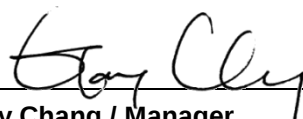


FCC Test Report

FCC ID : NKR-DHSMW97
Equipment : 802.11 abgn/ac 2x2 module with BT
Model No. : DHSM-W97
Brand Name : WNC
Applicant : Wistron NeWeb Corp.
Address : 20 Park Avenue II, Hsinchu Science Park,
Hsinchu 308, Taiwan, R.O.C.
Standard : 47 CFR FCC Part 15.247
Received Date : Dec. 17, 2015
Tested Date : Jan. 09 ~ Jan. 29, 2016

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.

Approved & Reviewed by:



Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR5D1702AC	Rev. 01	Initial issue	Feb. 05, 2016

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.220MHz 49.42 (Margin -13.41dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2386.00MHz 52.99 (Margin -1.01dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 29.31	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 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]	2	1-11 Mbps
2400-2483.5	g	2412-2462	1-11 [11]	2	6-54 Mbps
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	2	MCS 0-15
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	2	MCS 0-15
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: 801.11b only transmits at chain 0.					

1.1.2 Antenna Details

Ant. No.	Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)					Cable length (mm)
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850	
1	95EEW15 GLR	PIFA	U.FL	-1.34	4.69	4.69	3.03	1.59	200
	95EEW15 GLS	PIFA	U.FL	0.08	1.57	1.04	1.04	-1.56	370
2	E40 (White cable)	PIFA	U.FL	1.61	0.79	2.02	2.08	0.46	400
	E40 (Black cable)	PIFA	U.FL	0.81	-0.61	0.62	0.68	-0.94	700
3	E48 (White cable)	PIFA	U.FL	1.51	0.59	1.82	1.88	0.26	450
	E48 (Black cable)	PIFA	U.FL	0.81	-0.61	0.62	0.68	-0.94	700
4	E55 (White cable)	PIFA	U.FL	-1.79	-5.31	-4.08	-4.02	-5.64	450
	E55 (Black cable)	PIFA	U.FL	0.01	-2.11	-0.88	-0.82	-2.44	1050

Note: Ant. No. 2 with highest gain and Ant. No. 4 (E55, black cable) with longest cable were for 2.4G final test.

Ant. No. 1 with highest gain and Ant. No. 4 (E55, black cable) with longest cable were for 5G final test.

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
--------------------------	------------------

1.1.4 Accessories

N/A

1.1.5 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	---	---

1.1.6 Test Tool and Duty Cycle

Test Tool	Dut Wlan BT Labtool, V 2.0.0.68		
Duty Cycle and Duty Factor	Mode	Duty cycle (%)	Duty factor (dB)
	11b	99.83%	0.01
	11g	98.51%	0.06
	HT20	99.47%	0.02
	HT40	98.36%	0.07

1.1.7 Power Setting

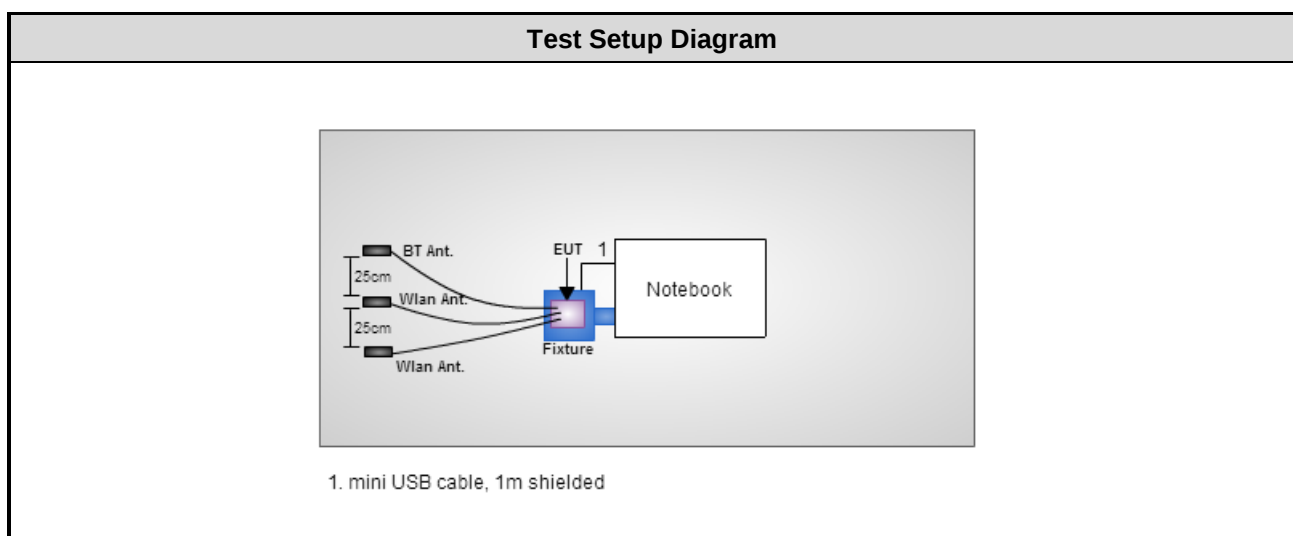
Modulation Mode	Test Frequency (MHz)	Power Set
11b	2412	20
11b	2437	19
11b	2462	18
11g	2412	16
11g	2437	20
11g	2462	15
HT20	2412	16
HT20	2437	20
HT20	2462	15
HT40	2422	13
HT40	2437	15
HT40	2452	12

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	E6500	DoC	Mini USB, 1m shielded.

Note: Notebook & Mini USB cable are supplied by applicant.

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jan. 19, 2016				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
EMC Receiver	R&S	ESCS 30	100169	Oct. 21, 2015	Oct. 20, 2016
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2015	Nov. 12, 2016
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 21, 2015	Dec. 20, 2016
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission below 1GHz				
Test Site	966 chamber 2 / (03CH02-WS)				
Tested Date	Jan. 27, 2016				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 12, 2016	Jan. 11, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-523	Nov. 09, 2015	Nov. 08, 2016
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 10, 2015	Dec. 09, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16015/4	Dec. 10, 2015	Dec. 09, 2016
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-003	Dec. 10, 2015	Dec. 09, 2016
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission above 1GHz				
Test Site	966 chamber 2 / (03CH02-WS)				
Tested Date	Jan. 09 ~ Jan. 27, 2016				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Dec. 17, 2015	Dec. 16, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1095	Oct. 07, 2015	Oct. 06, 2016
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 04, 2015	Nov. 03, 2016
Preamplifier	Burgeon	BPA-530	100218	Nov. 03, 2015	Nov. 02, 2016
Preamplifier	Agilent	83017A	MY39501309	Sep. 22, 2015	Sep. 21, 2016
Preamplifier	EMC	EMC184045B	980192	Sep. 01, 2015	Aug. 31, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16140/4	Dec. 10, 2015	Dec. 09, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16018/4	Dec. 10, 2015	Dec. 09, 2016
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)				
Tested Date	Jan. 28 ~ Jan. 29, 2016				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Feb. 03, 2015	Feb. 02, 2016
Power Meter	Anritsu	ML2495A	1241002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor	Anritsu	MA2411B	1207366	Sep. 21, 2015	Sep. 20, 2016
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 v03r04

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	±3.87 dB
Radiated emission > 1GHz	±5.60 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	18°C / 59%	Sky Huang
Radiated Emissions	03CH02-WS	21-22°C / 61-64%	Anderson Hong Morgan Chen
RF Conducted	TH01-WS	22°C / 64%	Alex Huang

➤ FCC site registration No.: 657002

➤ IC site registration No.: 10807A-2

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	1
Radiated Emissions ≤1GHz	11g	2437	6 Mbps	1, 2
Radiated Emissions >1GHz	11b	2412 / 2437 / 2462	1 Mbps	1
Maximum Output Power	11g	2412 / 2437 / 2462	6 Mbps	
6dB bandwidth	HT20	2412 / 2437 / 2462	MCS 0	
Power spectral density	HT40	2422 / 2437 / 2452	MCS 0	

NOTE:

1. The following antennas are used for final testing for this module: (See item 1.1.2 for more details.)

- 1) Configuration 1: Ant. No. 2 (E40), PIFA antenna.
- 2) Configuration 2: Ant. No. 4 (E55, black cable), PIFA 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.

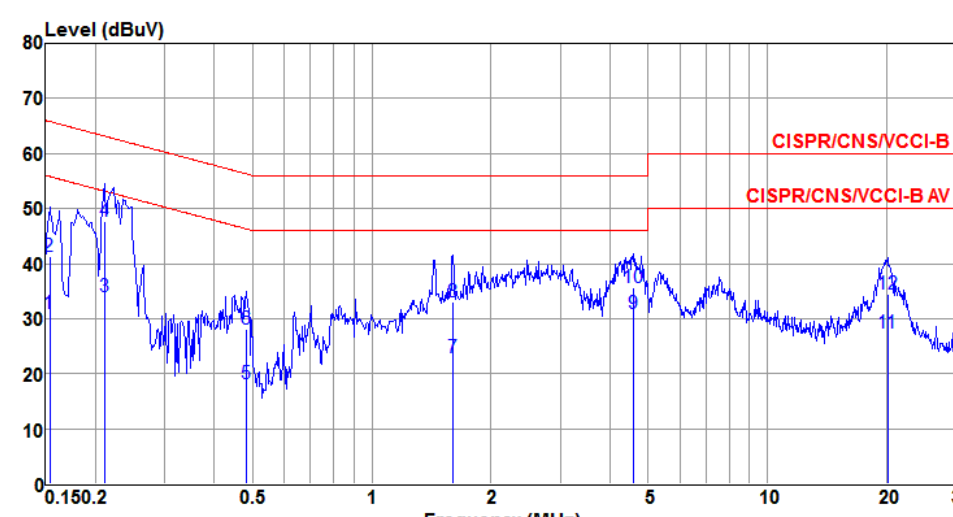
3.1.3 Test Setup



- 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

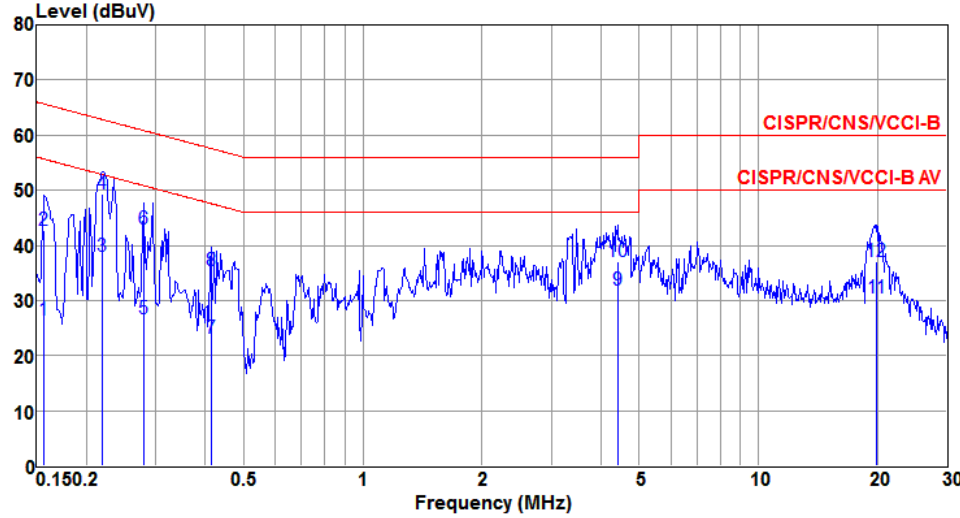
Modulation	11g	Test Freq. (MHz)	2437
Power Phase	Line		



	Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark
1	0.153	31.04	55.82	-24.78	30.14	0.88	0.02	Average
2	0.153	41.40	65.82	-24.42	40.50	0.88	0.02	QP
3	0.211	34.04	53.18	-19.14	33.78	0.24	0.02	Average
4	0.211	47.63	63.18	-15.55	47.37	0.24	0.02	QP
5	0.481	18.29	46.32	-28.03	18.09	0.16	0.04	Average
6	0.481	28.14	56.32	-28.18	27.94	0.16	0.04	QP
7	1.602	23.00	46.00	-23.00	22.47	0.46	0.07	Average
8	1.602	33.08	56.00	-22.92	32.55	0.46	0.07	QP
9@	4.598	30.82	46.00	-15.18	30.37	0.32	0.13	Average
10	4.598	35.67	56.00	-20.33	35.22	0.32	0.13	QP
11	20.162	27.35	50.00	-22.65	26.40	0.78	0.17	Average
12	20.162	34.42	60.00	-25.58	33.47	0.78	0.17	QP

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

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



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.156	26.36	55.65	-29.29	25.58	0.76	0.02	Average
2	0.156	42.80	65.65	-22.85	42.02	0.76	0.02	QP
3	0.220	38.08	52.83	-14.75	37.84	0.22	0.02	Average
4@	0.220	49.42	62.83	-13.41	49.18	0.22	0.02	QP
5	0.279	26.65	50.85	-24.20	26.44	0.19	0.02	Average
6	0.279	42.89	60.85	-17.96	42.68	0.19	0.02	QP
7	0.413	23.25	47.59	-24.34	23.09	0.13	0.03	Average
8	0.413	35.49	57.59	-22.10	35.33	0.13	0.03	QP
9	4.407	31.75	46.00	-14.25	30.91	0.72	0.12	Average
10	4.407	37.06	56.00	-18.94	36.22	0.72	0.12	QP
11	19.950	30.55	50.00	-19.45	29.64	0.74	0.17	Average
12	19.950	37.13	60.00	-22.87	36.22	0.74	0.17	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).

