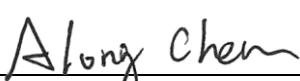


# FCC Test Report

**FCC ID** : 2ABLK-844FX-X  
**Equipment** : GigaCenter  
**Model No.** : 844FB-1 ; 844F-1 ; 844FB-2 ; 844F-2  
(refer to item 1.1.1 for more details)  
**Brand Name** : Calix Inc  
**Applicant** : Calix Inc  
**Address** : 1035 N. McDowell Blvd. Petaluma, CA 94954  
**Standard** : 47 CFR FCC Part 15.247  
**Received Date** : Jan. 10, 2017  
**Tested Date** : Feb. 07 ~ Mar. 07, 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
FR721305AC	Rev. 01	Initial issue	Apr. 10, 2017
FR721305AC	Rev. 02	Revising the accessories information ( P6)	May 05, 2017

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.153MHz 41.02 (Margin -4.98dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 12185.00MHz 52.99 (Margin -1.01dB) – AV  [dBuV/m at 3m]: 12310.00MHz 52.99 (Margin -1.01dB) – AV  [dBuV/m at 3m]: 2390.00MHz 72.99 (Margin -1.01dB) – PK  [dBuV/m at 3m]: 2483.50MHz 72.99 (Margin -1.01dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: <b>Non-beamforming mode</b> 27.41 <b>Beamforming mode</b> 26.63	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 device has 4 configurations as below table.

RF function is identical to each configuration. Differences between 4 configurations are only non-RF function by depopulation of components without PCB Modifications.

Model Name	844FB-1	844FB-2	844F-1	844F-2
LAN / WAN function	4 LAN ports	4 LAN ports 1WAN port	4 LAN ports	4 LAN ports 1WAN port
G.fast function	bonding G.fast	bonding G.fast	Single G.fast	Single G.fast
Power Supply	1. Adapter 2. UPS	Adapter (DC jack)	1. Adapter 2. UPS	Adapter (DC jack)
Housing Type	Housing 1	Housing 2	Housing 1	Housing 2
Frequency band (GHz)	2.412 ~ 2.462 / 5.18 ~ 5.24 / 5.745 ~ 5.825			
Bean forming mode	Supported			
Master or Client	Master			
USB function	USB3.0			
VOIP function	VOIP (FXS)			

Note: Four models (844FB-1, 844FB-2, 844F-1 and 844F-2) had been covered during the pretest, and found that 844F-1 was the worst case and was selected for final test.

### 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]	4	1-11 Mbps
2400-2483.5	g	2412-2462	1-11 [11]	4	6-54 Mbps
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	4	MCS 0-31
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	4	MCS 0-31
2400-2483.5	ac (VHT20)	2412-2462	1-11 [11]	4	MCS 0-9
2400-2483.5	ac (VHT40)	2422-2452	3-9 [7]	4	MCS 0-9

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.  
Note 2: 802.11b uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.  
Note 3: 802.11g/n/ac uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation..  
Note 4: 802.11ac supports beamforming function.

### 1.1.3 Antenna Details

Ant. No.	Model	Type	Connector	Operating Frequency (MHz) / Gain (dBi)		
				2400~2483.5	5150~5250	5725~5850
1	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
2	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
3	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
4	PCB antenna	Dipole	IPEX	0	-0.8	-1.2

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

Power Supply Type	12Vdc from AC adapter 12Vdc from UPS
-------------------	---

### 1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: MASS POWER Model: NBS65A120410M2 Power Rating: I/P: 100-240Vac, 50/60Hz, 1.5A O/P: 12Vdc, 4.1A Power Line: DC 1.2m non-shielded without core AC 1.5m non-shielded without core
2	UPS	Brand: Cyber Power Model: DTC50U12V3-G Power Rating: I/P: 100-240Vac, 50-60Hz, 1.5A O/P: 12Vdc, 50W Power Line: DC 1.2m non-shielded without core AC 2.45m non-shielded without core

### 1.1.6 Channel List

Frequency band (MHz)		2400~2483.5	
802.11 b / g / n HT20 / ac VHT20		802.11n HT40 / ac VHT40	
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	Non-beamforming: MTool, Version: 3.0.0.1 Beamforming: iperf LanTest20, Version: 2.0.0.2				
Duty Cycle and Duty Factor	Mode	Non-beamforming		Beamforming	
		Duty cycle (%)	Duty factor (dB)	Duty cycle (%)	Duty factor (dB)
	11b	100.00%	0.00	---	---
	11g	99.31%	0.03	---	---
	VHT20	99.63%	0.02	98.35%	0.07
	VHT40	98.67%	0.06	97.01%	0.13

### 1.1.8 Power Setting

Modulation Mode	Test Frequency (MHz)	Power Set	
		Non-beamforming	Beamforming
11b	2412	84	---
11b	2437	84	---
11b	2462	84	---
11g	2412	76	---
11g	2437	86	---
11g	2462	70	---
HT20	2412	76	70
HT20	2437	86	86
HT20	2462	70	70
HT40	2422	68	62
HT40	2437	72	68
HT40	2452	66	64
VHT20	2412	76	70
VHT20	2437	86	86
VHT20	2462	70	70
VHT40	2422	68	62
VHT40	2437	72	68
VHT40	2452	66	64

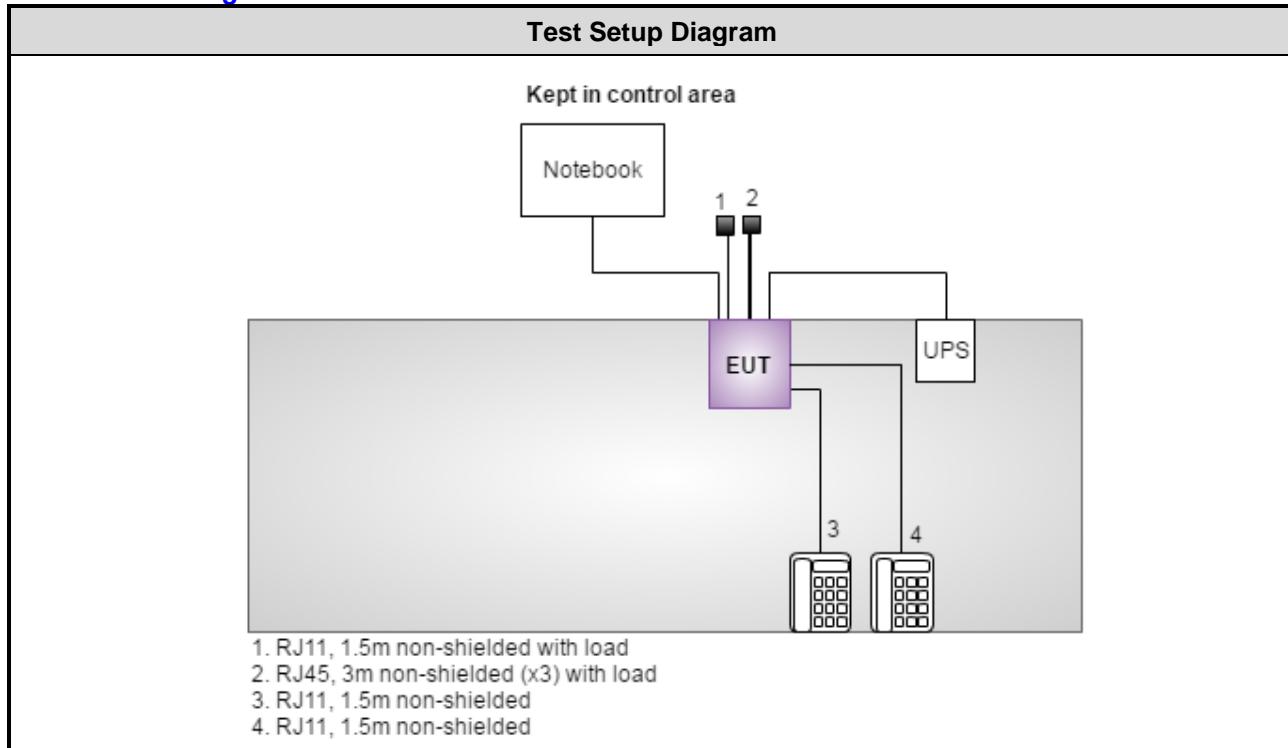
## 1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E6430	DoC	RJ45, 10m non-shielded.
2	Telephone	HTT	HTT-806	---	RJ11, 1.5m non-shielded
3	Telephone	HTT	HTT-806	---	RJ11, 1.5m non-shielded
4	Load	ICC	---	---	RJ45, 1m(x3) non-shielded.
5	Load	ICC	---	---	RJ11, 1.5m non-shielded.
6	Client	ASUS	PCE-AC88	MSQ-PCIE 0U00	---

Note: No. 6 was supplied by applicant.

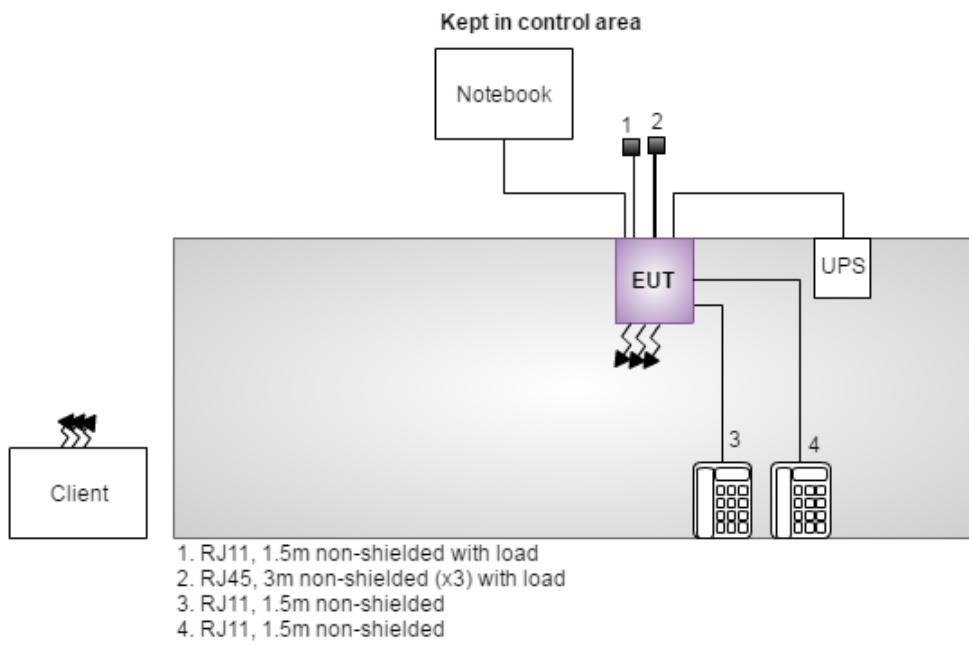
## 1.3 Test Setup Chart

### *Non-beamforming mode*



**Beamforming mode**

**Test Setup Diagram**



## 1.4 The Equipment List

<b>Test Item</b>	Conducted Emission				
<b>Test Site</b>	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.

<b>Test Item</b>	Radiated Emission				
<b>Test Site</b>	966 chamber1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Nov. 25, 2016	Nov. 24, 2017
Receiver	R&S	ESR3	101658	Nov. 24, 2016	Nov. 23, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Aug. 04, 2016	Aug. 03, 2017
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 21, 2016	Dec. 20, 2017
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	980225	Aug. 05, 2016	Aug. 04, 2017
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2016	Oct. 05, 2017
Preamplifier	EMC	EMC184045B	980192	Aug. 24, 2016	Aug. 23, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 09, 2016	Dec. 08, 2017
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 09, 2016	Dec. 08, 2017
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 09, 2016	Dec. 08, 2017
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 09, 2016	Dec. 08, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

<b>Test Item</b>	RF Conducted				
<b>Test Site</b>	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101486	Nov. 15, 2016	Nov. 14, 2017
Power Sensor	Anritsu	MA2411B	1207366	Oct. 06, 2016	Oct. 05, 2017
Signal Generator	R&S	SMB100A	175727	Oct. 19, 2016	Oct. 18, 2017
AC POWER SOURCE	APC	AFC-500W	F312060012	Oct. 28, 2016	Oct. 27, 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 v03r05

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	±5.63 dB

## 2 Test Configuration

### 2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	17°C / 59%	Howard Huang
Radiated Emissions	03CH01-WS	20-22°C / 61-64%	Vincent Yeh Kevin Lee
RF Conducted	TH01-WS	21°C / 64%	Brad Wu

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

## 2.2 The Worst Test Modes and Channel Details

### *Non-beamforming mode*

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate (Mbps) / MCS	Test Configuration
Conducted Emissions	11b	2437	1 Mbps	---
Radiated Emissions ≤1GHz	11b	2437	1 Mbps	---
Maximum Output Power	11b	2412 / 2437 / 2462	1 Mbps	---
	11g	2412 / 2437 / 2462	6 Mbps	
	HT20	2412 / 2437 / 2462	MCS 0	
	HT40	2422 / 2437 / 2452	MCS 0	
	VHT20	2412 / 2437 / 2462	MCS 0	
	VHT40	2422 / 2437 / 2452	MCS 0	
Radiated Emissions >1GHz	11b	2412 / 2437 / 2462	1 Mbps	---
6dB bandwidth	11g	2412 / 2437 / 2462	6 Mbps	
Power spectral density	VHT20	2412 / 2437 / 2462	MCS 0	
	VHT40	2422 / 2437 / 2452	MCS 0	

**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. Two power supply (Adapter and UPS) had been covered during the pretest, and found that conducted emissions with adapter and radiated Emissions with UPS were the worst case for final test.

### *Beamforming mode*

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate (Mbps) / MCS	Test Configuration
Conducted Emissions	VHT20	2437	MCS 0	---
Radiated Emissions ≤1GHz	VHT20	2437	MCS 0	---
Radiated Emissions >1GHz				
Maximum Output Power	VHT20	2412 / 2437 / 2462	MCS 0	---
6dB bandwidth	VHT40	2422 / 2437 / 2452	MCS 0	
Power spectral density				

**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. Two power supply (Adapter and UPS) had been covered during the pretest, and found that conducted emissions with adapter and radiated Emissions with UPS were the worst case for final test.

## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

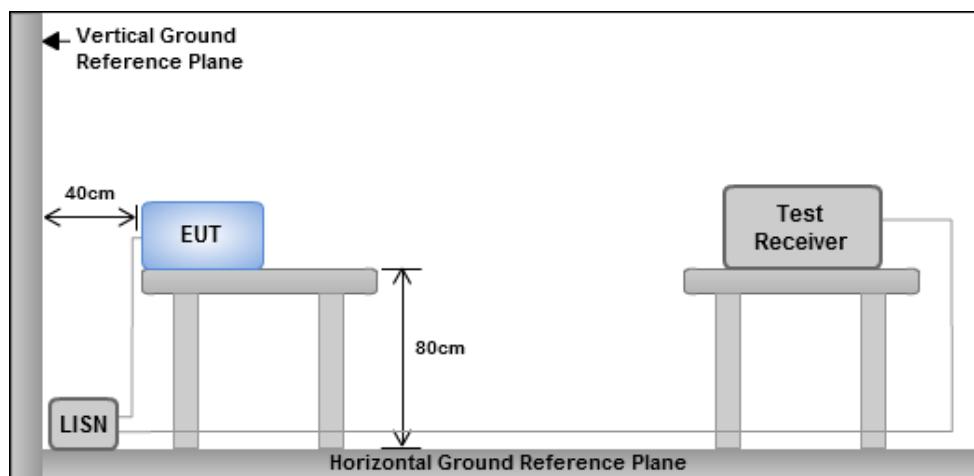
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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.

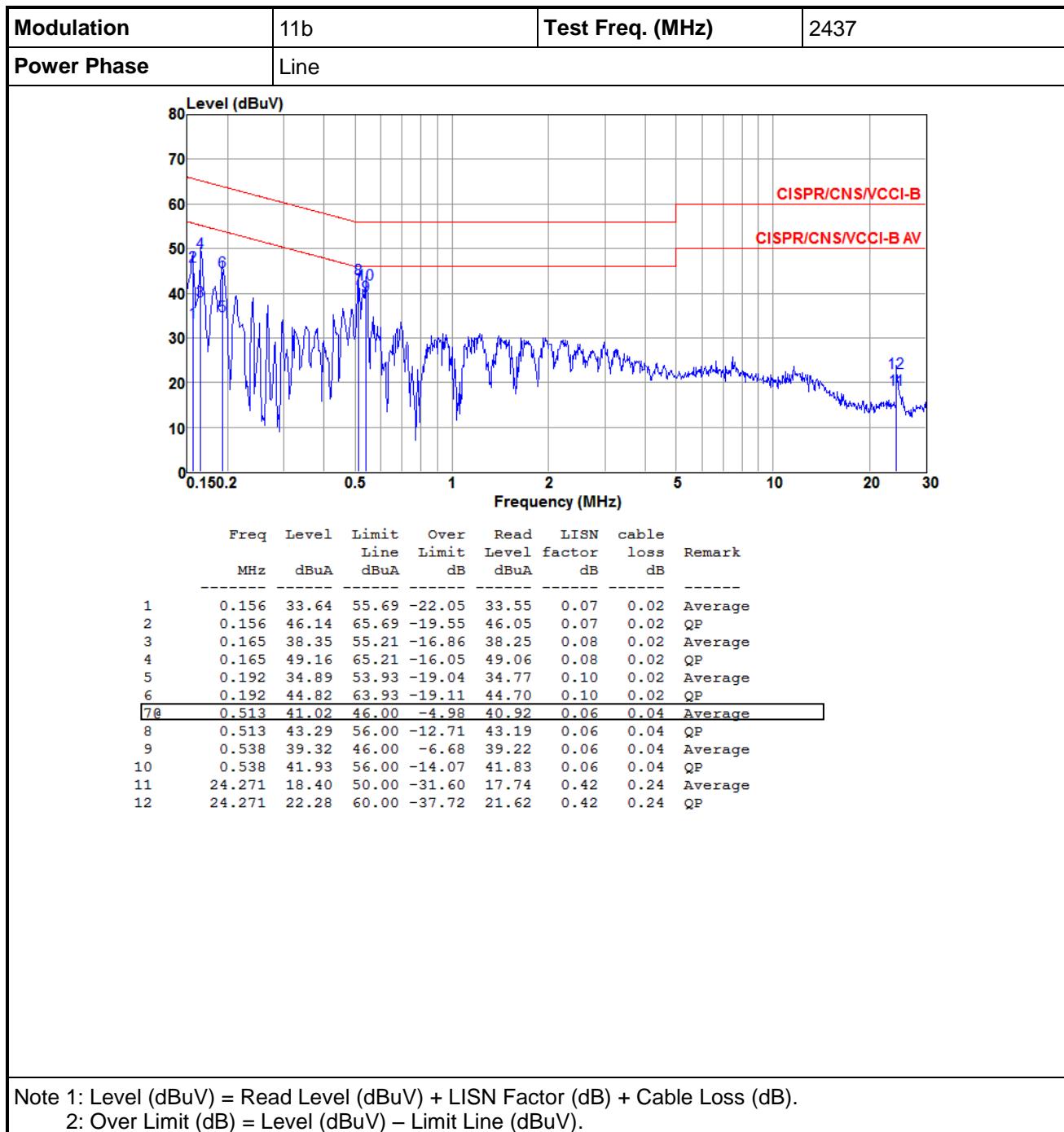
#### 3.1.3 Test Setup

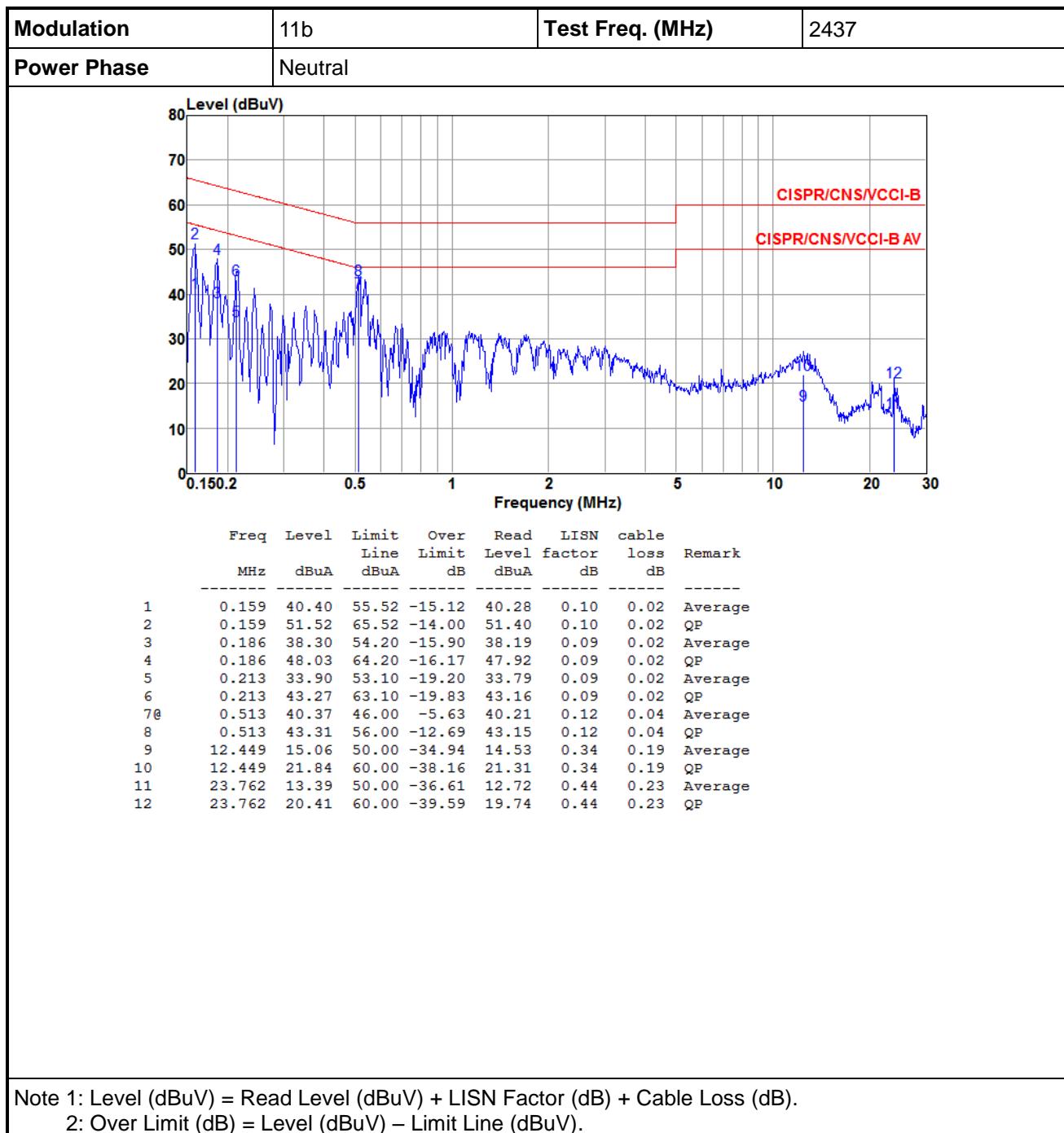


- Note:**
1. Support units were connected to second LISN.
  2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

