	264
6	7386.00	58.09	74.00	-15.91	48.51	9.58	Peak	206	264

\*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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## 3.5.6 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11g



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

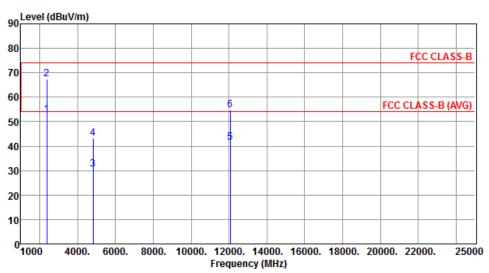
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Polarization Vertical	



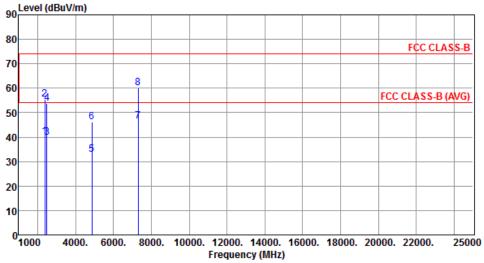
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	52.64	54.00	-1.36	54.61	-1.97	Average	215	77
2	2390.00	67.32	74.00	-6.68	69.29	-1.97	Peak	215	77
3	4824.00	30.57	54.00	-23.43	25.90	4.67	Average	100	120
4	4824.00	43.17	74.00	-30.83	38.50	4.67	Peak	100	120
5	12060.00	41.57	54.00	-12.43	27.74	13.83	Average	100	130
6	12060.00	54.72	74.00	-19.28	40.89	13.83	Peak	100	130

\*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	on 11g			Test Freq. (MHz)				2437		
Polarization	Horizontal									
90 Level (dBu	J/m)						٦			



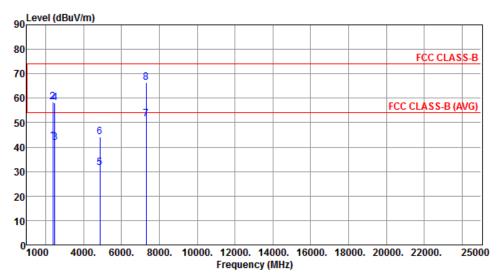
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	40.28	54.00	-13.72	42.25	-1.97	Average	269	146
2	2390.00	55.54	74.00	-18.46	57.51	-1.97	Peak	269	146
3	2483.50	39.81	54.00	-14.19	41.43	-1.62	Average	269	146
4	2483.50	53.81	74.00	-20.19	55.43	-1.62	Peak	269	146
5	4874.00	32.97	54.00	-21.03	28.20	4.77	Average	100	330
6	4874.00	46.10	74.00	-27.90	41.33	4.77	Peak	100	330
7	7311.00	46.41	54.00	-7.59	37.10	9.31	Average	100	40
8	7311.00	60.10	74.00	-13.90	50.79	9.31	Peak	100	40

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		



	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	42.58	54.00	-11.42	44.55	-1.97	Average	216	75
2	2390.00	58.52	74.00	-15.48	60.49	-1.97	Peak	216	75
3	2483.50	41.91	54.00	-12.09	43.53	-1.62	Average	216	75
4	2483.50	58.01	74.00	-15.99	59.63	-1.62	Peak	216	75
5	4874.00	31.49	54.00	-22.51	26.72	4.77	Average	100	180
6	4874.00	44.21	74.00	-29.79	39.44	4.77	Peak	100	180
7	7311.00	51.40	54.00	-2.60	42.09	9.31	Average	227	252
8	7311.00	66.37	74.00	-7.63	57.06	9.31	Peak	227	252

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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01000

4000.

