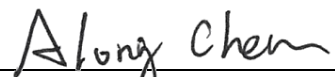


FCC Test Report

FCC ID : SQG-60SIPT
Equipment : 802.11 ac/a/b/g/n + Bluetooth 4.2 module
(please refer to section 1.1.1 for more details.)
Model No. : ST60-SIPT
(please refer to section 1.1.1 for more details.)
Brand Name : Laird Technologies
Applicant : Laird Technologies
Address : W66N220 Commerce Court, Cedarburg,
Wisconsin 53012, USA
Standard : 47 CFR FCC Part 15.247
Received Date : Apr. 07, 2017
Tested Date : Apr. 12 ~ May 10, 2017

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:


Along Chen / Assistant Manager

Approved by:

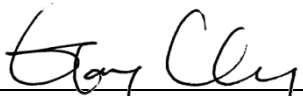

Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR740701AC	Rev. 01	Initial issue	Jul. 13, 2017
FR740701AC	Rev. 02	Revised model name	Jul. 21, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 4.476MHz 49.97(Margin -6.03dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2483.50MHz 53.88 (Margin -0.12dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 29.41	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

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description	
Laird Technologies	ST60-SIPT	802.11 ac/a/b/g/n + Bluetooth 4.2 module	SIPT only	For marketing purpose
	SU60-SIPT			
	ST60-2230C	802.11 ac/a/b/g/n M.2 2230 + Bluetooth 4.2 module	with carrier board	
	SU60-2230C			
✦ The above models, model ST60-2230C was selected as a representative one for the final test and only its data was recorded in this report.				

1.1.2 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 _{TX})	Data Rate / MCS
2400-2483.5	b	2412-2462	1-11 [11]	1	1-11 Mbps
				2	1-11 Mbps
2400-2483.5	g	2412-2462	1-11 [11]	1	6-54 Mbps
				2	6-54 Mbps
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	1	MCS 0~7
				2	MCS 0~7
				2	MCS 8~15
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	1	MCS 0~7
				2	MCS 0~7
				2	MCS 8~15
Note 1: RF output power specifies that Maximum Peak Conducted Output Power. 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. Note 4: The device supports TX antenna diversity function. The conducted power of single chain is same for 1TX and 2TX operating mode. Therefore, Ant1 + Ant 2 configuration is chosen for final testing.					

1.1.3 Antenna Details

Ant. No.	Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)				
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
1	LSR/001-0009	Dipole	IPEX U.FL	2	2	2	2	2
2	Laird NanoBlade-IP04	PCB Dipole	IPEX U.FL	2	3.9	3.9	4	4
3	Laird MAF95310 Mini NanoBlade Flex	PCB Dipole	IPEX U.FL	2.79	3.38	3.38	3.38	3.38
4	LSR/FlexPIFA 001-0016	PIFA	IPEX U.FL	2.5	3	3	3	3
5	Ethertronics WLAN_1000146	Isolated Magnetic Dipole	IPEX U.FL	2.5	3.5	3.5	3.5	3.5

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	DC 3.3V from host
-------------------	-------------------

1.1.5 Accessories

N/A

1.1.6 Channel List

Frequency band (MHz)		2400~2483.5	
802.11 b / g / n HT20		802.11n HT40	
Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	3	2422
2	2417	4	2427
3	2422	5	2432
4	2427	6	2437
5	2432	7	2442
6	2437	8	2447
7	2442	9	2452
8	2447	---	---
9	2452	---	---
10	2457	---	---
11	2462	---	---

1.1.7 Test Tool and Duty Cycle

Test Tool	DutApiMimoBT, Version: 1.0.0.133		
Duty Cycle and Duty Factor	Mode	Duty cycle (%)	Duty factor (dB)
	11b	100.00%	0.00
	11g	100.00%	0.00
	HT20	100.00%	0.00
	HT40	100.00%	0.00

1.1.8 Power Setting

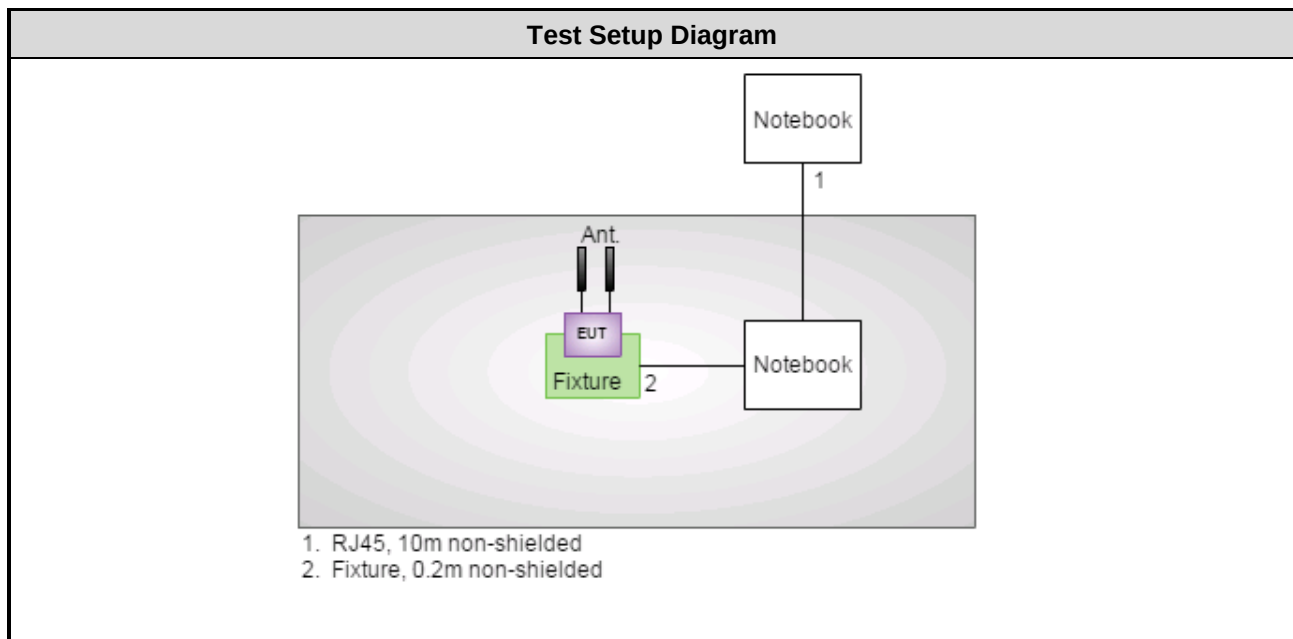
Modulation Mode	Test Frequency (MHz)	Power Set
11b	2412	19
11b	2437	19
11b	2462	18
11g	2412	17
11g	2437	19
11g	2462	15
HT20	2412	16
HT20	2437	19
HT20	2462	13
HT40	2422	14
HT40	2437	17
HT40	2452	12

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E5420	DoC	RJ45, 10m non-shielded
2	Notebook	Lenovo	T430	DoC	---
3	50 Ω terminator	---	---	---	---
4	Fixture	---	---	---	Fixture, 0.2m non-shielded

Note: No2. & No. 4 were provided by applicant.

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	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	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)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	Agilent	N9010A	MY53400091	Sep. 09, 2016	Sep. 08, 2017
Receiver	Agilent	N9038A	MY53290044	Oct. 06, 2016	Oct. 05, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Aug. 04, 2016	Aug. 03, 2017
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 9170517	Oct. 25, 2016	Oct. 24, 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. 08, 2016	Sep. 07, 2017
Preamplifier	Agilent	83017A	MY53270014	Aug. 22, 2016	Aug. 21, 2017
Preamplifier	EMC	EMC184045B	980192	Aug. 24, 2016	Aug. 23, 2017
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-3000	131103	Feb. 04, 2017	Feb. 03, 2018
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 04, 2017	Feb. 03, 2018
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
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. 06, 2016	Oct. 05, 2017
Power Sensor	Anritsu	MA2411B	1207366	Oct. 06, 2016	Oct. 05, 2017
DC POWER SOURCE	GW INSTEK	GPC-6030D	EM892433	Oct. 20, 2016	Oct. 19, 2017
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed 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

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

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

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	20°C / 57%	Alex Tsai
Radiated Emissions	03CH03-WS	22-24°C / 66-67%	Aska Huang
RF Conducted	TH01-WS	22°C / 64%	Brad Wu

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- IC site registration No.: 10807C-1

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	11g	2437	6 Mbps	2
Radiated Emissions ≤1GHz	11g	2437	6 Mbps	1, 2, 3, 4
Radiated Emissions >1GHz	11b 11g HT20 HT40	2412 / 2437 / 2462 2412 / 2437 / 2462 2412 / 2437 / 2462 2422 / 2437 / 2452	1 Mbps 6 Mbps MCS 0 MCS 0	1, 2, 3, 4
Maximum Output Power 6dB bandwidth Power spectral density	11b 11g HT20 HT40	2412 / 2437 / 2462 2412 / 2437 / 2462 2412 / 2437 / 2462 2422 / 2437 / 2452	1 Mbps 6 Mbps MCS 0 MCS 0	2

NOTE:

1. 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.
2. The test configurations are listed as follows:
 - Configuration 1 : Dipole Antenna
 - Configuration 2 : PCB Dipole Antenna
 - Configuration 3 : PIFA Antenna
 - Configuration 4 : Isolated Magnetic Dipole Antenna

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

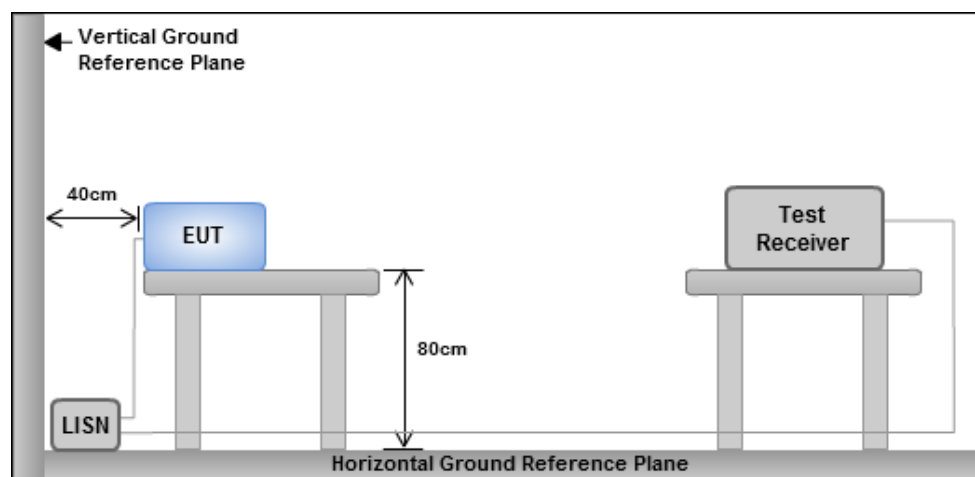
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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 Ω 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.

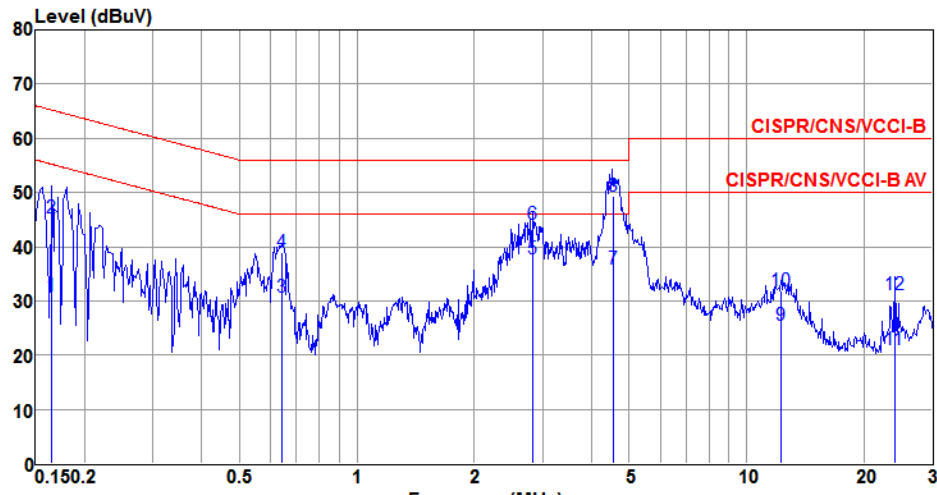
3.1.3 Test Setup



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

3.1.4 Test Result of Conducted Emissions

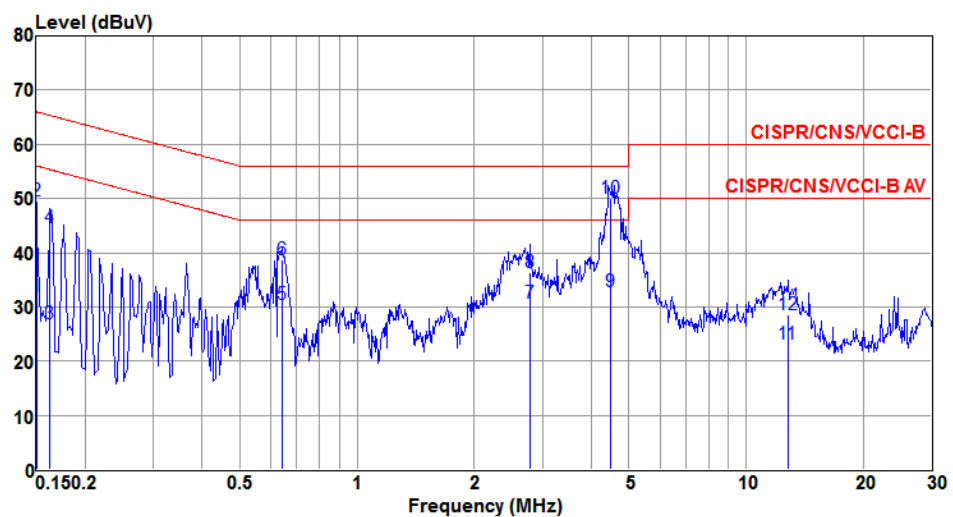
Modulation	11g	Test Freq. (MHz)	2437
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.165	30.83	55.21	-24.38	30.71	0.08	0.04	Average
2	0.165	45.39	65.21	-19.82	45.27	0.08	0.04	QP
3	0.641	30.58	46.00	-15.42	30.47	0.07	0.04	Average
4	0.641	38.95	56.00	-17.05	38.84	0.07	0.04	QP
5	2.824	37.72	46.00	-8.28	37.47	0.15	0.10	Average
6	2.824	44.06	56.00	-11.94	43.81	0.15	0.10	QP
7	4.556	35.98	46.00	-10.02	35.64	0.17	0.17	Average
8	4.556	49.35	56.00	-6.65	49.01	0.17	0.17	QP
9	12.253	25.43	50.00	-24.57	24.95	0.26	0.22	Average
10	12.253	31.82	60.00	-28.18	31.34	0.26	0.22	QP
11	24.015	20.90	50.00	-29.10	20.20	0.42	0.28	Average
12	24.015	31.07	60.00	-28.93	30.37	0.42	0.28	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation	11g	Test Freq. (MHz)	2437
Power Phase	Neutral		



The graph displays the measured level in dBuV against frequency in MHz. The y-axis ranges from 0 to 80 dBuV, and the x-axis ranges from 0.15 to 30 MHz. Two red limit lines are shown: CISPR/CNS/VCCI-B (upper) and CISPR/CNS/VCCI-B AV (lower). The blue line represents the measured spectrum, with several peaks labeled with numbers 1 through 12. Peak 10 is the highest, reaching approximately 50 dBuV at 4.476 MHz.

	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.150	31.90	56.00	-24.10	31.76	0.10	0.04	Average
2	0.150	49.64	66.00	-16.36	49.50	0.10	0.04	QP
3	0.162	27.02	55.34	-28.32	26.88	0.10	0.04	Average
4	0.162	44.69	65.34	-20.65	44.55	0.10	0.04	QP
5	0.641	30.47	46.00	-15.53	30.32	0.11	0.04	Average
6	0.641	38.81	56.00	-17.19	38.66	0.11	0.04	QP
7	2.779	30.72	46.00	-15.28	30.47	0.15	0.10	Average
8	2.779	36.39	56.00	-19.61	36.14	0.15	0.10	QP
9	4.476	32.92	46.00	-13.08	32.59	0.16	0.17	Average
10	4.476	49.97	56.00	-6.03	49.64	0.16	0.17	QP
11	12.784	23.11	50.00	-26.89	22.53	0.35	0.23	Average
12	12.784	28.67	60.00	-31.33	28.09	0.35	0.23	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

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

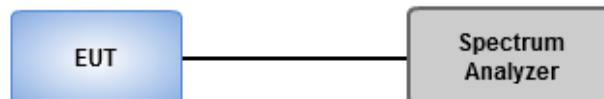
6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. 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.