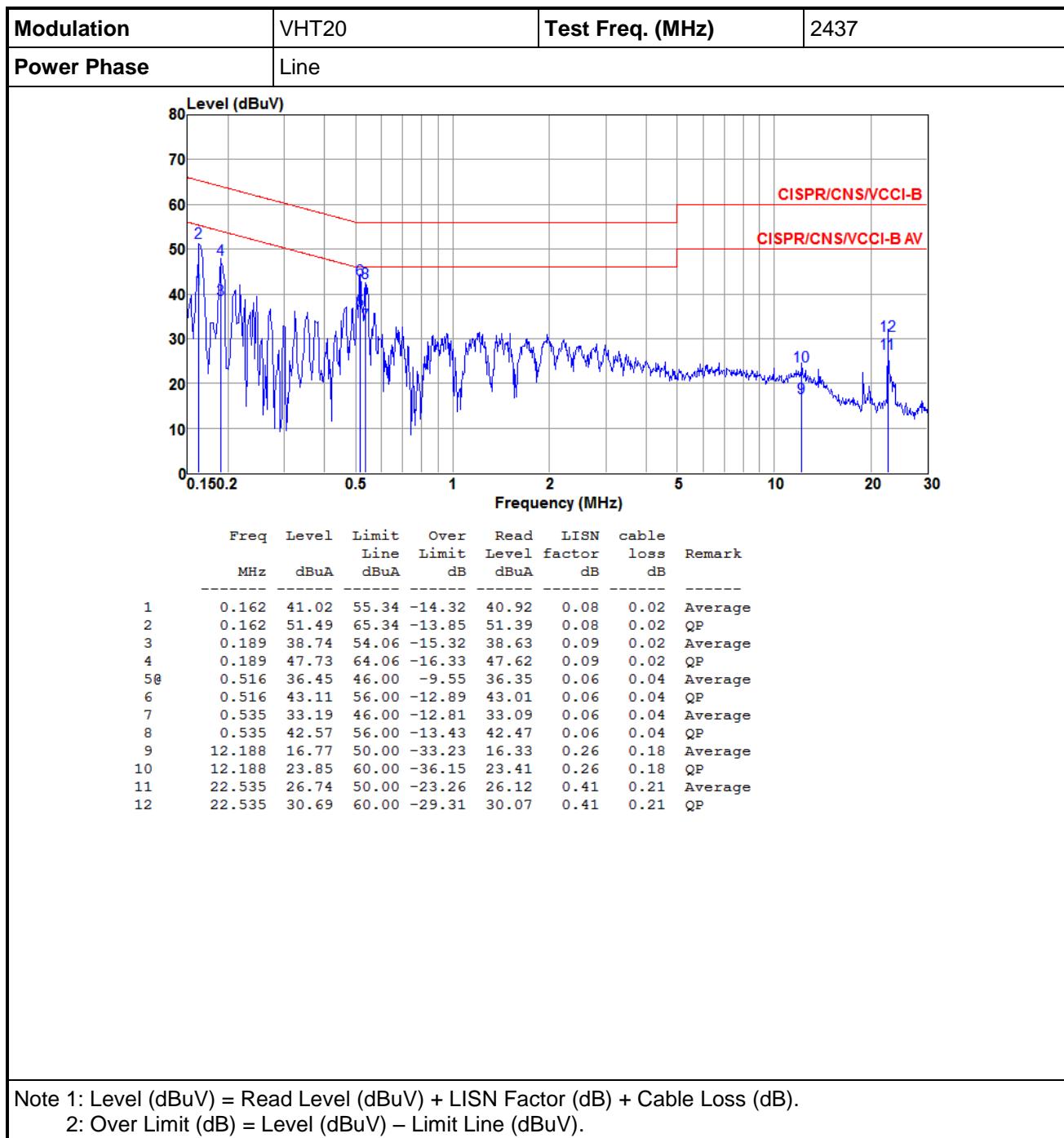
### 3.1.4 Test Result of Conducted Emissions

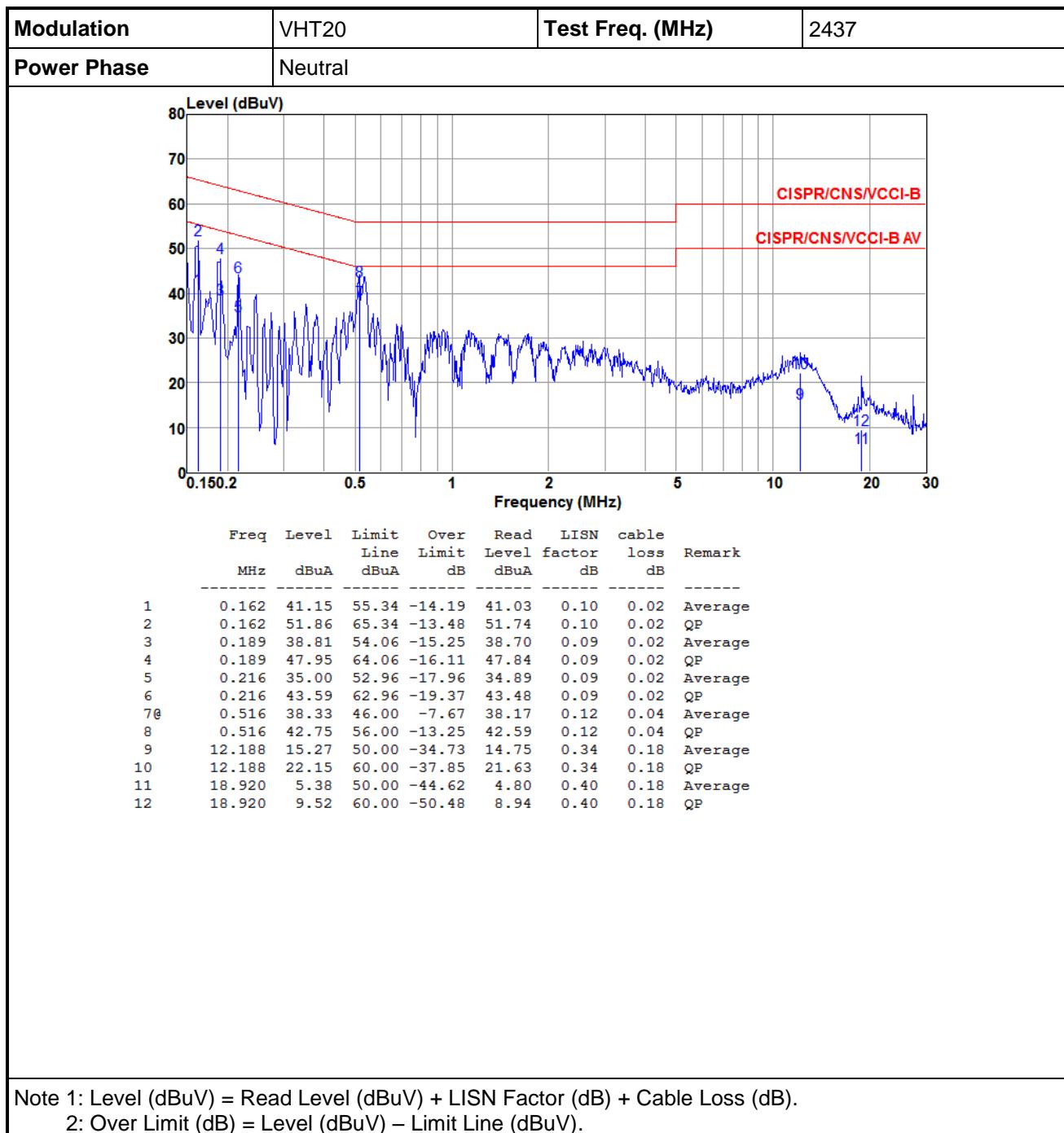
#### **Non-beamforming mode**





### Beamforming mode





## 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

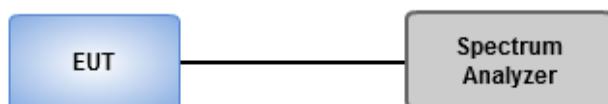
#### 6dB Bandwidth

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.

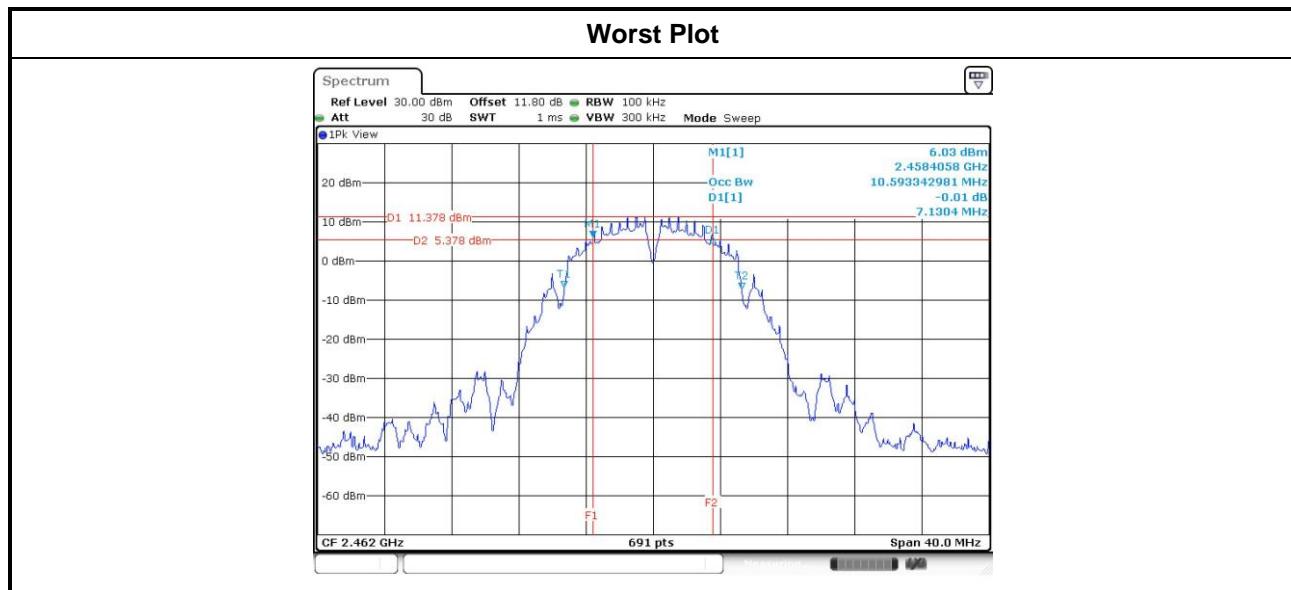
### 3.2.3 Test Setup



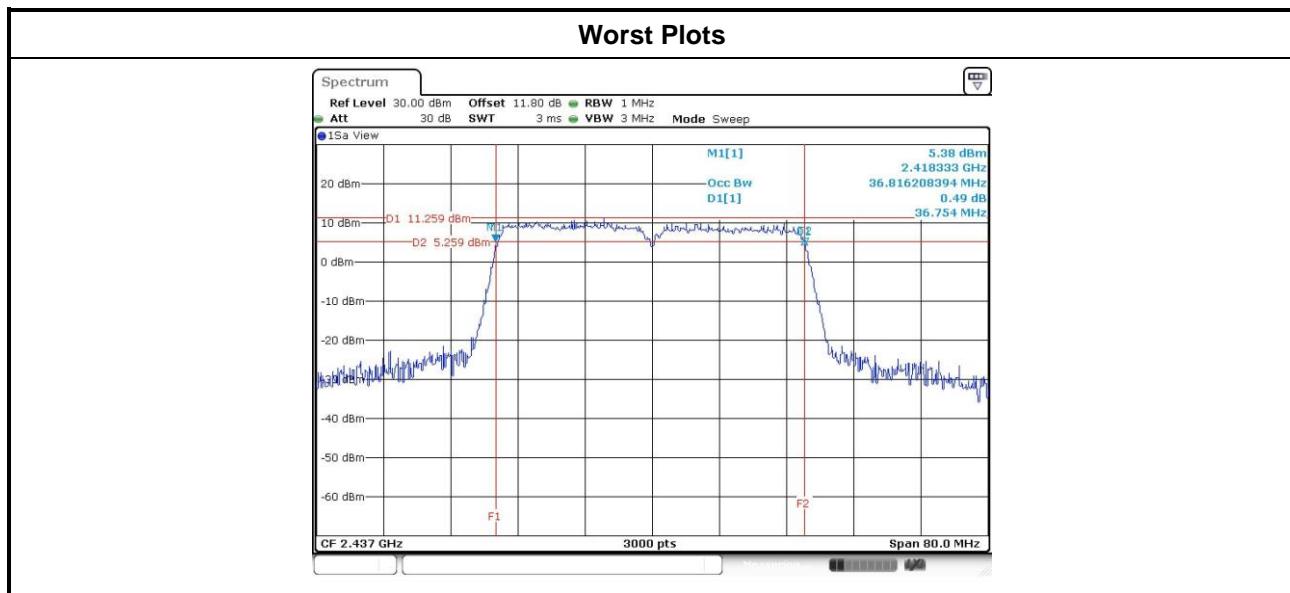
### 3.2.4 Test Result of 6dB and Occupied Bandwidth

#### *Non-beamforming mode*

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	6dB Bandwidth (MHz)				Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
11b	4	2412	8.06	8.06	7.59	7.59	500
11b	4	2437	8.06	8.06	8.06	8.06	500
11b	4	2462	8.06	8.06	7.13	8.06	500
11g	4	2412	15.48	13.86	13.86	13.86	500
11g	4	2437	15.42	15.07	15.13	15.13	500
11g	4	2462	15.65	15.13	15.07	15.13	500
VHT20	4	2412	15.01	15.13	14.09	15.30	500
VHT20	4	2437	15.07	15.13	15.71	15.71	500
VHT20	4	2462	15.07	15.65	15.71	15.07	500
VHT40	4	2422	36.29	36.29	36.06	35.94	500
VHT40	4	2437	36.41	36.41	35.83	36.41	500
VHT40	4	2452	36.29	36.41	36.29	35.83	500

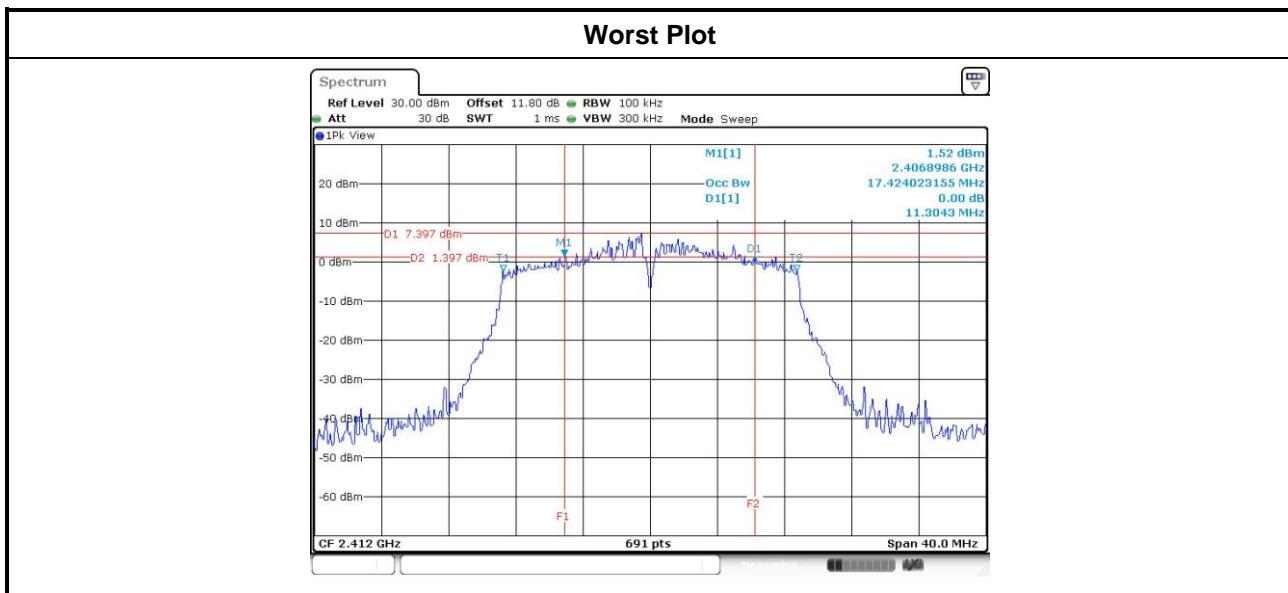


Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	99% Occupied Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
11b	4	2412	10.88	10.65	10.59	10.48
11b	4	2437	11.06	10.71	10.65	10.48
11b	4	2462	11.06	10.82	10.82	10.48
11g	4	2412	16.67	16.56	16.50	16.50
11g	4	2437	17.48	16.96	17.08	16.85
11g	4	2462	16.61	16.50	16.50	16.44
VHT20	4	2412	17.71	17.60	17.66	17.60
VHT20	4	2437	18.35	17.89	18.12	17.83
VHT20	4	2462	17.77	17.60	17.66	17.60
VHT40	4	2422	36.70	36.58	36.58	36.58
VHT40	4	2437	36.82	36.70	36.82	36.82
VHT40	4	2452	36.82	36.58	36.70	36.70

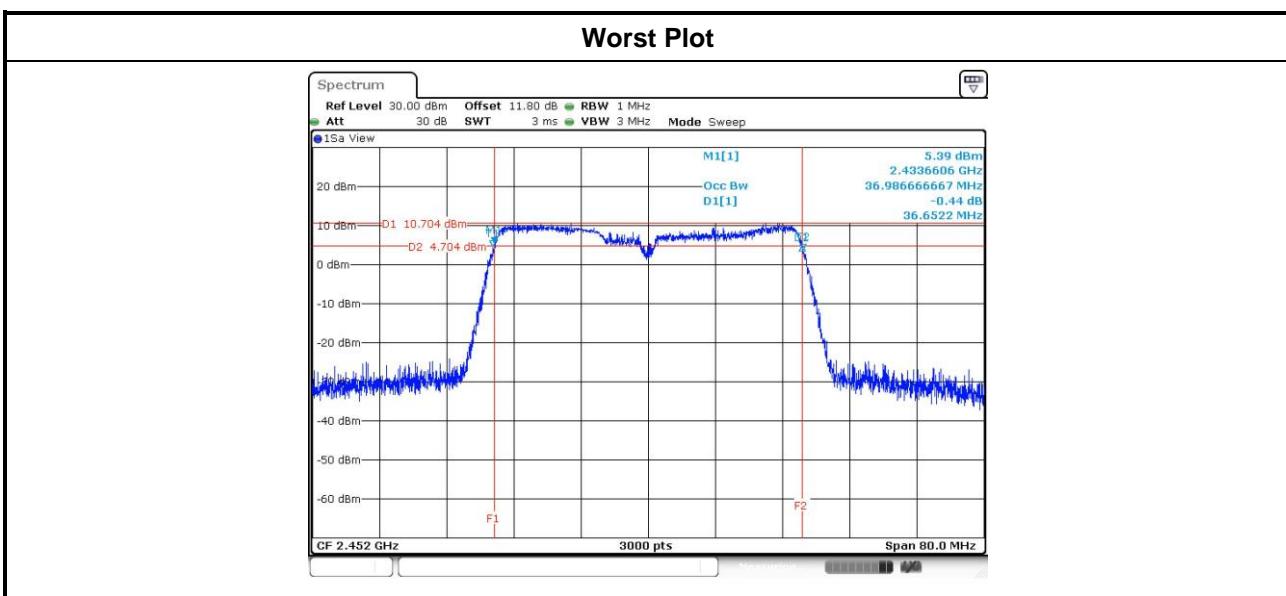


### Beamforming mode

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	6dB Bandwidth (MHz)				Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
VHT20	4	2412	13.86	11.30	12.58	12.64	500
VHT20	4	2437	13.86	16.81	15.13	15.13	500
VHT20	4	2462	16.00	15.71	13.80	11.36	500
VHT40	4	2422	35.71	35.13	35.01	35.01	500
VHT40	4	2437	35.01	35.01	36.41	32.46	500
VHT40	4	2452	35.01	35.25	35.01	35.01	500



Modulation Mode	$N_{TX}$	Freq. (MHz)	99% Occupied Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
VHT20	4	2412	17.65	17.51	17.71	17.49
VHT20	4	2437	17.92	18.01	17.76	18.17
VHT20	4	2462	17.97	17.49	17.55	17.49
VHT40	4	2422	36.69	36.67	36.37	36.40
VHT40	4	2437	36.56	36.40	36.35	36.35
VHT40	4	2452	36.99	36.45	36.59	36.40



### 3.3 RF Output Power

#### 3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

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

Antenna gain > 6dBi

Non Fixed, point to point operations.

The conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB

Fixed, point to point operations

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

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

#### 3.3.2 Test Procedures

Maximum Peak Conducted Output Power

**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

**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

#### *Non-beamforming mode*

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Conducted (Average) 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	4	2412	21.34	21.09	21.49	21.14	535.619	27.29	30.00	0.00	27.29	36.00
11b	4	2437	21.44	21.43	21.46	21.24	551.315	27.41	30.00	0.00	27.41	36.00
11b	4	2462	21.42	21.5	21.39	21.11	546.772	27.38	30.00	0.00	27.38	36.00
11g	4	2412	18.27	18.18	18.54	18.26	271.347	24.34	30.00	0.00	24.34	36.00
11g	4	2437	21.14	21.06	21.25	21.13	520.731	27.17	30.00	0.00	27.17	36.00
11g	4	2462	17.28	16.95	17.16	16.88	203.754	23.09	30.00	0.00	23.09	36.00
HT20	4	2412	18.16	17.82	17.59	18.03	246.942	23.93	30.00	0.00	23.93	36.00
HT20	4	2437	20.88	20.35	20.43	20.65	457.407	26.60	30.00	0.00	26.60	36.00
HT20	4	2462	17.01	16.79	16.69	16.43	188.607	22.76	30.00	0.00	22.76	36.00
HT40	4	2422	16.35	16.41	16.06	16.01	167.171	22.23	30.00	0.00	22.23	36.00
HT40	4	2437	17.79	17.11	17.43	17.16	218.856	23.40	30.00	0.00	23.40	36.00
HT40	4	2452	15.79	15.77	15.43	15.32	144.644	21.60	30.00	0.00	21.60	36.00
VHT20	4	2412	18.22	17.86	17.65	18.09	250.096	23.98	30.00	0.00	23.98	36.00
VHT20	4	2437	20.91	20.46	20.55	20.71	465.745	26.68	30.00	0.00	26.68	36.00
VHT20	4	2462	17.02	16.84	16.82	16.51	191.511	22.82	30.00	0.00	22.82	36.00
VHT40	4	2422	16.45	16.47	16.18	16.03	170.100	22.31	30.00	0.00	22.31	36.00
VHT40	4	2437	17.84	17.29	17.56	17.25	224.498	23.51	30.00	0.00	23.51	36.00
VHT40	4	2452	15.86	15.86	15.52	15.41	147.494	21.69	30.00	0.00	21.69	36.00

### Beamforming mode

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Conducted (Average) 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)			
HT20	4	2412	16.52	15.64	16.13	15.72	159.864	22.04	29.98	6.02	28.06	36.00
HT20	4	2437	20.71	20.04	20.52	20.71	449.166	26.52	29.98	6.02	32.54	36.00
HT20	4	2462	17.03	16.11	16.64	15.92	176.514	22.47	29.98	6.02	28.49	36.00
HT40	4	2422	14.82	14.91	15.13	14.96	125.230	20.98	29.98	6.02	27.00	36.00
HT40	4	2437	16.31	16.35	16.64	16.58	177.539	22.49	29.98	6.02	28.51	36.00
HT40	4	2452	15.14	15.23	15.61	15.32	136.434	21.35	29.98	6.02	27.37	36.00
VHT20	4	2412	16.65	15.78	16.21	15.89	164.680	22.17	29.98	6.02	28.19	36.00
VHT20	4	2437	20.84	20.12	20.64	20.80	460.245	<b>26.63</b>	29.98	6.02	32.65	36.00
VHT20	4	2462	17.18	16.24	16.74	16.02	181.513	22.59	29.98	6.02	28.61	36.00
VHT40	4	2422	14.98	15.04	15.26	15.08	129.177	21.11	29.98	6.02	27.13	36.00
VHT40	4	2437	16.42	16.51	16.76	16.72	183.038	22.63	29.98	6.02	28.65	36.00
VHT40	4	2452	15.29	15.36	15.75	15.44	140.741	21.48	29.98	6.02	27.50	36.00

Note: Directional gain = 0dBi + 10\*log(4/1)= 6.02 dBi > 6 dBi

Conducted power limit shall be reduced to 30 dBm - (6.02 dBi - 6dBi ) = 29.98 dBm

## 3.4 Power Spectral Density

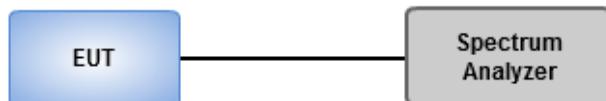
### 3.4.1 Limit of Power Spectral Density

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

### 3.4.2 Test Procedures

- Method AVGPSD-1 (Non Beam forming: all modes / Beam forming: 11ac VHT20)
  1. Set the RBW = 30kHz, VBW = 100kHz.
  2. Detector = RMS, Sweep time = auto couple.
  3. Employ trace averaging (RMS) mode over a minimum of 100 traces.
  4. Use the peak marker function to determine the maximum amplitude level.
- Method AVGPSD-2 Alternative (Beam forming: 11ac VHT40)
  1. Set the RBW = 30kHz, VBW = 100 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.
  6. Add  $10 \log (1/x)$ , where x is the duty cycle

### 3.4.3 Test Setup



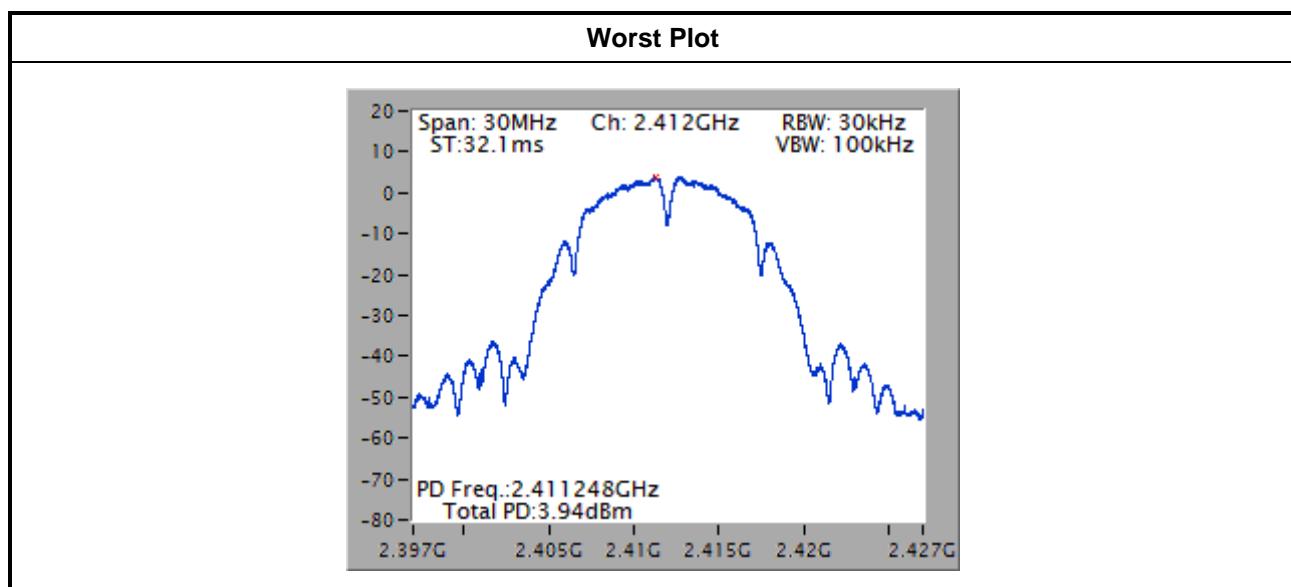
### 3.4.4 Test Result of Power Spectral Density

#### *Non-beamforming mode*

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	PPSD w/o D.F (dBm/30kHz)	Duty Factor (dB)	PPSD with D.F (dBm/30kHz)	Limit (dBm/3kHz)
11b	4	2412	3.94	0.00	3.94	8.00
11b	4	2437	3.72	0.00	3.72	8.00
11b	4	2462	3.90	0.00	3.90	8.00
11g	4	2412	-0.80	0.00	-0.80	8.00
11g	4	2437	2.22	0.00	2.22	8.00
11g	4	2462	-1.32	0.00	-1.32	8.00
VHT20	4	2412	-1.20	0.00	-1.20	8.00
VHT20	4	2437	1.41	0.00	1.41	8.00
VHT20	4	2462	-2.84	0.00	-2.84	8.00
VHT40	4	2422	-7.13	0.00	-7.13	8.00
VHT40	4	2437	-5.79	0.00	-5.79	8.00
VHT40	4	2452	-8.03	0.00	-8.03	8.00

Note 1: Test result is bin-by-bin summing measured value of each TX port.

Note 2: D.F is duty factor

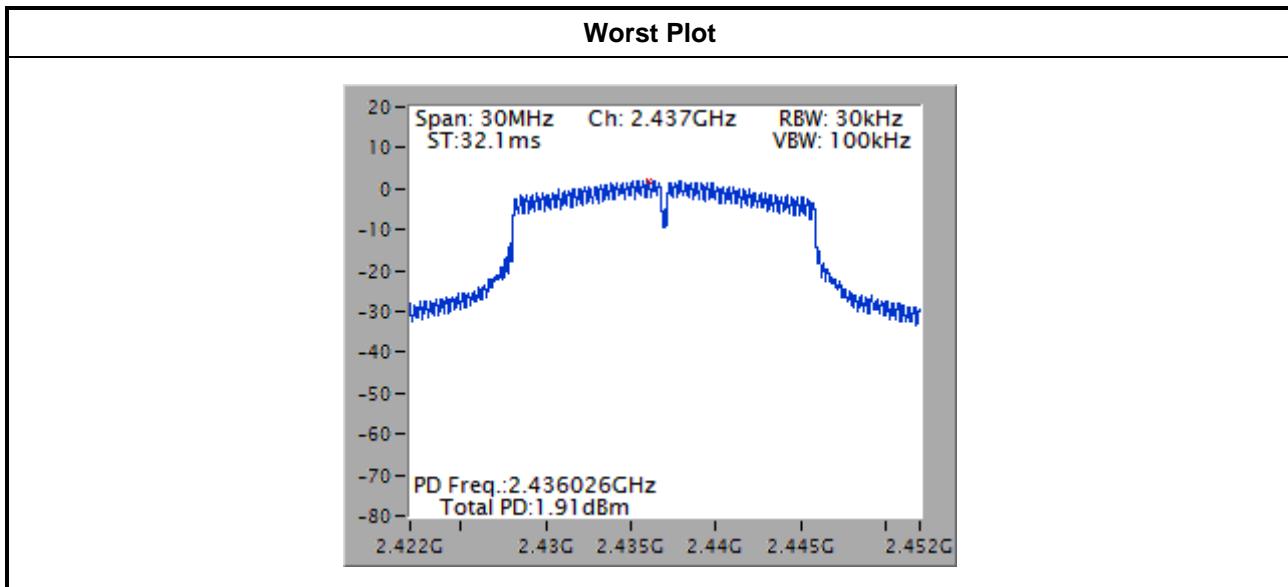


### Beamforming mode

Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	PPSD w/o D.F (dBm/30kHz)	Duty Factor (dB)	PPSD with D.F (dBm/30kHz)	Limit (dBm/3kHz)
VHT20	4	2412	-1.82	0.00	-1.82	8.00
VHT20	4	2437	1.91	0.00	1.91	8.00
VHT20	4	2462	-2.88	0.00	-2.88	8.00
VHT40	4	2422	-7.53	0.13	-7.40	8.00
VHT40	4	2437	-5.28	0.13	-5.15	8.00
VHT40	4	2452	-6.40	0.13	-6.27	8.00

Note 1: Test result is bin-by-bin summing measured value of each TX port.

Note 2: D.F is duty factor



## 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

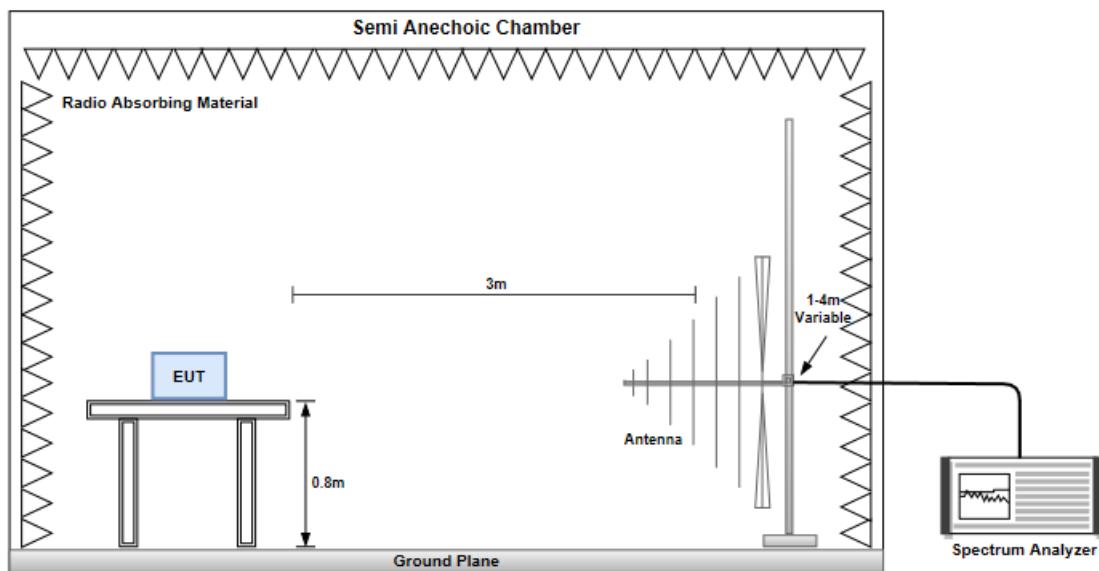
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

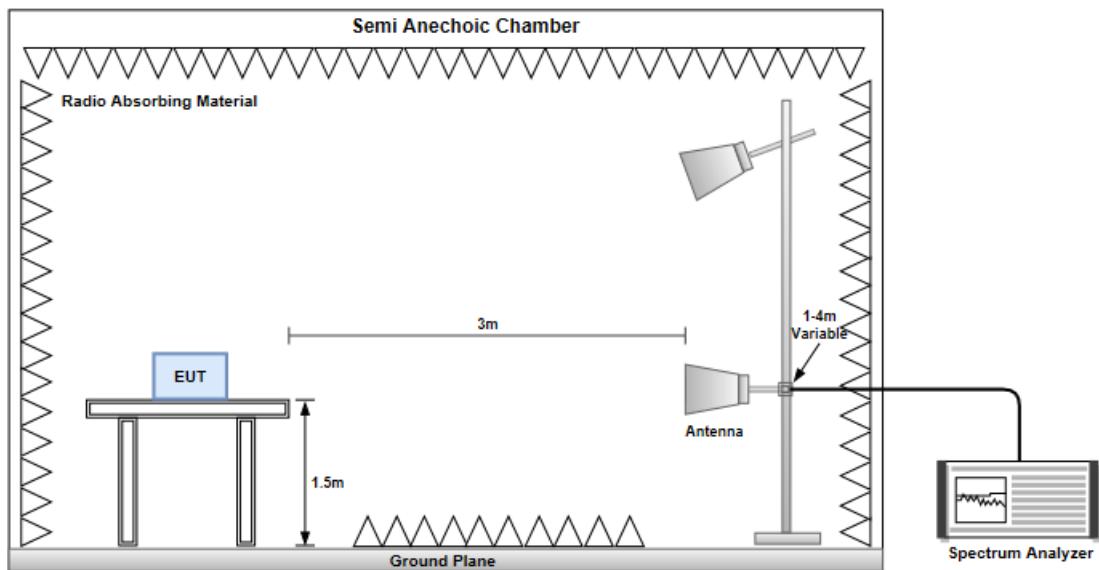
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

### 3.5.3 Test Setup

#### Radiated Emissions below 1 GHz

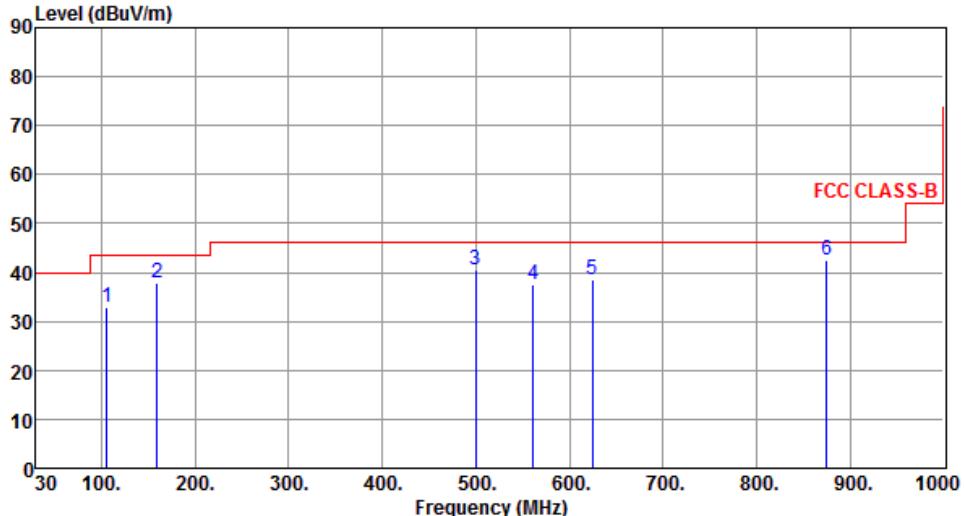
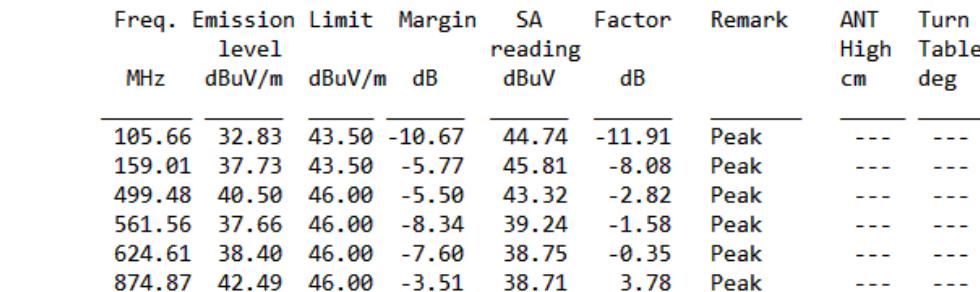


#### Radiated Emissions above 1 GHz

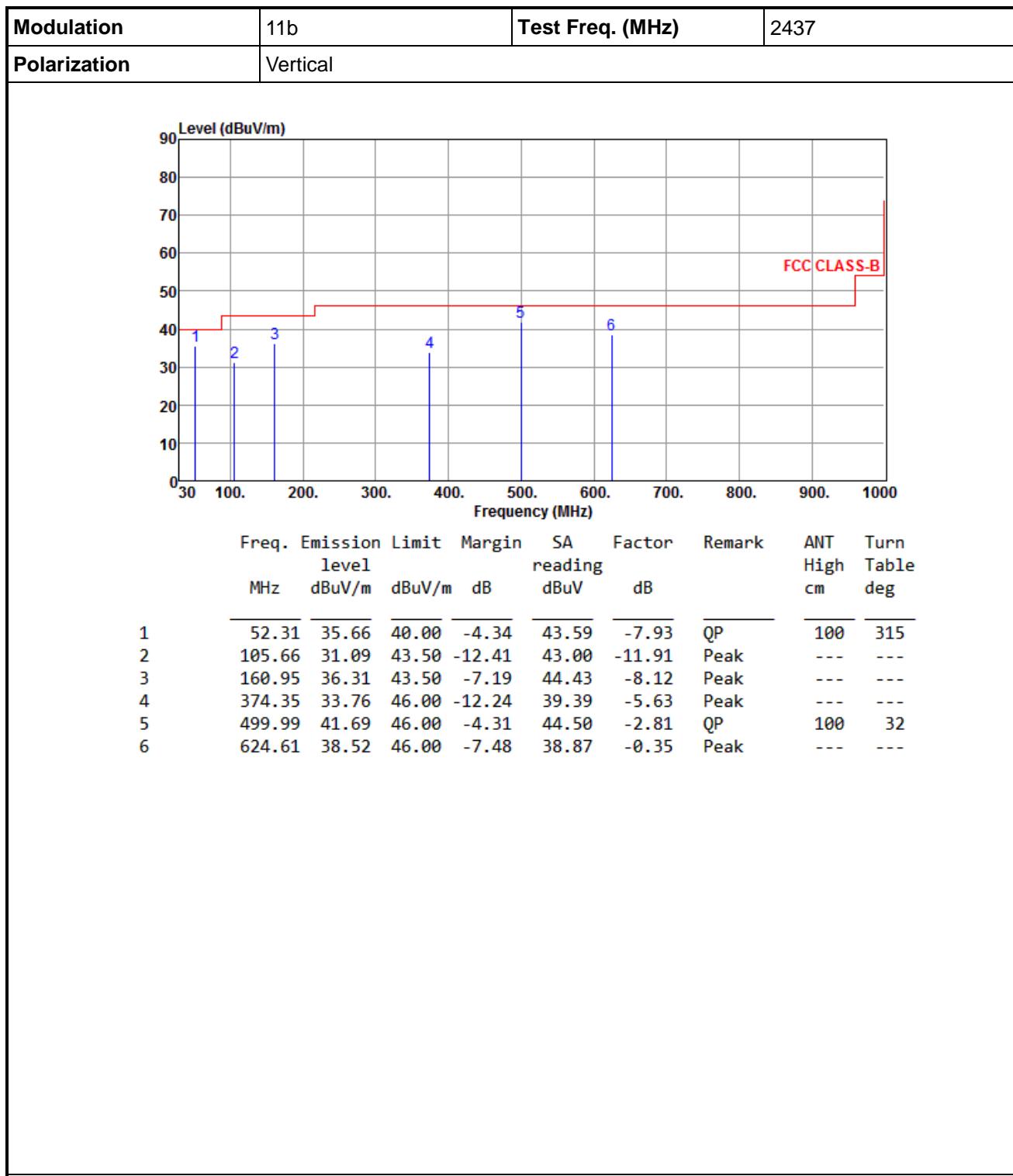


### Non-beamforming mode

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

<b>Modulation</b>	11b	<b>Test Freq. (MHz)</b>	2437						
<b>Polarization</b>	Horizontal								
									
									
1	105.66	32.83	43.50	-10.67	44.74	-11.91	Peak	---	---
2	159.01	37.73	43.50	-5.77	45.81	-8.08	Peak	---	---
3	499.48	40.50	46.00	-5.50	43.32	-2.82	Peak	---	---
4	561.56	37.66	46.00	-8.34	39.24	-1.58	Peak	---	---
5	624.61	38.40	46.00	-7.60	38.75	-0.35	Peak	---	---
6	874.87	42.49	46.00	-3.51	38.71	3.78	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.