Modulation			11g			Test	Freq.	(MHz)	)	24	62	
Polarization			Horizo	ntal								
			•									
	90	Level (dBu	V/m)									
	80											
	70	2								F	CC CLAS	S-B
	60			6								
				Ĭ						FCC CL	ASS-B (A	WG)
	50		4	5								
	40											
	30		3									
	20											
	40											

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ū	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	50.03	54.00	-3.97	51.65	-1.62	Average	261	33
2	2483.50	68.78	74.00	-5.22	70.40	-1.62	Peak	261	33
3	4924.00	31.35	54.00	-22.65	26.49	4.86	Average	100	120
4	4924.00	44.13	74.00	-29.87	39.27	4.86	Peak	100	120
5	7386.00	42.63	54.00	-11.37	33.05	9.58	Average	100	39
6	7386.00	57.30	74.00	-16.70	47.72	9.58	Peak	100	39

Frequency (MHz)

8000. 10000. 12000. 14000. 16000. 18000. 20000. 22000.

25000

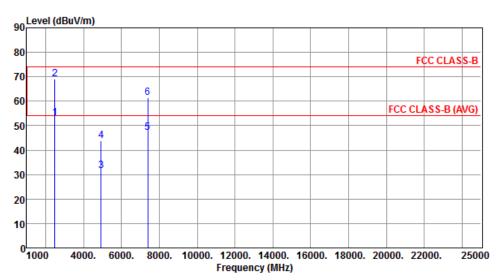
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Polarization	Modulation	11g	Test Freq. (MHz)	2462
Vertical vertical	Polarization	Vertical		



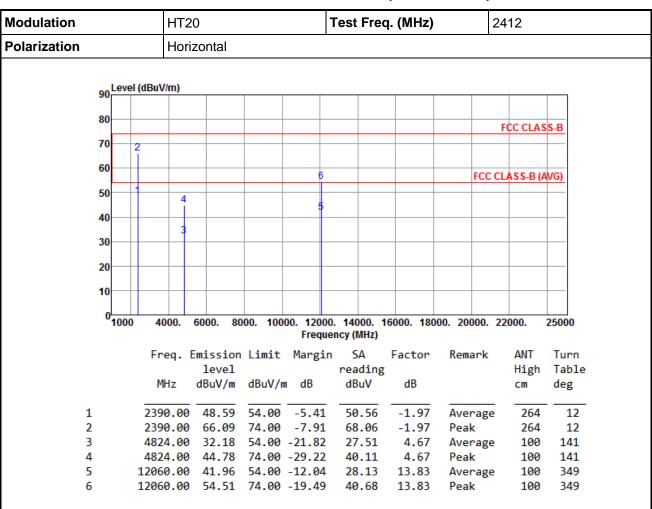
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	52.98	54.00	-1.02	54.60	-1.62	Average	216	77
2	2483.50	69.06	74.00	-4.94	70.68	-1.62	Peak	216	77
3	4924.00	31.56	54.00	-22.44	26.70	4.86	Average	100	135
4	4924.00	43.75	74.00	-30.25	38.89	4.86	Peak	100	135
5	7386.00	47.29	54.00	-6.71	37.71	9.58	Average	264	270
6	7386.00	61.31	74.00	-12.69	51.73	9.58	Peak	264	270

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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## 3.5.7 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

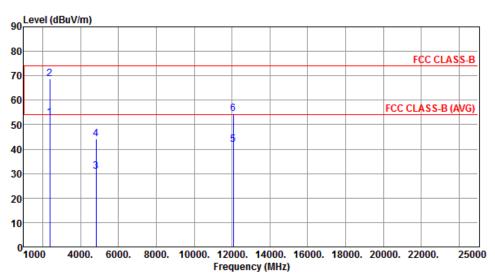
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		



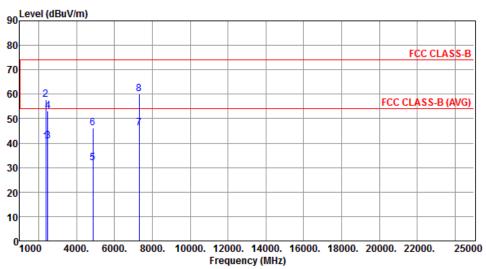
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	52.95	54.00	-1.05	54.92	-1.97	Average	214	78
2	2390.00	68.74	74.00	-5.26	70.71	-1.97	Peak	214	78
3	4824.00	30.77	54.00	-23.23	26.10	4.67	Average	100	121
4	4824.00	44.14	74.00	-29.86	39.47	4.67	Peak	100	121
5	12060.00	41.69	54.00	-12.31	27.86	13.83	Average	100	132
6	12060.00	54.51	74.00	-19.49	40.68	13.83	Peak	100	132