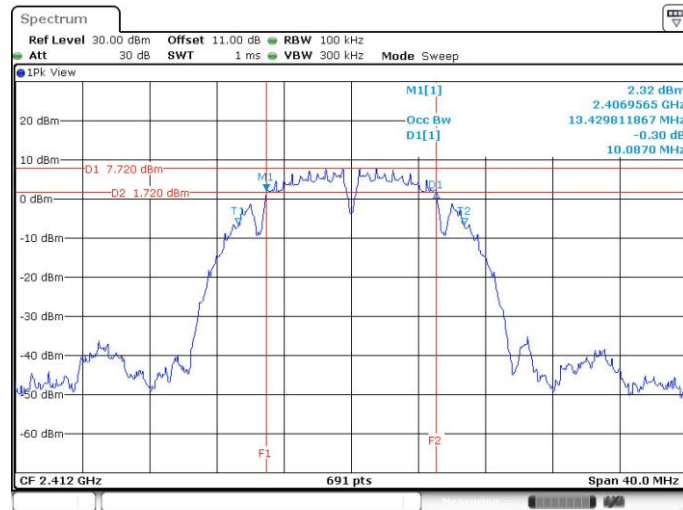
3.2.3 Test Setup



3.2.4 Test Result of 6dB and Occupied Bandwidth

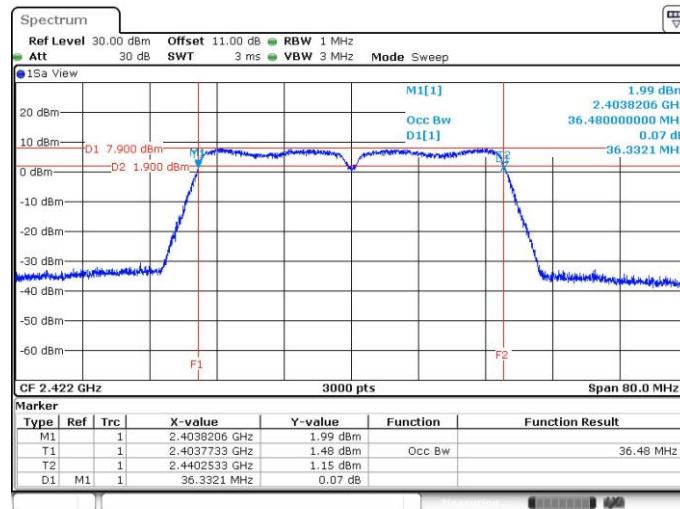
Modulation Mode	N _{TX}	Freq. (MHz)	6dB Bandwidth (MHz)				Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
11b	2	2412	10.09	10.09	---	---	500
11b	2	2437	10.09	10.09	---	---	500
11b	2	2462	10.09	10.09	---	---	500
11g	2	2412	16.58	16.58	---	---	500
11g	2	2437	16.58	16.58	---	---	500
11g	2	2462	16.58	16.58	---	---	500
HT20	2	2412	17.68	17.62	---	---	500
HT20	2	2437	17.74	17.62	---	---	500
HT20	2	2462	17.68	17.68	---	---	500
HT40	2	2422	36.41	36.41	---	---	500
HT40	2	2437	36.41	36.41	---	---	500
HT40	2	2452	36.41	36.41	---	---	500

Worst Plot



Modulation Mode	N _{TX}	Freq. (MHz)	99% Occupied Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
11b	2	2412	13.48	13.48	---	---
11b	2	2437	13.45	13.48	---	---
11b	2	2462	13.48	13.49	---	---
11g	2	2412	16.80	16.73	---	---
11g	2	2437	16.92	16.81	---	---
11g	2	2462	16.80	16.73	---	---
HT20	2	2412	17.69	17.67	---	---
HT20	2	2437	17.72	17.68	---	---
HT20	2	2462	17.68	17.65	---	---
HT40	2	2422	36.48	36.37	---	---
HT40	2	2437	36.45	36.37	---	---
HT40	2	2452	36.43	36.37	---	---

Worst Plot



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

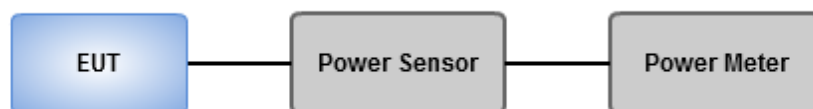
- ☒ Antenna gain $\leq 6\text{dBi}$, no any corresponding reduction is in output power limit.
- ☐ Antenna gain $> 6\text{dBi}$
 - ☐ Non Fixed, point to point operations.
The conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna 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
 - ☐ **Spectrum analyzer**
 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.
 - ☒ **Power meter**
 1. 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)
 - ☒ **Power meter**
 1. 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



3.3.4 Test Result of Maximum Output Power

Modulation Mode	N _{TX}	Freq. (MHz)	Peak conducted Output Power (dBm)							Ant. Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)
			Chain 0	Chain 1	Chain 2	Chain 3	Total Power (mW)	Total Power (dBm)	Limit (dBm)			
11b	2	2412	20.96	20.61	---	---	239.818	23.80	30.00	2.79	26.59	36.00
11b	2	2437	20.81	20.85	---	---	242.122	23.84	30.00	2.79	26.63	36.00
11b	2	2462	19.95	19.84	---	---	195.238	22.91	30.00	2.79	25.70	36.00
11g	2	2412	25.05	25.06	---	---	640.516	28.07	30.00	2.79	30.86	36.00
11g	2	2437	26.47	26.32	---	---	872.157	29.41	30.00	2.79	32.20	36.00
11g	2	2462	24.21	24.48	---	---	544.177	27.36	30.00	2.79	30.15	36.00
HT20	2	2412	24.69	24.61	---	---	583.510	27.66	30.00	2.79	30.45	36.00
HT20	2	2437	26.19	26.22	---	---	834.704	29.22	30.00	2.79	32.01	36.00
HT20	2	2462	21.68	21.62	---	---	292.442	24.66	30.00	2.79	27.45	36.00
HT40	2	2422	22.2	21.94	---	---	322.273	25.08	30.00	2.79	27.87	36.00
HT40	2	2437	24.65	24.89	---	---	600.061	27.78	30.00	2.79	30.57	36.00
HT40	2	2452	20.07	19.84	---	---	198.008	22.97	30.00	2.79	25.76	36.00

Modulation Mode	N _{TX}	Freq. (MHz)	Conducted (Average) Output Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)
			Chain 0	Chain 1	Chain 2	Chain 3			
11b	2	2412	18.44	18.06	---	---	133.797	21.26	---
11b	2	2437	18.24	18.26	---	---	133.669	21.26	---
11b	2	2462	17.41	17.34	---	---	109.281	20.39	---
11g	2	2412	16.48	16.49	---	---	89.029	19.50	---
11g	2	2437	18.29	18.22	---	---	133.827	21.27	---
11g	2	2462	14.43	14.58	---	---	56.441	17.52	---
HT20	2	2412	15.66	15.64	---	---	73.457	18.66	---
HT20	2	2437	18.38	18.41	---	---	138.208	21.41	---
HT20	2	2462	12.76	12.72	---	---	37.587	15.75	---
HT40	2	2422	13.72	13.56	---	---	46.249	16.65	---
HT40	2	2437	16.42	16.44	---	---	87.909	19.44	---
HT40	2	2452	11.71	11.64	---	---	29.413	14.69	---

Note: Conducted average output power is for reference only.

3.4 Power Spectral Density

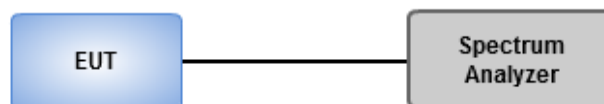
3.4.1 Limit of Power Spectral Density

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.
 1. Set the RBW = 3kHz, VBW = 10kHz.
 2. 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.
 1. Set the RBW = 100kHz, VBW = 300 kHz.
 2. Detector = RMS, Sweep time = auto couple.
 3. Set the sweep time to: $\geq 10 \times (\text{number of measurement points in sweep}) \times (\text{maximum data rate per stream})$.
 4. Perform the measurement over a single sweep.
 5. Use the peak marker function to determine the maximum amplitude level.

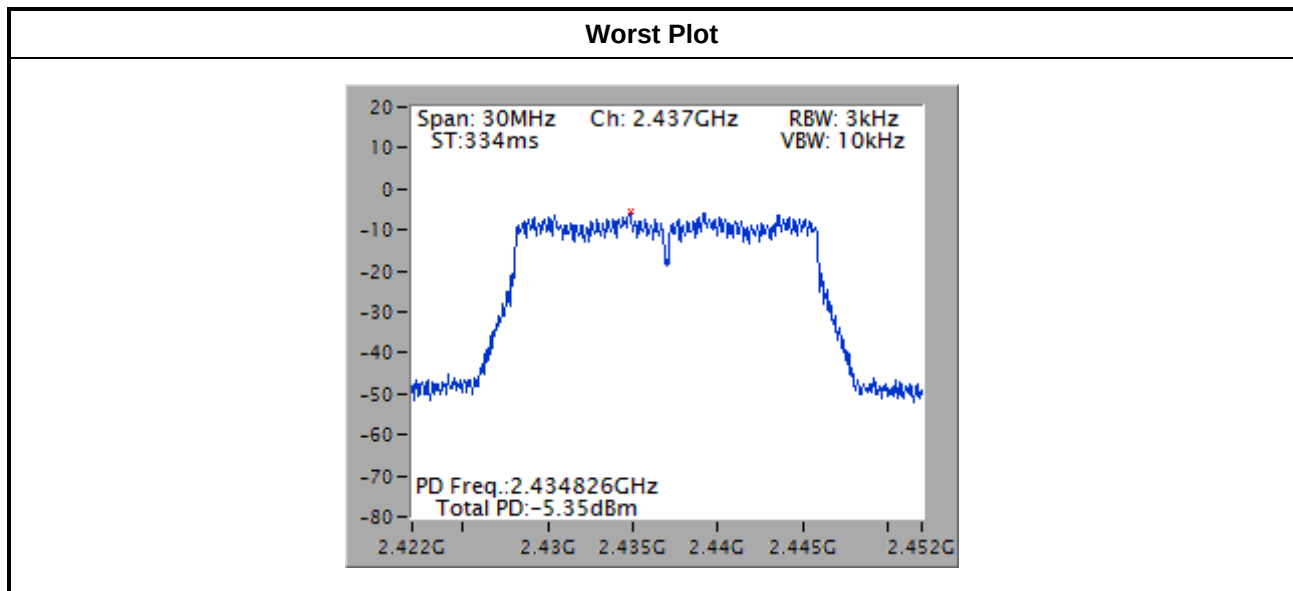
3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Modulation Mode	N _{TX}	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
11b	2	2412	-7.36	8.00
11b	2	2437	-7.38	8.00
11b	2	2462	-8.27	8.00
11g	2	2412	-7.28	8.00
11g	2	2437	-5.43	8.00
11g	2	2462	-9.40	8.00
HT20	2	2412	-8.30	8.00
HT20	2	2437	-5.35	8.00
HT20	2	2462	-11.32	8.00
HT40	2	2422	-11.85	8.00
HT40	2	2437	-9.86	8.00
HT40	2	2452	-14.48	8.00

Note: Test result is bin-by-bin summing measured value of each TX port.



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:
Quasi-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

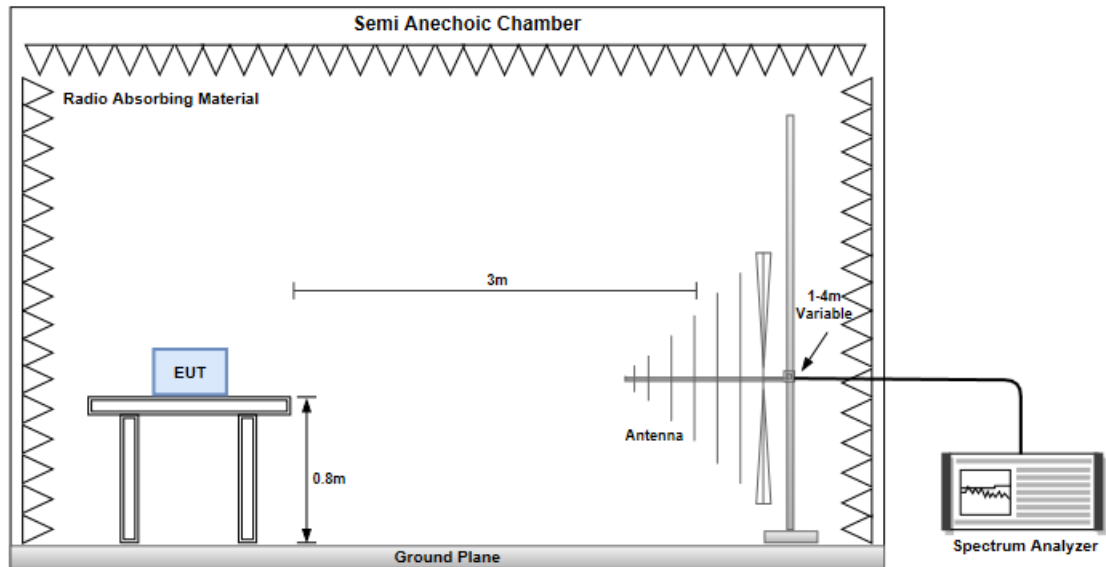
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:

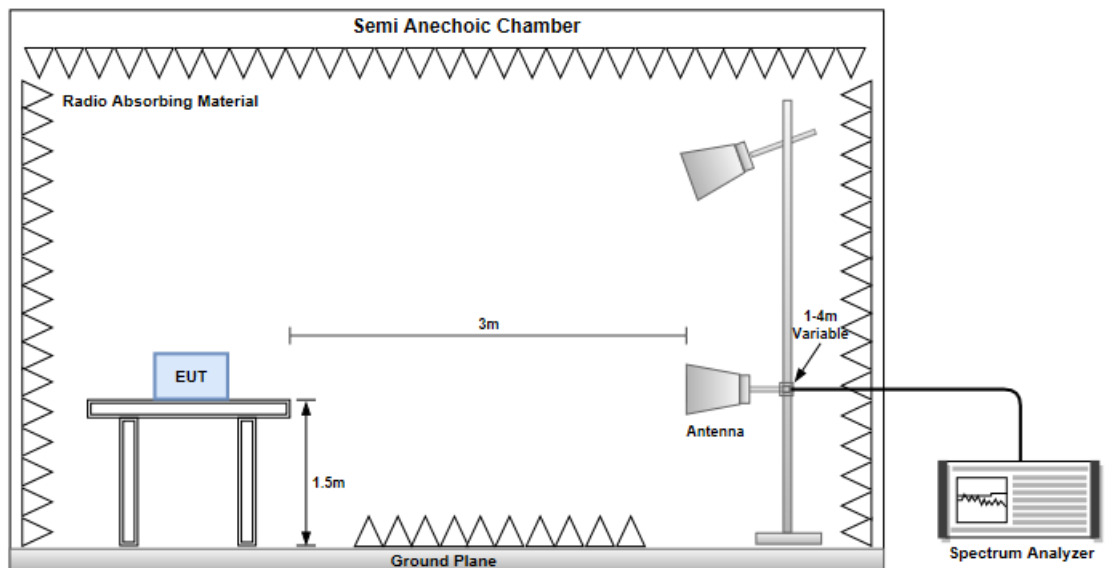
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz

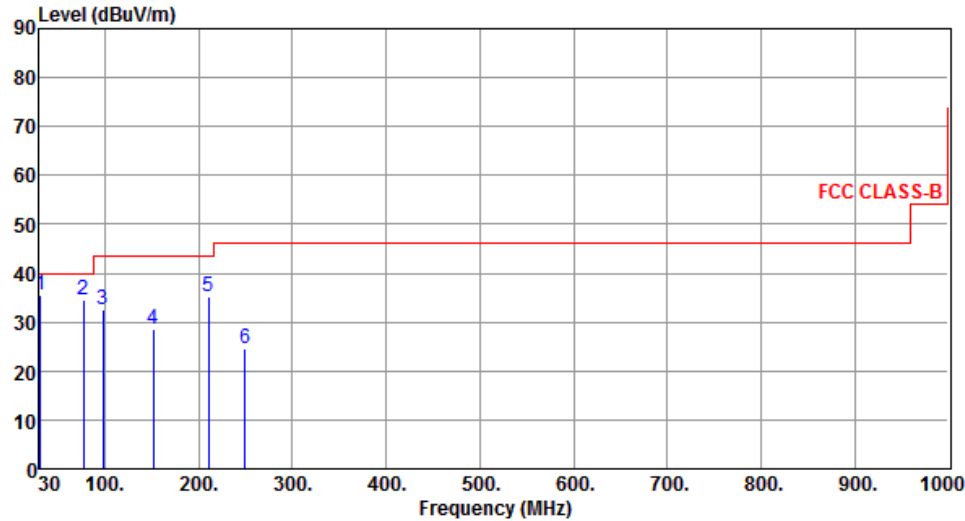


Configuration 1 : Dipole Antenna

3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

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

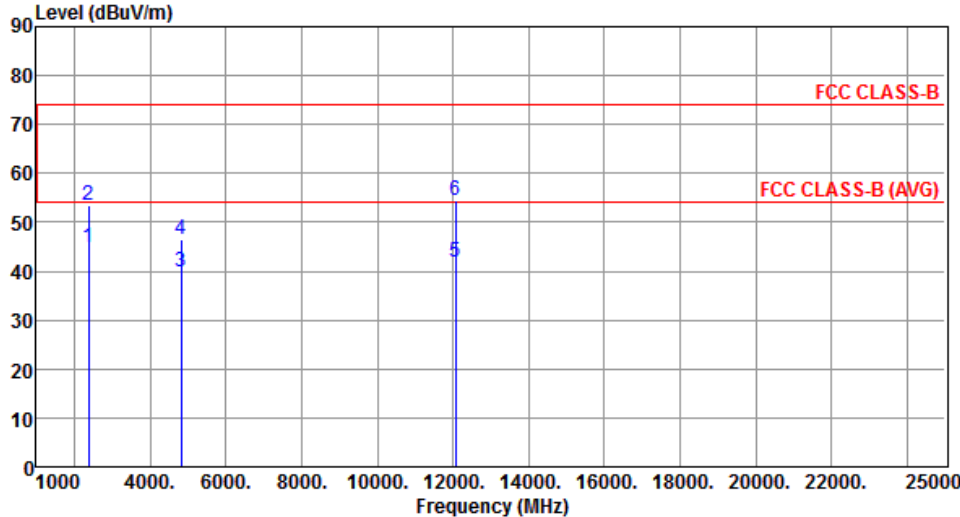


	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.96	35.42	40.00	-4.58	44.76	-9.34	Peak	---	---
2	77.42	34.53	40.00	-5.47	47.16	-12.63	Peak	---	---
3	97.56	32.48	43.50	-11.02	46.29	-13.81	Peak	---	---
4	151.37	28.55	43.50	-14.95	37.05	-8.50	Peak	---	---
5	210.37	35.12	43.50	-8.38	46.40	-11.28	Peak	---	---
6	249.36	24.55	46.00	-21.45	34.17	-9.62	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.