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

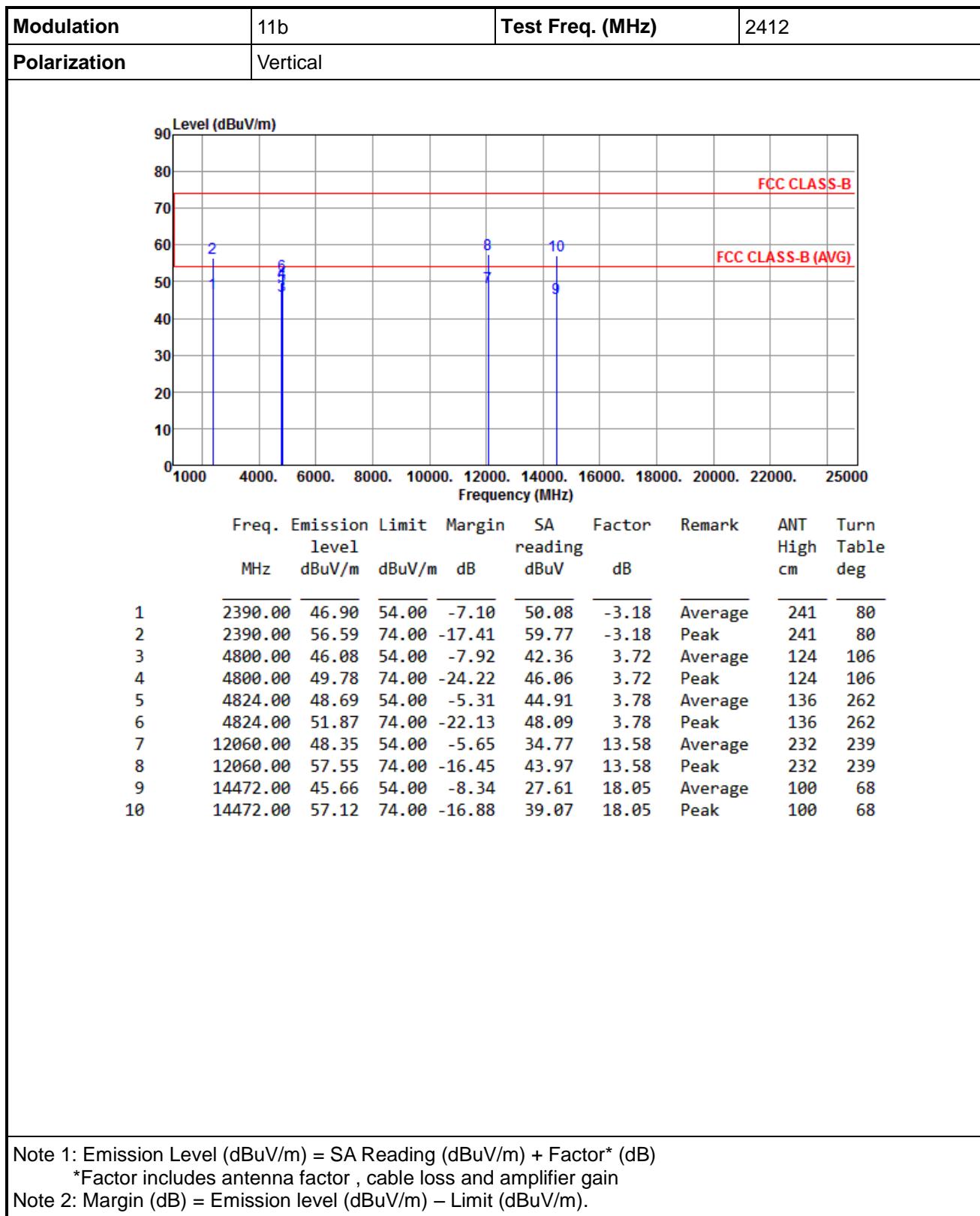
\*Factor includes antenna factor , cable loss and amplifier gain

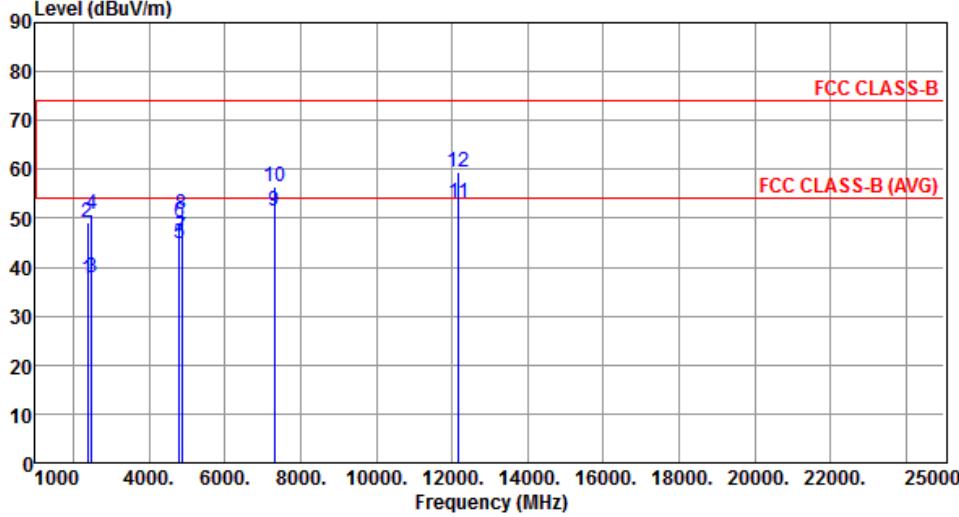
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

<b>Modulation</b>	11b	<b>Test Freq. (MHz)</b>	2412																																																																																																													
<b>Polarization</b>	Horizontal																																																																																																															
<table border="1"> <thead> <tr> <th>Freq. MHz</th> <th>Emission level dBuV/m</th> <th>Limit level dBuV/m</th> <th>Margin dB</th> <th>SA reading dBuV</th> <th>Factor dB</th> <th>Remark</th> <th>ANT High cm</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr><td>1</td><td>2390.00</td><td>45.18</td><td>54.00</td><td>-8.82</td><td>48.36</td><td>-3.18</td><td>Average</td><td>172</td><td>112</td></tr> <tr><td>2</td><td>2390.00</td><td>55.42</td><td>74.00</td><td>-18.58</td><td>58.60</td><td>-3.18</td><td>Peak</td><td>172</td><td>112</td></tr> <tr><td>3</td><td>4800.00</td><td>44.80</td><td>54.00</td><td>-9.20</td><td>41.08</td><td>3.72</td><td>Average</td><td>253</td><td>176</td></tr> <tr><td>4</td><td>4800.00</td><td>49.19</td><td>74.00</td><td>-24.81</td><td>45.47</td><td>3.72</td><td>Peak</td><td>253</td><td>176</td></tr> <tr><td>5</td><td>4824.00</td><td>46.81</td><td>54.00</td><td>-7.19</td><td>43.03</td><td>3.78</td><td>Average</td><td>225</td><td>314</td></tr> <tr><td>6</td><td>4824.00</td><td>50.39</td><td>74.00</td><td>-23.61</td><td>46.61</td><td>3.78</td><td>Peak</td><td>225</td><td>314</td></tr> <tr><td>7</td><td>12060.00</td><td>52.96</td><td>54.00</td><td>-1.04</td><td>39.38</td><td>13.58</td><td>Average</td><td>177</td><td>305</td></tr> <tr><td>8</td><td>12060.00</td><td>59.75</td><td>74.00</td><td>-14.25</td><td>46.17</td><td>13.58</td><td>Peak</td><td>177</td><td>305</td></tr> <tr><td>9</td><td>14472.00</td><td>46.59</td><td>54.00</td><td>-7.41</td><td>28.54</td><td>18.05</td><td>Average</td><td>100</td><td>118</td></tr> <tr><td>10</td><td>14472.00</td><td>58.48</td><td>74.00</td><td>-15.52</td><td>40.43</td><td>18.05</td><td>Peak</td><td>100</td><td>118</td></tr> </tbody> </table>				Freq. MHz	Emission level dBuV/m	Limit level dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	2390.00	45.18	54.00	-8.82	48.36	-3.18	Average	172	112	2	2390.00	55.42	74.00	-18.58	58.60	-3.18	Peak	172	112	3	4800.00	44.80	54.00	-9.20	41.08	3.72	Average	253	176	4	4800.00	49.19	74.00	-24.81	45.47	3.72	Peak	253	176	5	4824.00	46.81	54.00	-7.19	43.03	3.78	Average	225	314	6	4824.00	50.39	74.00	-23.61	46.61	3.78	Peak	225	314	7	12060.00	52.96	54.00	-1.04	39.38	13.58	Average	177	305	8	12060.00	59.75	74.00	-14.25	46.17	13.58	Peak	177	305	9	14472.00	46.59	54.00	-7.41	28.54	18.05	Average	100	118	10	14472.00	58.48	74.00	-15.52	40.43	18.05	Peak	100	118
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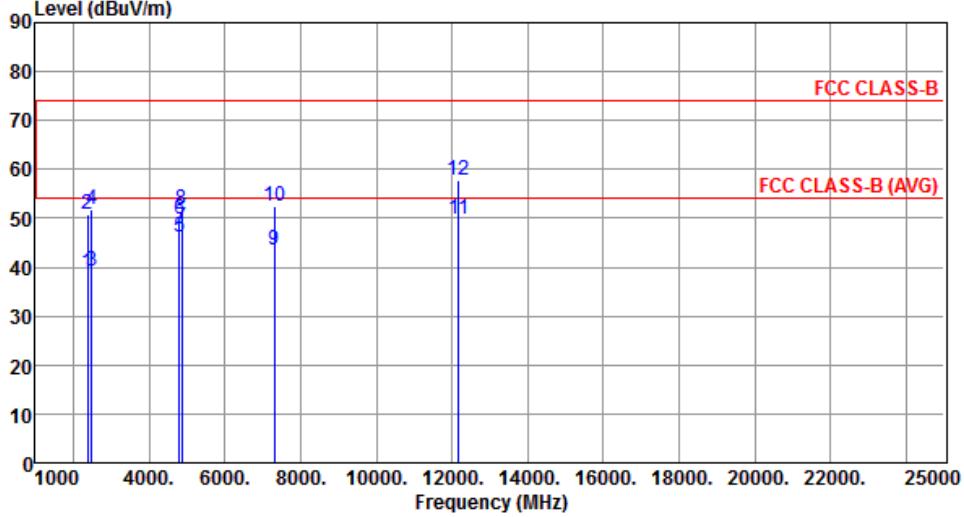


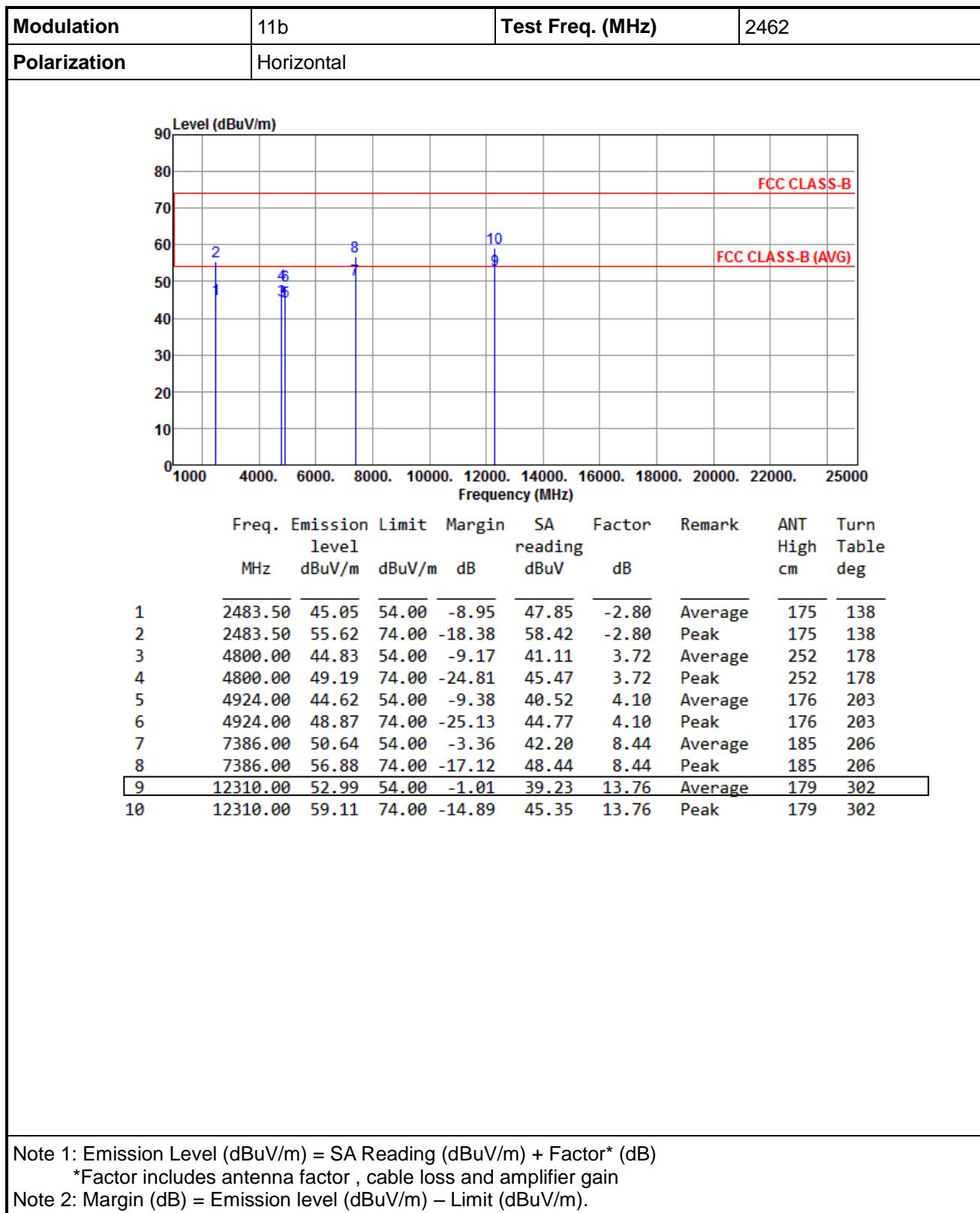
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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

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

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

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<b>Modulation</b>	11b	<b>Test Freq. (MHz)</b>	2462																																																																																																													
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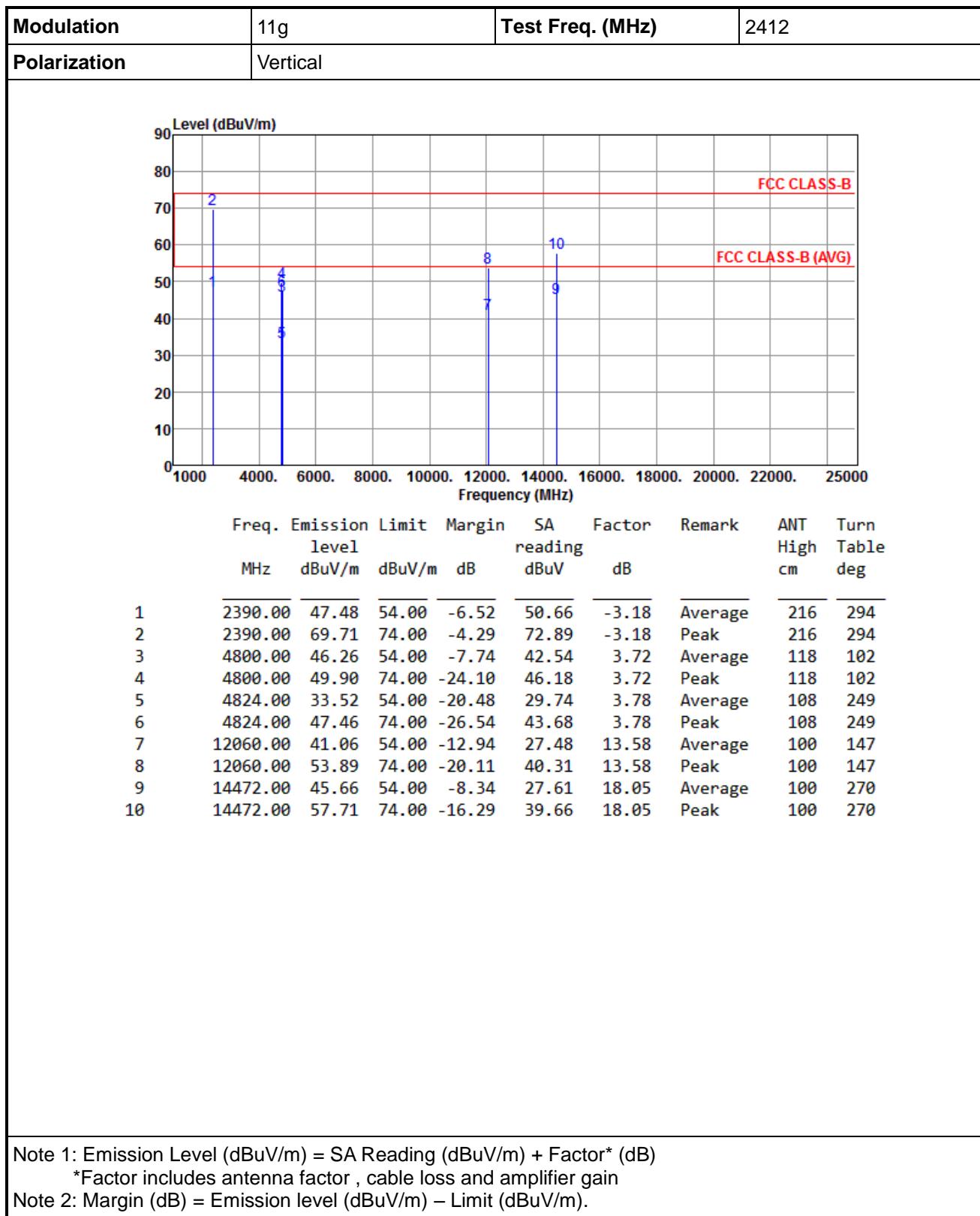
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

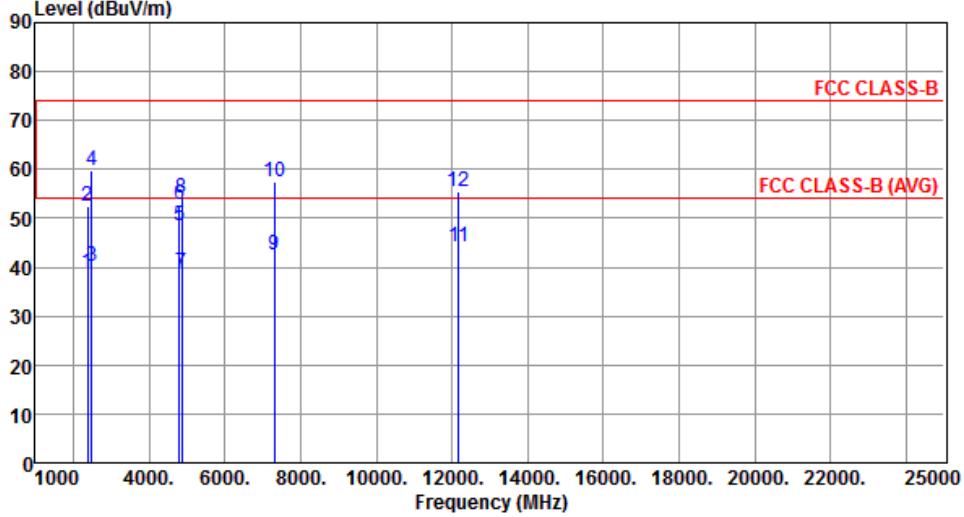
\*Factor includes antenna factor , cable loss and amplifier gain

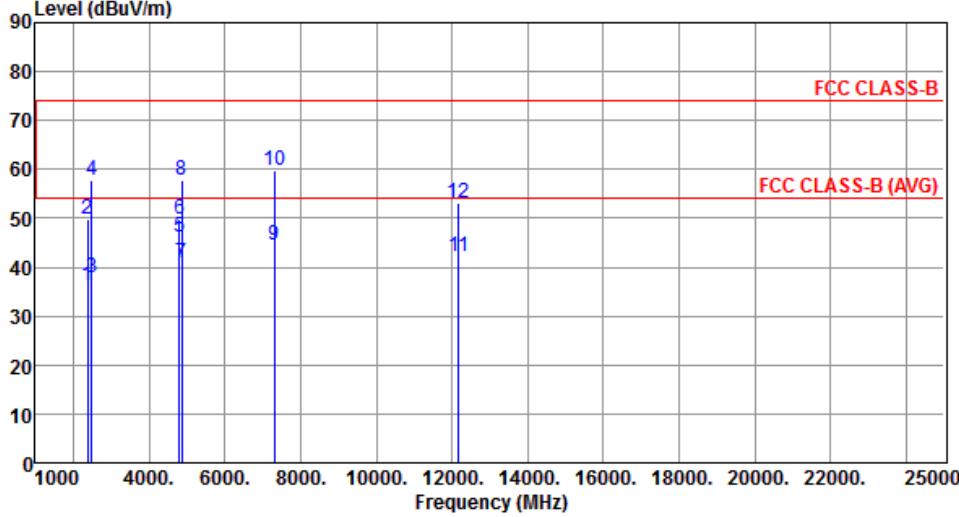
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