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		



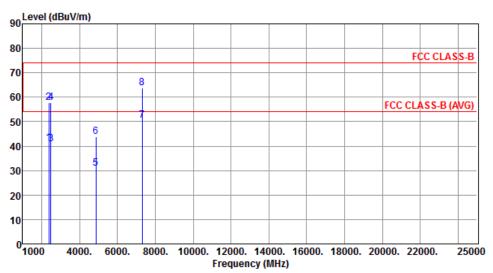
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m		SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	40.63	54.00	-13.37	42.60	-1.97	Average	268	150
2	2390.00	57.66	74.00	-16.34	59.63	-1.97	Peak	268	150
3	2483.50	40.88	54.00	-13.12	42.50	-1.62	Average	268	150
4	2483.50	53.15	74.00	-20.85	54.77	-1.62	Peak	268	150
5	4874.00	32.05	54.00	-21.95	27.28	4.77	Average	100	328
6	4874.00	46.33	74.00	-27.67	41.56	4.77	Peak	100	328
7	7311.00	46.26	54.00	-7.74	36.95	9.31	Average	100	39
8	7311.00	60.20	74.00	-13.80	50.89	9.31	Peak	100	39

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		



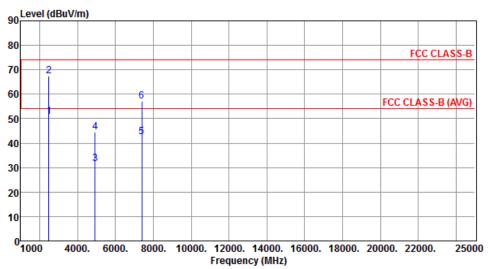
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ū	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	41.21	54.00	-12.79	43.18	-1.97	Average	130	186
2	2390.00	57.76	74.00	-16.24	59.73	-1.97	Peak	130	186
3	2483.50	40.80	54.00	-13.20	42.42	-1.62	Average	130	186
4	2483.50	57.88	74.00	-16.12	59.50	-1.62	Peak	130	186
5	4874.00	30.91	54.00	-23.09	26.14	4.77	Average	100	120
6	4874.00	43.84	74.00	-30.16	39.07	4.77	Peak	100	120
7	7311.00	50.36	54.00	-3.64	41.05	9.31	Average	224	246
8	7311.00	63.77	74.00	-10.23	54.46	9.31	Peak	224	246

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Horizontal		



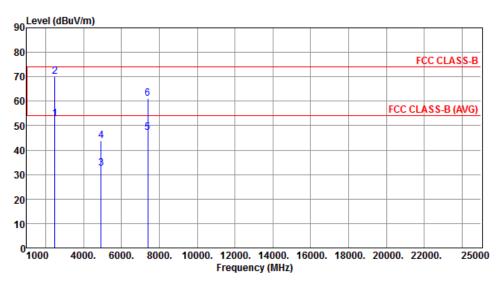
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Ū	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	50.67	54.00	-3.33	52.29	-1.62	Average	216	2
2	2483.50	67.46	74.00	-6.54	69.08	-1.62	Peak	216	2
3	4924.00	31.39	54.00	-22.61	26.53	4.86	Average	100	121
4	4924.00	44.36	74.00	-29.64	39.50	4.86	Peak	100	121
5	7386.00	42.52	54.00	-11.48	32.94	9.58	Average	100	40
6	7386.00	57.13	74.00	-16.87	47.55	9.58	Peak	100	40

\*Factor includes antenna factor, cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		