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

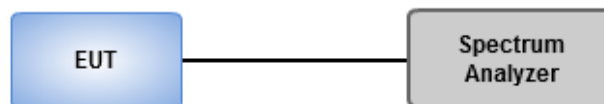
6dB Bandwidth

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.

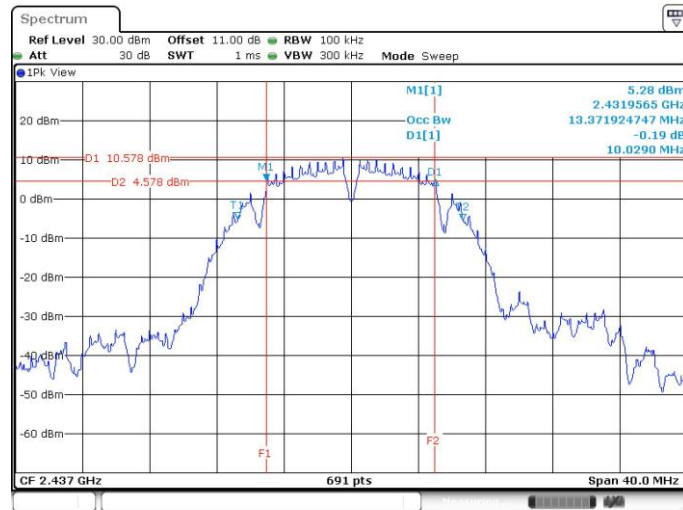
3.2.3 Test Setup



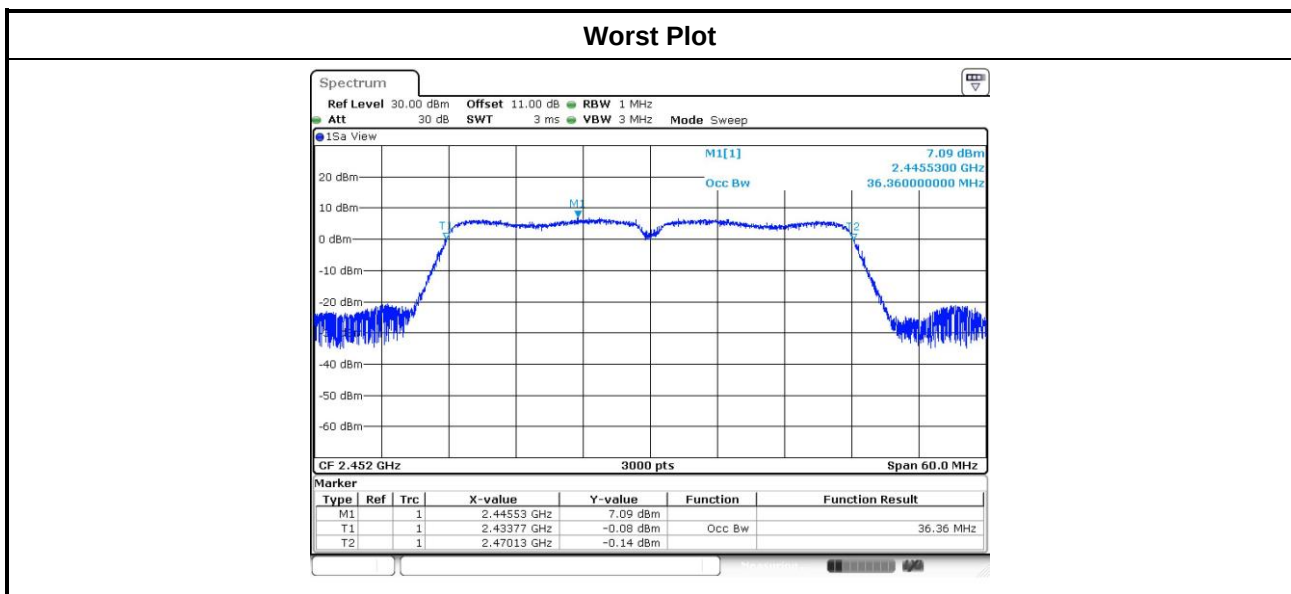
3.2.4 Test Result of 6dB and Occupied Bandwidth

Modulation Mode	N _{TX}	Freq. (MHz)	6dB Bandwidth (MHz)				Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
11b	2	2412	10.03	10.03	---	---	500
11b	2	2437	10.09	10.03	---	---	500
11b	2	2462	10.09	10.09	---	---	500
11g	2	2412	16.35	16.35	---	---	500
11g	2	2437	16.35	16.41	---	---	500
11g	2	2462	16.35	16.35	---	---	500
HT20	2	2412	17.28	17.62	---	---	500
HT20	2	2437	17.62	17.62	---	---	500
HT20	2	2462	17.28	17.62	---	---	500
HT40	2	2422	35.48	35.48	---	---	500
HT40	2	2437	35.59	35.48	---	---	500
HT40	2	2452	35.48	35.48	---	---	500

Worst Plot



Modulation Mode	N _{TX}	Freq. (MHz)	99% Occupied Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
11b	2	2412	13.69	13.54	---	---
11b	2	2437	13.44	13.42	---	---
11b	2	2462	13.33	13.25	---	---
11g	2	2412	16.72	16.61	---	---
11g	2	2437	16.89	16.77	---	---
11g	2	2462	16.71	16.62	---	---
HT20	2	2412	17.65	17.65	---	---
HT20	2	2437	18.02	17.76	---	---
HT20	2	2462	17.66	17.65	---	---
HT40	2	2422	36.30	36.32	---	---
HT40	2	2437	36.30	36.34	---	---
HT40	2	2452	36.36	36.28	---	---



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	22.53	22.88	---	---	373.149	25.72	30.00	1.61	27.33	36.00
11b	2	2437	22.17	22.06	---	---	325.510	25.13	30.00	1.61	26.74	36.00
11b	2	2462	21.15	21.32	---	---	265.836	24.25	30.00	1.61	25.86	36.00
11g	2	2412	25.04	24.31	---	---	588.928	27.70	30.00	1.61	29.31	36.00
11g	2	2437	26.29	26.3	---	---	852.178	29.31	30.00	1.61	30.92	36.00
11g	2	2462	25.24	23.34	---	---	549.969	27.40	30.00	1.61	29.01	36.00
HT20	2	2412	24.21	25.44	---	---	613.578	27.88	30.00	1.61	29.49	36.00
HT20	2	2437	26.3	26.28	---	---	851.199	29.30	30.00	1.61	30.91	36.00
HT20	2	2462	22.56	25.11	---	---	504.641	27.03	30.00	1.61	28.64	36.00
HT40	2	2422	22.62	20.82	---	---	303.591	24.82	30.00	1.61	26.43	36.00
HT40	2	2437	23.09	24.89	---	---	512.023	27.09	30.00	1.61	28.70	36.00
HT40	2	2452	23.08	20.69	---	---	320.455	25.06	30.00	1.61	26.67	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	19.82	20.35	---	---	204.333	23.10	---
11b	2	2437	19.24	19.36	---	---	170.244	22.31	---
11b	2	2462	18.23	18.5	---	---	137.322	21.38	---
11g	2	2412	16.09	15.5	---	---	76.126	18.82	---
11g	2	2437	20.13	21.28	---	---	237.315	23.75	---
11g	2	2462	15.31	14.99	---	---	65.513	18.16	---
HT20	2	2412	16.03	15.74	---	---	77.584	18.90	---
HT20	2	2437	20.05	20.69	---	---	218.377	23.39	---
HT20	2	2462	15.07	15.25	---	---	65.633	18.17	---
HT40	2	2422	13.14	12.71	---	---	39.270	15.94	---
HT40	2	2437	15.09	15.24	---	---	65.704	18.18	---
HT40	2	2452	12.2	12.05	---	---	32.628	15.14	---

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.

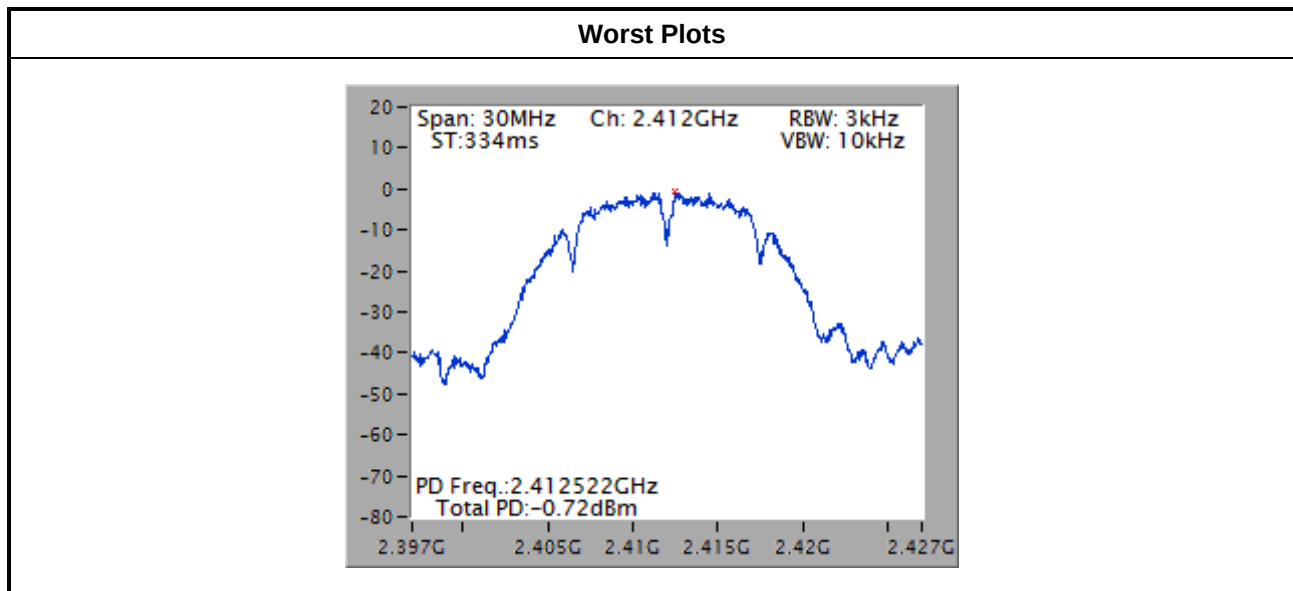
3.4.3 Test Setup



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	-0.72	8.00
11b	2	2437	-1.37	8.00
11b	2	2462	-1.58	8.00
11g	2	2412	-7.76	8.00
11g	2	2437	-2.99	8.00
11g	2	2462	-8.11	8.00
HT20	2	2412	-6.14	8.00
HT20	2	2437	-1.79	8.00
HT20	2	2462	-7.98	8.00
HT40	2	2422	-12.65	8.00
HT40	2	2437	-10.36	8.00
HT40	2	2452	-13.85	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

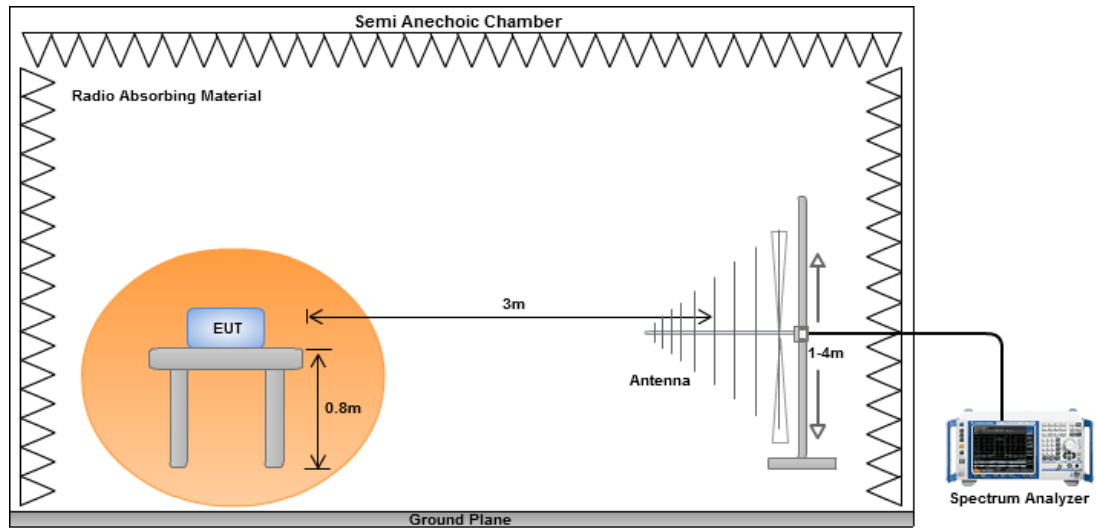
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