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	44.69	54.00	-9.31	46.81	-2.12	Average	100	340
2	2390.00	53.60	74.00	-20.40	55.72	-2.12	Peak	100	340
3	4824.00	39.99	54.00	-14.01	35.51	4.48	Average	136	304
4	4824.00	46.38	74.00	-27.62	41.90	4.48	Peak	136	304
5	12060.00	41.97	54.00	-12.03	28.31	13.66	Average	100	188
6	12060.00	54.35	74.00	-19.65	40.69	13.66	Peak	100	188

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).

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11b	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBUV/m)			

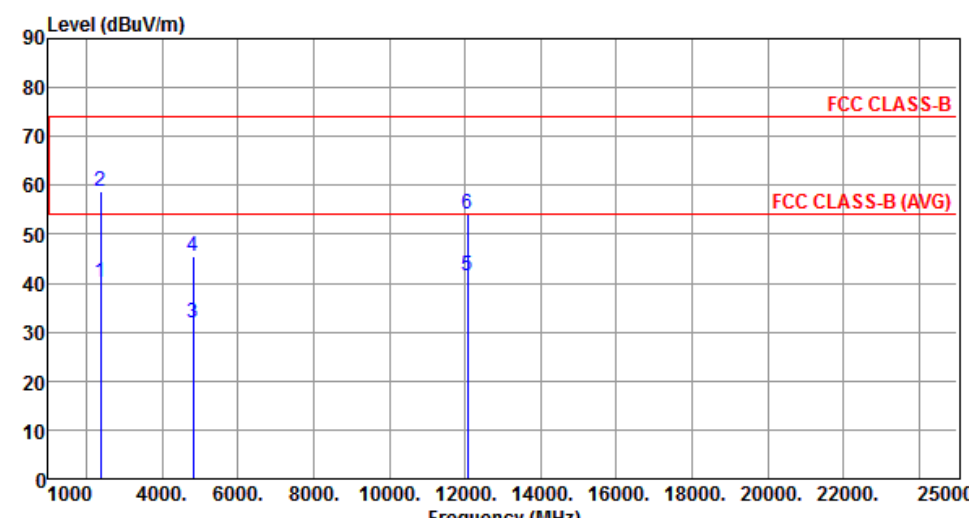
Modulation	11b	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) <			

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

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Horizontal		

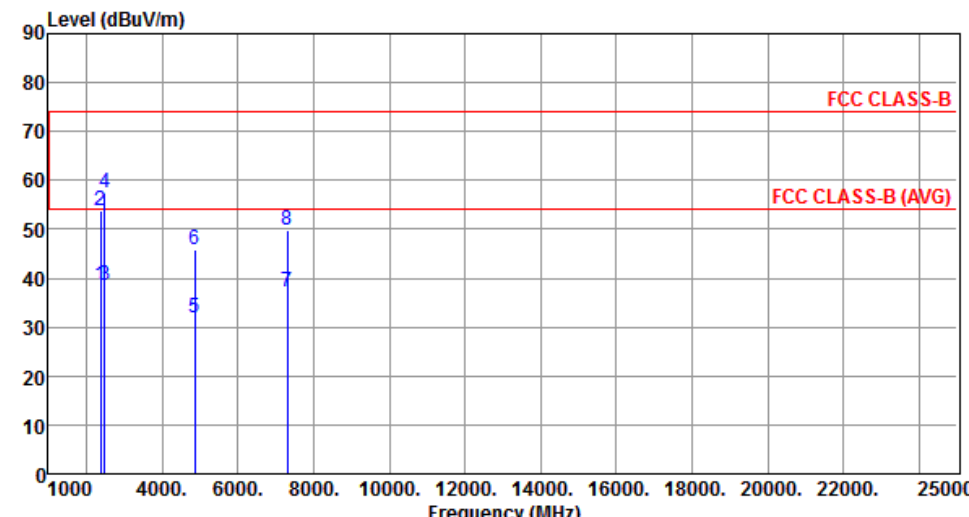


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	40.15	54.00	-13.85	42.27	-2.12	Average	100	338
2	2390.00	58.85	74.00	-15.15	60.97	-2.12	Peak	100	338
3	4824.00	31.72	54.00	-22.28	27.24	4.48	Average	103	311
4	4824.00	45.57	74.00	-28.43	41.09	4.48	Peak	103	311
5	12060.00	41.65	54.00	-12.35	27.99	13.66	Average	100	196
6	12060.00	54.08	74.00	-19.92	40.42	13.66	Peak	100	196

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).

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m) </			

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



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	38.47	54.00	-15.53	40.59	-2.12	Average	100	339
2	2390.00	53.64	74.00	-20.36	55.76	-2.12	Peak	100	339
3	2483.50	38.65	54.00	-15.35	40.42	-1.77	Average	100	339
4	2483.50	57.35	74.00	-16.65	59.12	-1.77	Peak	100	339
5	4874.00	31.93	54.00	-22.07	27.35	4.58	Average	116	304
6	4874.00	45.87	74.00	-28.13	41.29	4.58	Peak	116	304
7	7311.00	37.19	54.00	-16.81	28.06	9.13	Average	100	325
8	7311.00	49.78	74.00	-24.22	40.65	9.13	Peak	100	325

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).

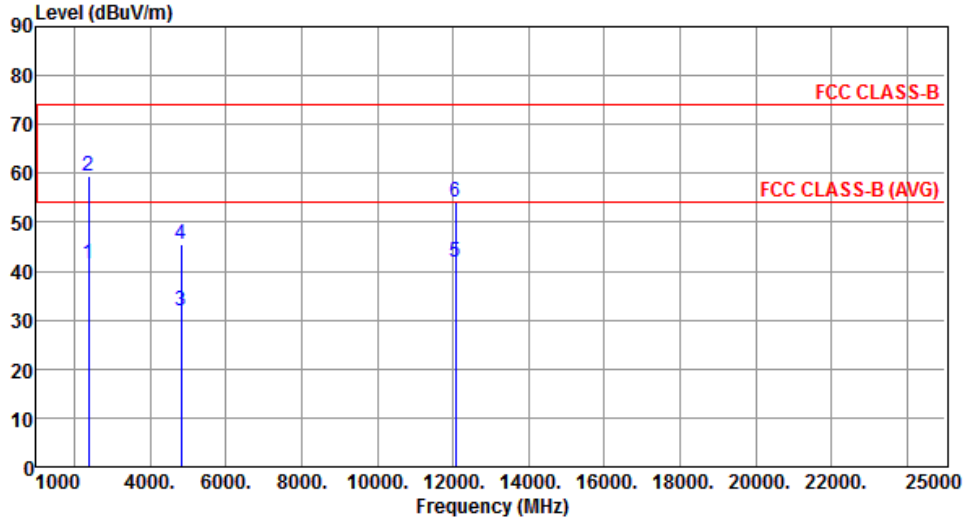
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

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

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	41.44	54.00	-12.56	43.56	-2.12	Average	100	340
2	2390.00	59.59	74.00	-14.41	61.71	-2.12	Peak	100	340
3	4824.00	31.86	54.00	-22.14	27.38	4.48	Average	100	319
4	4824.00	45.63	74.00	-28.37	41.15	4.48	Peak	100	319
5	12060.00	41.77	54.00	-12.23	28.11	13.66	Average	100	213
6	12060.00	54.20	74.00	-19.80	40.54	13.66	Peak	100	213

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).

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m)			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

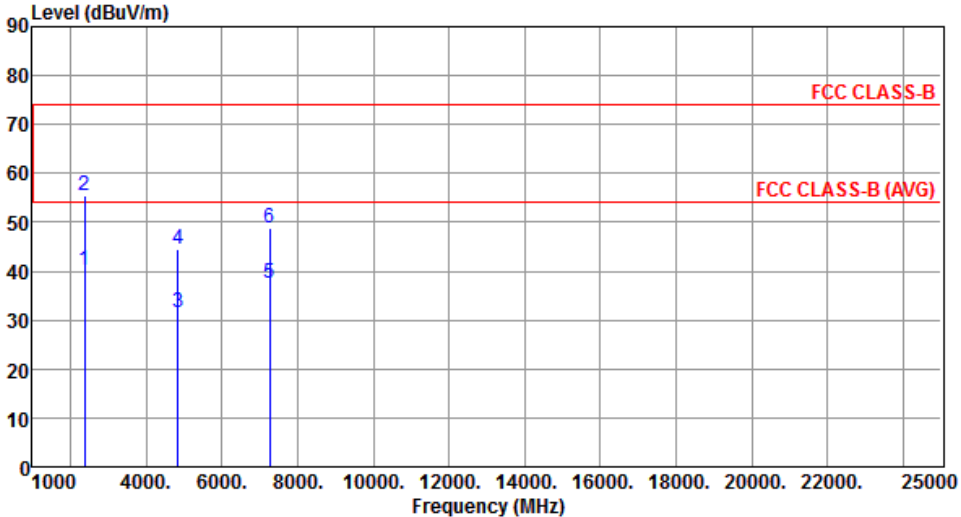
Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBuV/m)			

3.5.8 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		



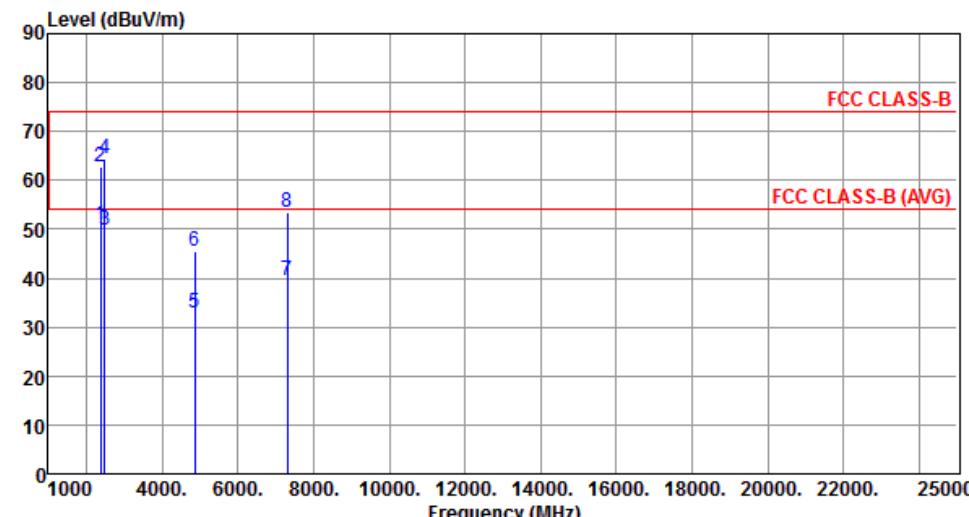
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	40.25	54.00	-13.75	42.37	-2.12	Average	100	339
2	2390.00	55.60	74.00	-18.40	57.72	-2.12	Peak	100	339
3	4844.00	31.56	54.00	-22.44	27.05	4.51	Average	104	298
4	4844.00	44.59	74.00	-29.41	40.08	4.51	Peak	104	298
5	7266.00	37.53	54.00	-16.47	28.56	8.97	Average	100	201
6	7266.00	48.83	74.00	-25.17	39.86	8.97	Peak	100	201

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).

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		
Level (dBUV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	50.74	54.00	-3.26	52.86	-2.12	Average	379	357
2	2390.00	62.69	74.00	-11.31	64.81	-2.12	Peak	379	357
3	2483.50	49.94	54.00	-4.06	51.71	-1.77	Average	379	357
4	2483.50	64.32	74.00	-9.68	66.09	-1.77	Peak	379	357
5	4874.00	32.84	54.00	-21.16	28.26	4.58	Average	100	52
6	4874.00	45.66	74.00	-28.34	41.08	4.58	Peak	100	52
7	7311.00	39.41	54.00	-14.59	30.28	9.13	Average	167	29
8	7311.00	53.35	74.00	-20.65	44.22	9.13	Peak	167	29

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).

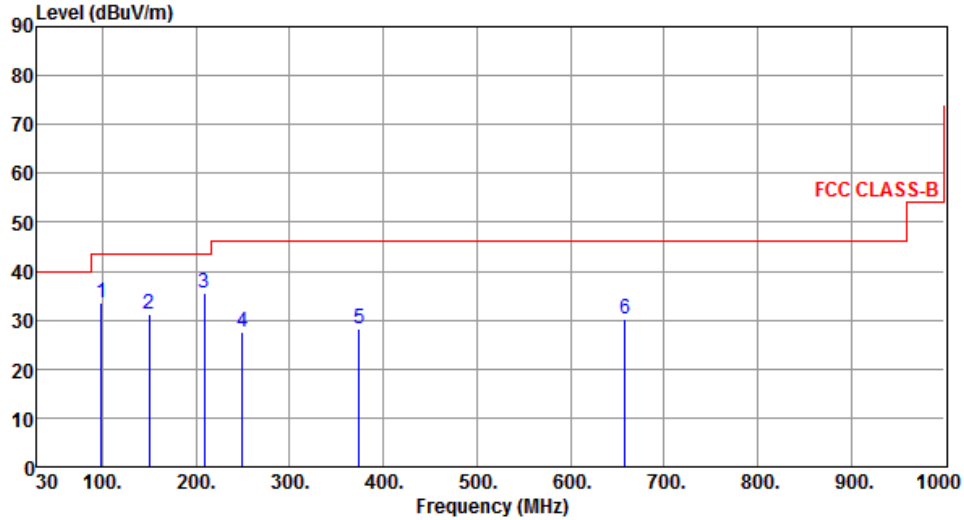
Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		
Level (dBuV/m) <			

Configuration 2 : PCB Dipole Antenna

3.5.9 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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



The graph displays the radiated unwanted emissions for a PCB Dipole Antenna. The y-axis represents the Level in dBUV/m, ranging from 0 to 90. The x-axis represents the Frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBUV/m from 30 MHz to 100 MHz, 45 dBUV/m from 100 MHz to 1000 MHz, and 55 dBUV/m from 1000 MHz to 10000 MHz. Six measured peaks are labeled with numbers 1 through 6, corresponding to the data in the table below.

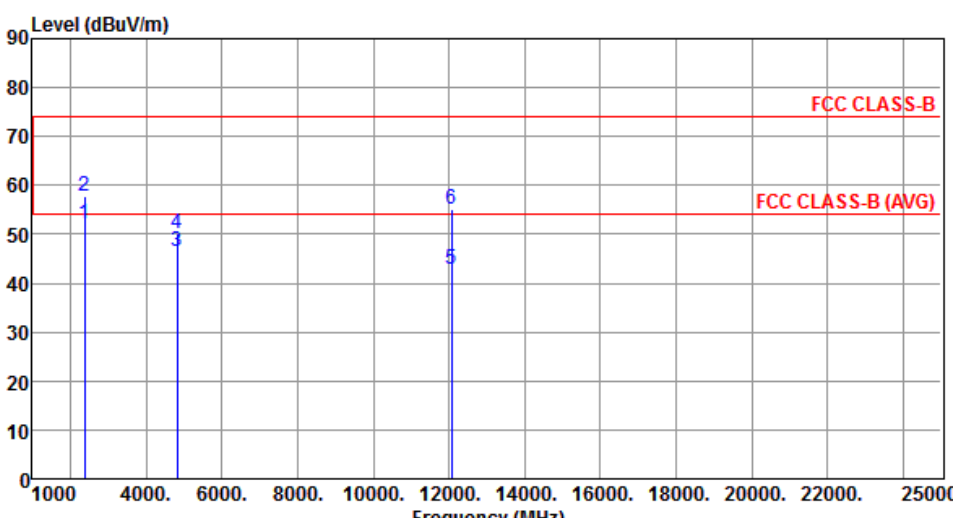
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.75	33.52	43.50	-9.98	47.20	-13.68	Peak	---	---
2	149.46	31.24	43.50	-12.26	39.78	-8.54	Peak	---	---
3	208.66	35.52	43.50	-7.98	46.81	-11.29	Peak	---	---
4	249.47	27.55	46.00	-18.45	37.17	-9.62	Peak	---	---
5	374.42	28.28	46.00	-17.72	34.20	-5.92	Peak	---	---
6	658.41	30.38	46.00	-15.62	30.47	-0.09	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.

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	51.99	54.00	-2.01	54.11	-2.12	Average	280	350
2	2390.00	57.84	74.00	-16.16	59.96	-2.12	Peak	280	350
3	4824.00	46.62	54.00	-7.38	42.14	4.48	Average	101	308
4	4824.00	50.25	74.00	-23.75	45.77	4.48	Peak	101	308
5	12060.00	43.00	54.00	-11.00	29.34	13.66	Average	100	165
6	12060.00	55.10	74.00	-18.90	41.44	13.66	Peak	100	165

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).