	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2483.50	52.97	54.00	-1.03	54.59	-1.62	Average	216	77
2	2483.50	70.20	74.00	-3.80	71.82	-1.62	Peak	216	77
3	4924.00	32.56	54.00	-21.44	27.70	4.86	Average	100	137
4	4924.00	43.98	74.00	-30.02	39.12	4.86	Peak	100	137
5	7386.00	47.13	54.00	-6.87	37.55	9.58	Average	265	272
6	7386.00	61.23	74.00	-12.77	51.65	9.58	Peak	265	272

\*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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# 3.6 Emissions in Non-Restricted Frequency Bands

## 3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power 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

### 3.6.2 Test Procedures

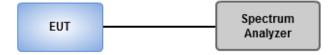
### Reference level measurement

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Use the peak marker function to determine the maximum PSD level

#### **Emission level measurement**

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Scan Frequency range is up to 25GHz
- 4. Use the peak marker function to determine the maximum amplitude level

## 3.6.3 Test Setup

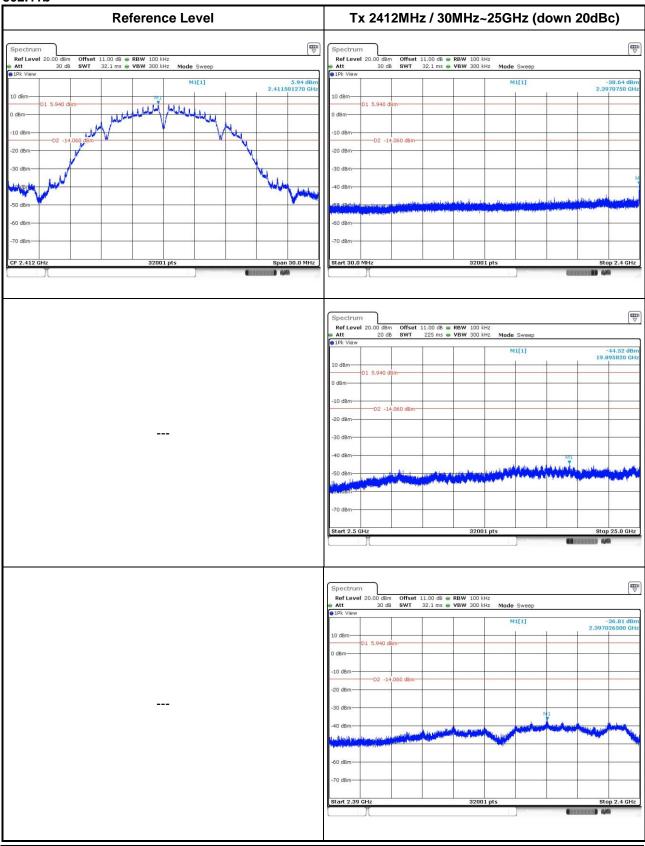


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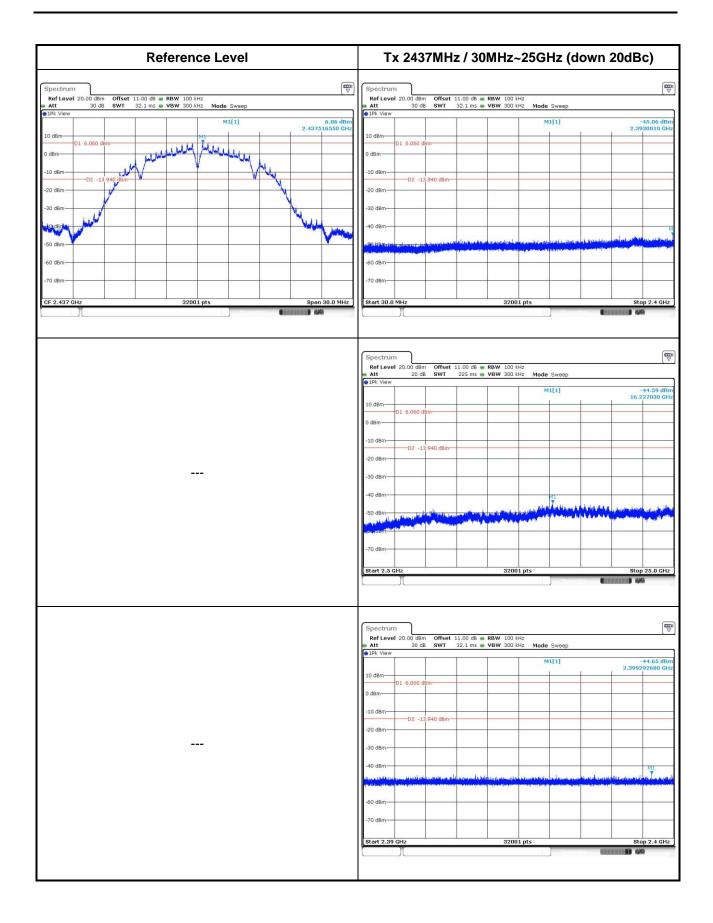
## 3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands