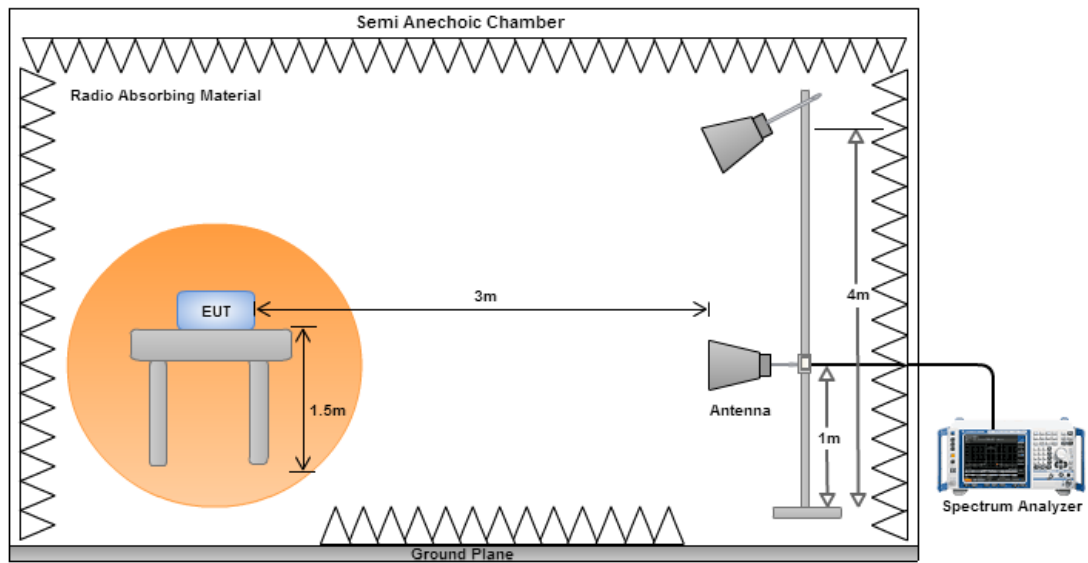
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

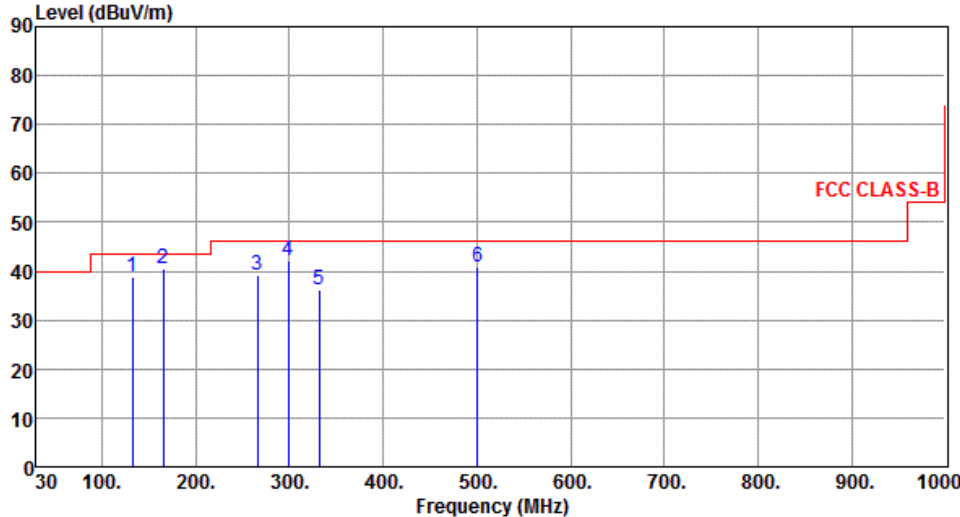


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

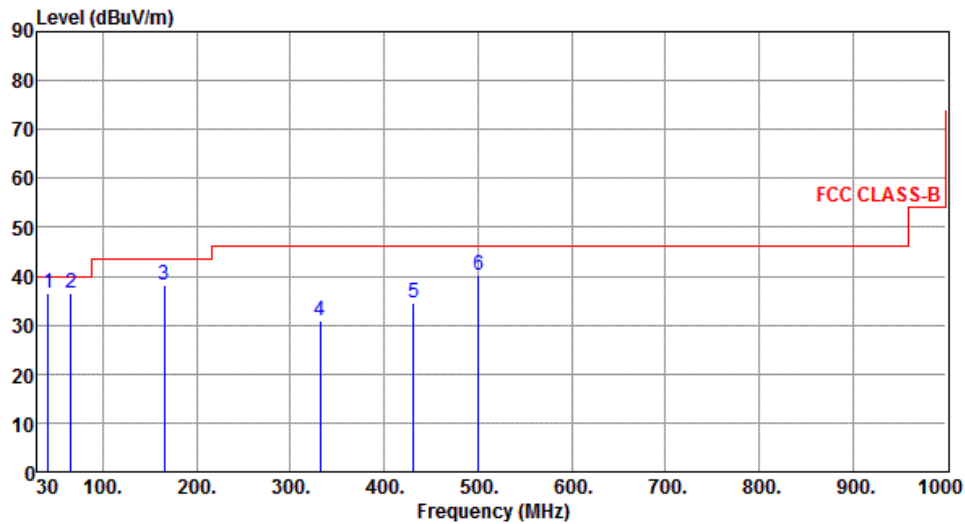
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal	Test Configuration	1



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	132.82	39.02	43.50	-4.48	51.82	-12.80	Peak	---	---
2	165.80	40.60	43.50	-2.90	52.45	-11.85	Peak	---	---
3	265.71	39.22	46.00	-6.78	51.45	-12.23	Peak	---	---
4	298.69	42.24	46.00	-3.76	53.38	-11.14	Peak	---	---
5	331.61	36.22	46.00	-9.78	46.65	-10.43	Peak	---	---
6	500.45	40.74	46.00	-5.26	47.24	-6.50	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	Test Configuration	1



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.21	36.45	40.00	-3.55	48.23	-11.78	QP	100	15
2	65.89	36.65	40.00	-3.35	50.37	-13.72	Peak	---	---
3	165.80	38.21	43.50	-5.29	50.06	-11.85	Peak	---	---
4	331.57	30.83	46.00	-15.17	41.26	-10.43	Peak	---	---
5	431.58	34.38	46.00	-11.62	42.33	-7.95	Peak	---	---
6	500.45	40.21	46.00	-5.79	46.71	-6.50	Peak	---	---

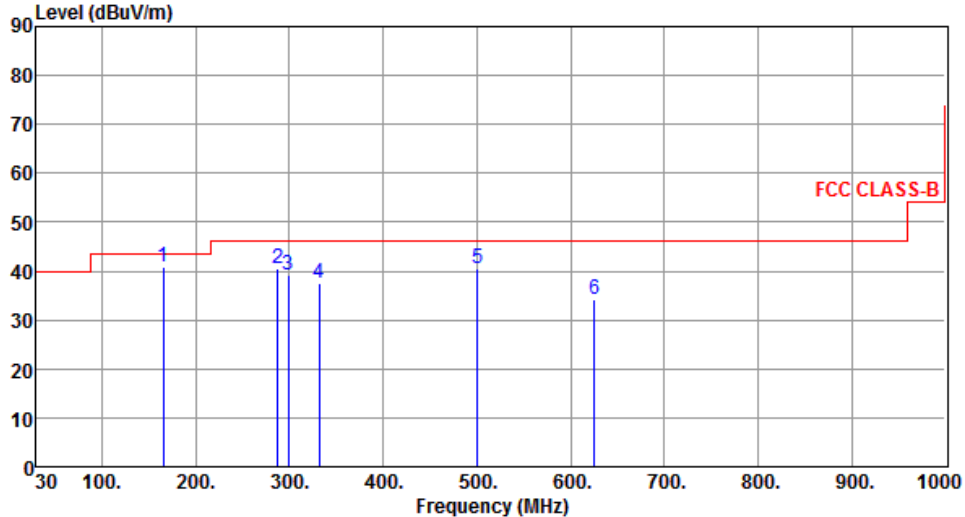
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

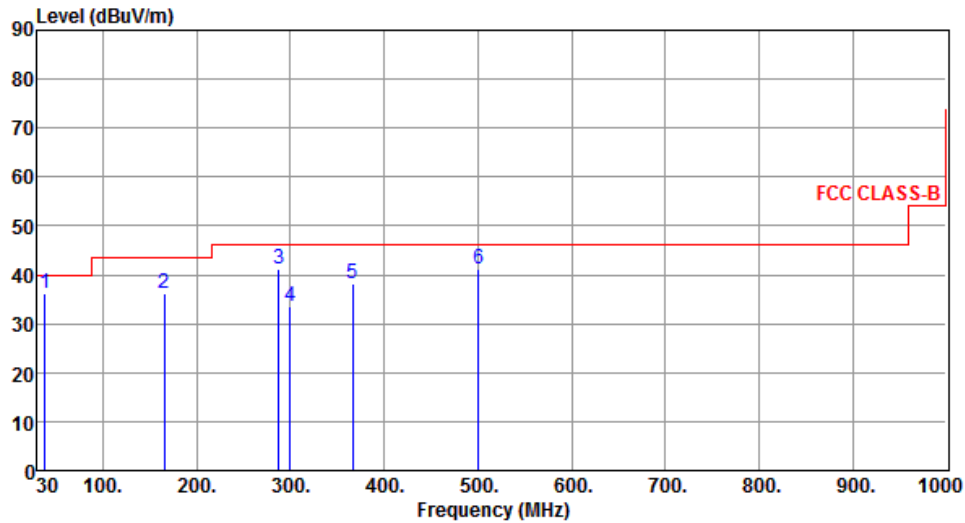
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Horizontal	Test Configuration	2



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	165.80	40.87	43.50	-2.63	52.72	-11.85	Peak	---	---
2	288.02	40.49	46.00	-5.51	51.87	-11.38	Peak	---	---
3	298.66	39.35	46.00	-6.65	50.49	-11.14	Peak	---	---
4	331.67	37.57	46.00	-8.43	48.00	-10.43	Peak	---	---
5	500.45	40.40	46.00	-5.60	46.90	-6.50	Peak	---	---
6	625.58	34.25	46.00	-11.75	38.52	-4.27	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	Test Configuration	2



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	38.24	36.24	40.00	-3.76	48.27	-12.03	QP	100	20
2	165.80	36.14	43.50	-7.36	47.99	-11.85	Peak	---	---
3	288.02	41.28	46.00	-4.72	52.66	-11.38	Peak	---	---
4	299.69	33.45	46.00	-12.55	44.57	-11.12	Peak	---	---
5	366.59	38.27	46.00	-7.73	47.83	-9.56	Peak	---	---
6	500.45	41.19	46.00	-4.81	47.69	-6.50	Peak	---	---

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

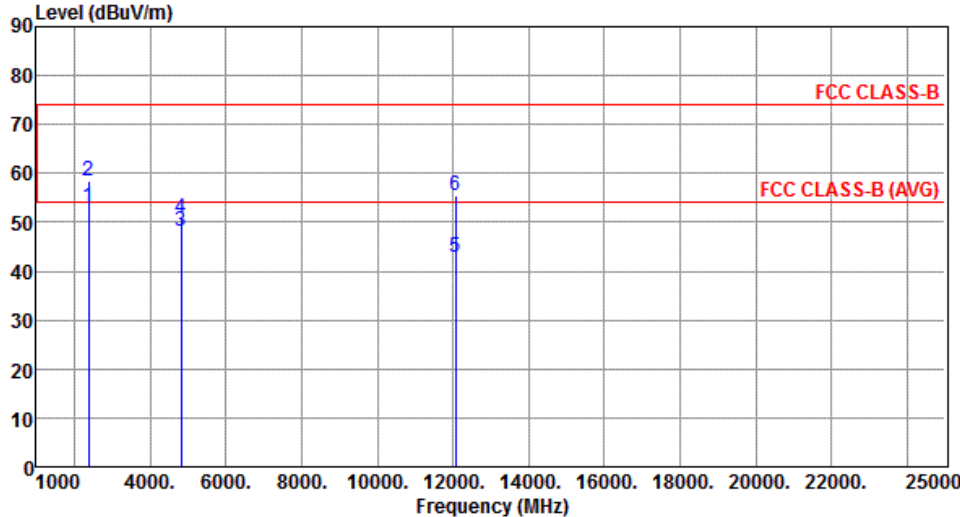
*Factor includes antenna factor , cable loss and amplifier gain

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	2386.00	52.99	54.00	-1.01	56.06	-3.07	Average	198	329
2	2386.00	58.38	74.00	-15.62	61.45	-3.07	Peak	198	329
3	4824.00	48.15	54.00	-5.85	43.89	4.26	Average	147	144
4	4824.00	50.77	74.00	-23.23	46.51	4.26	Peak	147	144
5	12060.00	42.80	54.00	-11.20	28.95	13.85	Average	188	43
6	12060.00	55.31	74.00	-18.69	41.46	13.85	Peak	188	43