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m) </			

Modulation	11b	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBUV/m)			

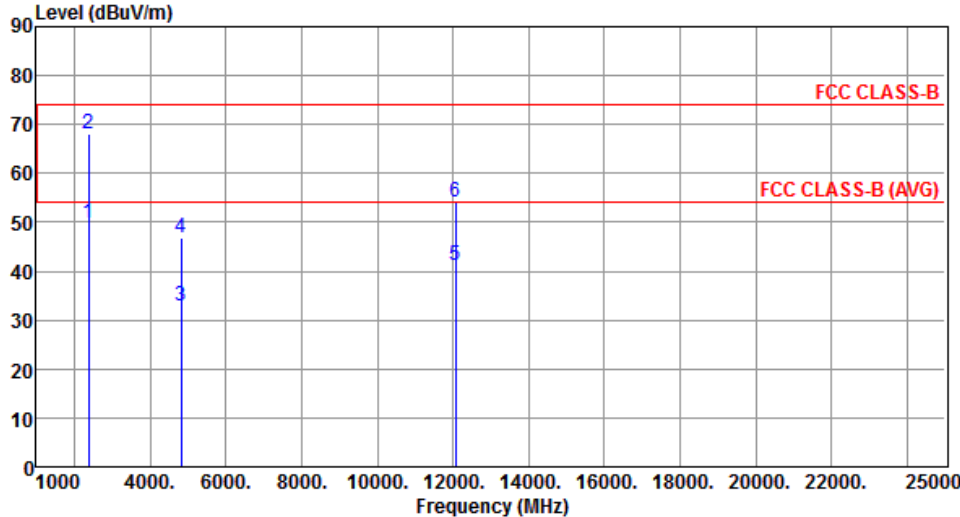
Modulation	11b	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m) <			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBuV/m) <			

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

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Horizontal		

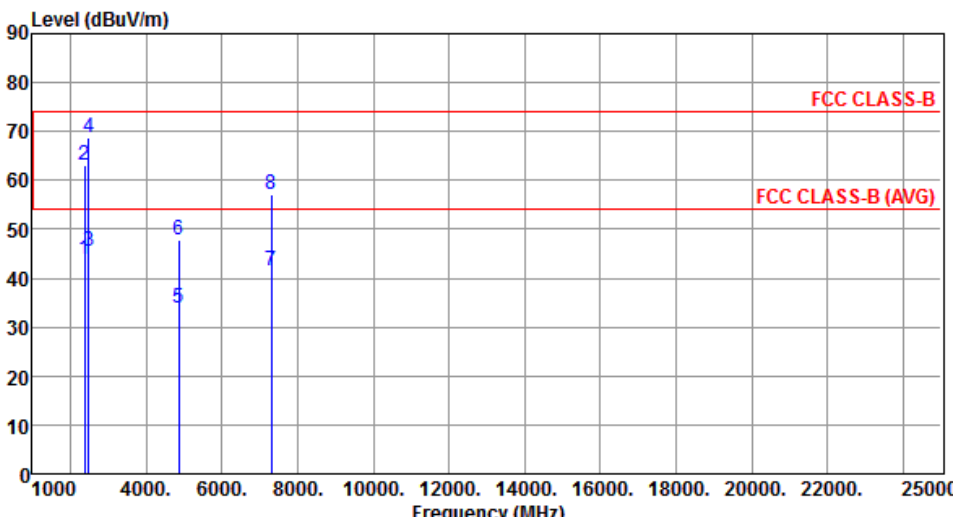


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	49.80	54.00	-4.20	51.92	-2.12	Average	380	0
2	2390.00	68.10	74.00	-5.90	70.22	-2.12	Peak	380	0
3	4824.00	32.81	54.00	-21.19	28.33	4.48	Average	108	175
4	4824.00	46.77	74.00	-27.23	42.29	4.48	Peak	108	175
5	12060.00	41.31	54.00	-12.69	27.65	13.66	Average	100	161
6	12060.00	54.05	74.00	-19.95	40.39	13.66	Peak	100	161

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).

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m) </			

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	43.82	54.00	-10.18	45.94	-2.12	Average	246	8
2	2390.00	62.97	74.00	-11.03	65.09	-2.12	Peak	246	8
3	2483.50	45.34	54.00	-8.66	47.11	-1.77	Average	387	8
4	2483.50	68.88	74.00	-5.12	70.65	-1.77	Peak	387	8
5	4874.00	33.93	54.00	-20.07	29.35	4.58	Average	111	173
6	4874.00	47.84	74.00	-26.16	43.26	4.58	Peak	111	173
7	7311.00	41.39	54.00	-12.61	32.26	9.13	Average	114	149
8	7311.00	57.18	74.00	-16.82	48.05	9.13	Peak	114	149

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).

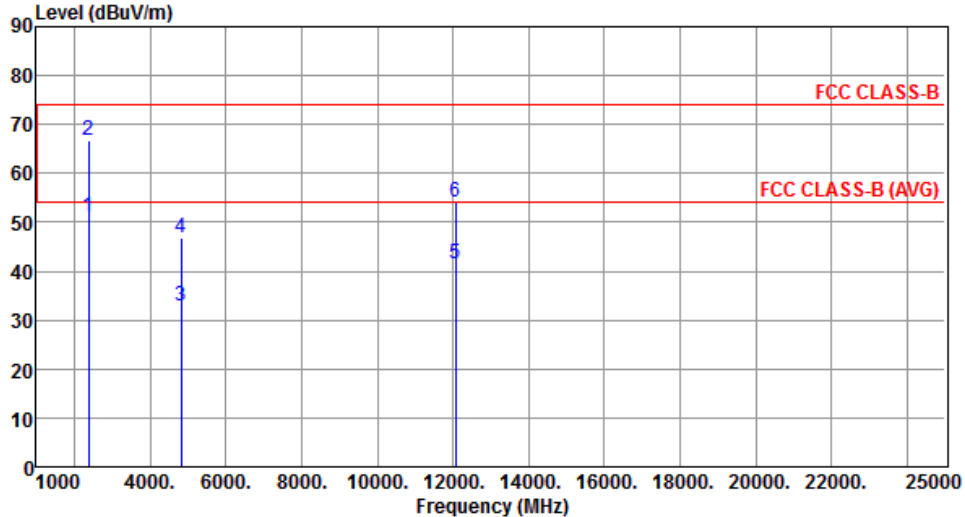
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m) <			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m)			

3.5.12 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	50.99	54.00	-3.01	53.11	-2.12	Average	384	356
2	2390.00	66.66	74.00	-7.34	68.78	-2.12	Peak	384	356
3	4824.00	32.94	54.00	-21.06	28.46	4.48	Average	106	171
4	4824.00	46.85	74.00	-27.15	42.37	4.48	Peak	106	171
5	12060.00	41.39	54.00	-12.61	27.73	13.66	Average	100	168
6	12060.00	54.23	74.00	-19.77	40.57	13.66	Peak	100	168

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).

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m) </			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

Modulation	HT20		Test Freq. (MHz)		2462	
Polarization	Horizontal					
Level (dBUV/m)						

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBuV/m)			

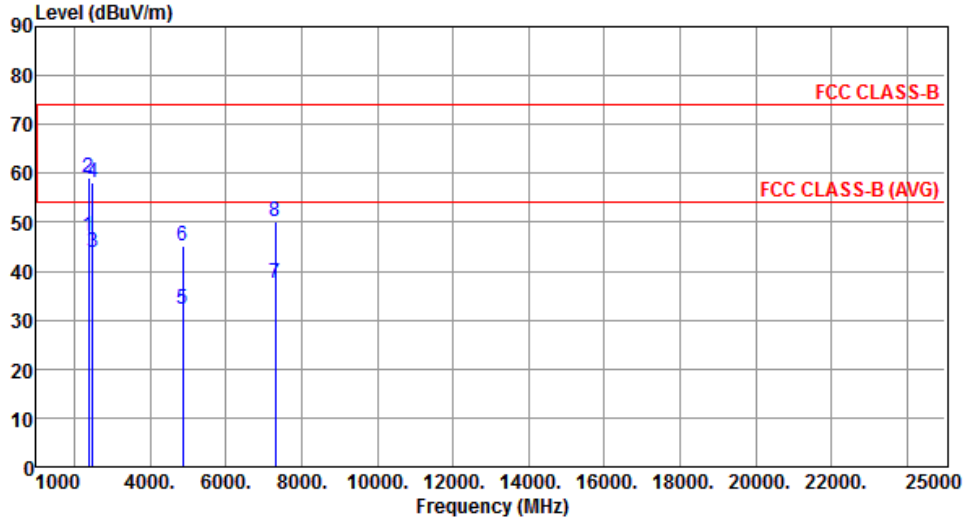
3.5.13 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	47.14	54.00	-6.86	49.26	-2.12	Average	100	220
2	2390.00	59.12	74.00	-14.88	61.24	-2.12	Peak	100	220
3	2483.50	43.68	54.00	-10.32	45.45	-1.77	Average	100	220
4	2483.50	58.07	74.00	-15.93	59.84	-1.77	Peak	100	220
5	4874.00	32.23	54.00	-21.77	27.65	4.58	Average	100	183
6	4874.00	45.26	74.00	-28.74	40.68	4.58	Peak	100	183
7	7311.00	37.68	54.00	-16.32	28.55	9.13	Average	100	216
8	7311.00	50.18	74.00	-23.82	41.05	9.13	Peak	100	216

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).

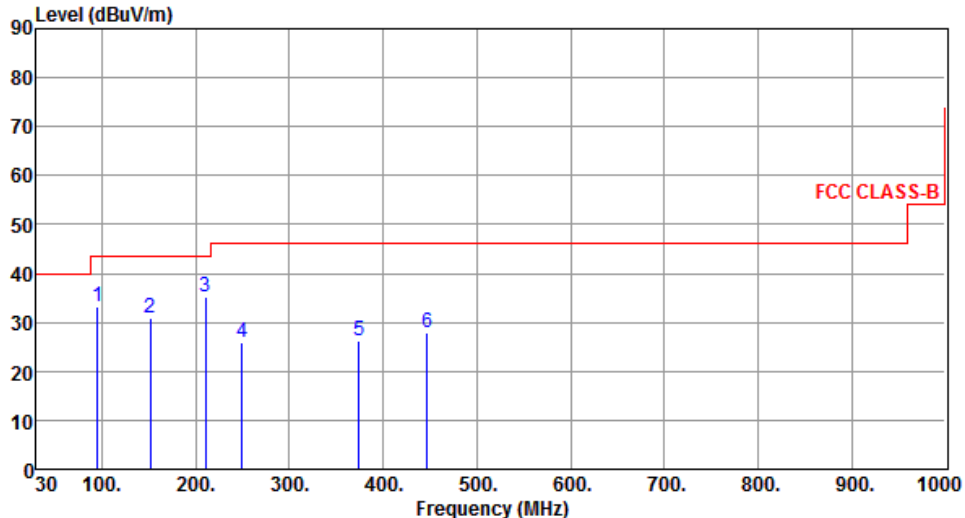
Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		
Level (dBUV/m)			

Configuration 3 : PIFA Antenna

3.5.14 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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



The graph displays the radiated unwanted emissions for a PIFA antenna. The y-axis represents the Level in dBuV/m, ranging from 0 to 90. The x-axis represents the Frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBuV/m from 30 MHz to 100 MHz, 45 dBuV/m from 100 MHz to 1000 MHz, and 55 dBuV/m from 1000 MHz to 1100 MHz. Six measured peaks are labeled with blue numbers 1 through 6, corresponding to the data in the table below.

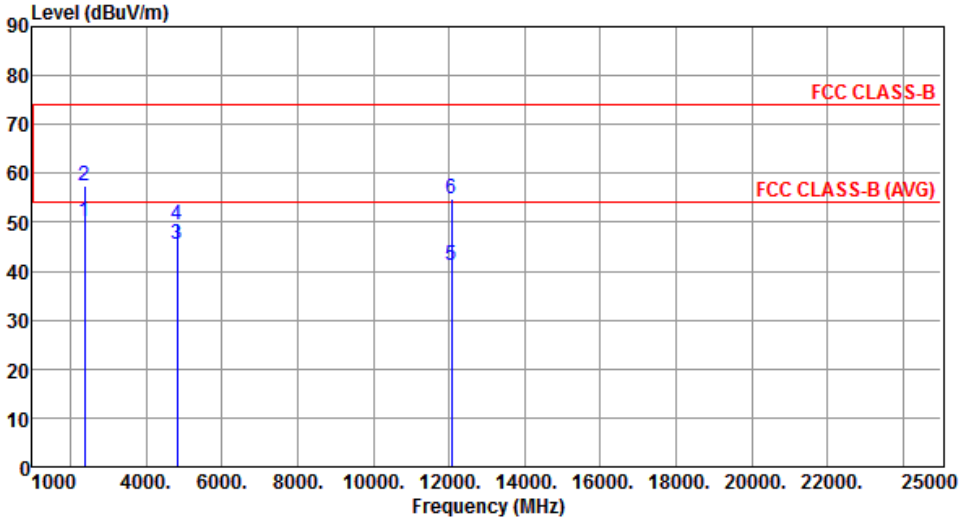
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	95.65	33.35	43.50	-10.15	47.38	-14.03	Peak	---	---
2	151.46	30.75	43.50	-12.75	39.25	-8.50	Peak	---	---
3	210.37	35.11	43.50	-8.39	46.39	-11.28	Peak	---	---
4	249.62	25.85	46.00	-20.15	35.47	-9.62	Peak	---	---
5	374.55	26.21	46.00	-19.79	32.13	-5.92	Peak	---	---
6	447.28	27.85	46.00	-18.15	31.78	-3.93	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.

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	50.20	54.00	-3.80	52.32	-2.12	Average	368	351
2	2390.00	57.57	74.00	-16.43	59.69	-2.12	Peak	368	351
3	4824.00	45.61	54.00	-8.39	41.13	4.48	Average	100	308
4	4824.00	49.60	74.00	-24.40	45.12	4.48	Peak	100	308
5	12060.00	41.12	54.00	-12.88	27.46	13.66	Average	100	326
6	12060.00	54.89	74.00	-19.11	41.23	13.66	Peak	100	326

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).

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11b	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

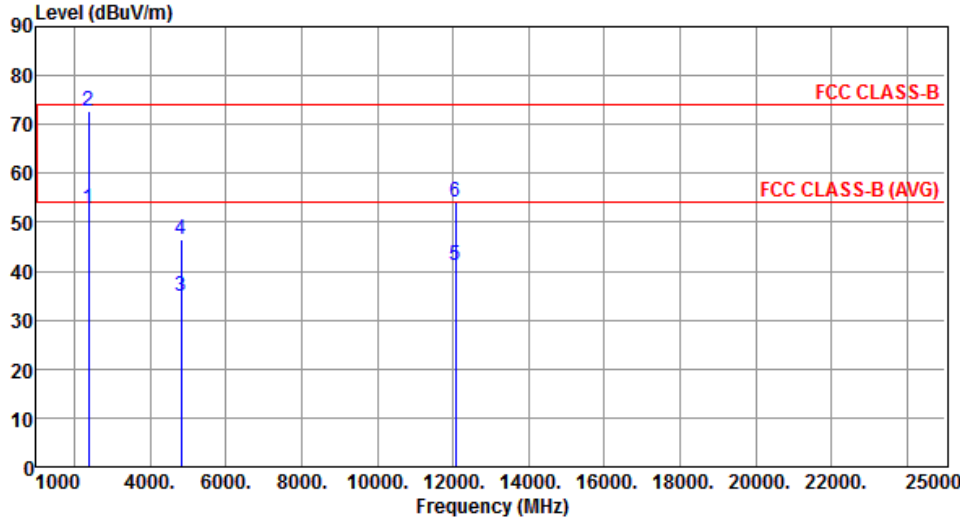
Modulation	11b	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

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

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	52.69	54.00	-1.31	54.81	-2.12	Average	211	19
2	2390.00	72.63	74.00	-1.37	74.75	-2.12	Peak	211	19
3	4824.00	34.79	54.00	-19.21	30.31	4.48	Average	100	315
4	4824.00	46.50	74.00	-27.50	42.02	4.48	Peak	100	315
5	12060.00	41.30	54.00	-12.70	27.64	13.66	Average	100	177
6	12060.00	54.21	74.00	-19.79	40.55	13.66	Peak	100	177

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).