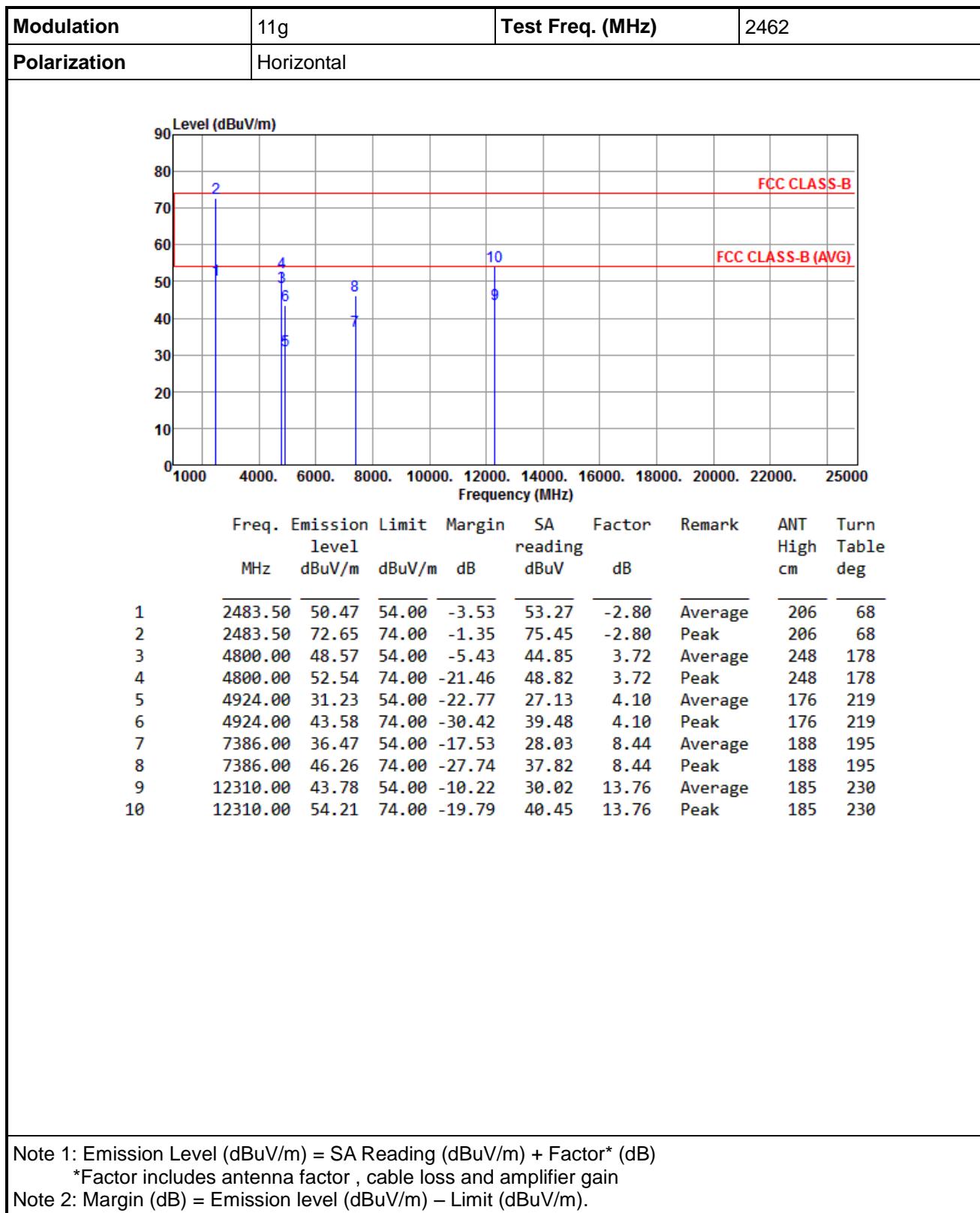
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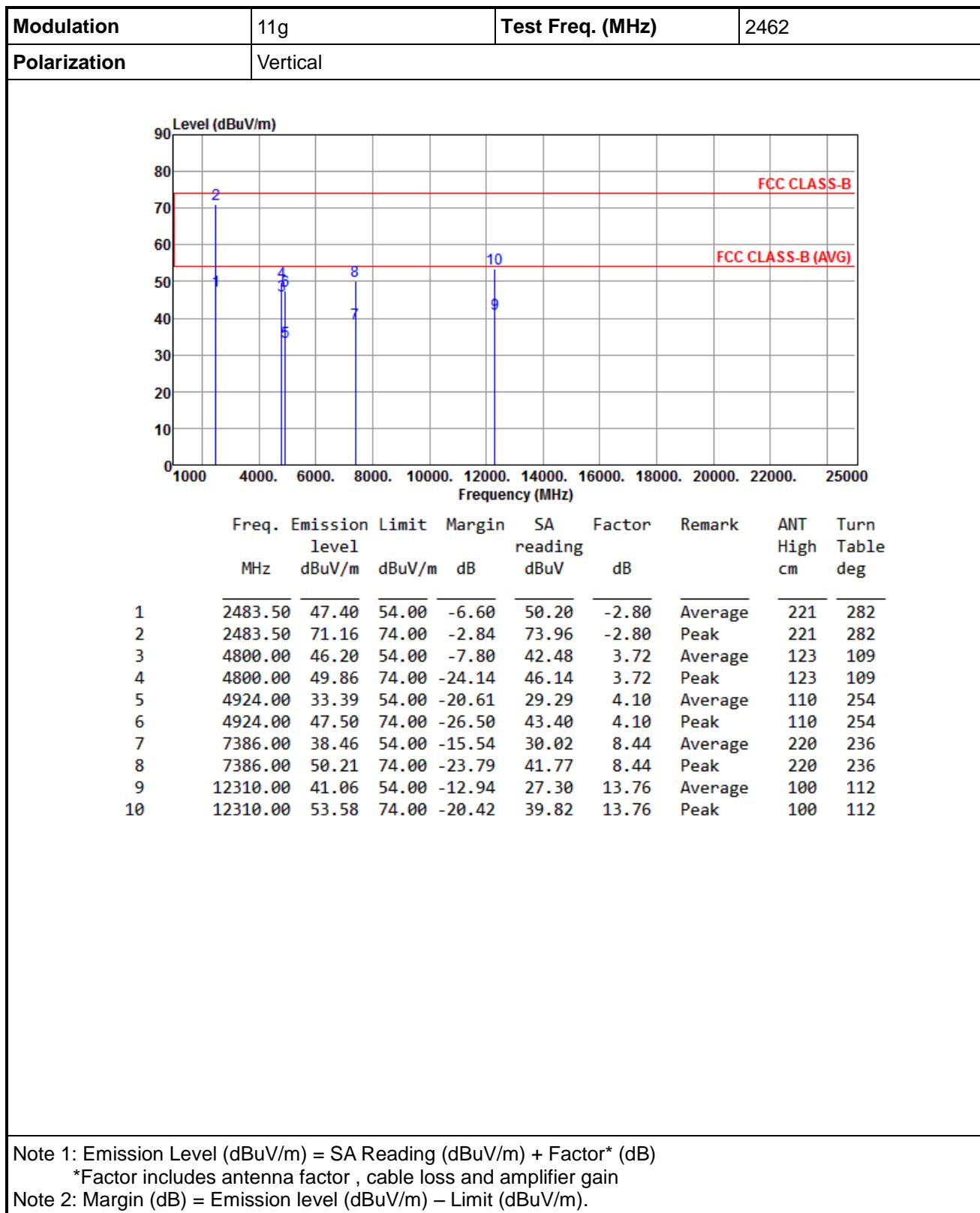
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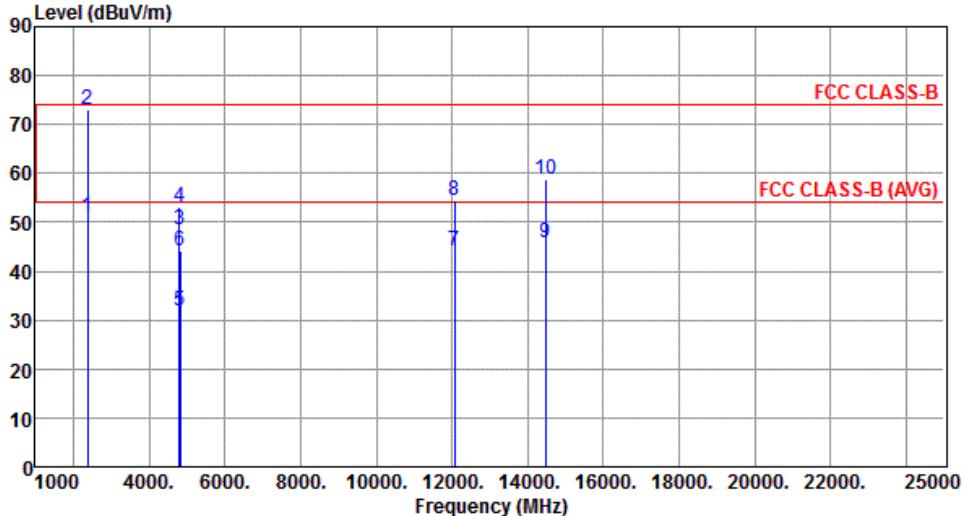
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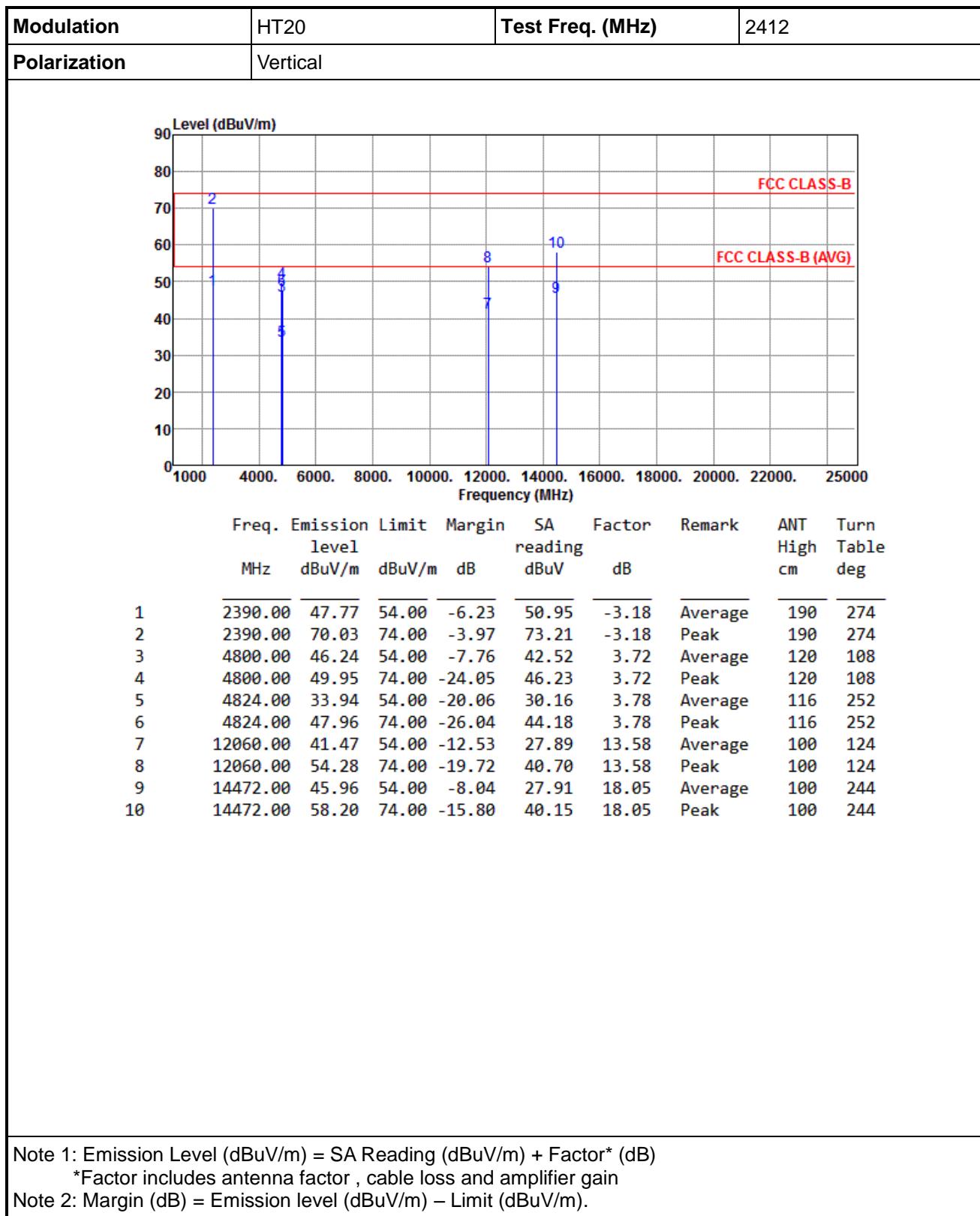
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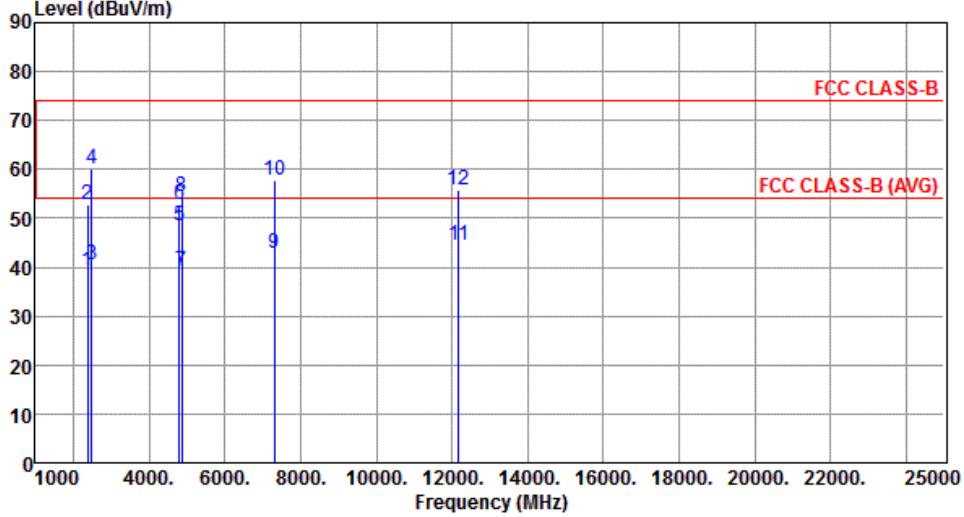


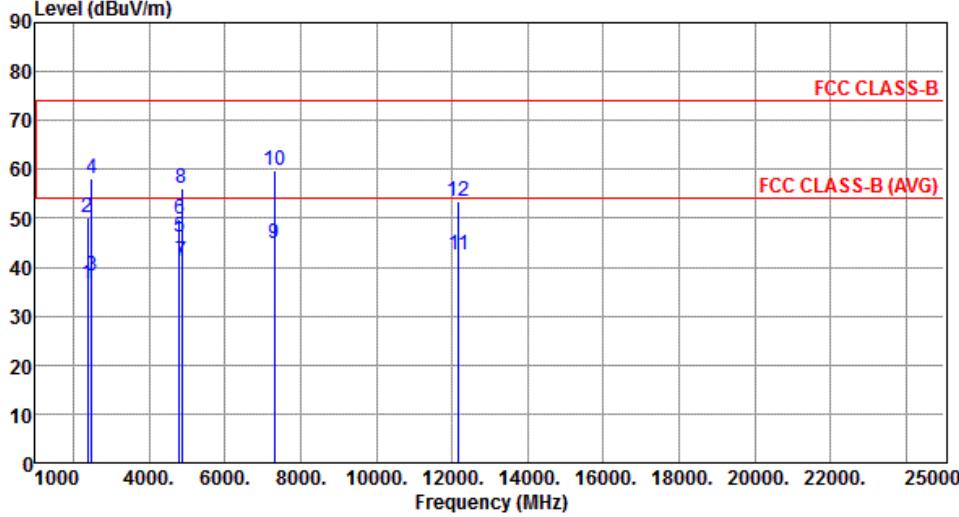


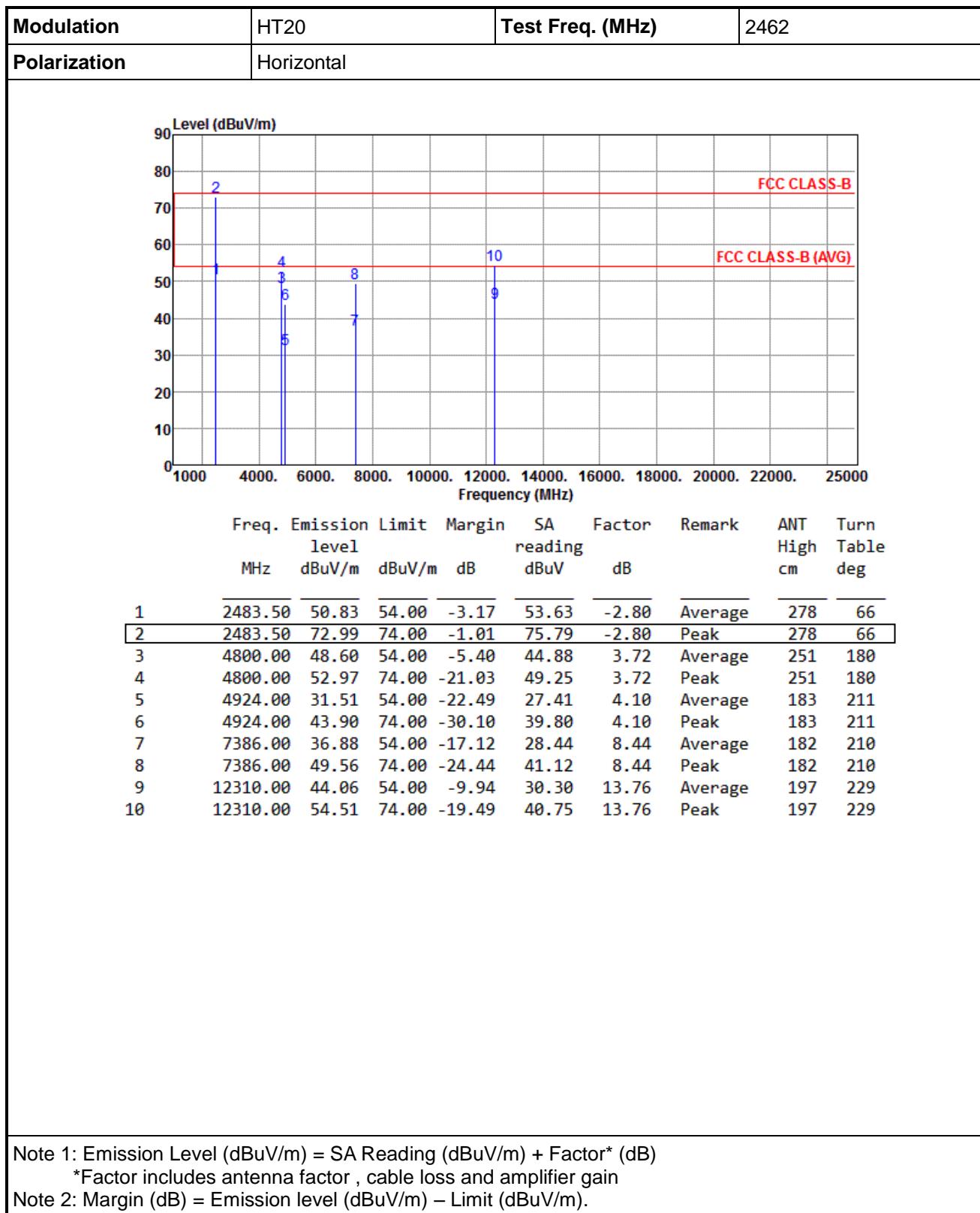
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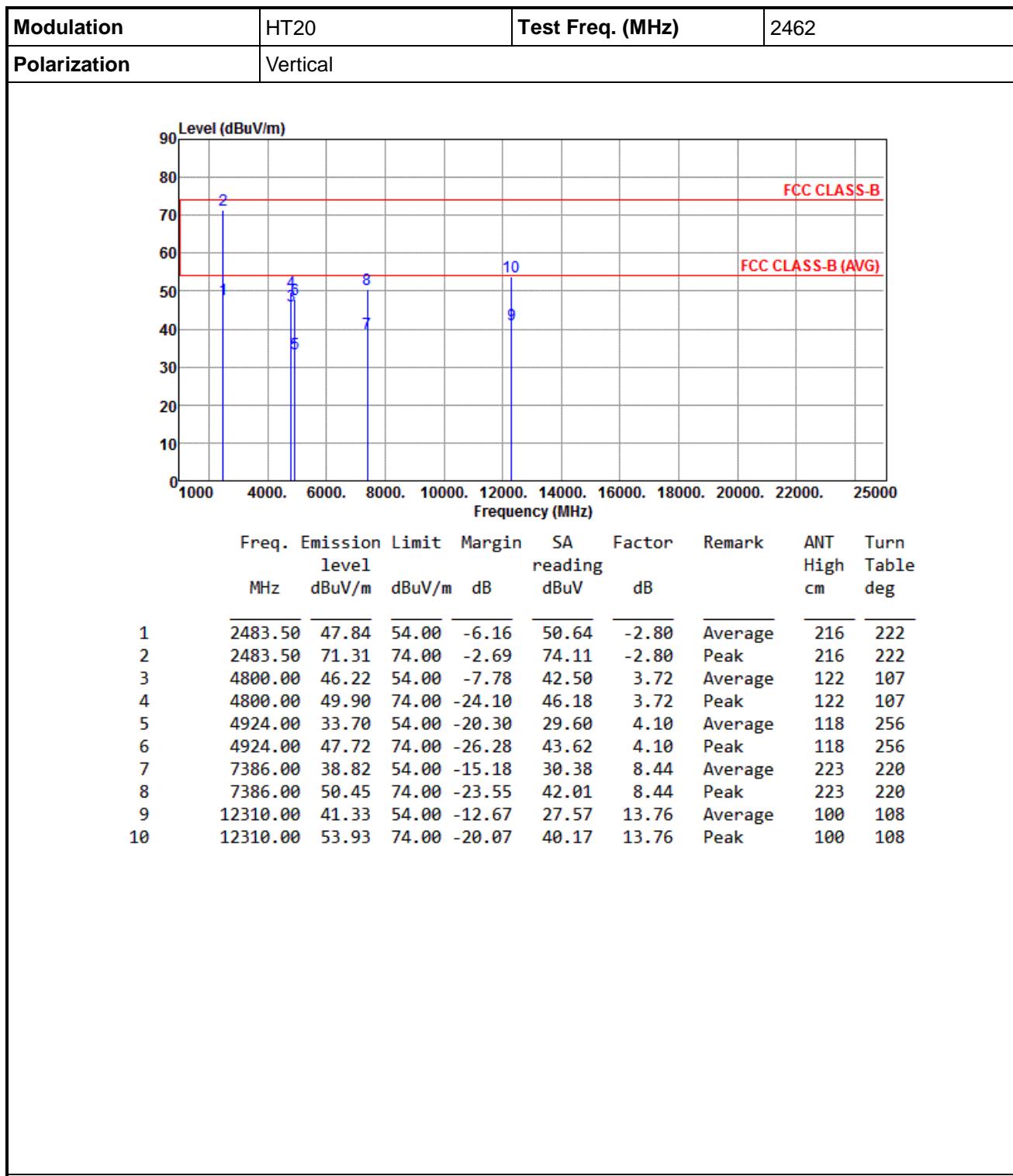
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<b>Modulation</b>	HT20	<b>Test Freq. (MHz)</b>	2437																																																																																																																																	
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<b>Modulation</b>	HT20	<b>Test Freq. (MHz)</b>	2437																																																																																																																																						
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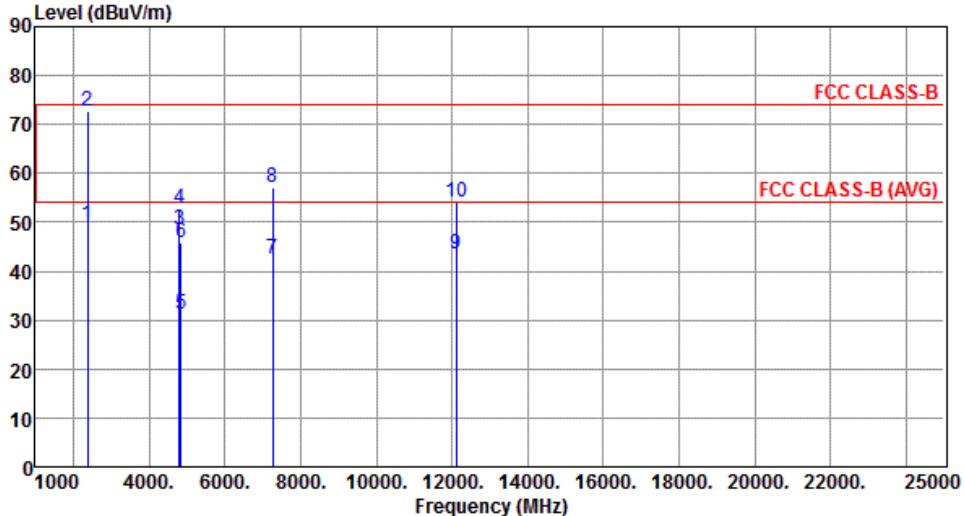