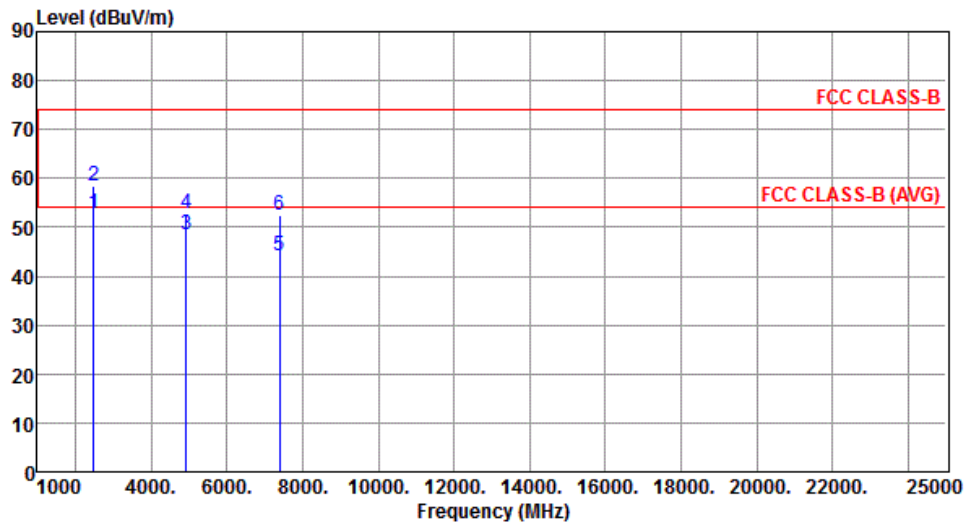
Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)
 *Factor includes antenna factor , cable loss and amplifier gain
 Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

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		



	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	52.97	54.00	-1.03	55.66	-2.69	Average	188	185
2	2483.50	58.51	74.00	-15.49	61.20	-2.69	Peak	188	185
3	4924.00	48.46	54.00	-5.54	43.93	4.53	Average	123	135
4	4924.00	52.70	74.00	-21.30	48.17	4.53	Peak	123	135
5	7386.00	44.25	54.00	-9.75	34.86	9.39	Average	196	210
6	7386.00	52.58	74.00	-21.42	43.19	9.39	Peak	196	210

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

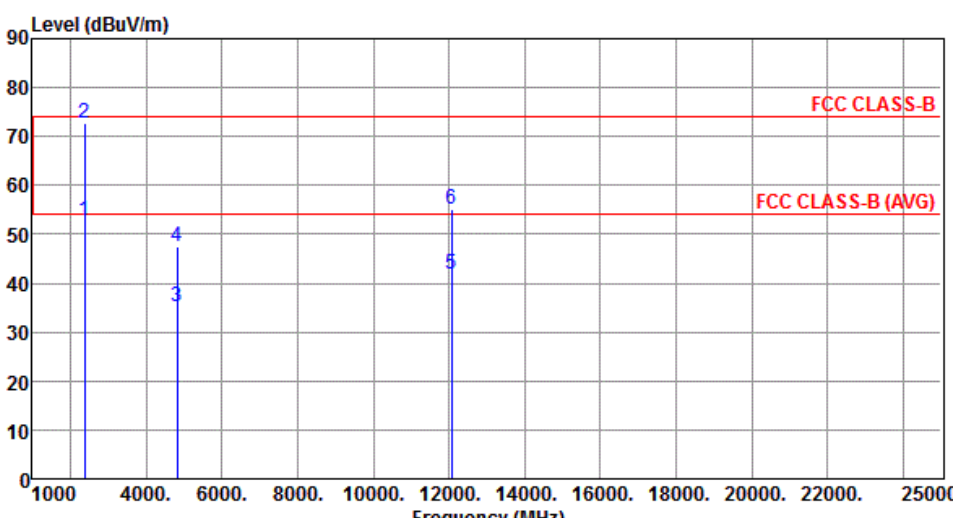
*Factor includes antenna factor , cable loss and amplifier gain

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

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

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

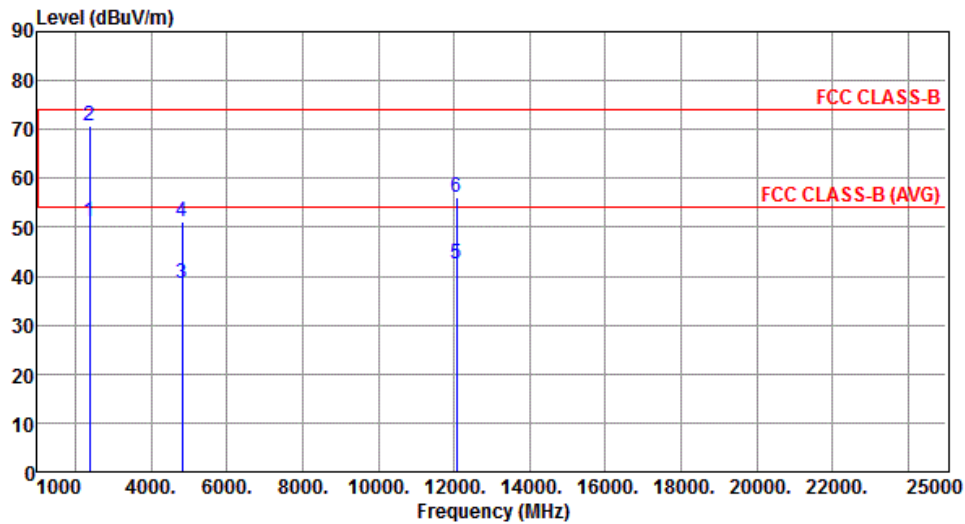
Modulation	11g	Test Freq. (MHz)	2412
Polarization	Horizontal		



	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	52.93	54.00	-1.07	55.99	-3.06	Average	285	342
2	2390.00	72.79	74.00	-1.21	75.85	-3.06	Peak	285	342
3	4824.00	35.13	54.00	-18.87	30.87	4.26	Average	231	85
4	4824.00	47.65	74.00	-26.35	43.39	4.26	Peak	231	85
5	12060.00	41.81	54.00	-12.19	27.96	13.85	Average	225	313
6	12060.00	55.29	74.00	-18.71	41.44	13.85	Peak	225	313

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		



	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	51.22	54.00	-2.78	54.28	-3.06	Average	265	263
2	2390.00	70.65	74.00	-3.35	73.71	-3.06	Peak	265	263
3	4824.00	38.62	54.00	-15.38	34.36	4.26	Average	324	62
4	4824.00	51.08	74.00	-22.92	46.82	4.26	Peak	324	62
5	12060.00	42.41	54.00	-11.59	28.56	13.85	Average	128	315
6	12060.00	56.01	74.00	-17.99	42.16	13.85	Peak	128	315

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	Horizontal		
Level (dBuV/m) </			

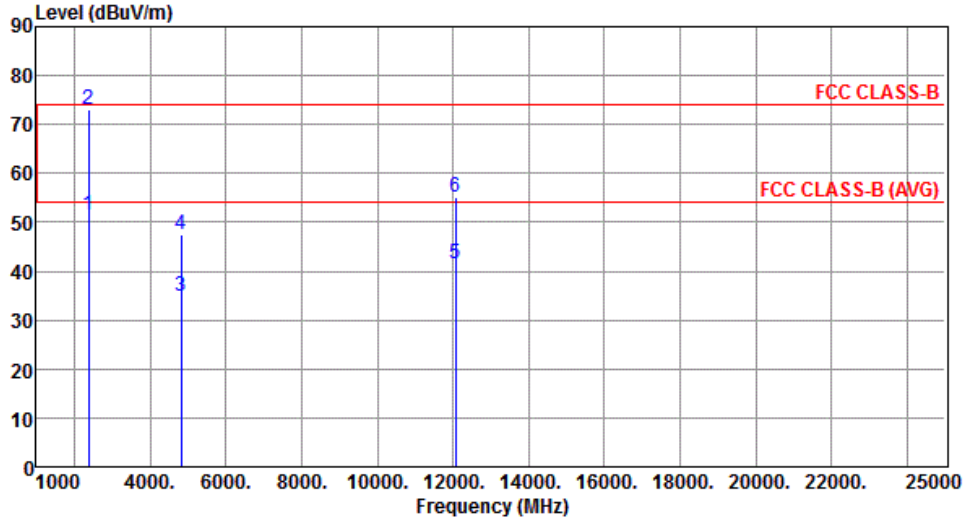
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m)			

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

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

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

Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Horizontal		

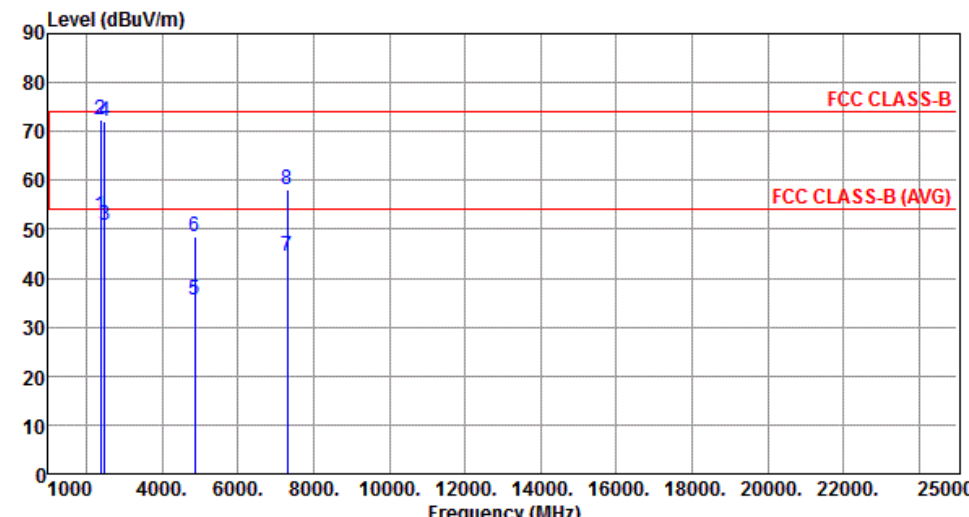


	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	51.58	54.00	-2.42	54.64	-3.06	Average	266	189
2	2390.00	72.90	74.00	-1.10	75.96	-3.06	Peak	266	189
3	4824.00	34.78	54.00	-19.22	30.52	4.26	Average	226	78
4	4824.00	47.36	74.00	-26.64	43.10	4.26	Peak	226	78
5	12060.00	41.65	54.00	-12.35	27.80	13.85	Average	221	318
6	12060.00	55.04	74.00	-18.96	41.19	13.85	Peak	221	318

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		

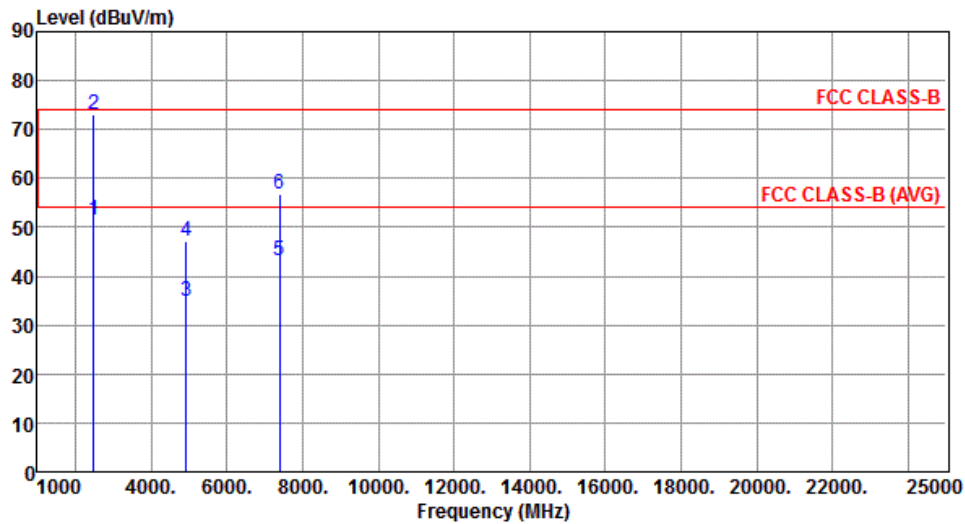


	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	52.81	54.00	-1.19	55.87	-3.06	Average	108	190
2	2390.00	72.53	74.00	-1.47	75.59	-3.06	Peak	108	190
3	2483.50	50.88	54.00	-3.12	53.57	-2.69	Average	233	188
4	2483.50	72.12	74.00	-1.88	74.81	-2.69	Peak	233	188
5	4874.00	35.64	54.00	-18.36	31.24	4.40	Average	258	81
6	4874.00	48.39	74.00	-25.61	43.99	4.40	Peak	258	81
7	7311.00	44.52	54.00	-9.48	35.31	9.21	Average	274	335
8	7311.00	58.06	74.00	-15.94	48.85	9.21	Peak	274	335