## 802.11b



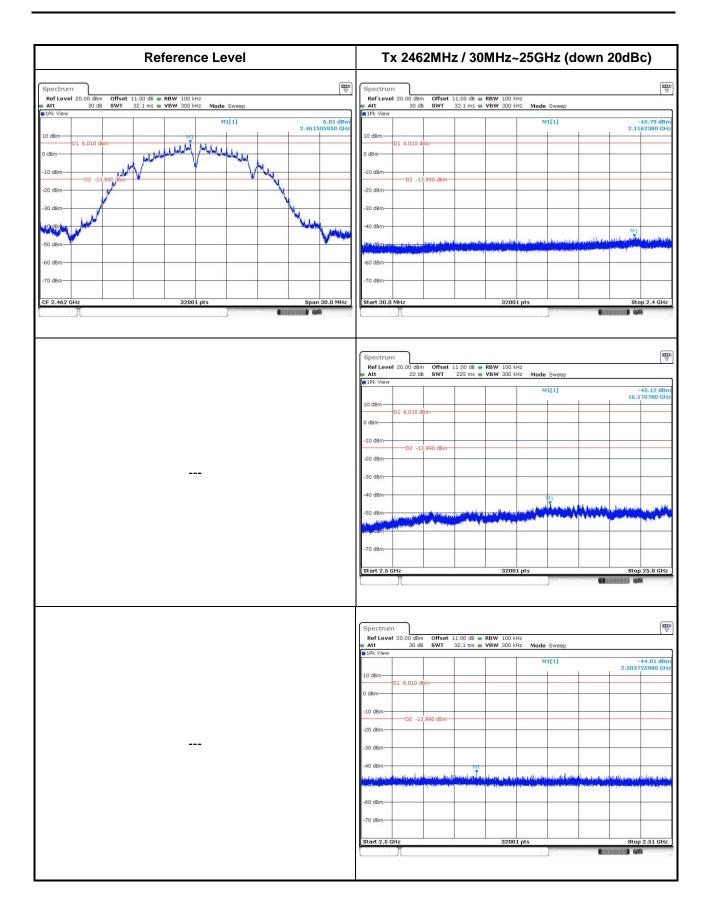
Report No.: FR792802AC Report Version: Rev. 01