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

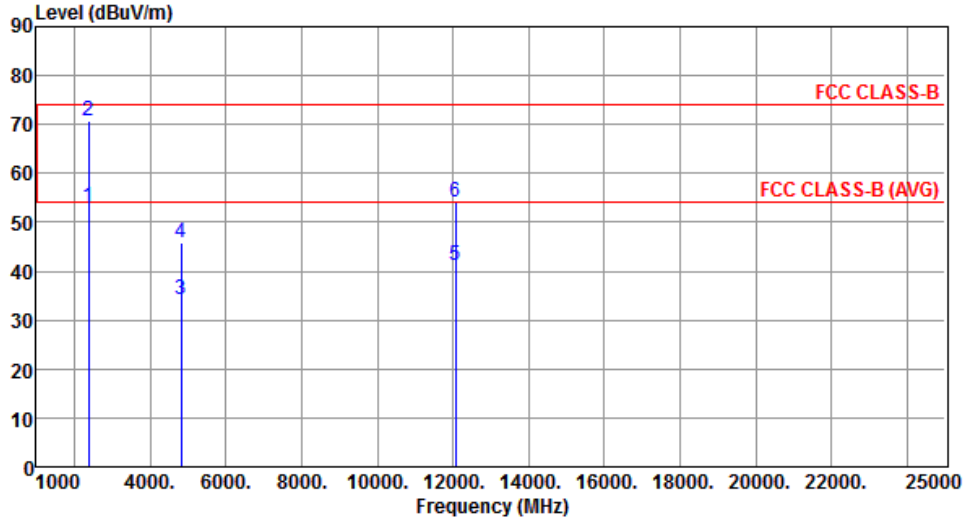
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

3.5.17 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	53.00	54.00	-1.00	55.12	-2.12	Average	211	19
2	2390.00	70.60	74.00	-3.40	72.72	-2.12	Peak	211	19
3	4824.00	34.16	54.00	-19.84	29.68	4.48	Average	100	312
4	4824.00	45.92	74.00	-28.08	41.44	4.48	Peak	100	312
5	12060.00	41.19	54.00	-12.81	27.53	13.66	Average	100	165
6	12060.00	54.08	74.00	-19.92	40.42	13.66	Peak	100	165

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).

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

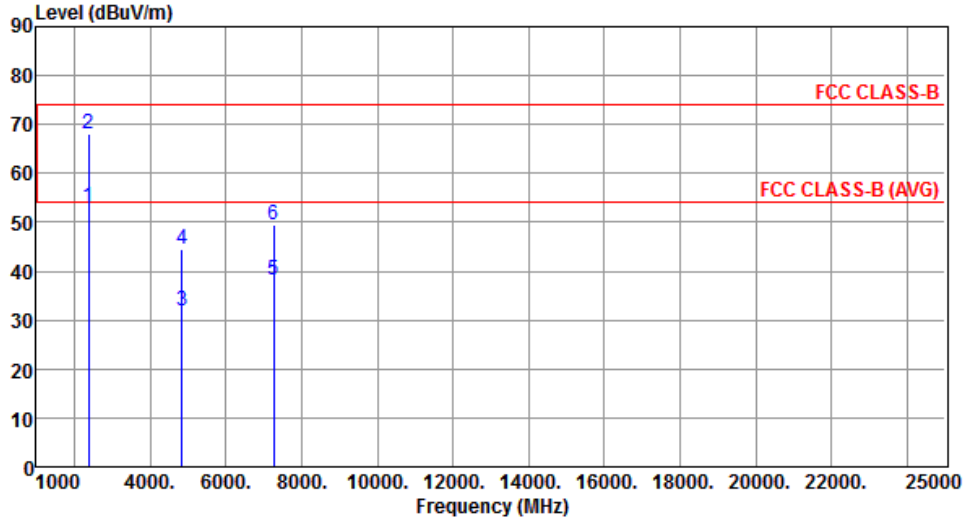
Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m) <			

Modulation	HT20		Test Freq. (MHz)		2462	
Polarization	Horizontal					
Level (dBUV/m)						

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBuV/m) </			

3.5.18 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	53.19	54.00	-0.81	55.31	-2.12	Average	215	23
2	2390.00	67.96	74.00	-6.04	70.08	-2.12	Peak	215	23
3	4844.00	31.78	54.00	-22.22	27.27	4.51	Average	100	312
4	4844.00	44.55	74.00	-29.45	40.04	4.51	Peak	100	312
5	7266.00	38.34	54.00	-15.66	29.37	8.97	Average	100	9
6	7266.00	49.46	74.00	-24.54	40.49	8.97	Peak	100	9

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).

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		
Level (dBuV/m)			

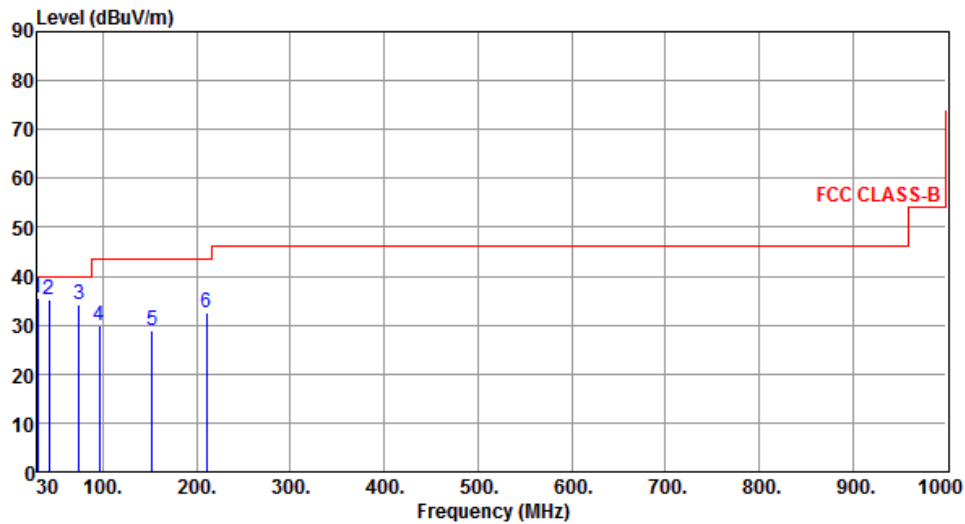
Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		
Level (dBUV/m)			

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.56	35.68	40.00	-4.32	45.04	-9.36	Peak	---	---
2	42.48	35.16	40.00	-4.84	43.64	-8.48	Peak	---	---
3	74.57	34.15	40.00	-5.85	46.15	-12.00	Peak	---	---
4	95.97	29.75	43.50	-13.75	43.74	-13.99	Peak	---	---
5	152.42	28.76	43.50	-14.74	37.24	-8.48	Peak	---	---
6	210.44	32.64	43.50	-10.86	43.92	-11.28	Peak	---	---

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

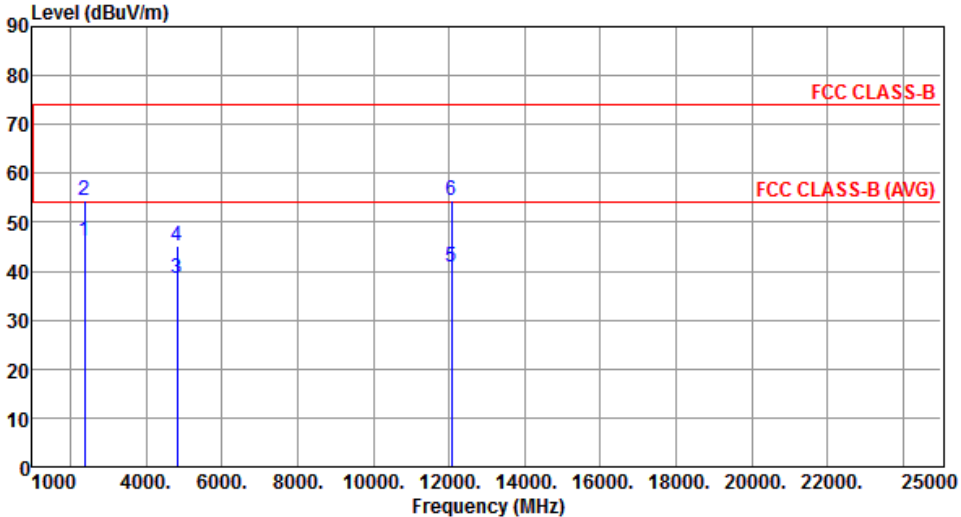
*Factor includes antenna factor , cable loss and amplifier gain

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.

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

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	46.23	54.00	-7.77	48.35	-2.12	Average	153	186
2	2390.00	54.54	74.00	-19.46	56.66	-2.12	Peak	153	186
3	4824.00	38.64	54.00	-15.36	34.16	4.48	Average	118	211
4	4824.00	45.01	74.00	-28.99	40.53	4.48	Peak	118	211
5	12060.00	40.73	54.00	-13.27	27.07	13.66	Average	100	112
6	12060.00	54.35	74.00	-19.65	40.69	13.66	Peak	100	112

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).

Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11b	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

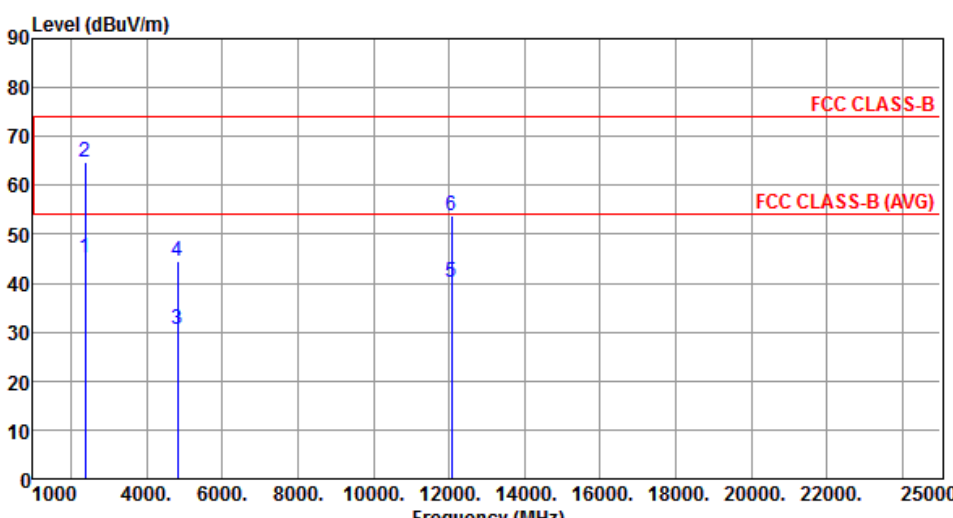
Modulation	11b	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	11b	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m)			

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

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	45.32	54.00	-8.68	47.44	-2.12	Average	216	171
2	2390.00	64.87	74.00	-9.13	66.99	-2.12	Peak	216	171
3	4824.00	30.55	54.00	-23.45	26.07	4.48	Average	118	210
4	4824.00	44.57	74.00	-29.43	40.09	4.48	Peak	118	210
5	12060.00	40.06	54.00	-13.94	26.40	13.66	Average	100	121
6	12060.00	53.78	74.00	-20.22	40.12	13.66	Peak	100	121

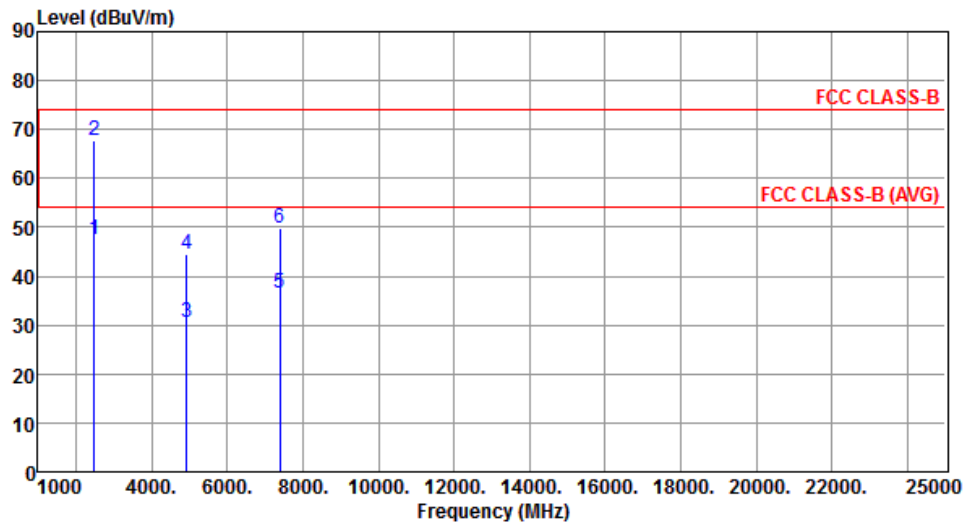
Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m)			

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	47.60	54.00	-6.40	49.37	-1.77	Average	207	170
2	2483.50	67.75	74.00	-6.25	69.52	-1.77	Peak	207	170
3	4924.00	30.62	54.00	-23.38	25.95	4.67	Average	110	206
4	4924.00	44.63	74.00	-29.37	39.96	4.67	Peak	110	206
5	7386.00	36.67	54.00	-17.33	27.27	9.40	Average	228	241
6	7386.00	49.83	74.00	-24.17	40.43	9.40	Peak	228	241

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

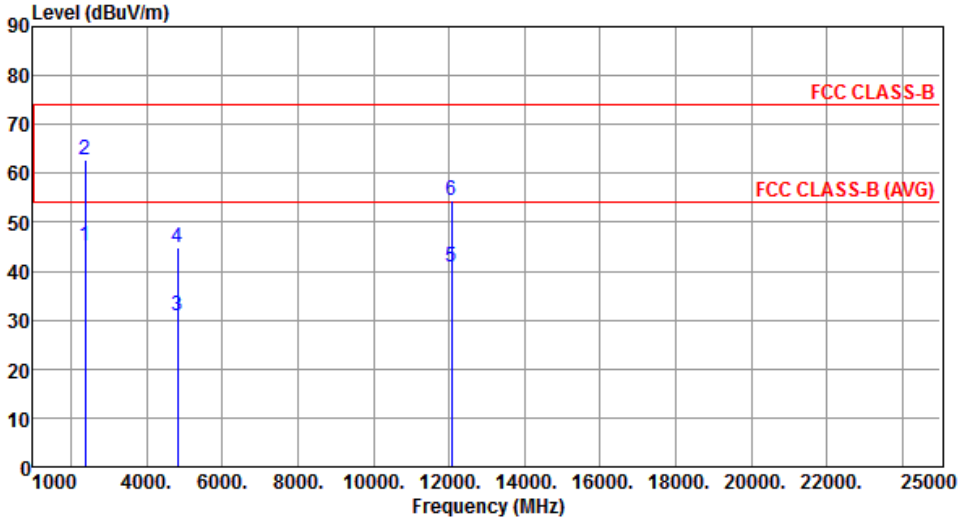
*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	11g	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) <			

3.5.22 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20

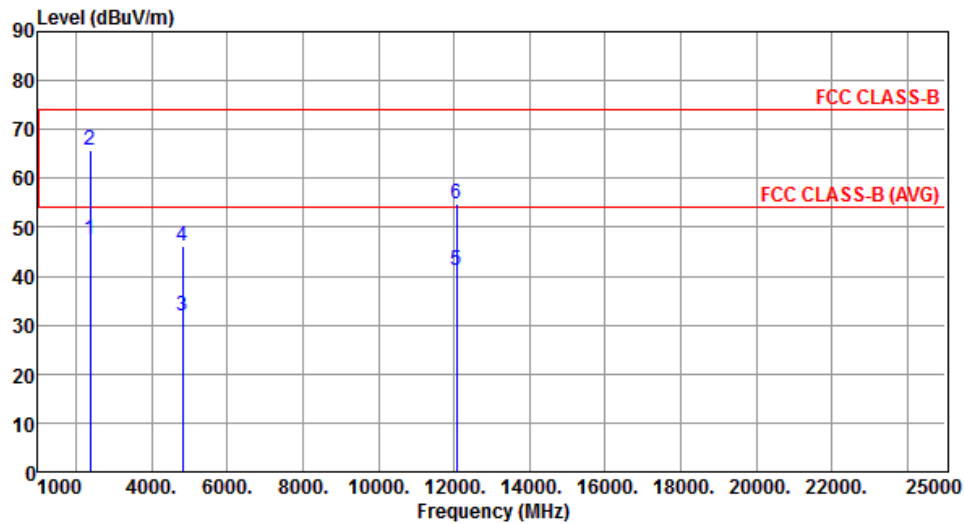
Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	45.28	54.00	-8.72	47.40	-2.12	Average	223	176
2	2390.00	62.75	74.00	-11.25	64.87	-2.12	Peak	223	176
3	4824.00	30.93	54.00	-23.07	26.45	4.48	Average	111	213
4	4824.00	44.95	74.00	-29.05	40.47	4.48	Peak	111	213
5	12060.00	40.93	54.00	-13.07	27.27	13.66	Average	100	128
6	12060.00	54.49	74.00	-19.51	40.83	13.66	Peak	100	128

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).