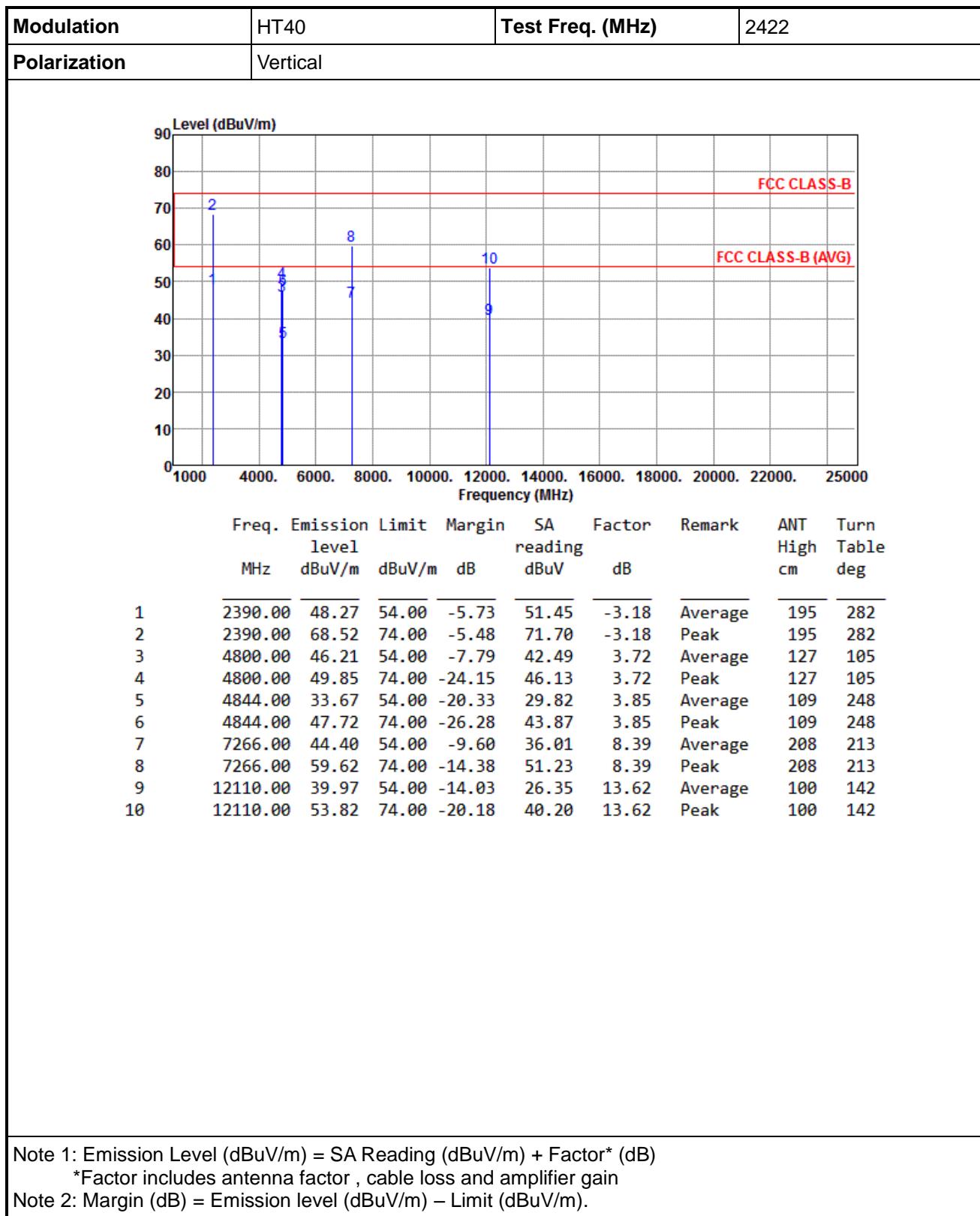
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

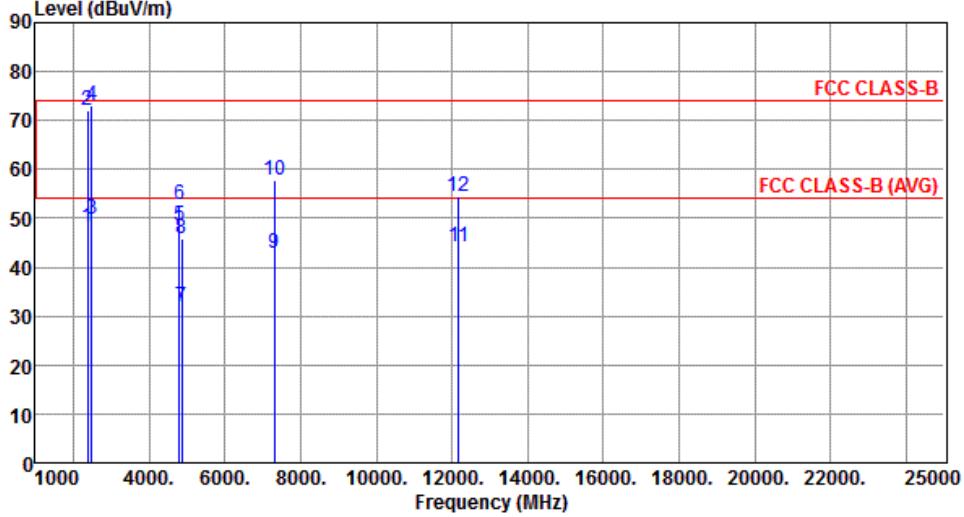
\*Factor includes antenna factor , cable loss and amplifier gain

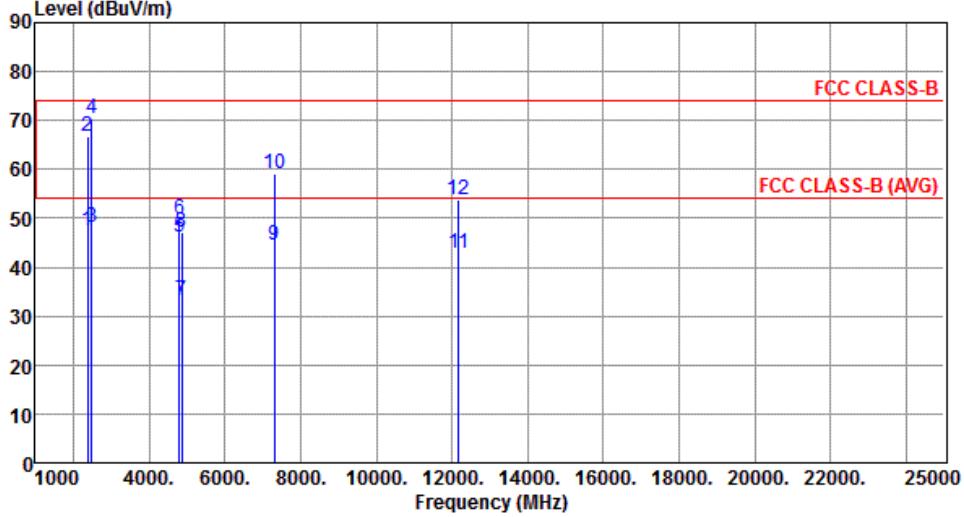
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

<b>Modulation</b>	HT40	<b>Test Freq. (MHz)</b>	2422																																																																																																													
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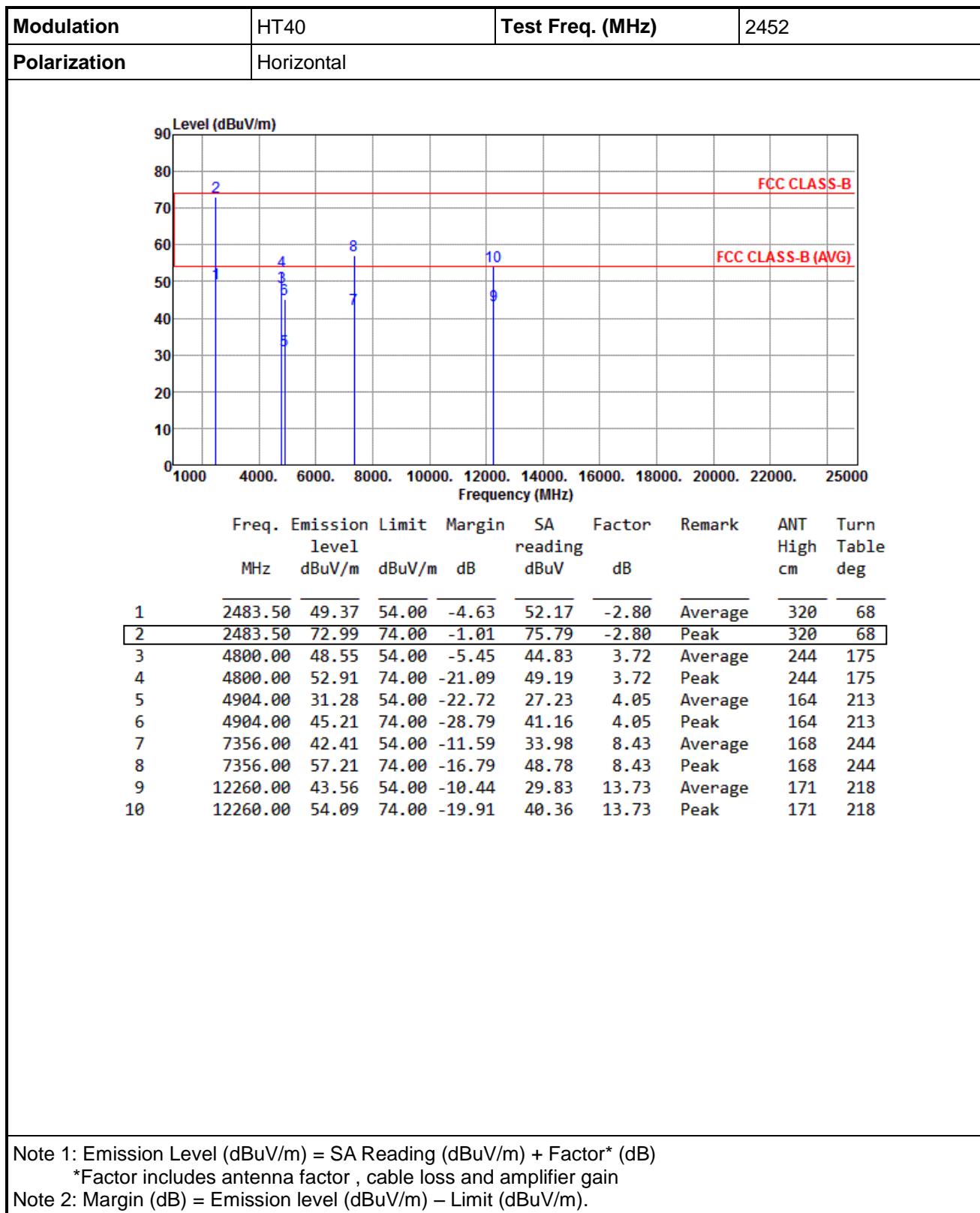
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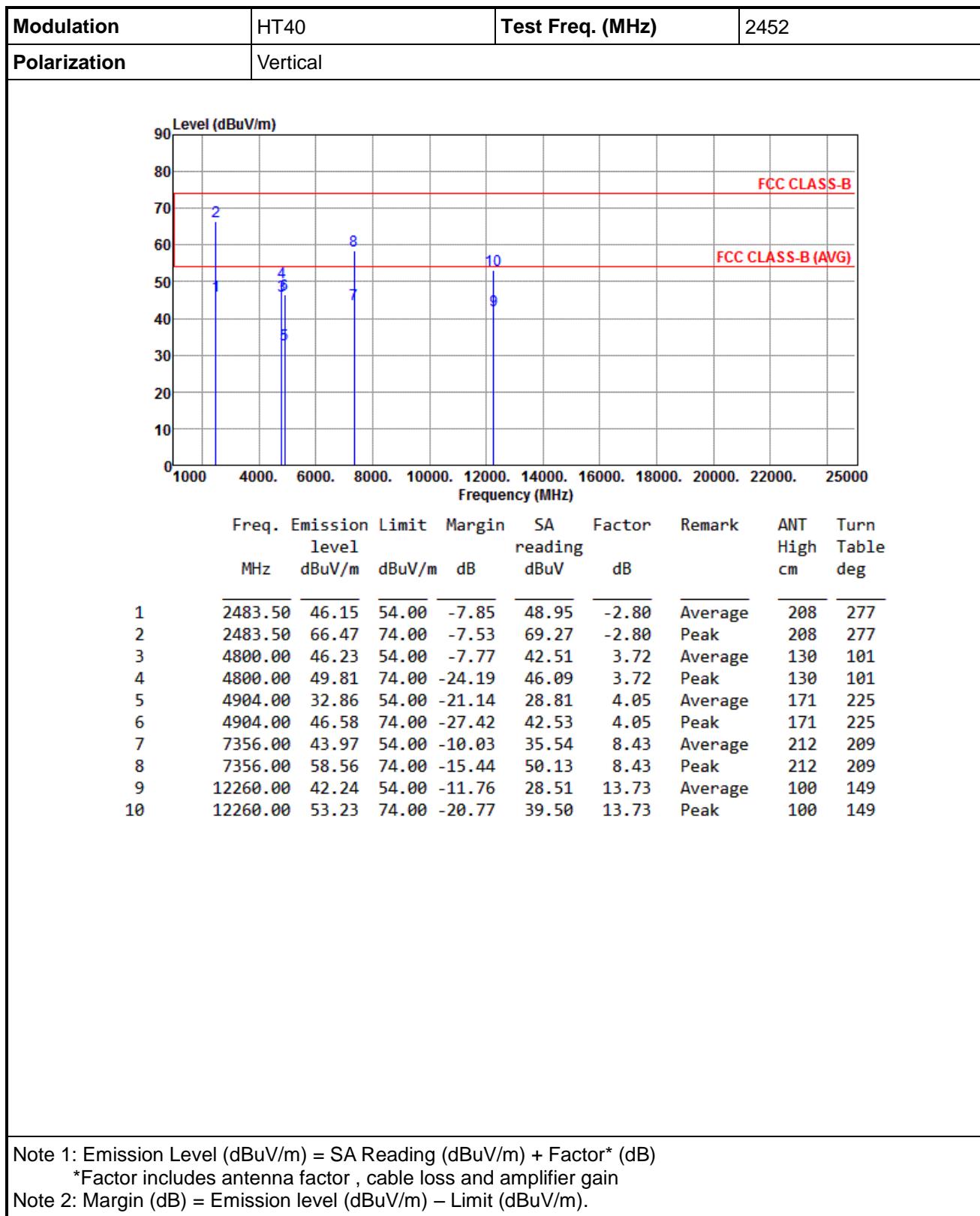
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8	4874.00	47.14	74.00	-26.86	43.20	3.94	Peak	167	233																																																																																																																											
9	7311.00	44.51	54.00	-9.49	36.10	8.41	Average	202	213																																																																																																																											
10	7311.00	59.16	74.00	-14.84	50.75	8.41	Peak	202	213																																																																																																																											
11	12185.00	42.84	54.00	-11.16	29.17	13.67	Average	100	152																																																																																																																											
12	12185.00	53.81	74.00	-20.19	40.14	13.67	Peak	100	152																																																																																																																											

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

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

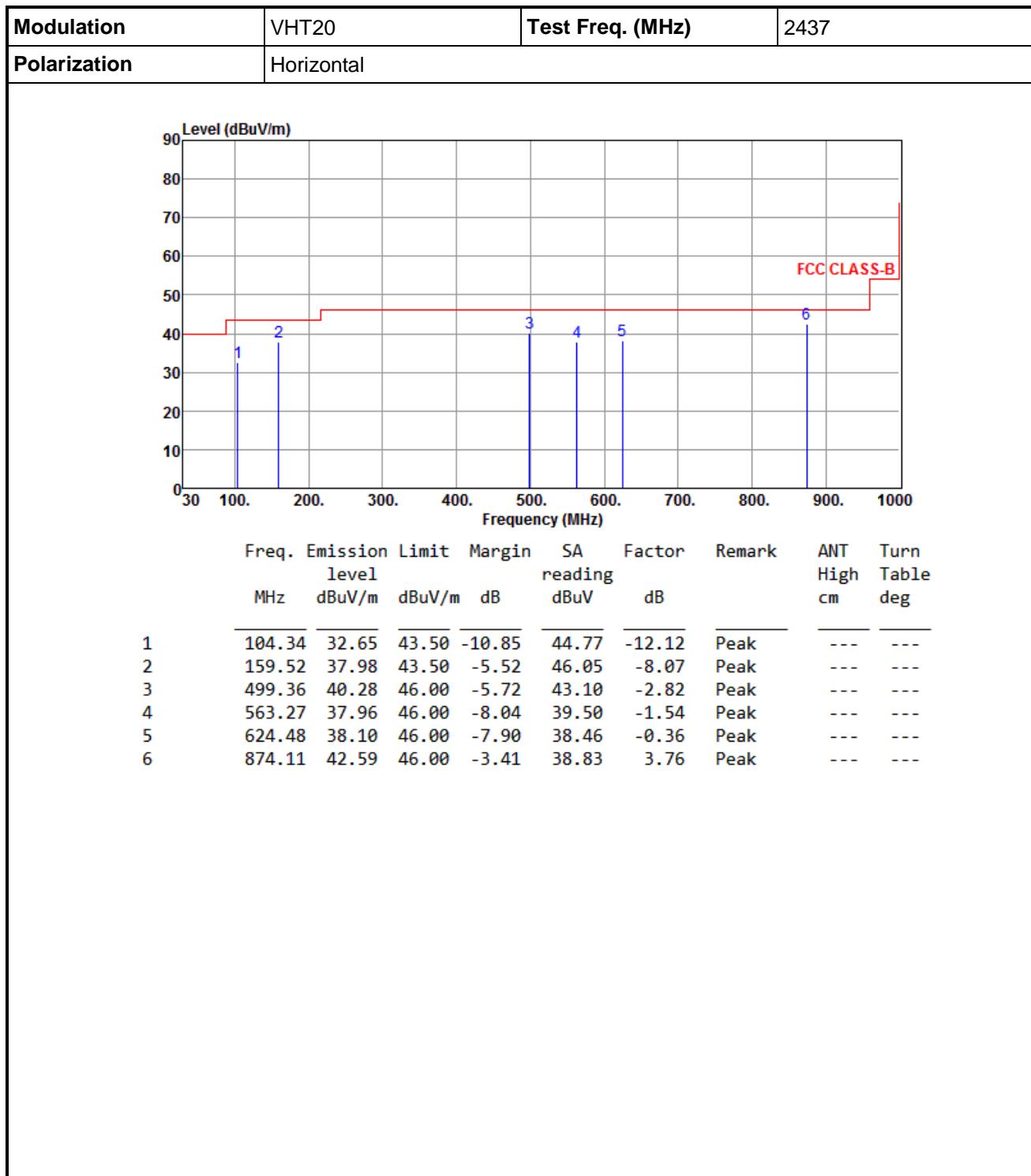
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).