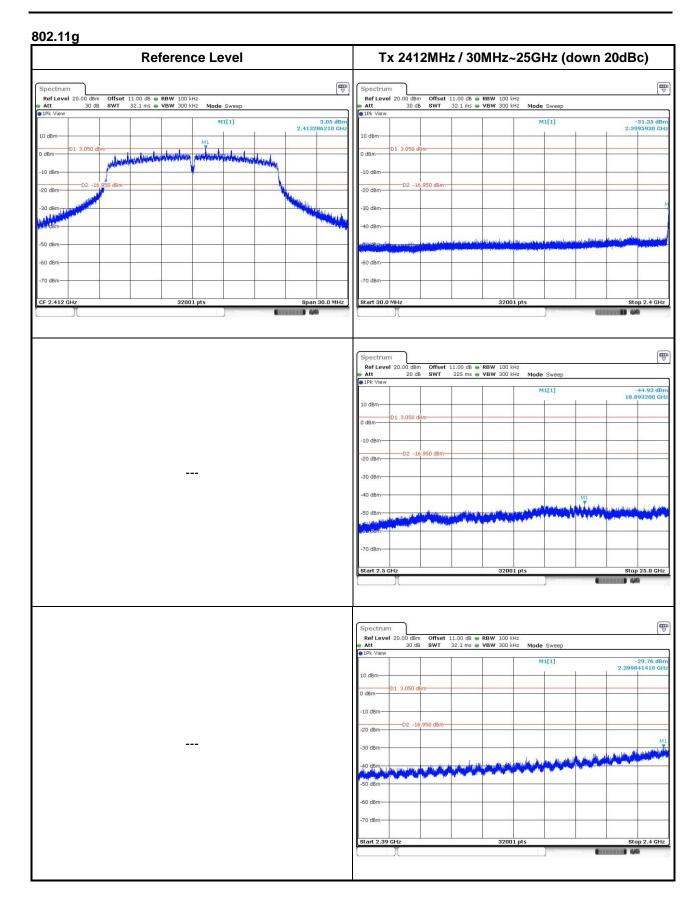
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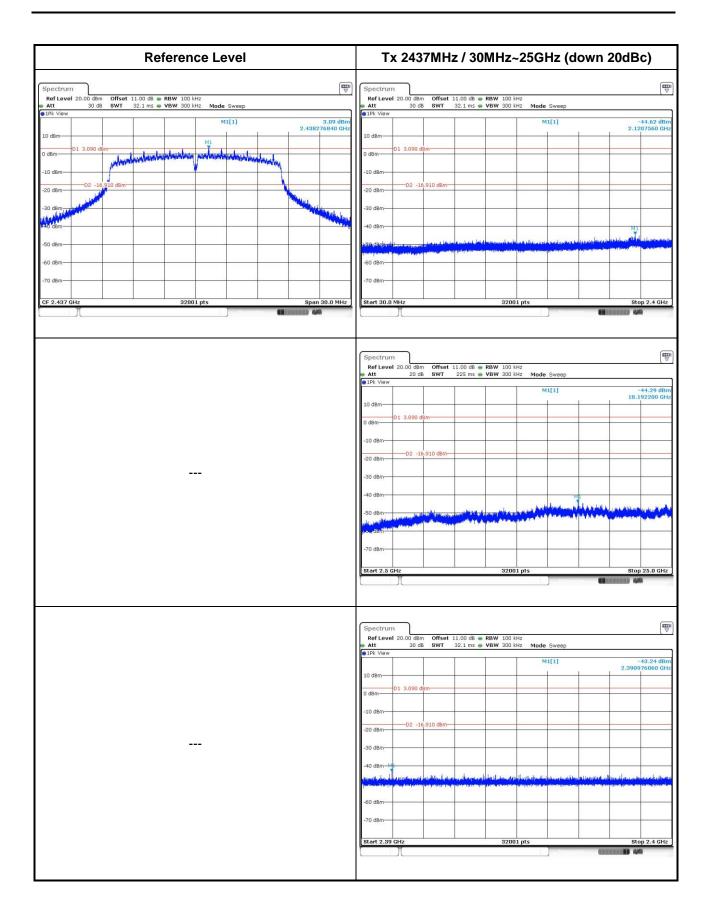
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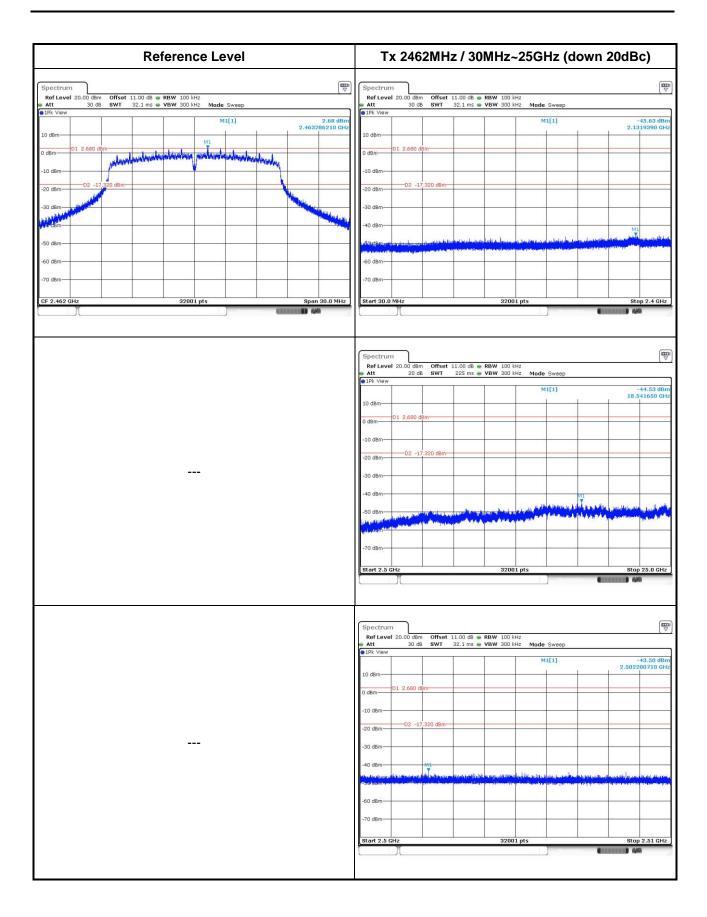
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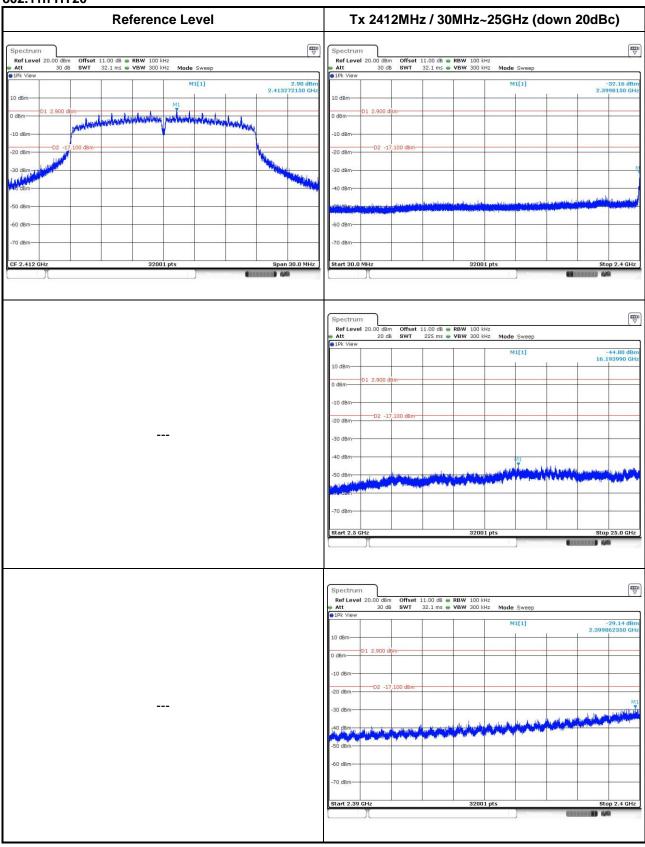