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	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	51.40	54.00	-2.60	54.09	-2.69	Average	237	326
2	2483.50	72.93	74.00	-1.07	75.62	-2.69	Peak	237	326
3	4924.00	34.87	54.00	-19.13	30.34	4.53	Average	217	75
4	4924.00	47.24	74.00	-26.76	42.71	4.53	Peak	217	75
5	7386.00	43.33	54.00	-10.67	33.94	9.39	Average	269	342
6	7386.00	56.85	74.00	-17.15	47.46	9.39	Peak	269	342

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

*Factor includes antenna factor , cable loss and amplifier gain

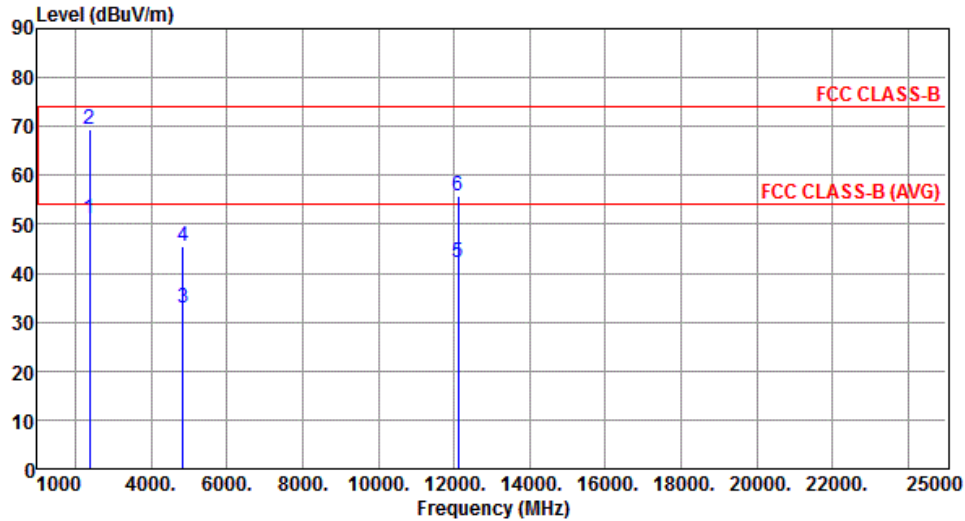
Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

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

3.5.8 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		



	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	51.23	54.00	-2.77	54.29	-3.06	Average	190	226
2	2390.00	69.54	74.00	-4.46	72.60	-3.06	Peak	190	226
3	4844.00	33.04	54.00	-20.96	28.72	4.32	Average	165	89
4	4844.00	45.56	74.00	-28.44	41.24	4.32	Peak	165	89
5	12110.00	42.33	54.00	-11.67	28.50	13.83	Average	221	148
6	12110.00	55.86	74.00	-18.14	42.03	13.83	Peak	221	148

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

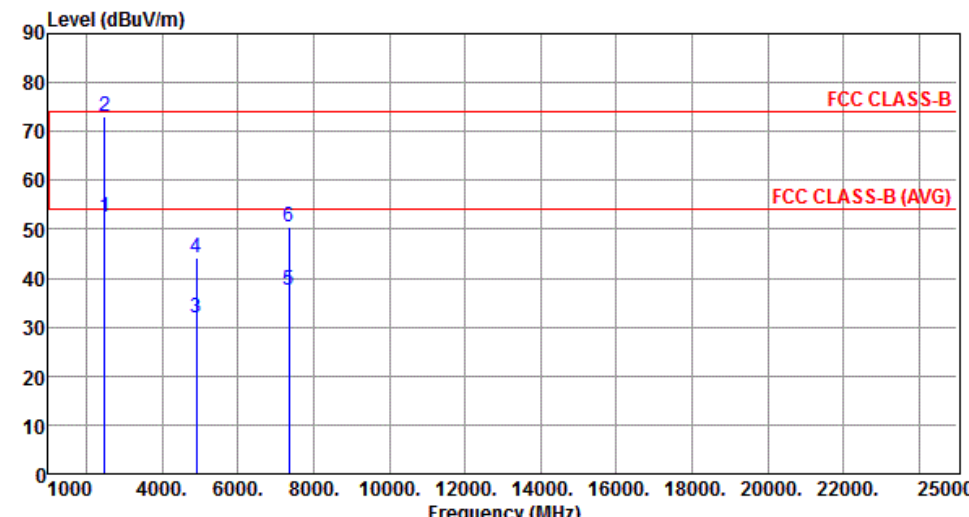
*Factor includes antenna factor , cable loss and amplifier gain

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		



	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	52.50	54.00	-1.50	55.19	-2.69	Average	100	187
2	2483.50	72.96	74.00	-1.04	75.65	-2.69	Peak	100	187
3	4904.00	31.72	54.00	-22.28	27.24	4.48	Average	296	341
4	4904.00	44.26	74.00	-29.74	39.78	4.48	Peak	296	341
5	7356.00	37.42	54.00	-16.58	28.11	9.31	Average	278	55
6	7356.00	50.51	74.00	-23.49	41.20	9.31	Peak	278	55

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	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 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

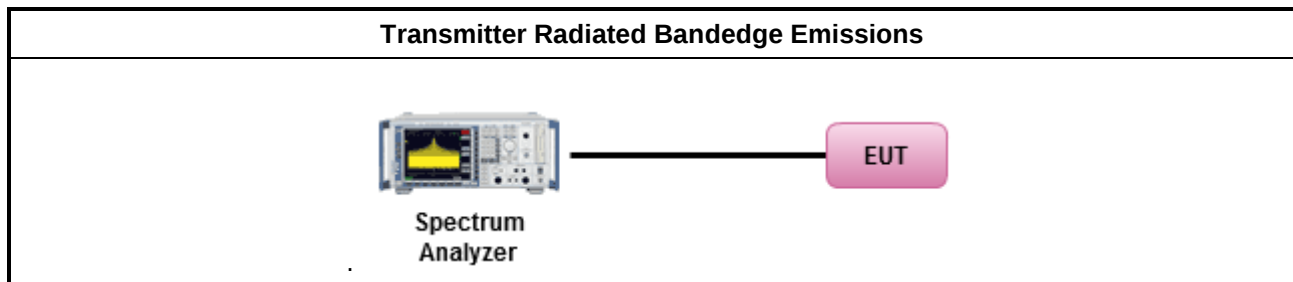
Reference level measurement

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

3.6.4 Test Setup

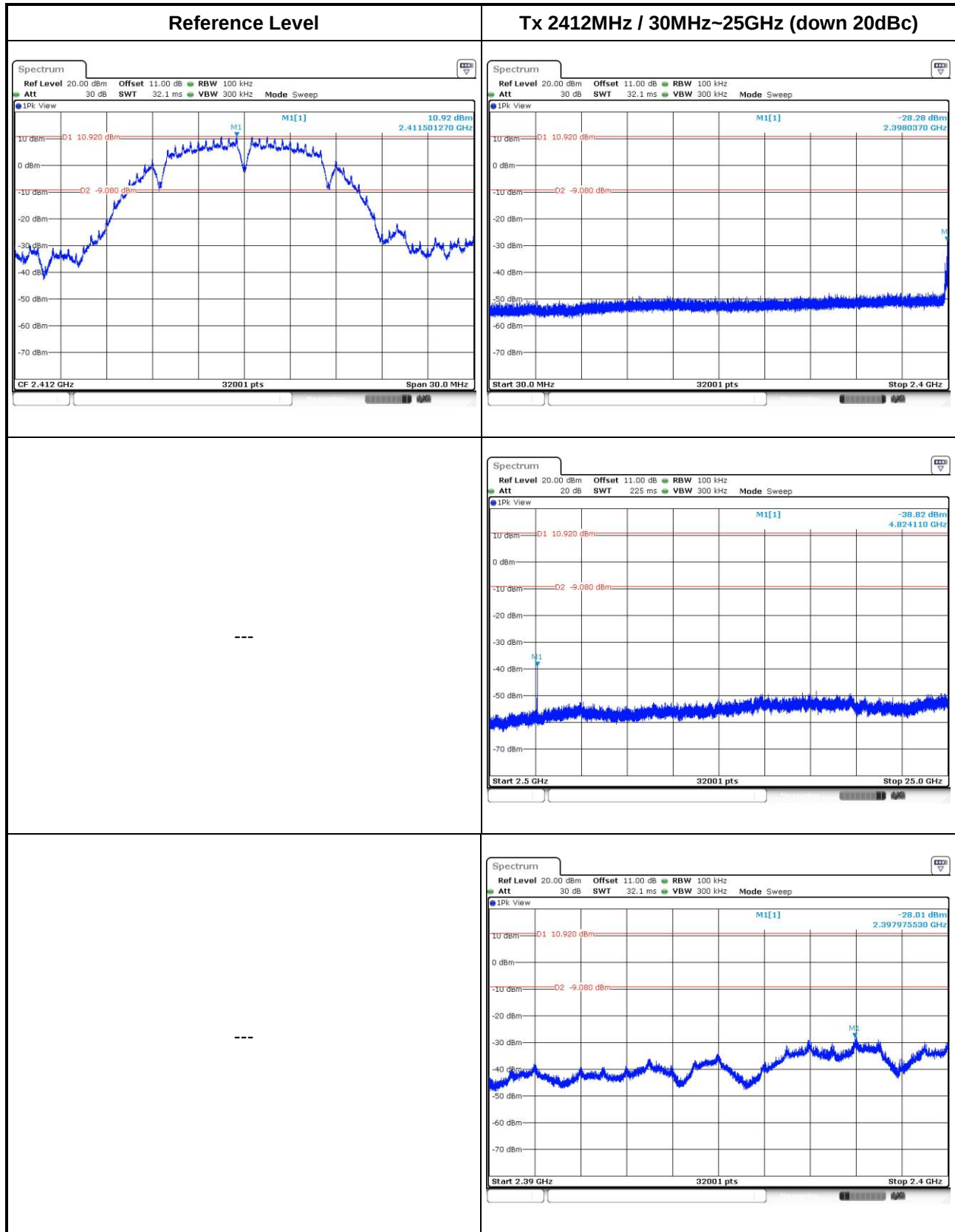


3.6.5 Test Result of Emissions in non-restricted frequency bands

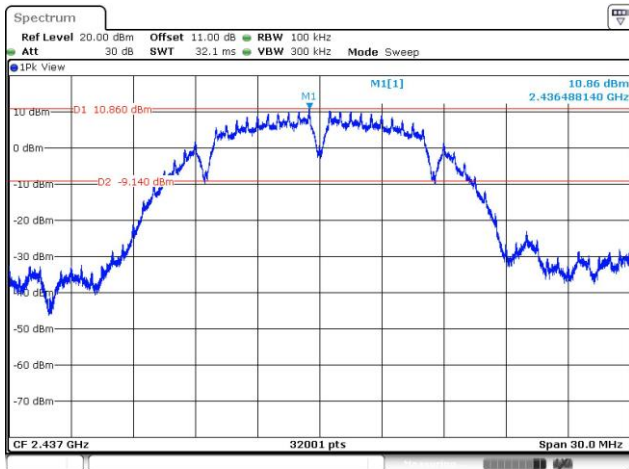
This test item is performed on each TX output individually without summing or adding $10 \log(N_{ANT})$ since measurements are made relative to the in-band emissions on the individual outputs. Only worst test result of each operating mode is presented.