### Beamforming mode

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

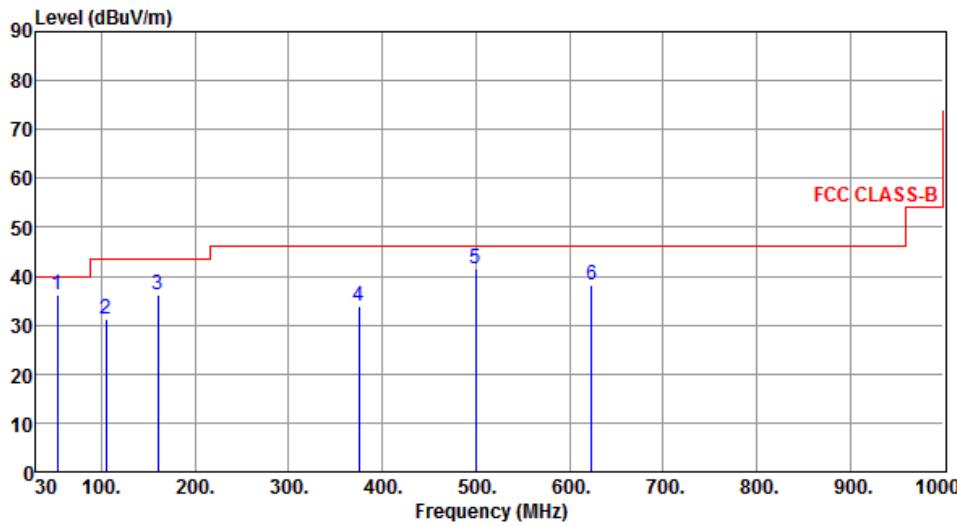


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

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

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

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

<b>Modulation</b>	VHT20	<b>Test Freq. (MHz)</b>	2437																																																																
<b>Polarization</b>	Vertical																																																																		
																																																																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding-bottom: 2px;">Freq.</th> <th style="text-align: left; padding-bottom: 2px;">Emission Limit</th> <th style="text-align: left; padding-bottom: 2px;">Margin</th> <th style="text-align: left; padding-bottom: 2px;">SA</th> <th style="text-align: left; padding-bottom: 2px;">Factor</th> <th style="text-align: left; padding-bottom: 2px;">Remark</th> <th style="text-align: left; padding-bottom: 2px;">ANT</th> <th style="text-align: left; padding-bottom: 2px;">Turn</th> </tr> <tr> <th style="text-align: left; padding-top: 2px;">level</th> <th style="text-align: left; padding-top: 2px;">MHz</th> <th style="text-align: left; padding-top: 2px;">dBuV/m</th> <th style="text-align: left; padding-top: 2px;">dBuV/m</th> <th style="text-align: left; padding-top: 2px;">dB</th> <th style="text-align: left; padding-top: 2px;">reading</th> <th style="text-align: left; padding-top: 2px;">dBiV</th> <th style="text-align: left; padding-top: 2px;">deg</th> </tr> </thead> <tbody> <tr> <td style="padding-top: 2px;">1</td><td style="padding-top: 2px;">52.68</td><td style="padding-top: 2px;">36.28</td><td style="padding-top: 2px;">40.00</td><td style="padding-top: 2px;">-3.72</td><td style="padding-top: 2px;">44.27</td><td style="padding-top: 2px;">-7.99</td><td style="padding-top: 2px;">QP</td></tr> <tr> <td style="padding-top: 2px;">2</td><td style="padding-top: 2px;">104.86</td><td style="padding-top: 2px;">31.30</td><td style="padding-top: 2px;">43.50</td><td style="padding-top: 2px;">-12.20</td><td style="padding-top: 2px;">43.33</td><td style="padding-top: 2px;">-12.03</td><td style="padding-top: 2px;">Peak</td></tr> <tr> <td style="padding-top: 2px;">3</td><td style="padding-top: 2px;">160.39</td><td style="padding-top: 2px;">36.19</td><td style="padding-top: 2px;">43.50</td><td style="padding-top: 2px;">-7.31</td><td style="padding-top: 2px;">44.28</td><td style="padding-top: 2px;">-8.09</td><td style="padding-top: 2px;">Peak</td></tr> <tr> <td style="padding-top: 2px;">4</td><td style="padding-top: 2px;">374.78</td><td style="padding-top: 2px;">33.94</td><td style="padding-top: 2px;">46.00</td><td style="padding-top: 2px;">-12.06</td><td style="padding-top: 2px;">39.56</td><td style="padding-top: 2px;">-5.62</td><td style="padding-top: 2px;">Peak</td></tr> <tr> <td style="padding-top: 2px;">5</td><td style="padding-top: 2px;">499.74</td><td style="padding-top: 2px;">41.48</td><td style="padding-top: 2px;">46.00</td><td style="padding-top: 2px;">-4.52</td><td style="padding-top: 2px;">44.29</td><td style="padding-top: 2px;">-2.81</td><td style="padding-top: 2px;">QP</td></tr> <tr> <td style="padding-top: 2px;">6</td><td style="padding-top: 2px;">623.84</td><td style="padding-top: 2px;">38.32</td><td style="padding-top: 2px;">46.00</td><td style="padding-top: 2px;">-7.68</td><td style="padding-top: 2px;">38.68</td><td style="padding-top: 2px;">-0.36</td><td style="padding-top: 2px;">Peak</td></tr> </tbody> </table>				Freq.	Emission Limit	Margin	SA	Factor	Remark	ANT	Turn	level	MHz	dBuV/m	dBuV/m	dB	reading	dBiV	deg	1	52.68	36.28	40.00	-3.72	44.27	-7.99	QP	2	104.86	31.30	43.50	-12.20	43.33	-12.03	Peak	3	160.39	36.19	43.50	-7.31	44.28	-8.09	Peak	4	374.78	33.94	46.00	-12.06	39.56	-5.62	Peak	5	499.74	41.48	46.00	-4.52	44.29	-2.81	QP	6	623.84	38.32	46.00	-7.68	38.68	-0.36	Peak
Freq.	Emission Limit	Margin	SA	Factor	Remark	ANT	Turn																																																												
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1	52.68	36.28	40.00	-3.72	44.27	-7.99	QP																																																												
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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

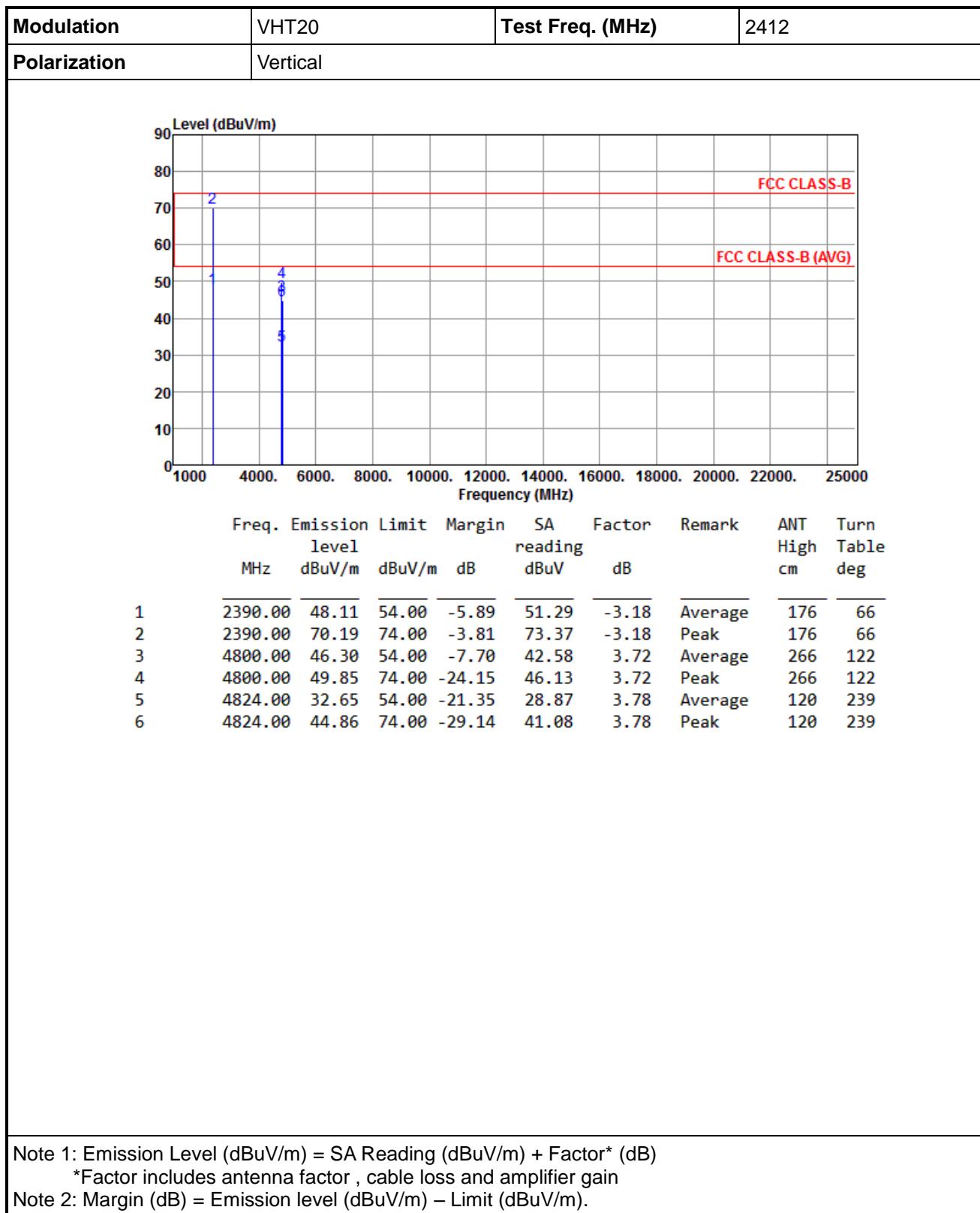
\*Factor includes antenna factor , cable loss and amplifier gain

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.

### 3.5.10 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT20

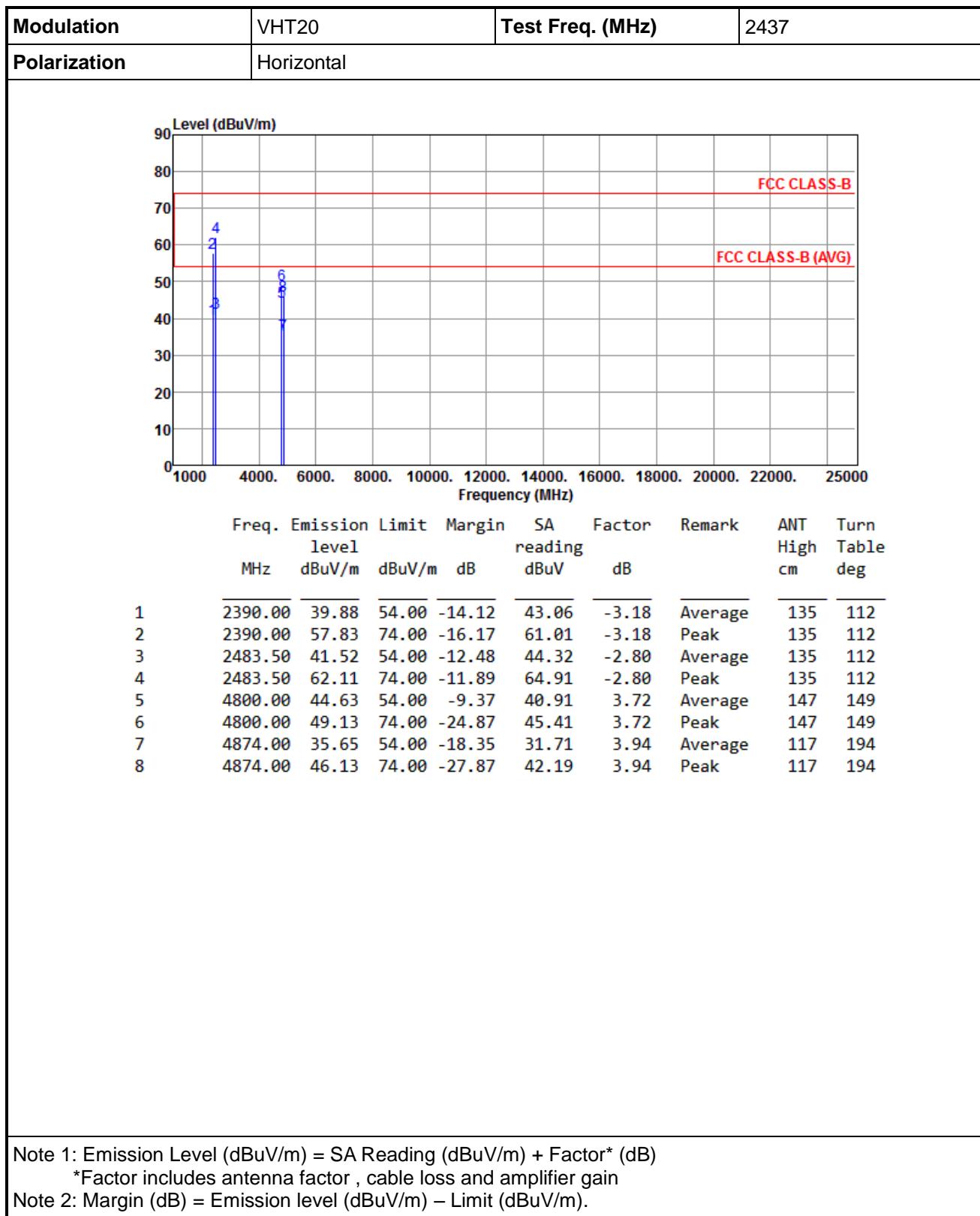
<b>Modulation</b>	VHT20	<b>Test Freq. (MHz)</b>	2412																																																															
<b>Polarization</b>	Horizontal																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Freq. MHz</th> <th style="text-align: left;">Emission level dBuV/m</th> <th style="text-align: left;">Limit dBuV/m</th> <th style="text-align: left;">Margin dB</th> <th style="text-align: left;">SA reading dBuV</th> <th style="text-align: left;">Factor dB</th> <th style="text-align: left;">Remark</th> <th style="text-align: left;">ANT High cm</th> <th style="text-align: left;">Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>1</td><td>2390.00</td><td>50.21</td><td>54.00</td><td>-3.79</td><td>53.39</td><td>-3.18</td><td>Average</td><td>155</td></tr> <tr> <td>2</td><td>2390.00</td><td>72.40</td><td>74.00</td><td>-1.60</td><td>75.58</td><td>-3.18</td><td>Peak</td><td>155</td></tr> <tr> <td>3</td><td>4800.00</td><td>44.21</td><td>54.00</td><td>-9.79</td><td>40.49</td><td>3.72</td><td>Average</td><td>100</td></tr> <tr> <td>4</td><td>4800.00</td><td>48.57</td><td>74.00</td><td>-25.43</td><td>44.85</td><td>3.72</td><td>Peak</td><td>100</td></tr> <tr> <td>5</td><td>4824.00</td><td>35.65</td><td>54.00</td><td>-18.35</td><td>31.87</td><td>3.78</td><td>Average</td><td>301</td></tr> <tr> <td>6</td><td>4824.00</td><td>45.71</td><td>74.00</td><td>-28.29</td><td>41.93</td><td>3.78</td><td>Peak</td><td>301</td></tr> </tbody> </table>				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	50.21	54.00	-3.79	53.39	-3.18	Average	155	2	2390.00	72.40	74.00	-1.60	75.58	-3.18	Peak	155	3	4800.00	44.21	54.00	-9.79	40.49	3.72	Average	100	4	4800.00	48.57	74.00	-25.43	44.85	3.72	Peak	100	5	4824.00	35.65	54.00	-18.35	31.87	3.78	Average	301	6	4824.00	45.71	74.00	-28.29	41.93	3.78	Peak	301
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																										
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4	4800.00	48.57	74.00	-25.43	44.85	3.72	Peak	100																																																										
5	4824.00	35.65	54.00	-18.35	31.87	3.78	Average	301																																																										
6	4824.00	45.71	74.00	-28.29	41.93	3.78	Peak	301																																																										
<p>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).</p>																																																																		

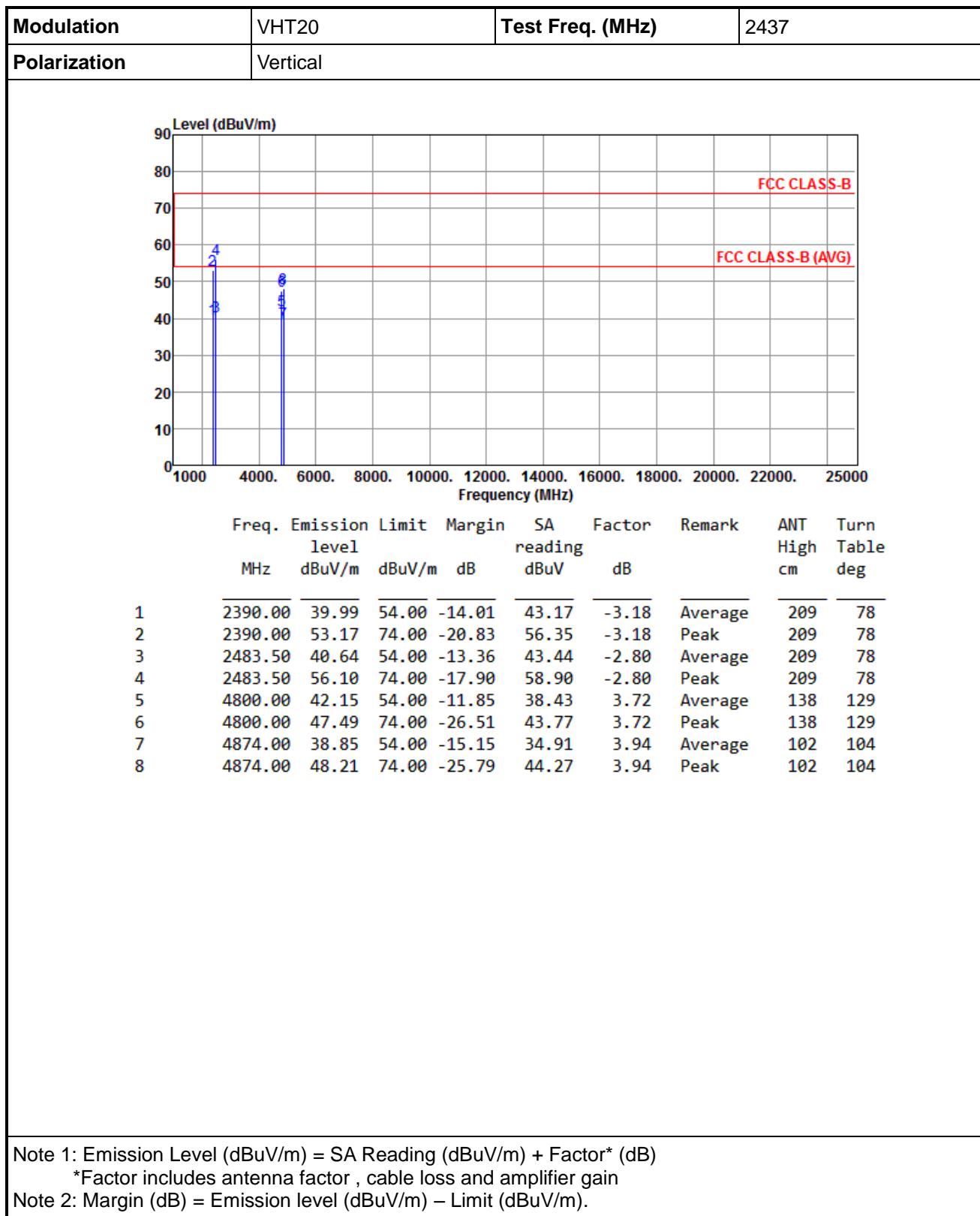


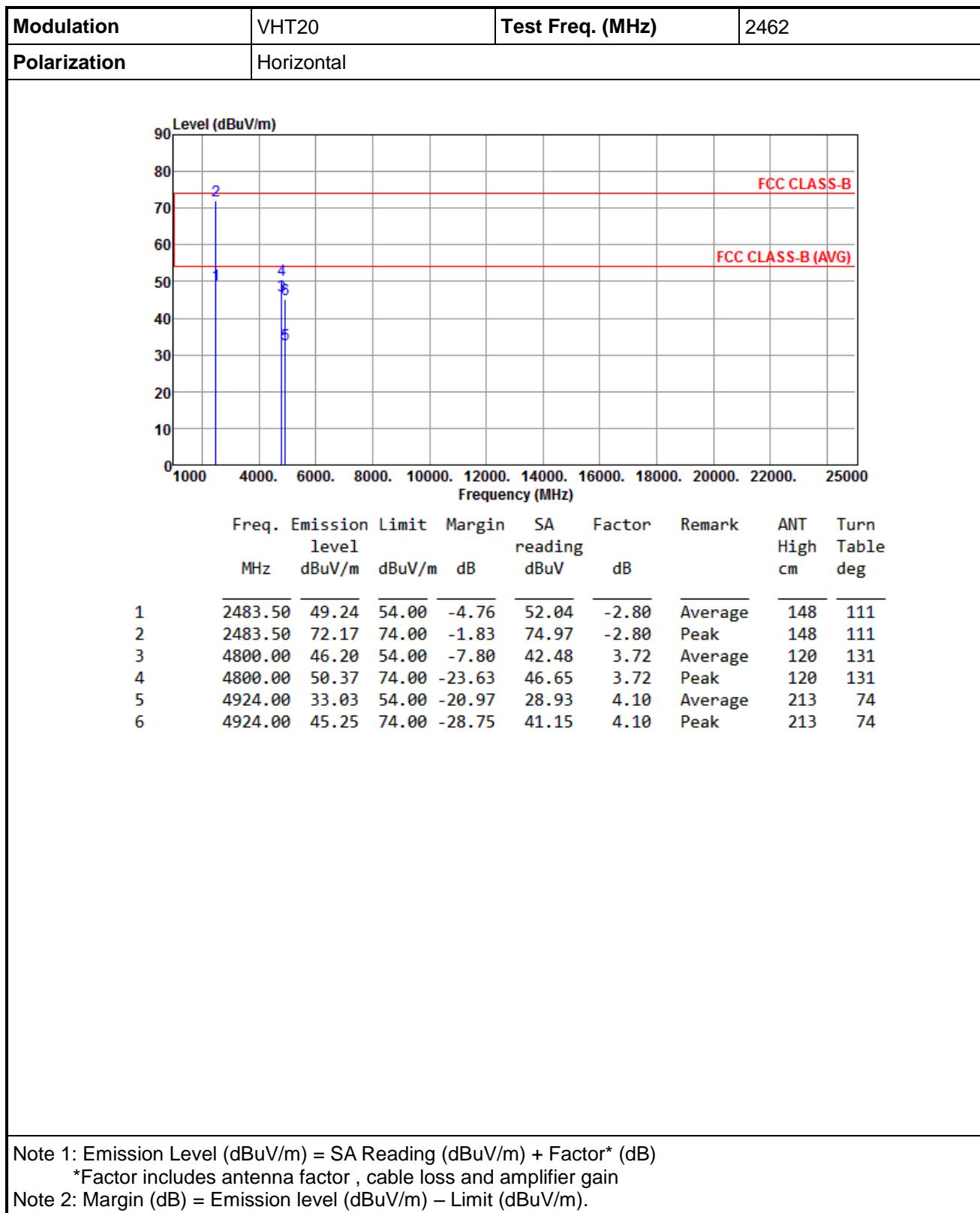
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