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	47.43	54.00	-6.57	49.55	-2.12	Average	211	260
2	2390.00	65.78	74.00	-8.22	67.90	-2.12	Peak	211	260
3	4824.00	31.87	54.00	-22.13	27.39	4.48	Average	104	185
4	4824.00	46.04	74.00	-27.96	41.56	4.48	Peak	104	185
5	12060.00	41.31	54.00	-12.69	27.65	13.66	Average	100	278
6	12060.00	54.80	74.00	-19.20	41.14	13.66	Peak	100	278

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

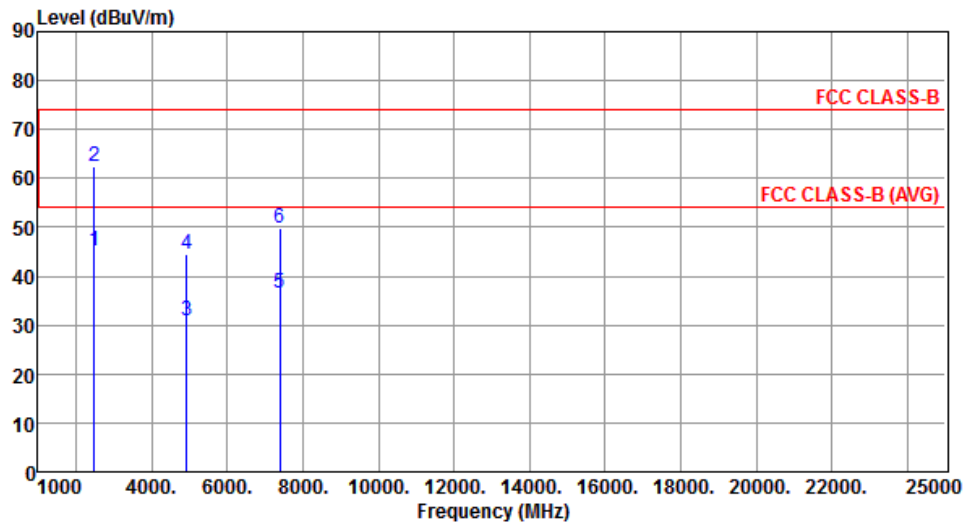
*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBUV/m) <			

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	45.14	54.00	-8.86	46.91	-1.77	Average	208	179
2	2483.50	62.56	74.00	-11.44	64.33	-1.77	Peak	208	179
3	4924.00	30.96	54.00	-23.04	26.29	4.67	Average	112	204
4	4924.00	44.55	74.00	-29.45	39.88	4.67	Peak	112	204
5	7386.00	36.52	54.00	-17.48	27.12	9.40	Average	221	236
6	7386.00	49.73	74.00	-24.27	40.33	9.40	Peak	221	236

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

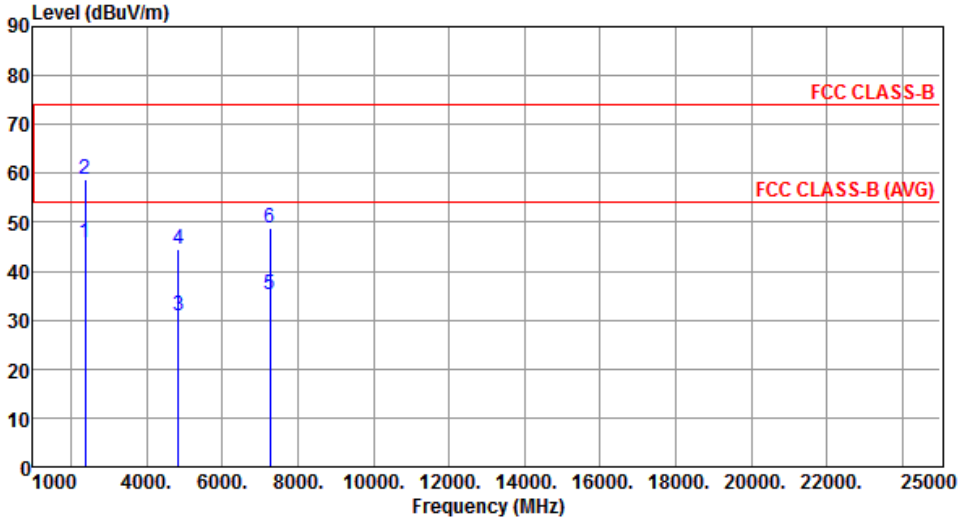
*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	HT20	Test Freq. (MHz)	2462
Polarization	Vertical		
Level (dBUV/m) </			

3.5.23 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40

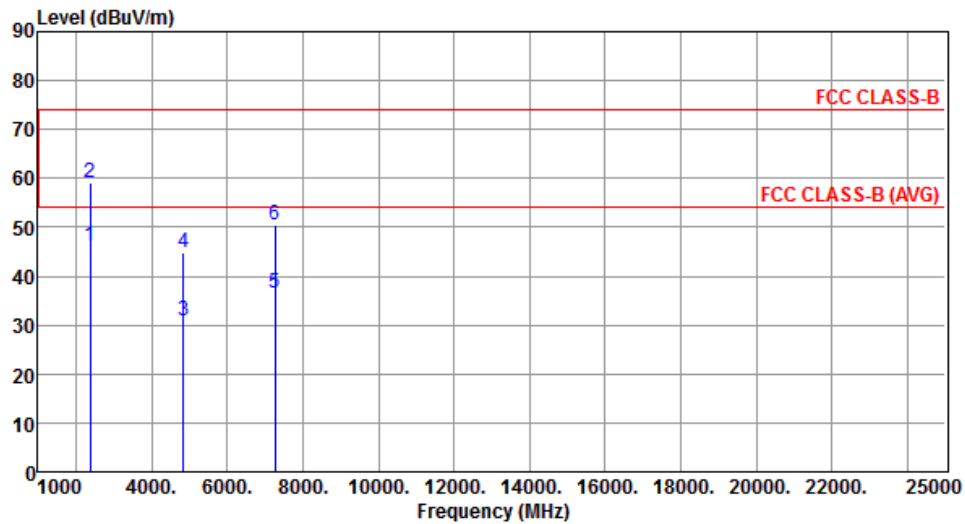
Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	45.79	54.00	-8.21	47.91	-2.12	Average	211	166
2	2390.00	58.79	74.00	-15.21	60.91	-2.12	Peak	211	166
3	4844.00	30.73	54.00	-23.27	26.22	4.51	Average	103	210
4	4844.00	44.57	74.00	-29.43	40.06	4.51	Peak	103	210
5	7266.00	35.15	54.00	-18.85	26.18	8.97	Average	219	240
6	7266.00	48.85	74.00	-25.15	39.88	8.97	Peak	219	240

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).

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Vertical		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	46.19	54.00	-7.81	48.31	-2.12	Average	214	269
2	2390.00	59.07	74.00	-14.93	61.19	-2.12	Peak	214	269
3	4844.00	30.78	54.00	-23.22	26.27	4.51	Average	106	181
4	4844.00	44.84	74.00	-29.16	40.33	4.51	Peak	106	181
5	7266.00	36.49	54.00	-17.51	27.52	8.97	Average	112	246
6	7266.00	50.39	74.00	-23.61	41.42	8.97	Peak	112	246

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).

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Horizontal		
Level (dBuV/m) </			

Modulation	HT40	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) </			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		
Level (dBUV/m) </			

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

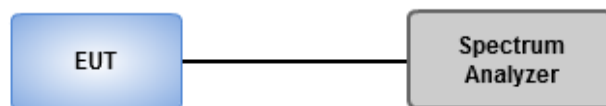
Reference level measurement

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

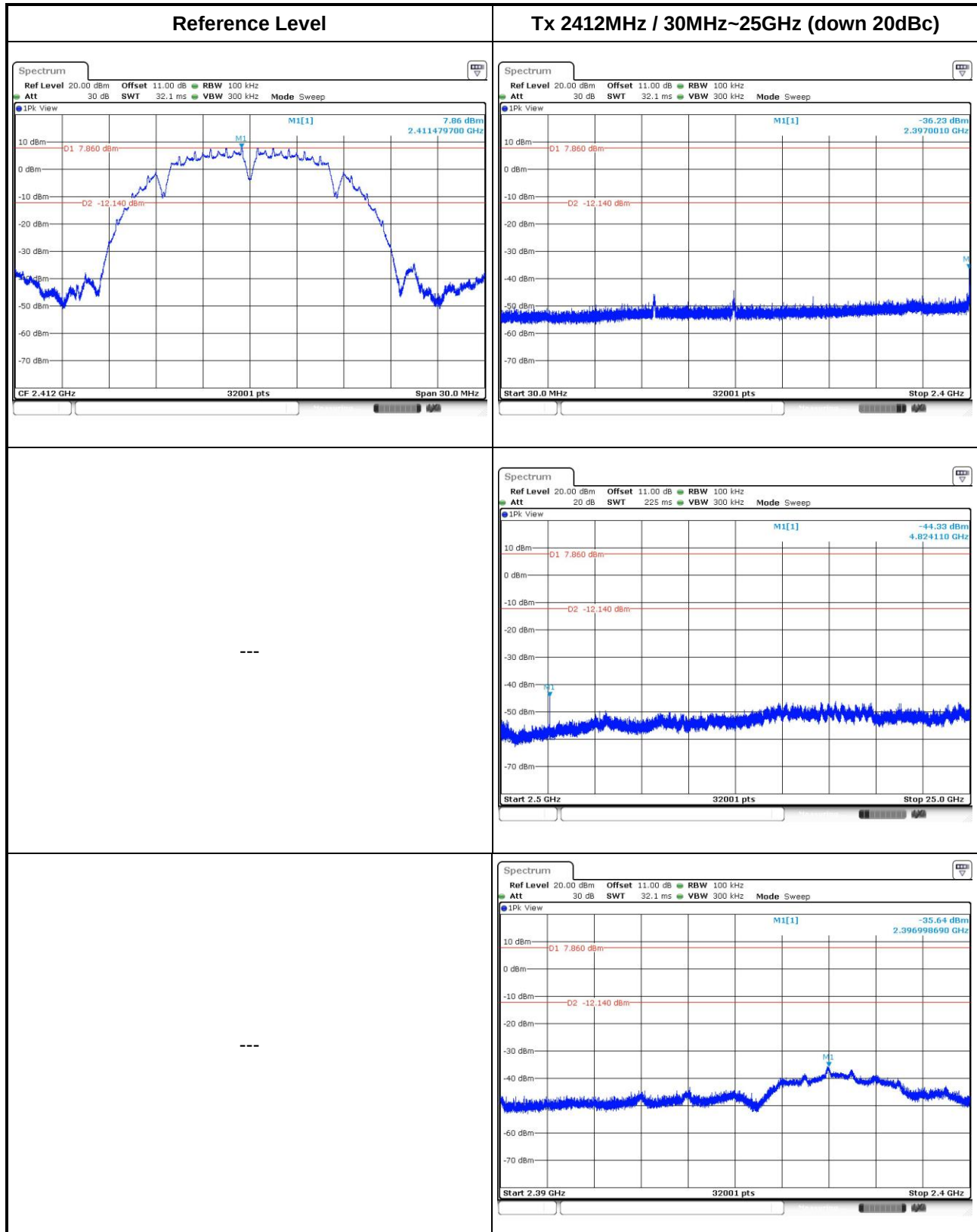


3.6.4 Test Result of Emissions in non-restricted frequency bands

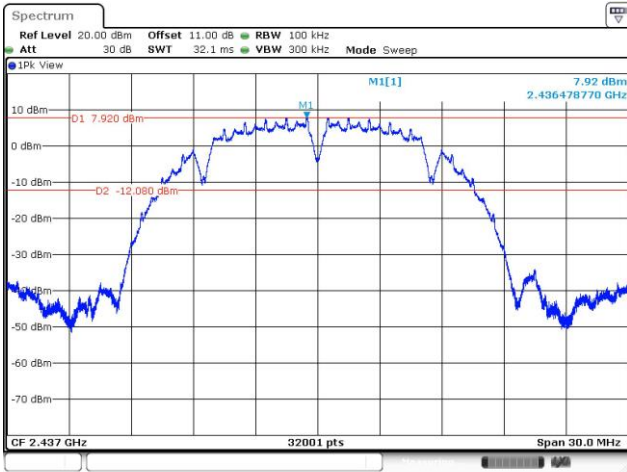
This test item is performed on each TX output individually without summing or adding $10 \log(N_{ANT})$ since measurements are made relative to the in-band emissions on the individual outputs. Only worst test result of each operating mode is presented.

3.6.5 Unwanted Emissions into Non-Restricted Frequency Bands

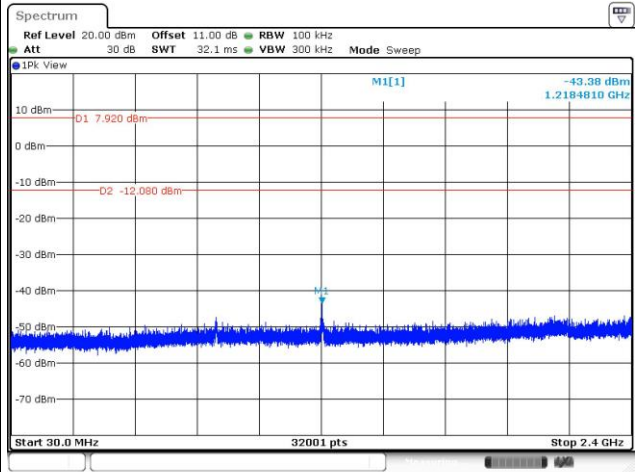
802.11b

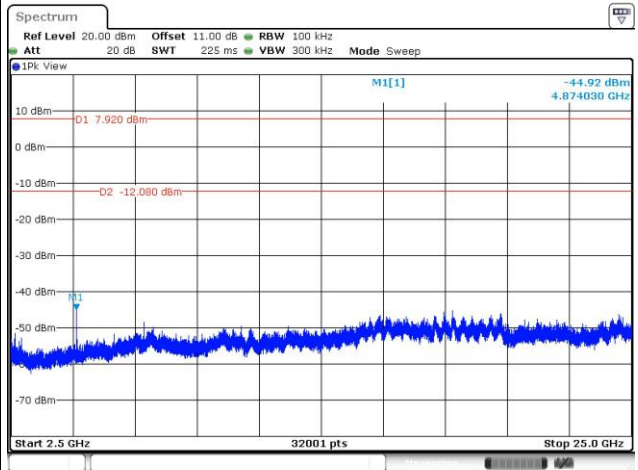


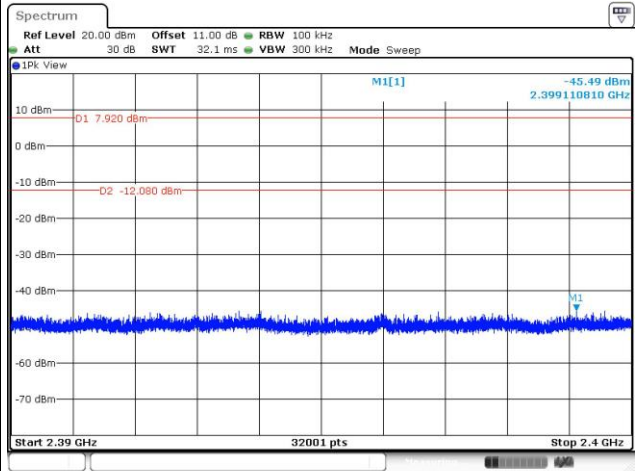
Reference Level



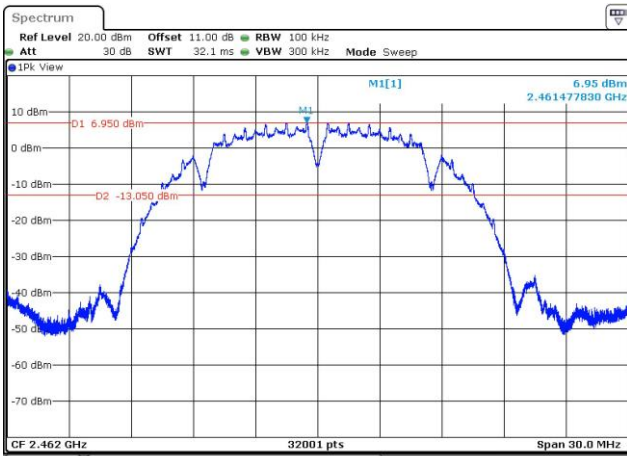
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