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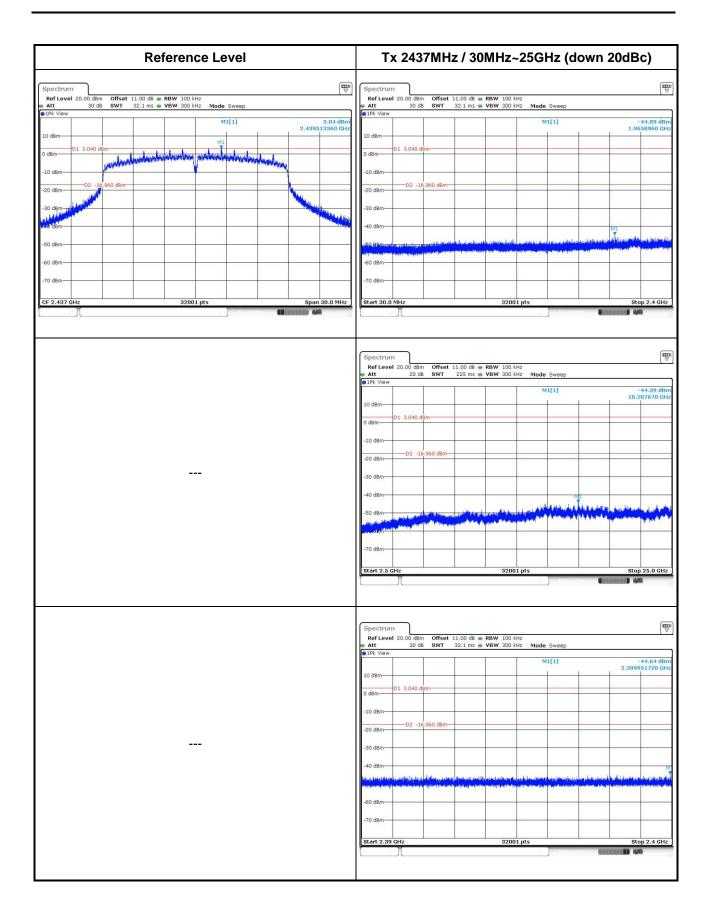