3.6.6 Unwanted Emissions into Non-Restricted Frequency Bands

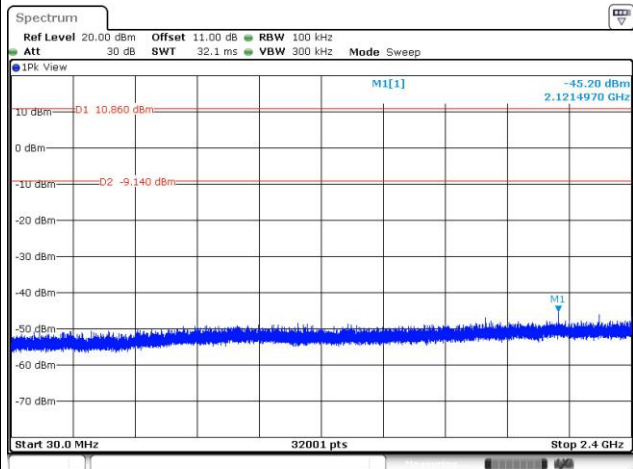
802.11b

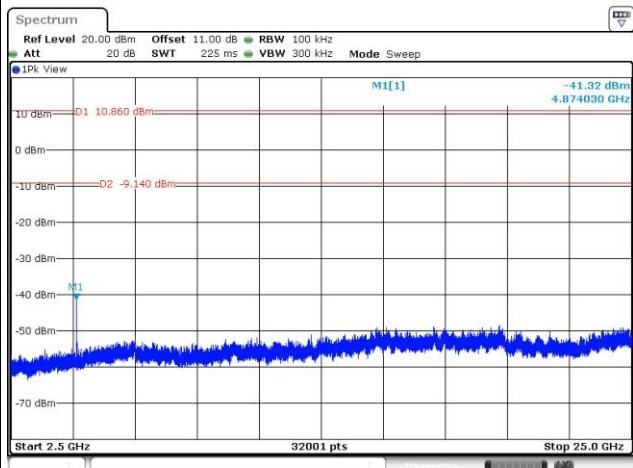


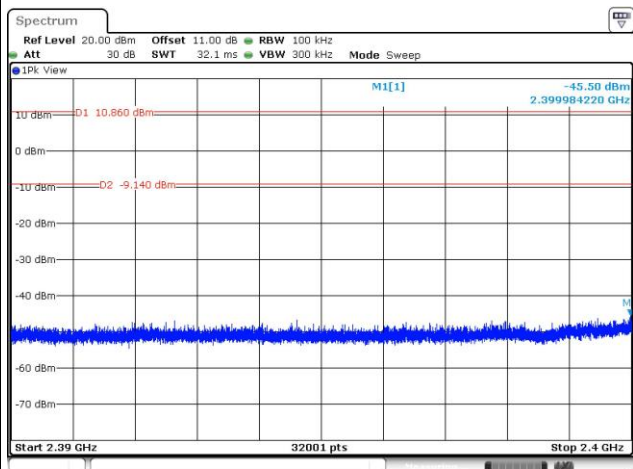
Reference Level

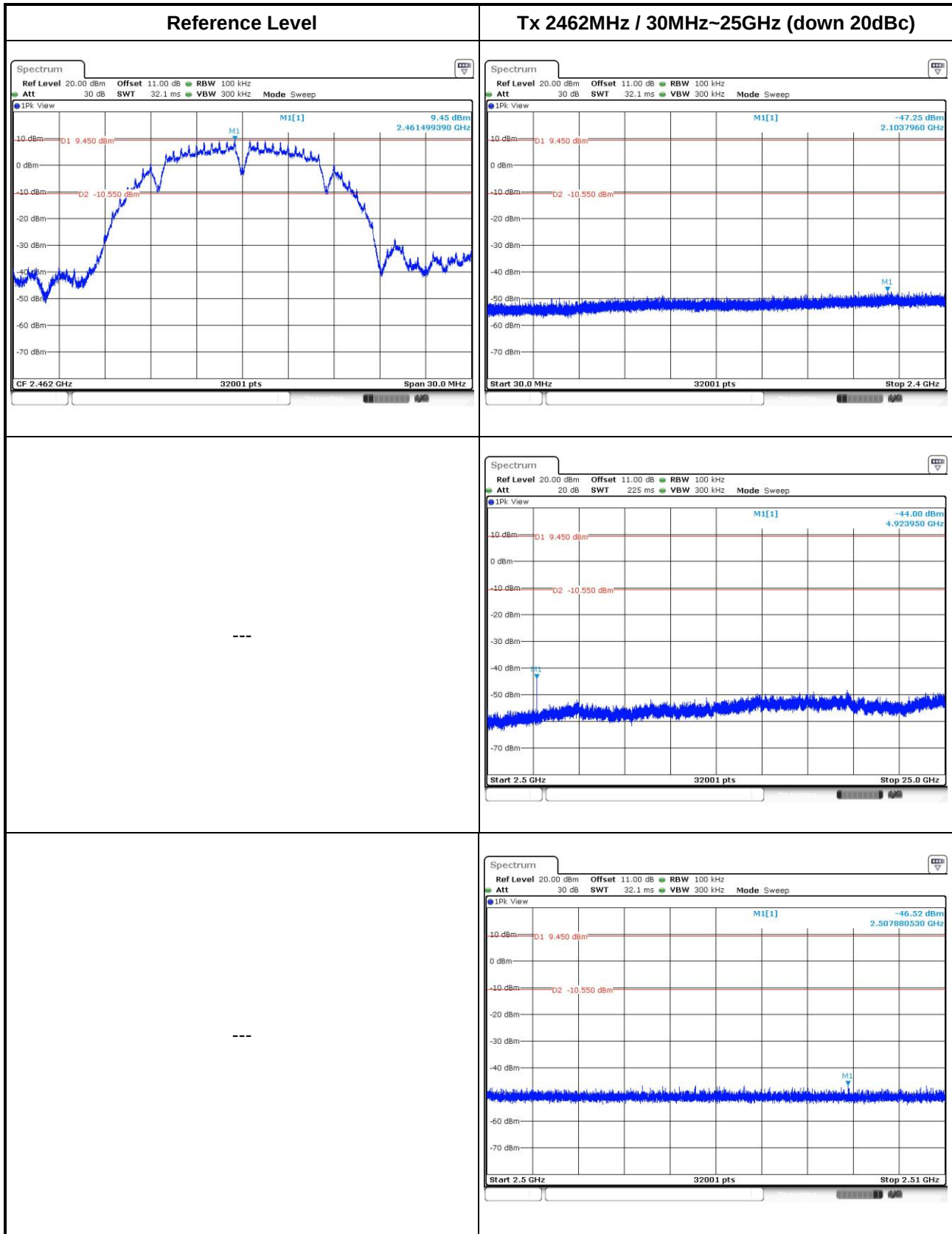


Tx 2437MHz / 30MHz~25GHz (down 20dBc)