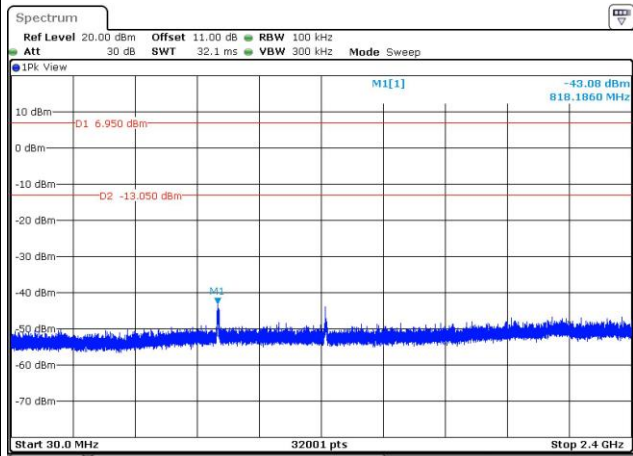


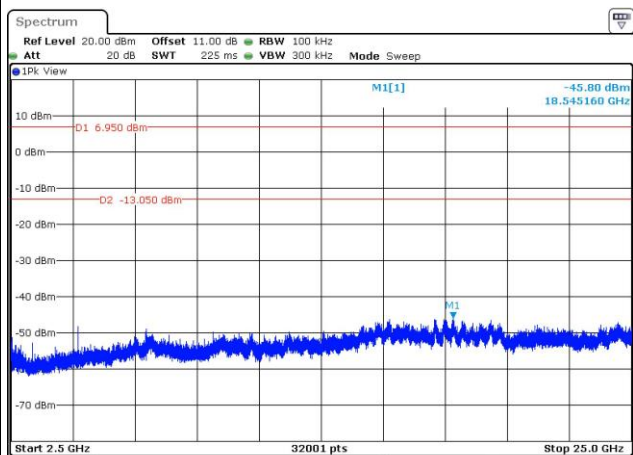


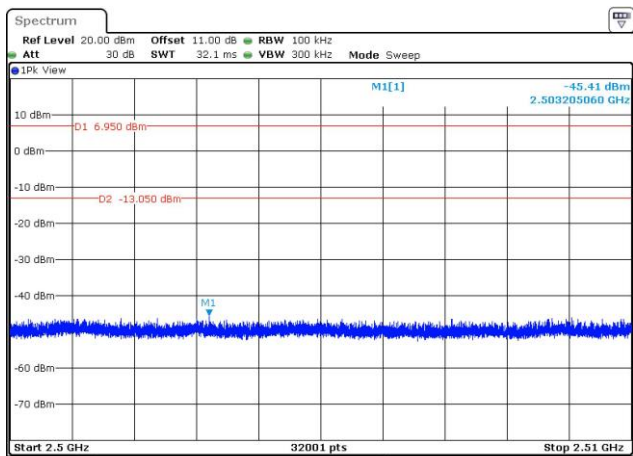
Reference Level



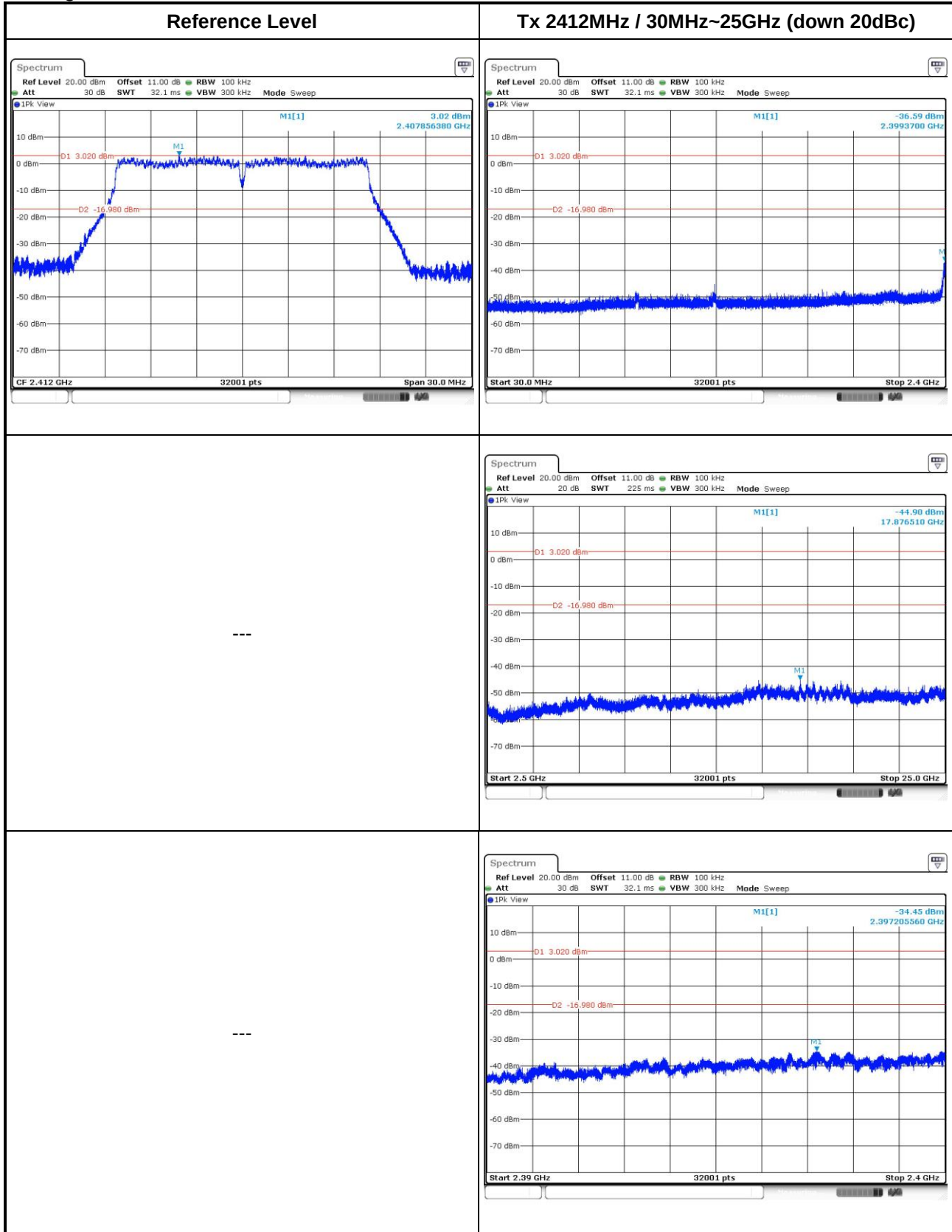
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



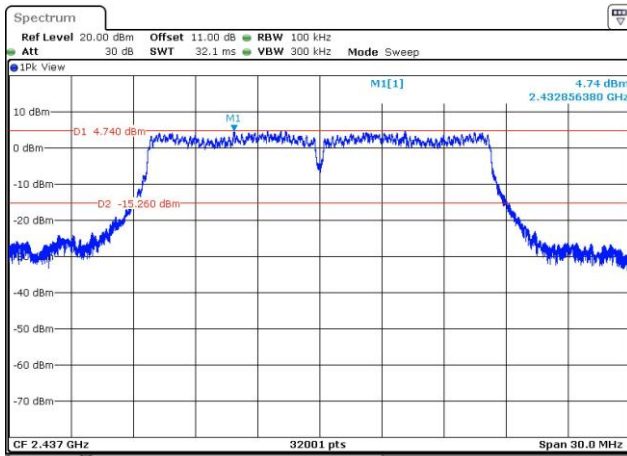




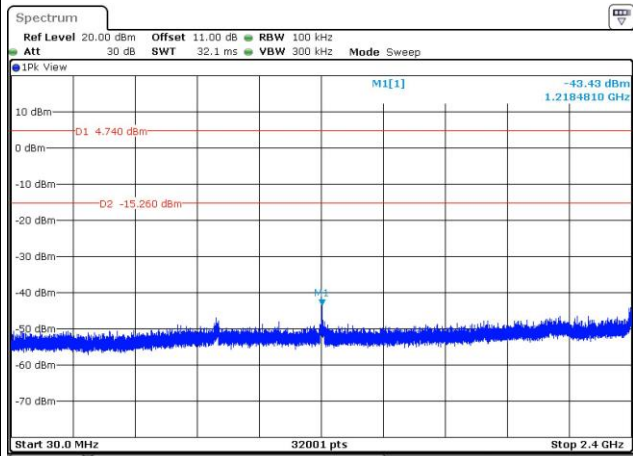
802.11g

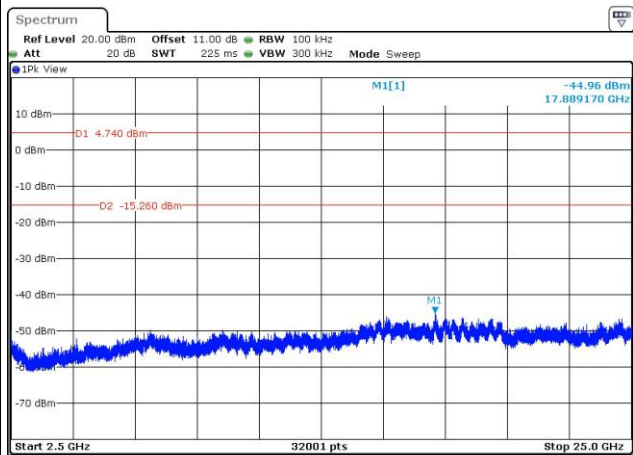


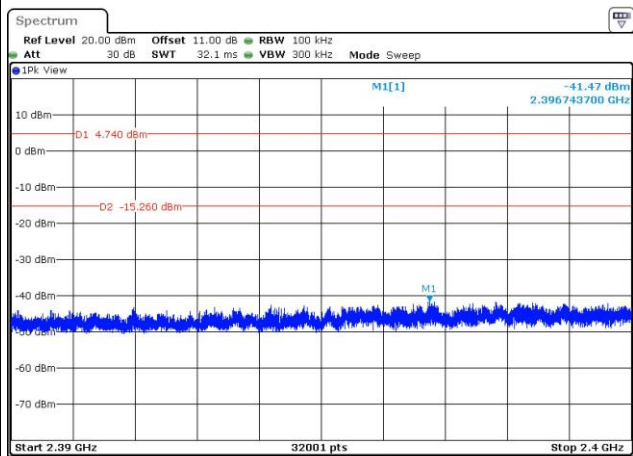
Reference Level

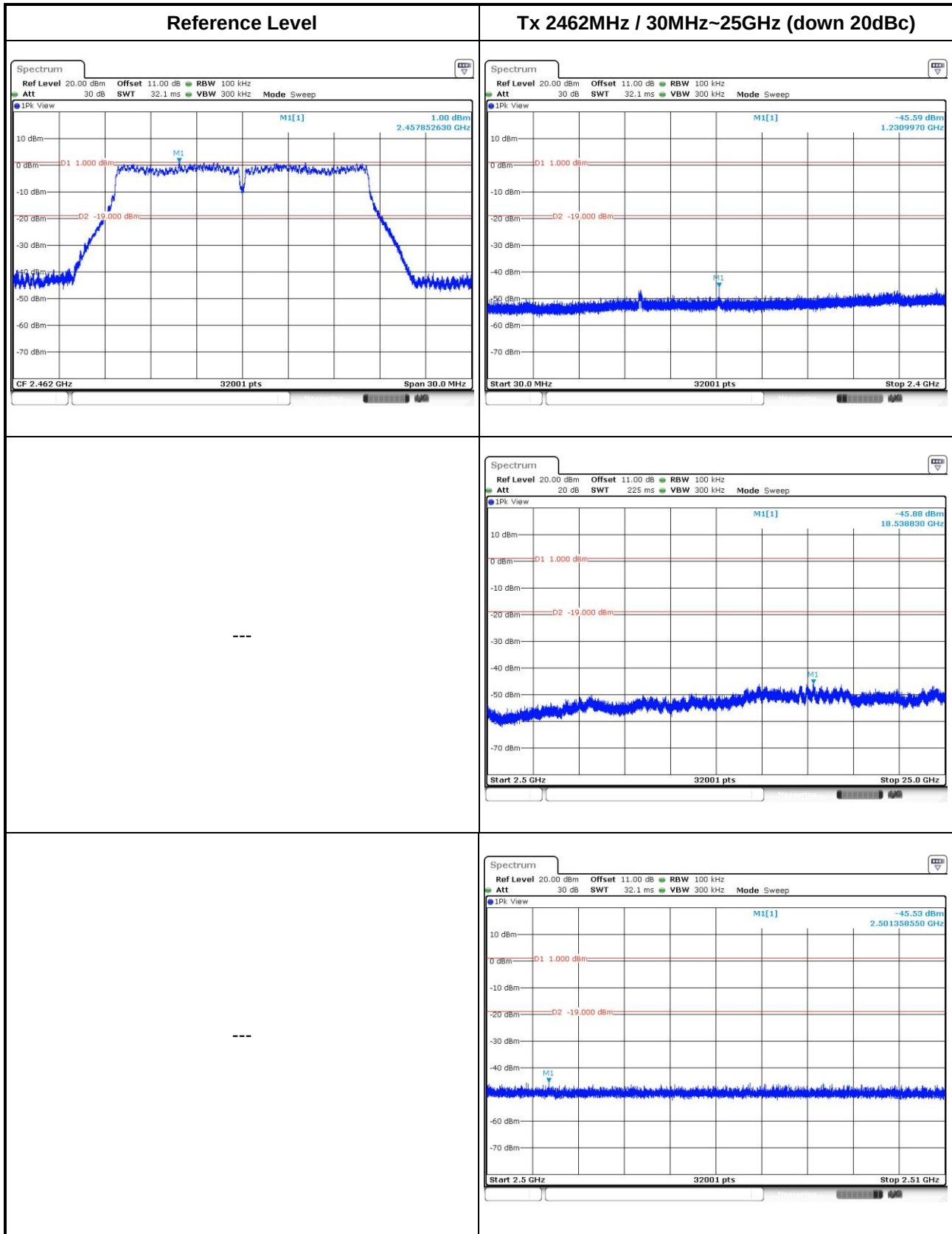


Tx 2437MHz / 30MHz~25GHz (down 20dBc)