## 802.11n HT20



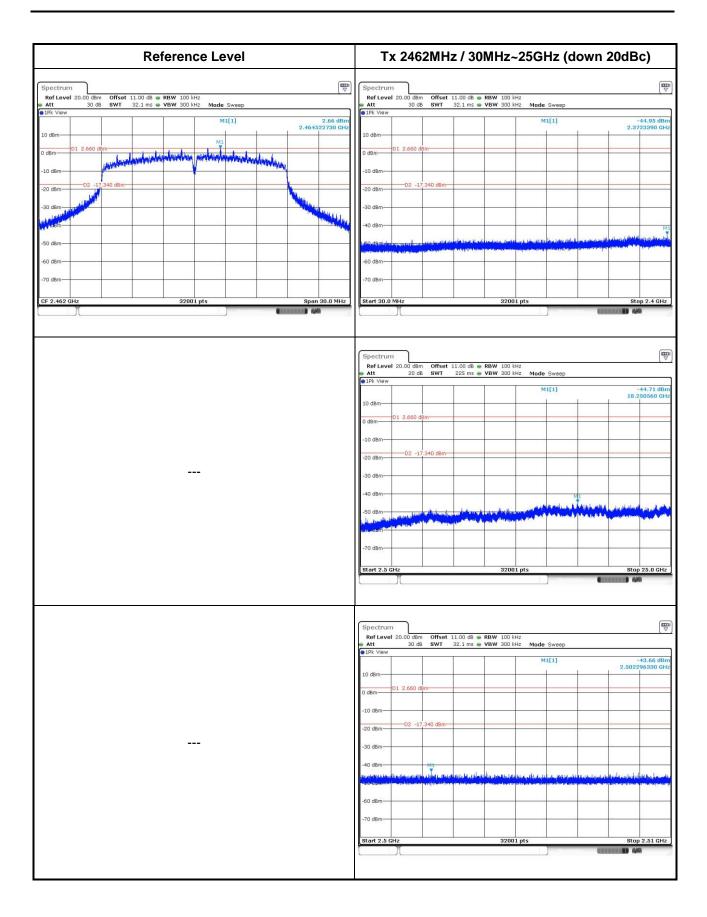
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# 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <a href="http://www.icertifi.com.tw">http://www.icertifi.com.tw</a>.

#### Linkou

Tel: 886-2-2601-1640 No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City,

Taiwan, R.O.C.

#### Kwei Shan

Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

### Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

==END==

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