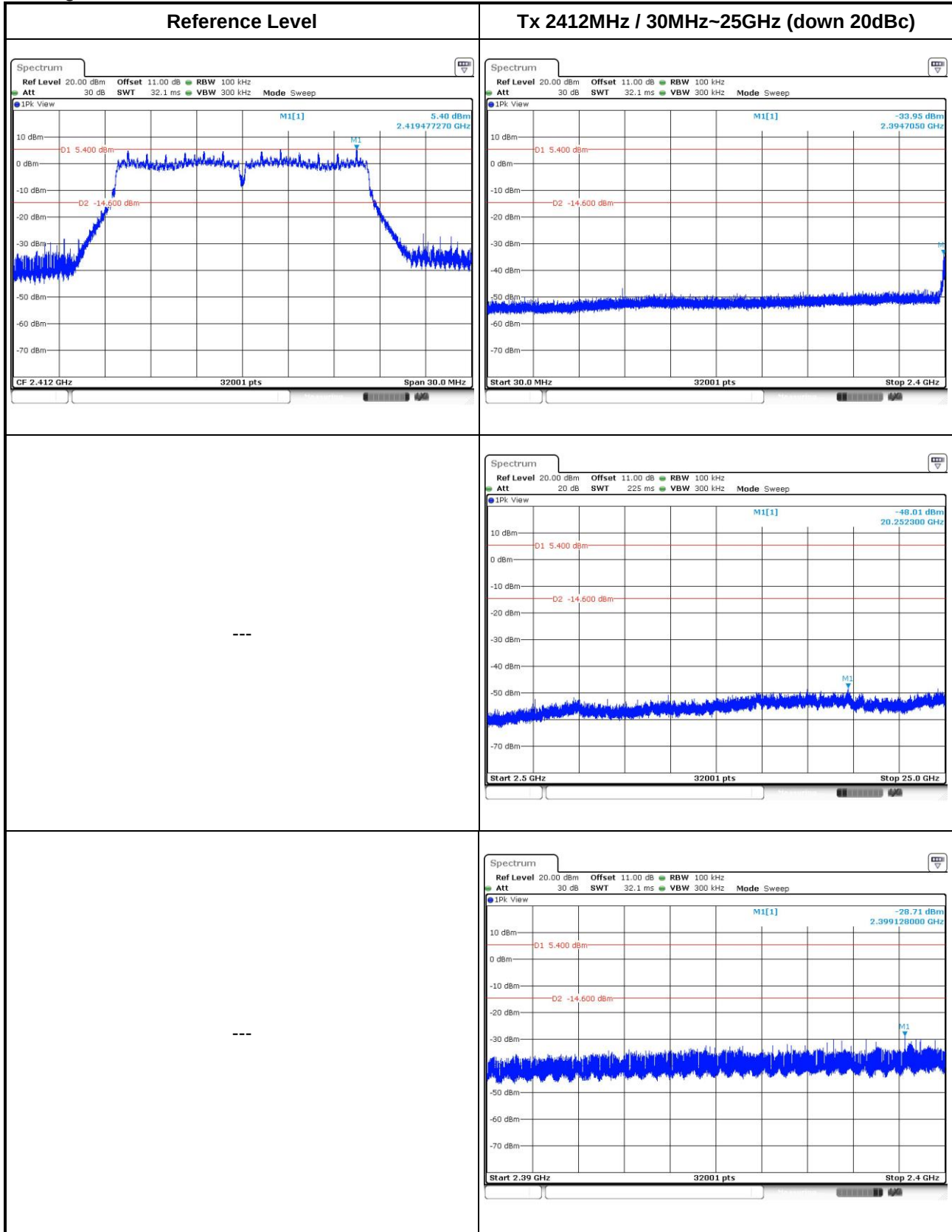


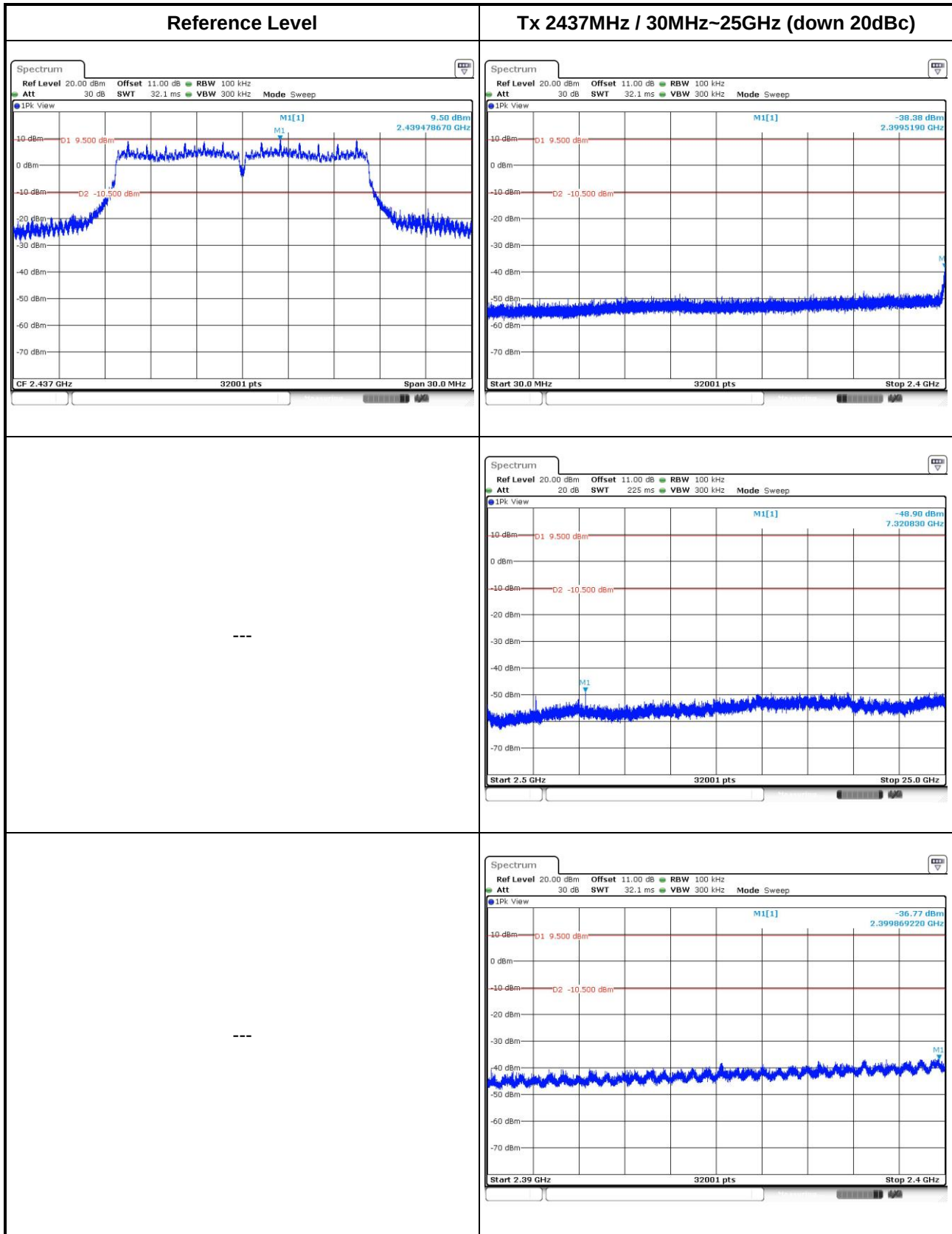


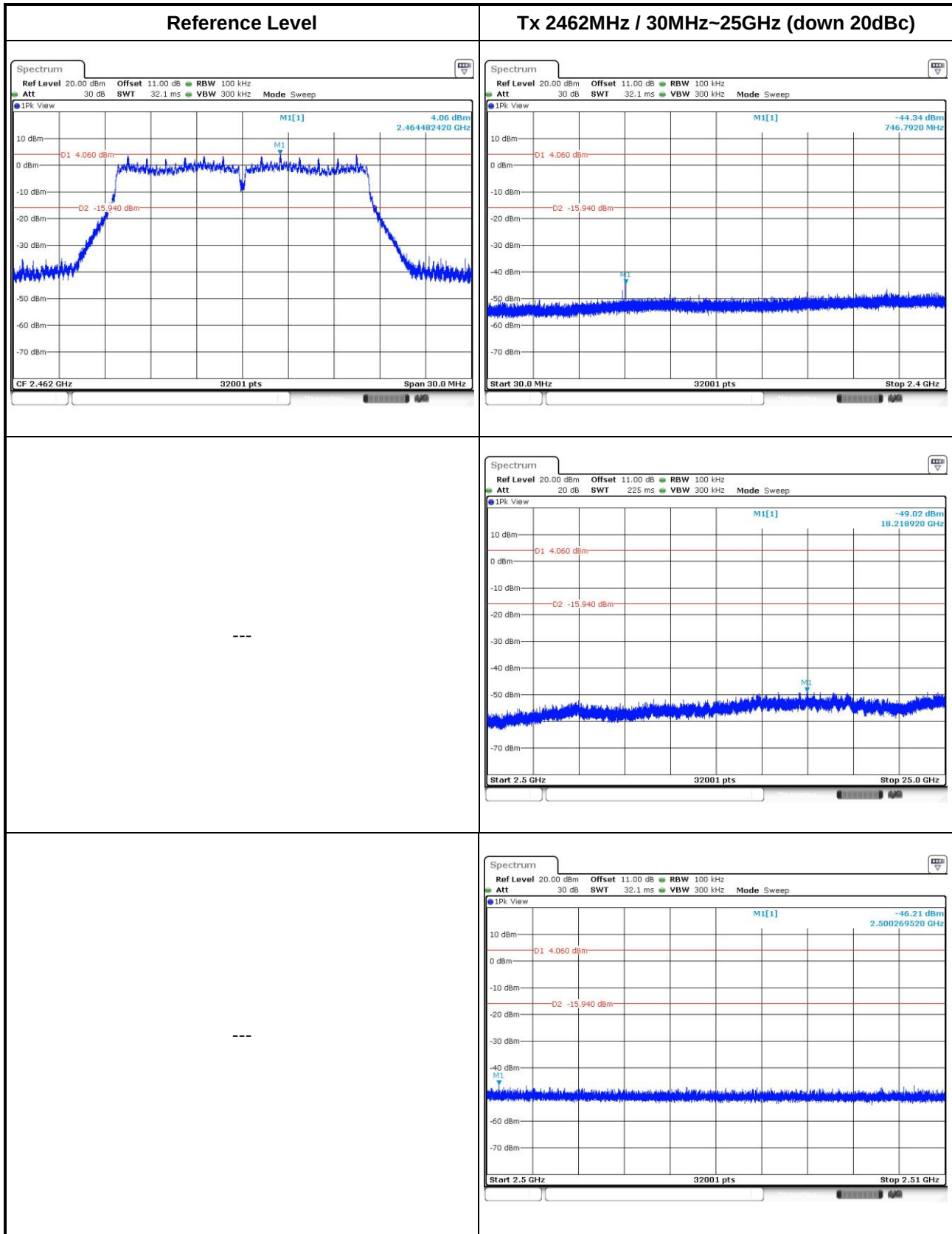




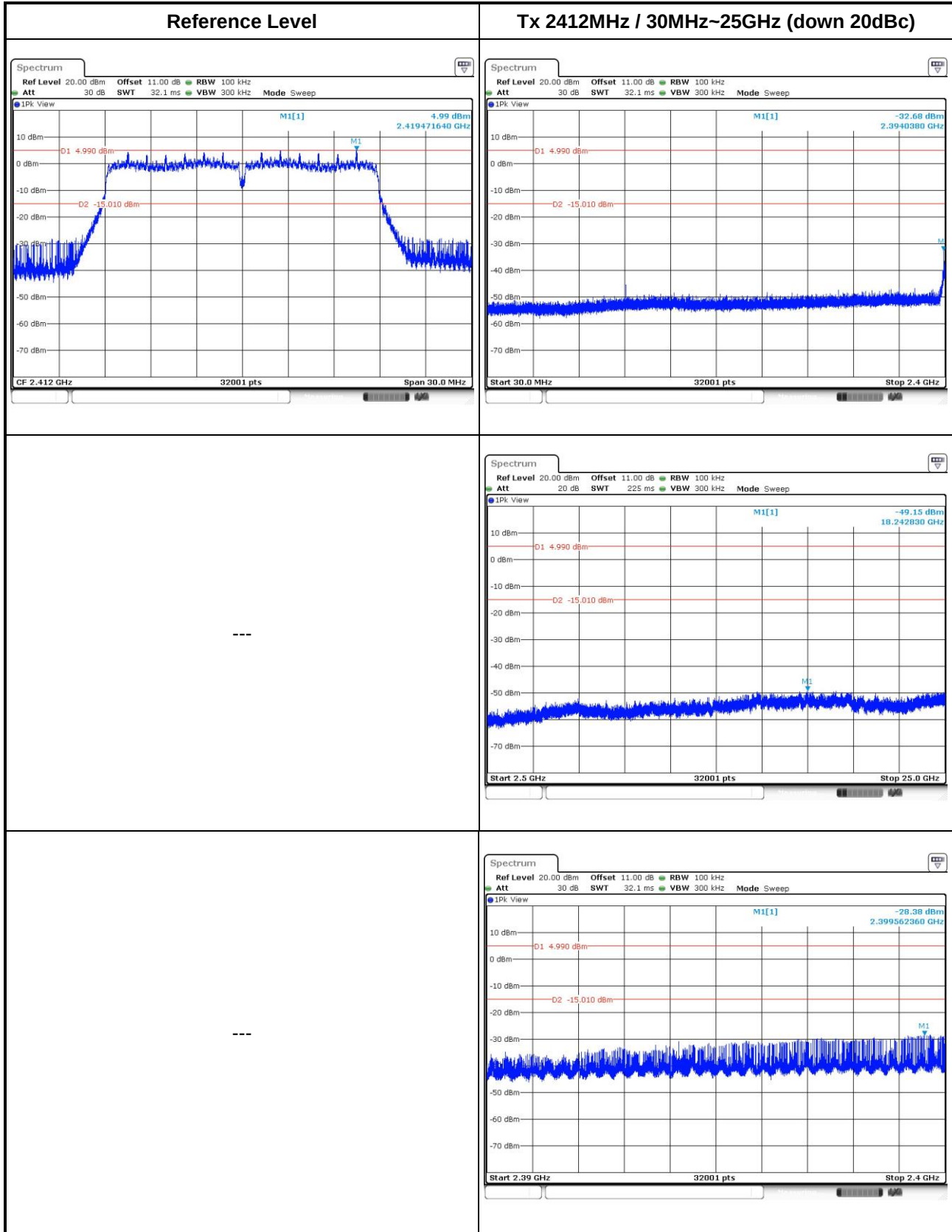
802.11g



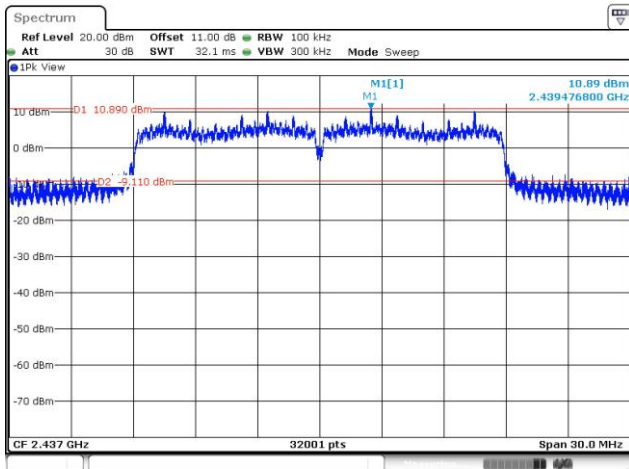




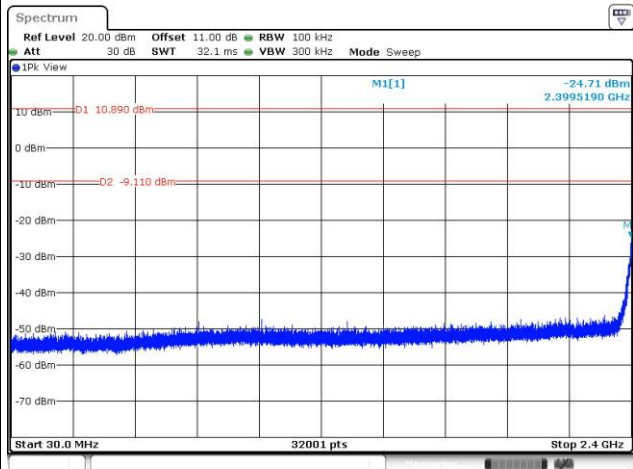
802.11n HT20

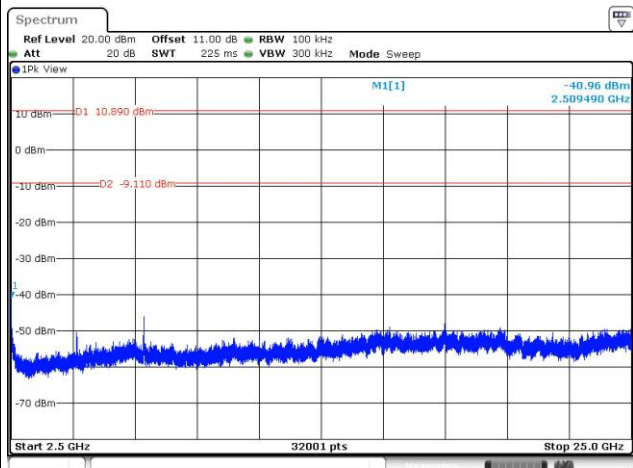


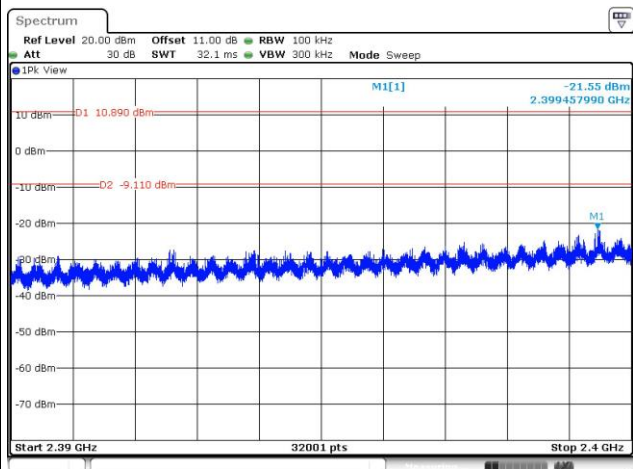
Reference Level



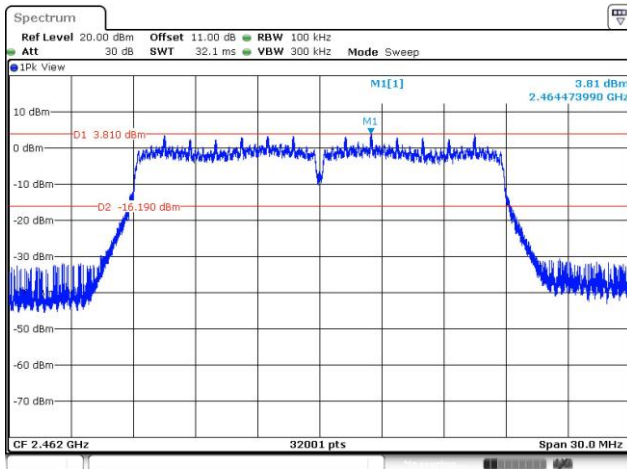
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