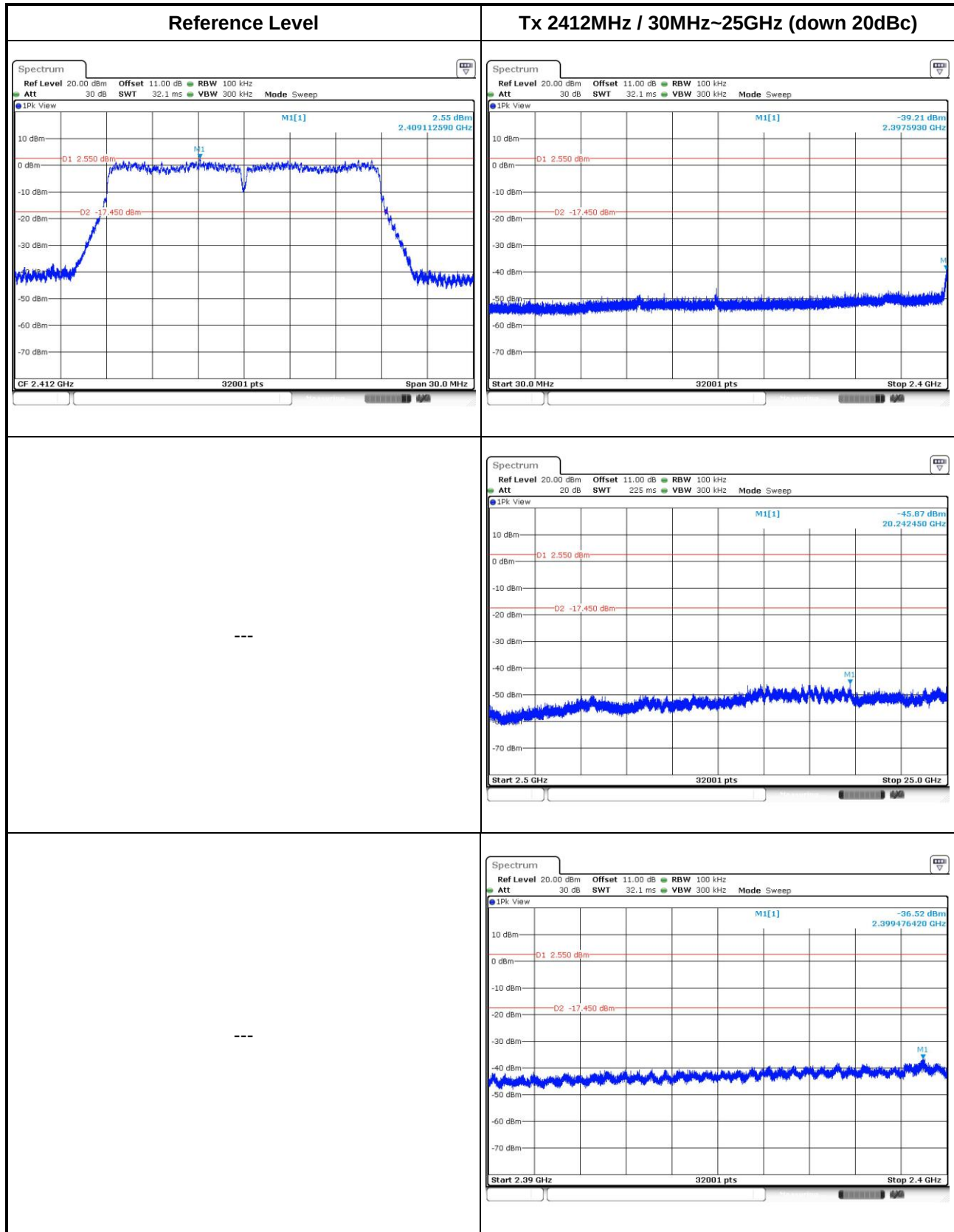




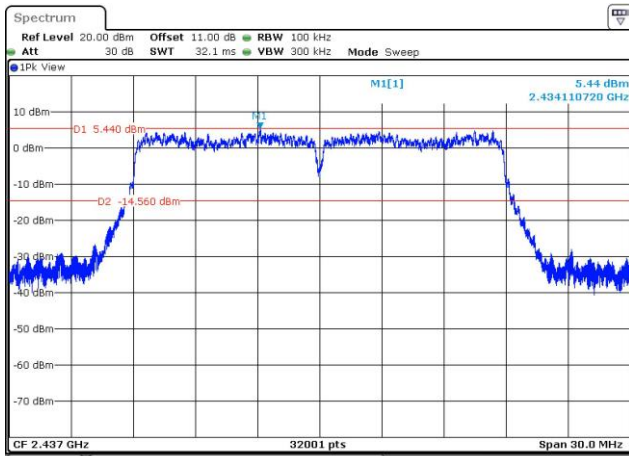




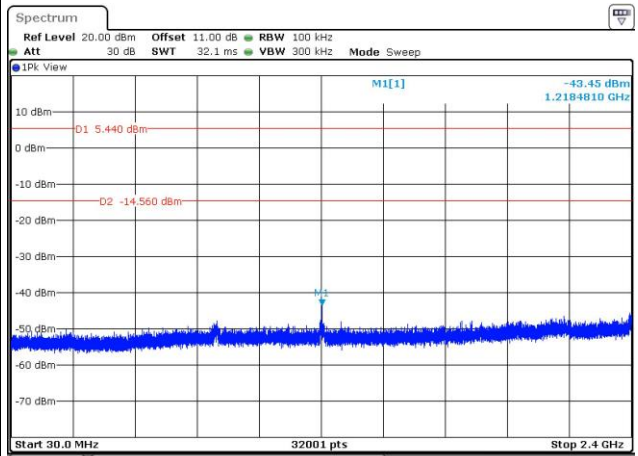
802.11n HT20

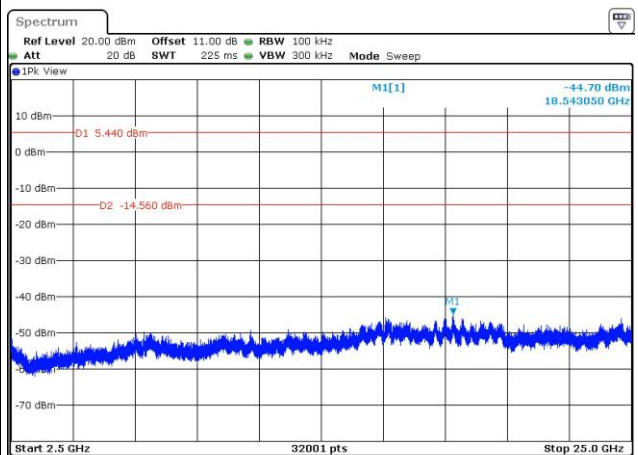


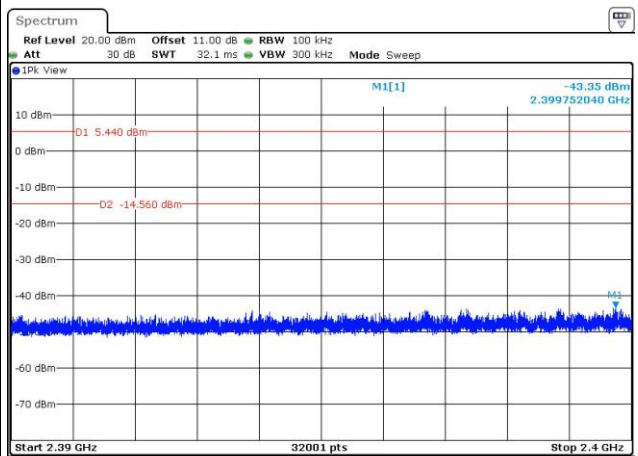
Reference Level



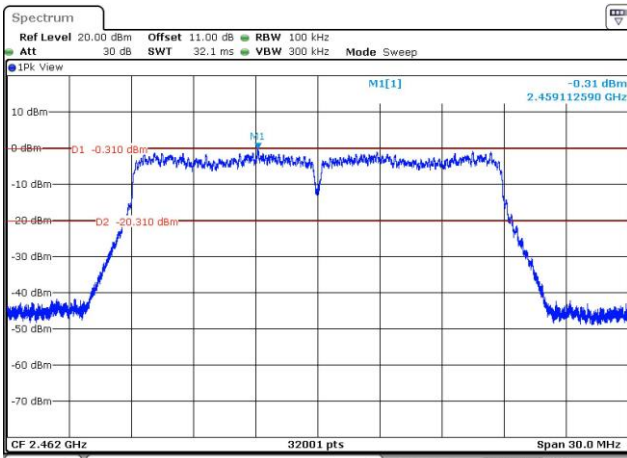
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



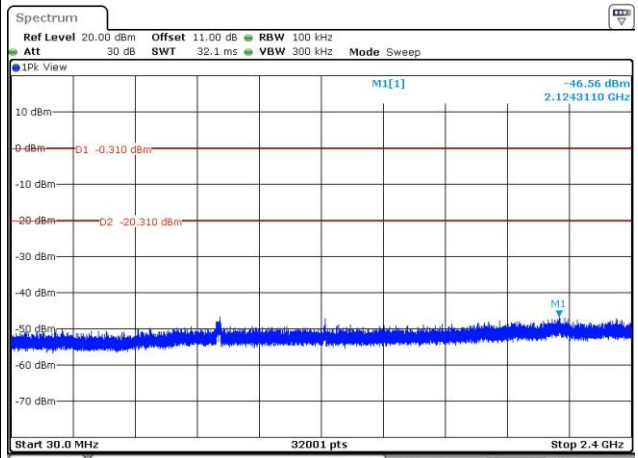


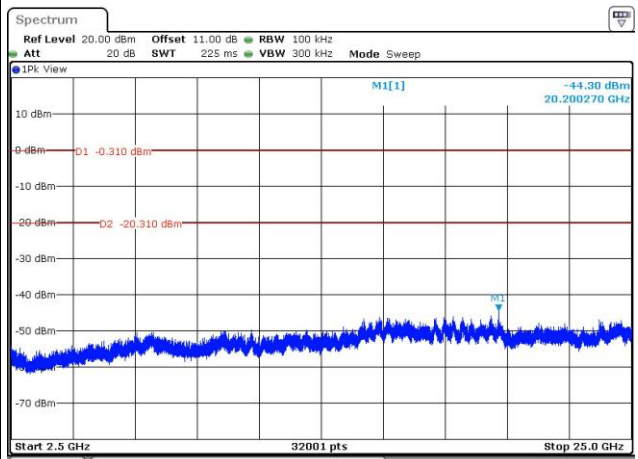


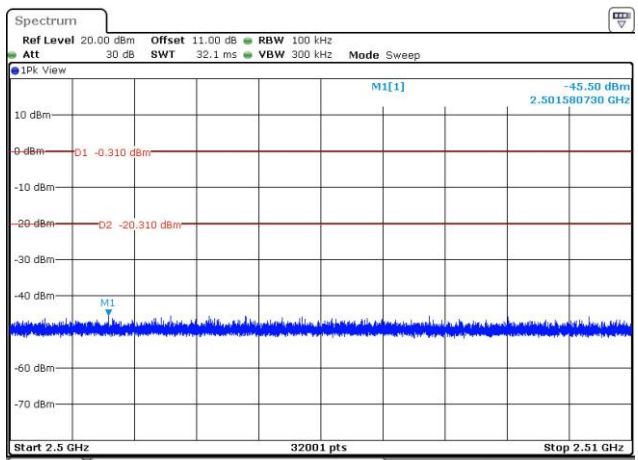
Reference Level



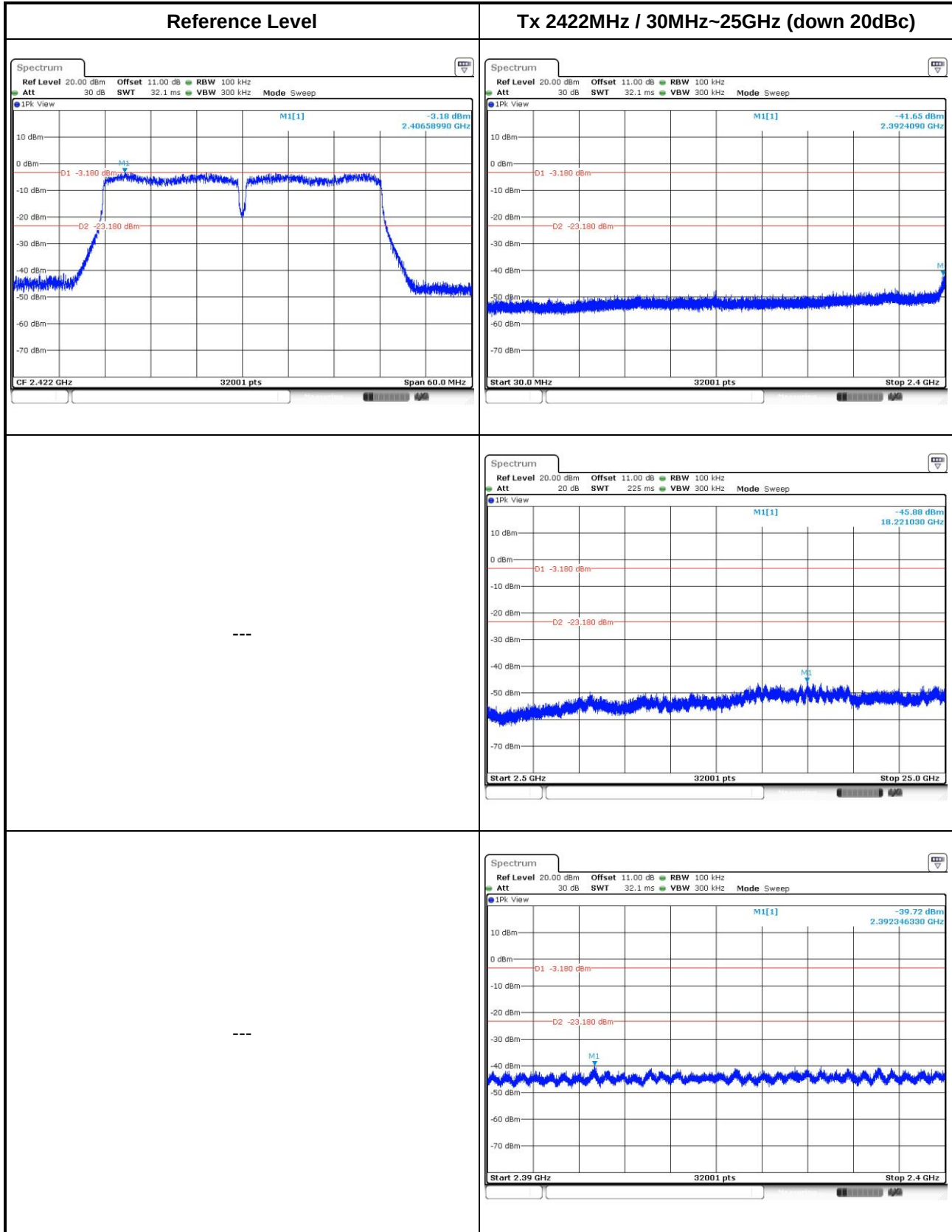
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



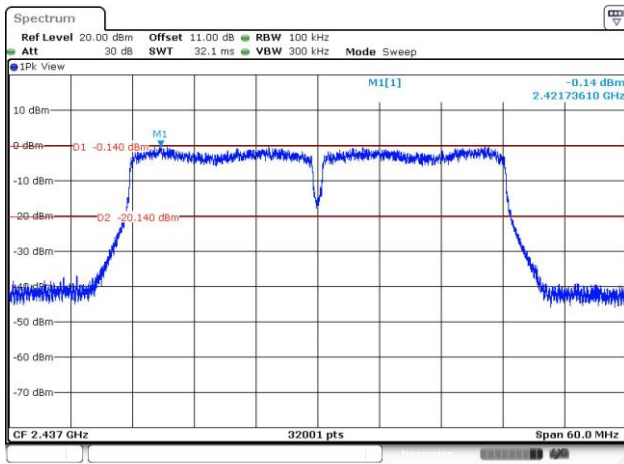




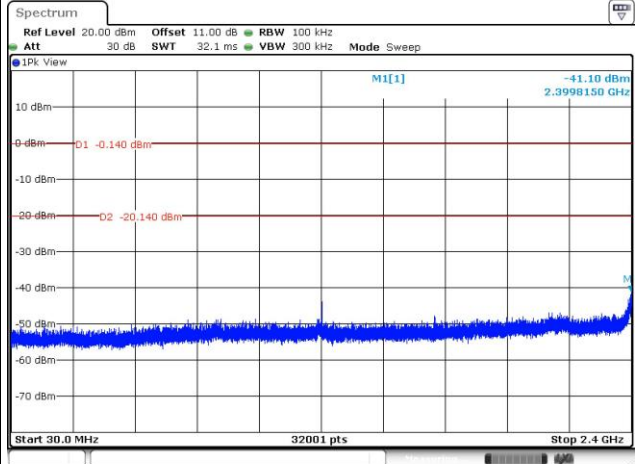
802.11n HT40

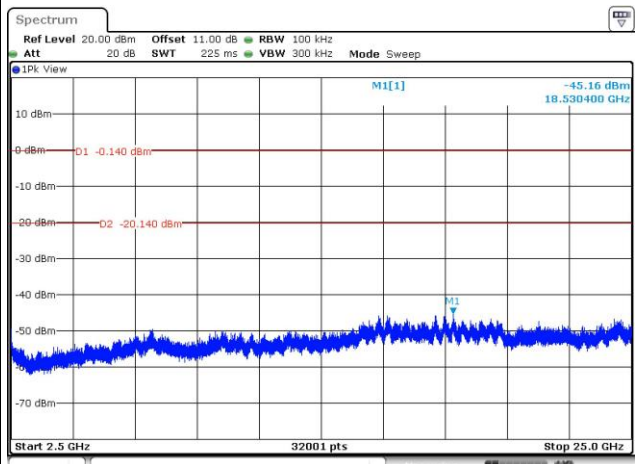


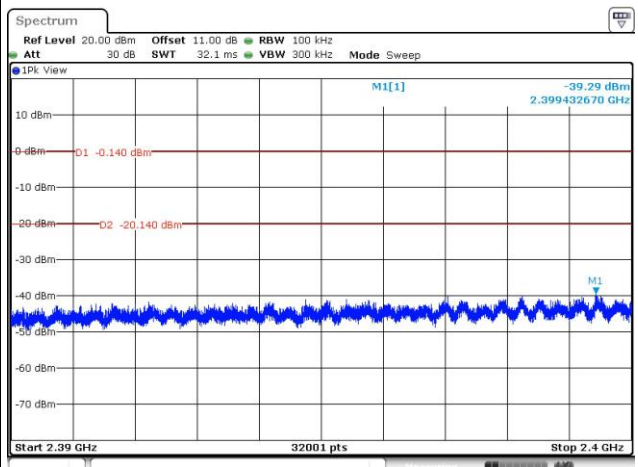
Reference Level



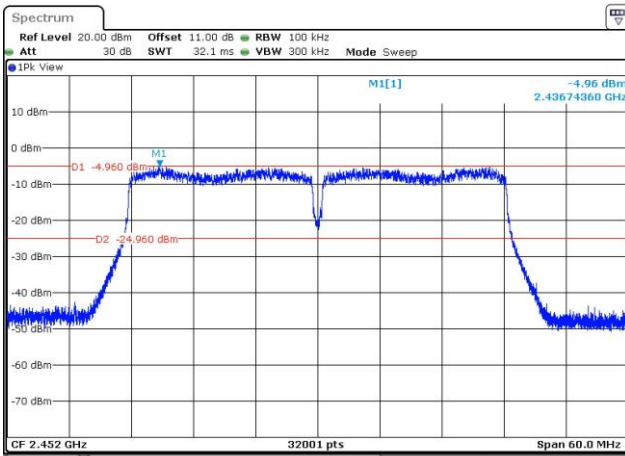
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



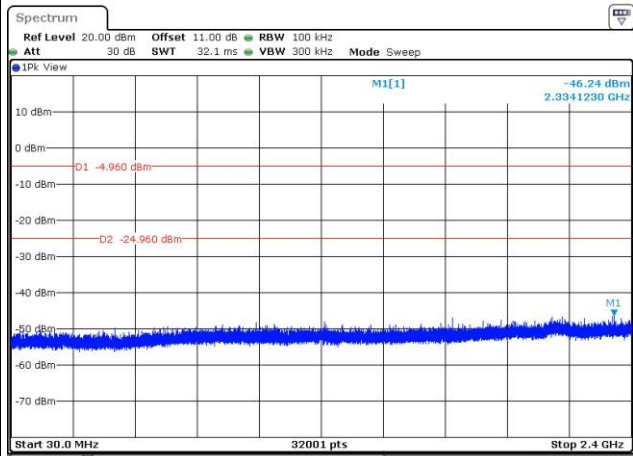


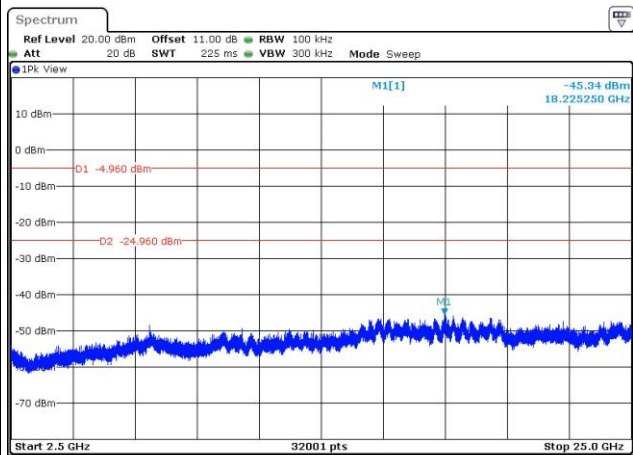


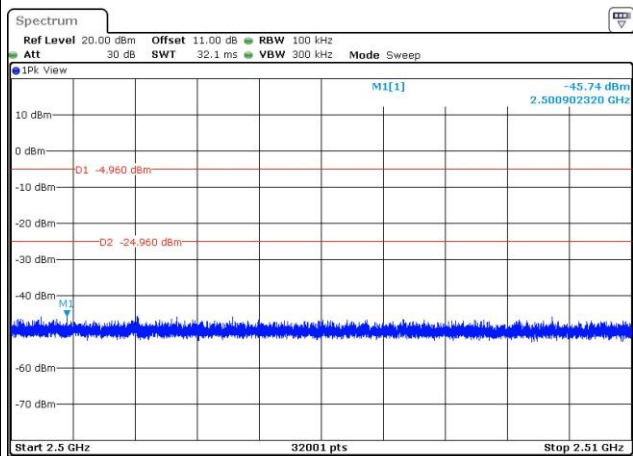
Reference Level



Tx 2452MHz / 30MHz~25GHz (down 20dBc)







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 <http://www.icertifi.com.tw>.

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