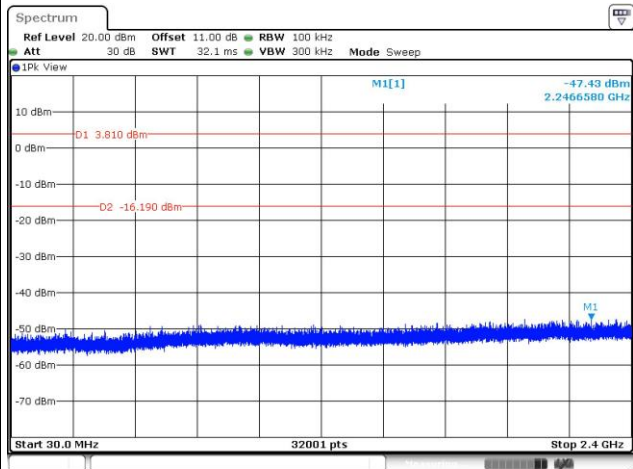


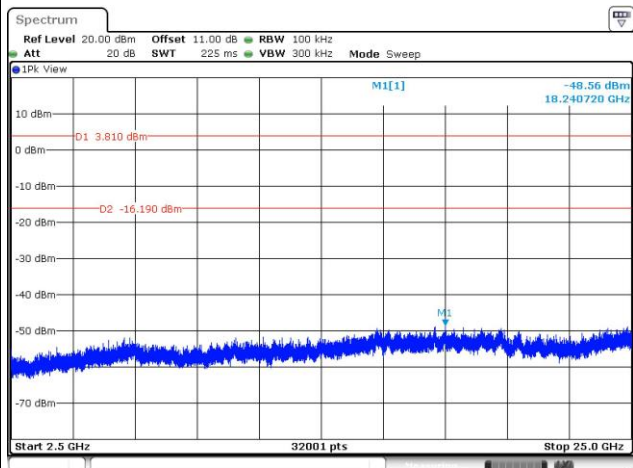


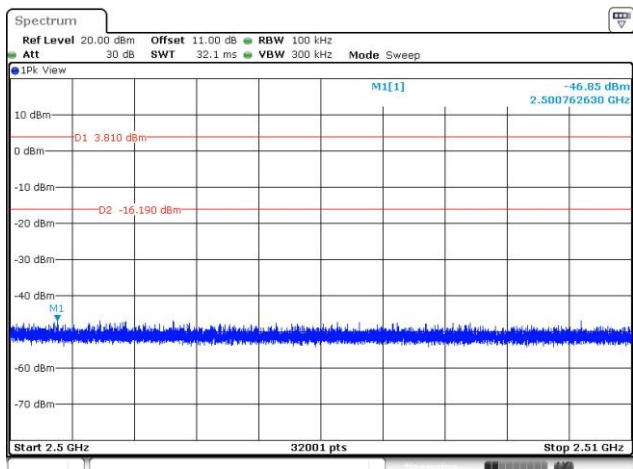
Reference Level



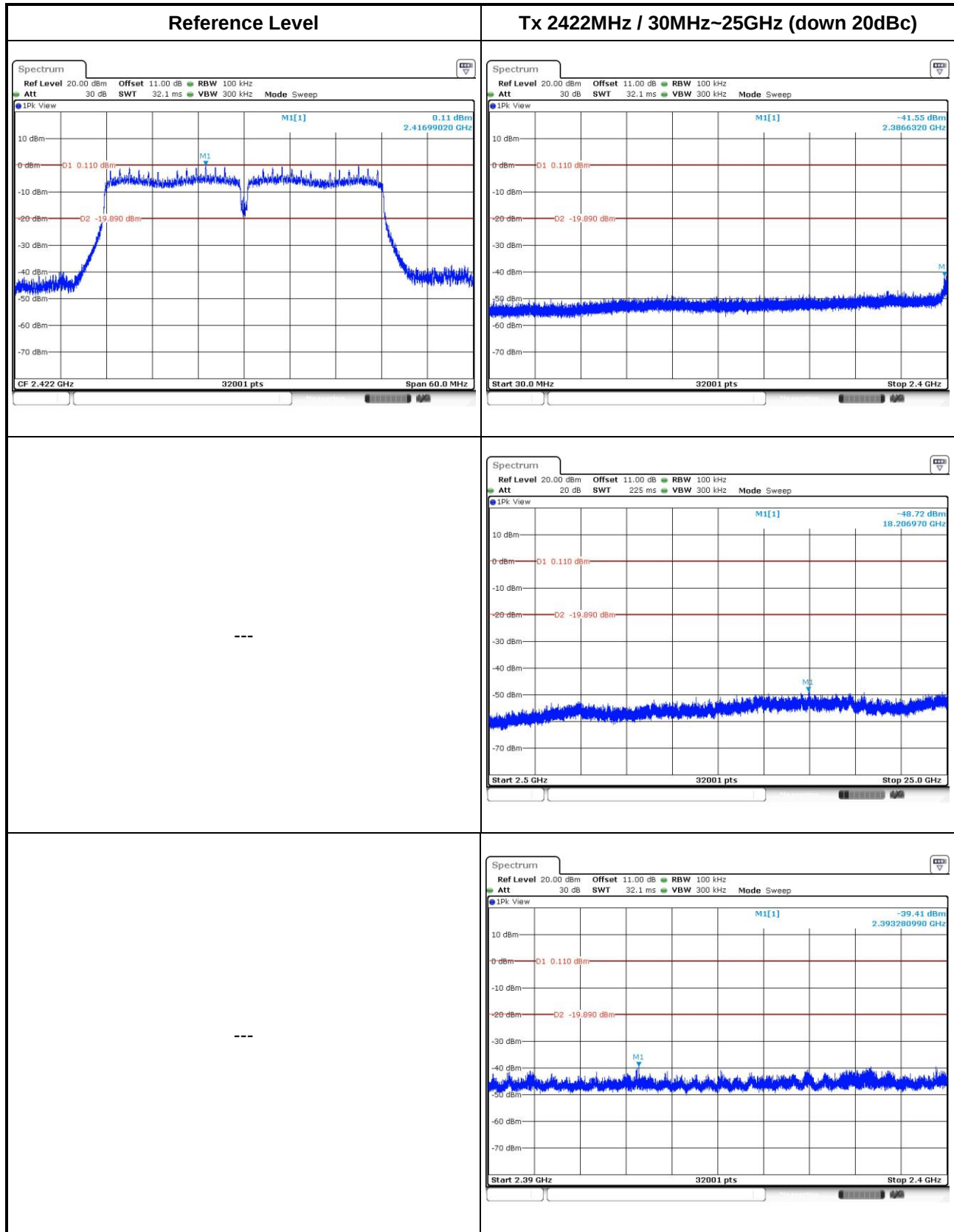
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



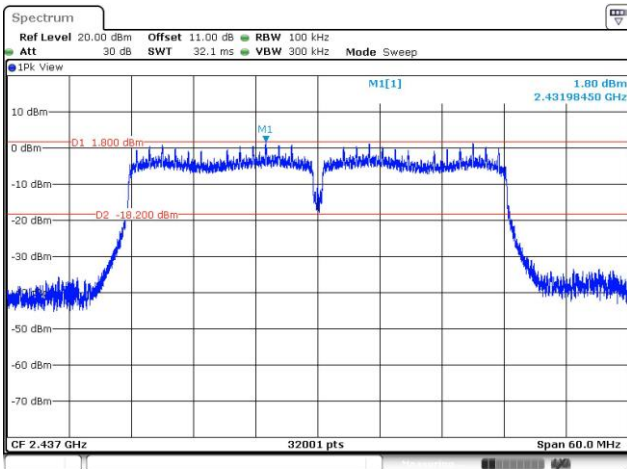




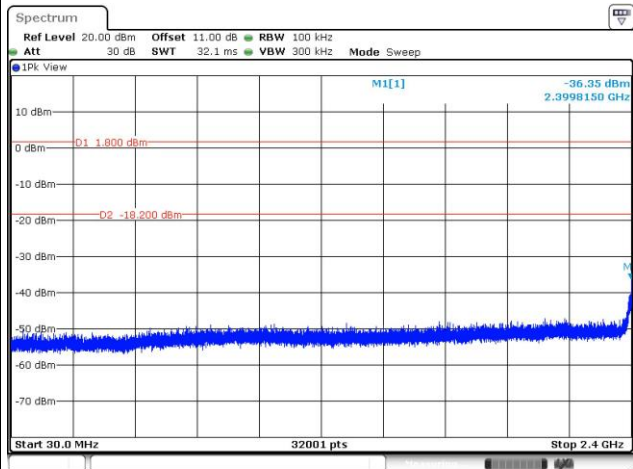
802.11n HT40

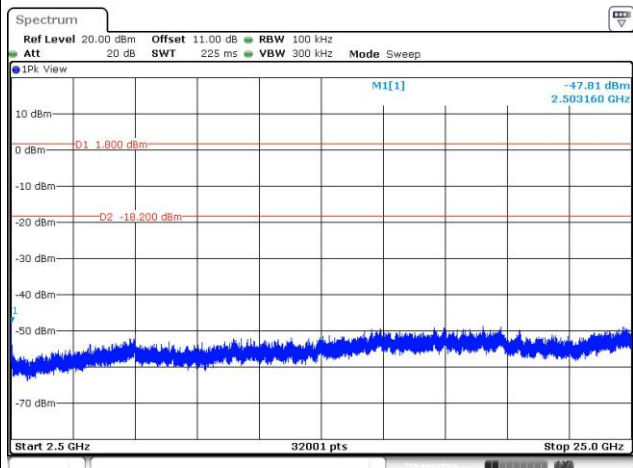


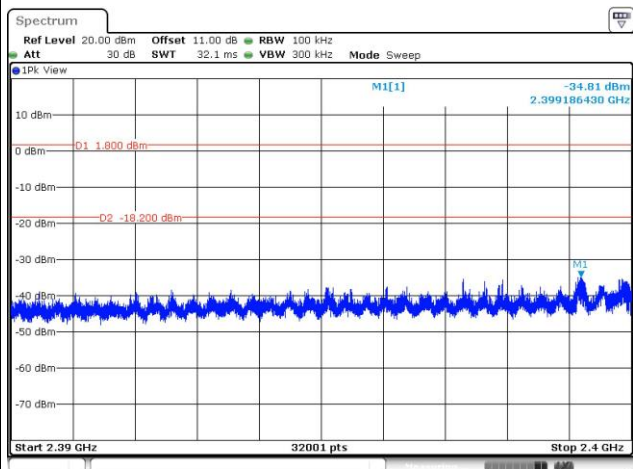
Reference Level



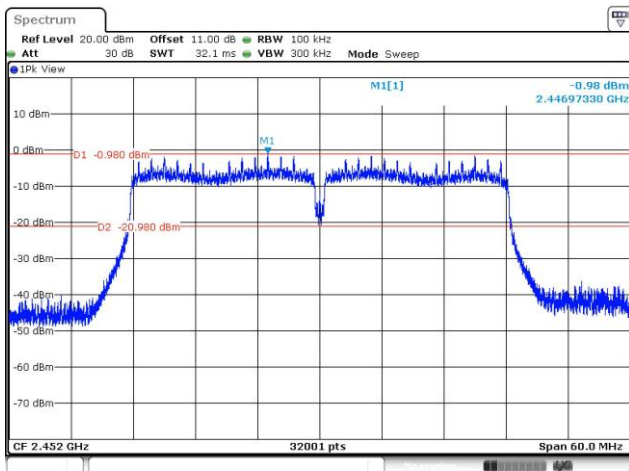
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



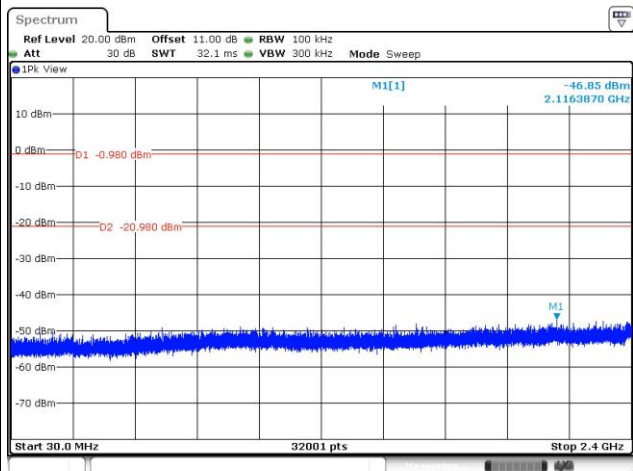


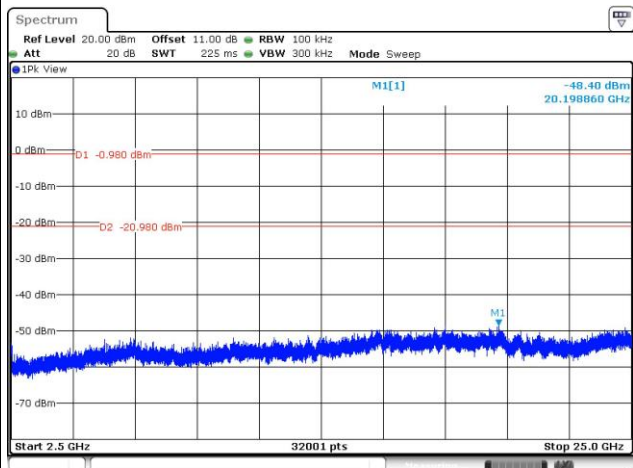


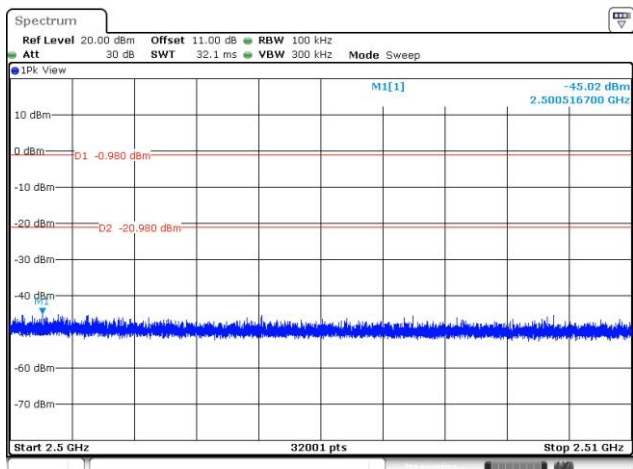
Reference Level



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, 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 Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

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District, New Taipei City, Taiwan,
R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd
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Kwei Shan Site II

Tel: 886-3-271-8640

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St., Kwei Shan Hsiang, Tao Yuan
Hsien 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==