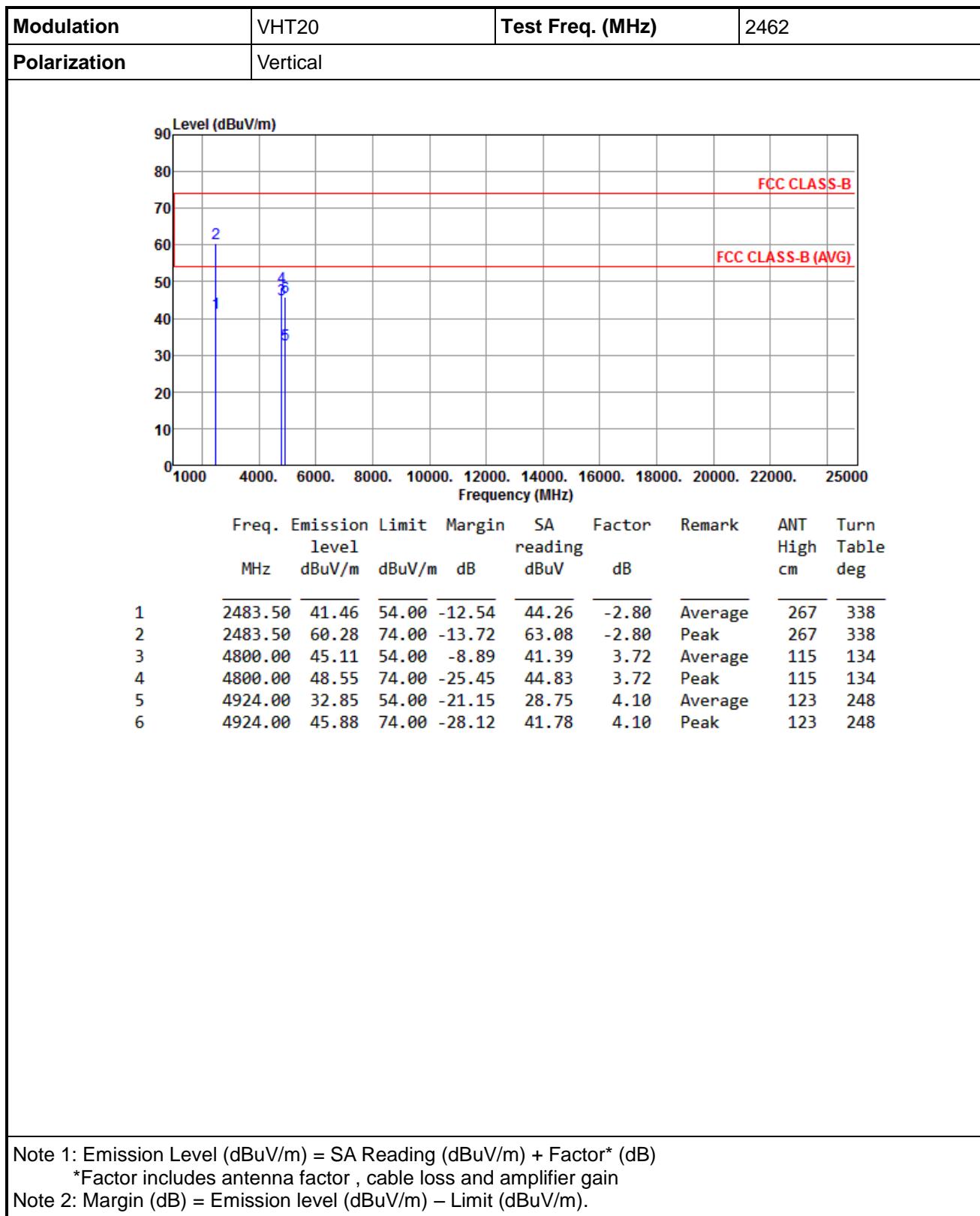
\*Factor includes antenna factor , cable loss and amplifier gain

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

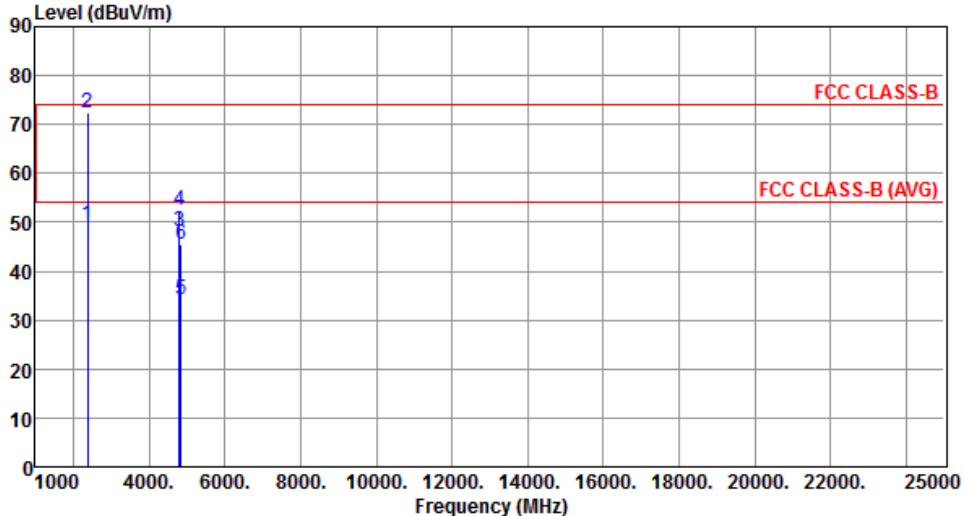


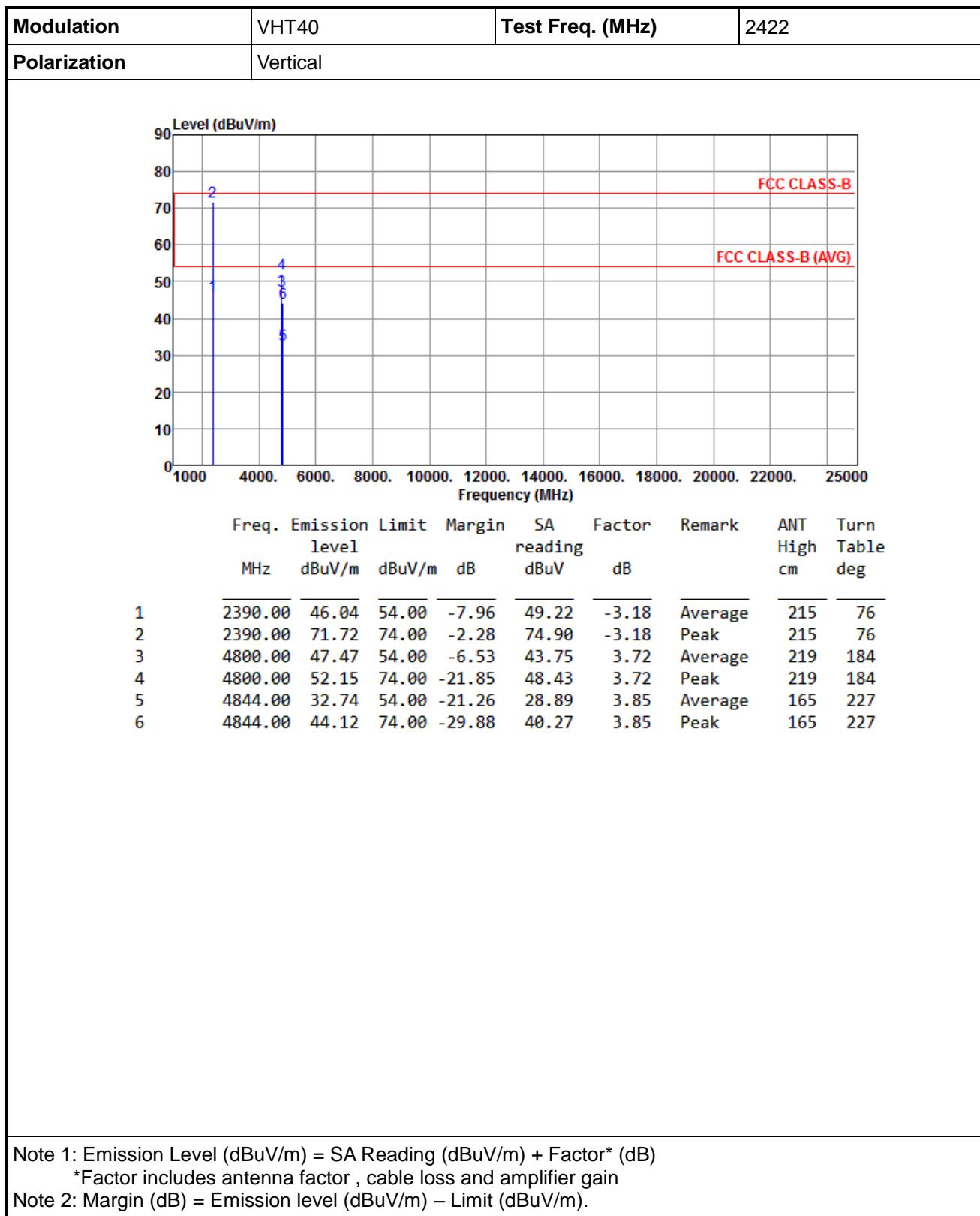






### 3.5.11 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT40

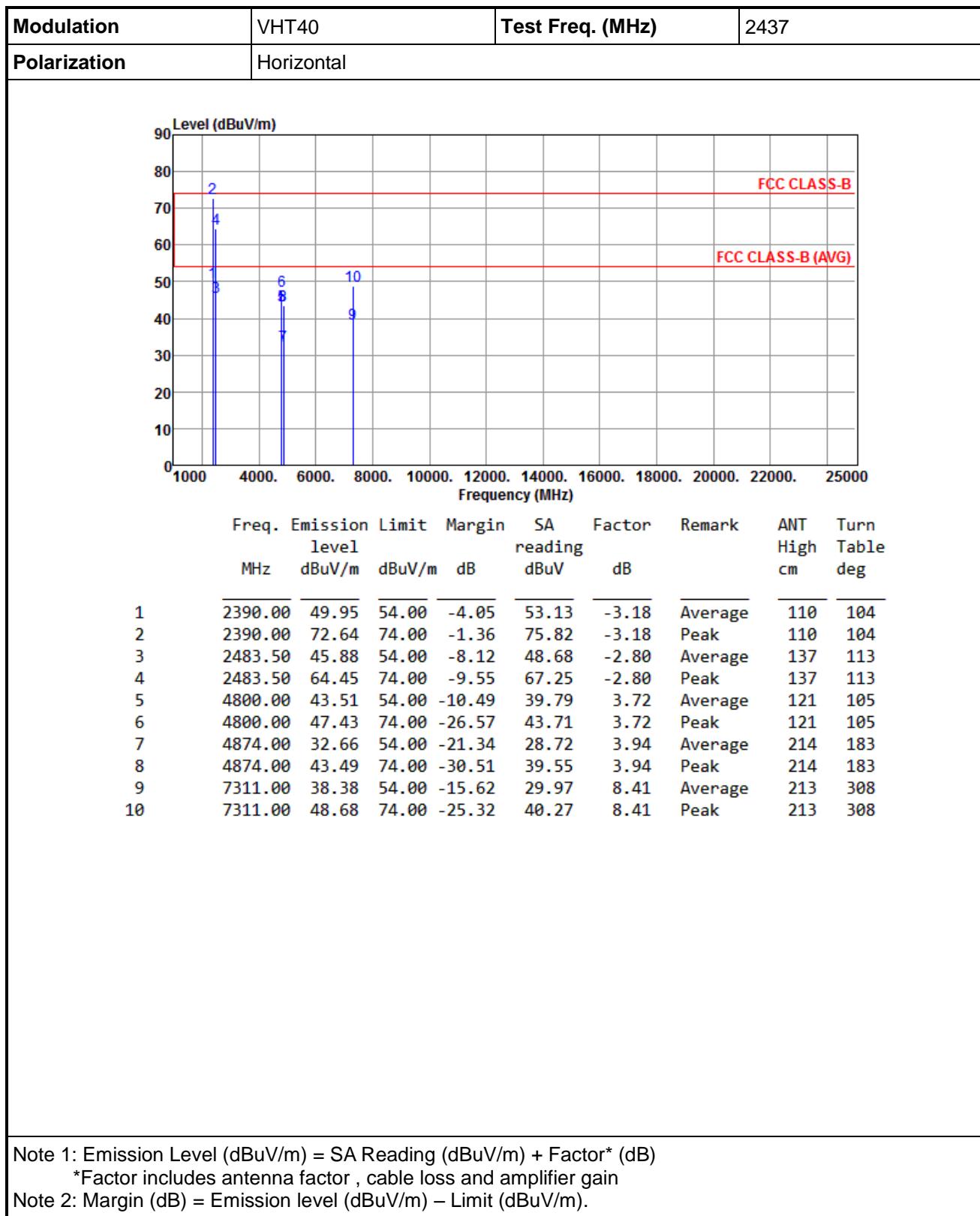
<b>Modulation</b>	VHT40	<b>Test Freq. (MHz)</b>	2422																																																																														
<b>Polarization</b>	Horizontal																																																																																
																																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding-bottom: 2px;">Freq.</th> <th style="text-align: left; padding-bottom: 2px;">Emission</th> <th style="text-align: left; padding-bottom: 2px;">Limit</th> <th style="text-align: left; padding-bottom: 2px;">Margin</th> <th style="text-align: left; padding-bottom: 2px;">SA</th> <th style="text-align: left; padding-bottom: 2px;">Factor</th> <th style="text-align: left; padding-bottom: 2px;">Remark</th> <th style="text-align: left; padding-bottom: 2px;">ANT</th> <th style="text-align: left; padding-bottom: 2px;">Turn</th> </tr> <tr> <th style="text-align: left;">MHz</th> <th style="text-align: left;">level</th> <th style="text-align: left;">dBuV/m</th> <th style="text-align: left;">dB</th> <th style="text-align: left;">reading</th> <th style="text-align: left;">dBuV</th> <th style="text-align: left;"> </th> <th style="text-align: left;">High</th> <th style="text-align: left;">Table</th> </tr> </thead> <tbody> <tr> <td style="padding-top: 2px;">1</td> <td style="padding-top: 2px;">2390.00</td> <td style="padding-top: 2px;">49.46</td> <td style="padding-top: 2px;">54.00</td> <td style="padding-top: 2px;">-4.54</td> <td style="padding-top: 2px;">52.64</td> <td style="padding-top: 2px;">-3.18</td> <td style="padding-top: 2px;">Average</td> <td style="padding-top: 2px;">146</td> <td style="padding-top: 2px;">110</td> </tr> <tr> <td style="padding-top: 2px;">2</td> <td style="padding-top: 2px;">2390.00</td> <td style="padding-top: 2px;">72.49</td> <td style="padding-top: 2px;">74.00</td> <td style="padding-top: 2px;">-1.51</td> <td style="padding-top: 2px;">75.67</td> <td style="padding-top: 2px;">-3.18</td> <td style="padding-top: 2px;">Peak</td> <td style="padding-top: 2px;">146</td> <td style="padding-top: 2px;">110</td> </tr> <tr> <td style="padding-top: 2px;">3</td> <td style="padding-top: 2px;">4800.00</td> <td style="padding-top: 2px;">48.25</td> <td style="padding-top: 2px;">54.00</td> <td style="padding-top: 2px;">-5.75</td> <td style="padding-top: 2px;">44.53</td> <td style="padding-top: 2px;">3.72</td> <td style="padding-top: 2px;">Average</td> <td style="padding-top: 2px;">120</td> <td style="padding-top: 2px;">231</td> </tr> <tr> <td style="padding-top: 2px;">4</td> <td style="padding-top: 2px;">4800.00</td> <td style="padding-top: 2px;">52.45</td> <td style="padding-top: 2px;">74.00</td> <td style="padding-top: 2px;">-21.55</td> <td style="padding-top: 2px;">48.73</td> <td style="padding-top: 2px;">3.72</td> <td style="padding-top: 2px;">Peak</td> <td style="padding-top: 2px;">120</td> <td style="padding-top: 2px;">231</td> </tr> <tr> <td style="padding-top: 2px;">5</td> <td style="padding-top: 2px;">4844.00</td> <td style="padding-top: 2px;">34.17</td> <td style="padding-top: 2px;">54.00</td> <td style="padding-top: 2px;">-19.83</td> <td style="padding-top: 2px;">30.32</td> <td style="padding-top: 2px;">3.85</td> <td style="padding-top: 2px;">Average</td> <td style="padding-top: 2px;">205</td> <td style="padding-top: 2px;">174</td> </tr> <tr> <td style="padding-top: 2px;">6</td> <td style="padding-top: 2px;">4844.00</td> <td style="padding-top: 2px;">45.54</td> <td style="padding-top: 2px;">74.00</td> <td style="padding-top: 2px;">-28.46</td> <td style="padding-top: 2px;">41.69</td> <td style="padding-top: 2px;">3.85</td> <td style="padding-top: 2px;">Peak</td> <td style="padding-top: 2px;">205</td> <td style="padding-top: 2px;">174</td> </tr> </tbody> </table>				Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn	MHz	level	dBuV/m	dB	reading	dBuV		High	Table	1	2390.00	49.46	54.00	-4.54	52.64	-3.18	Average	146	110	2	2390.00	72.49	74.00	-1.51	75.67	-3.18	Peak	146	110	3	4800.00	48.25	54.00	-5.75	44.53	3.72	Average	120	231	4	4800.00	52.45	74.00	-21.55	48.73	3.72	Peak	120	231	5	4844.00	34.17	54.00	-19.83	30.32	3.85	Average	205	174	6	4844.00	45.54	74.00	-28.46	41.69	3.85	Peak	205	174
Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn																																																																									
MHz	level	dBuV/m	dB	reading	dBuV		High	Table																																																																									
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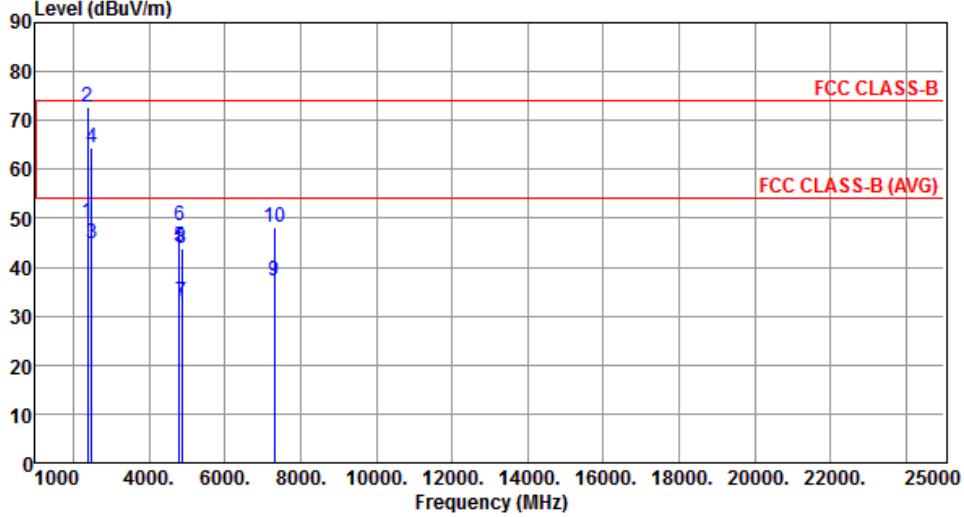


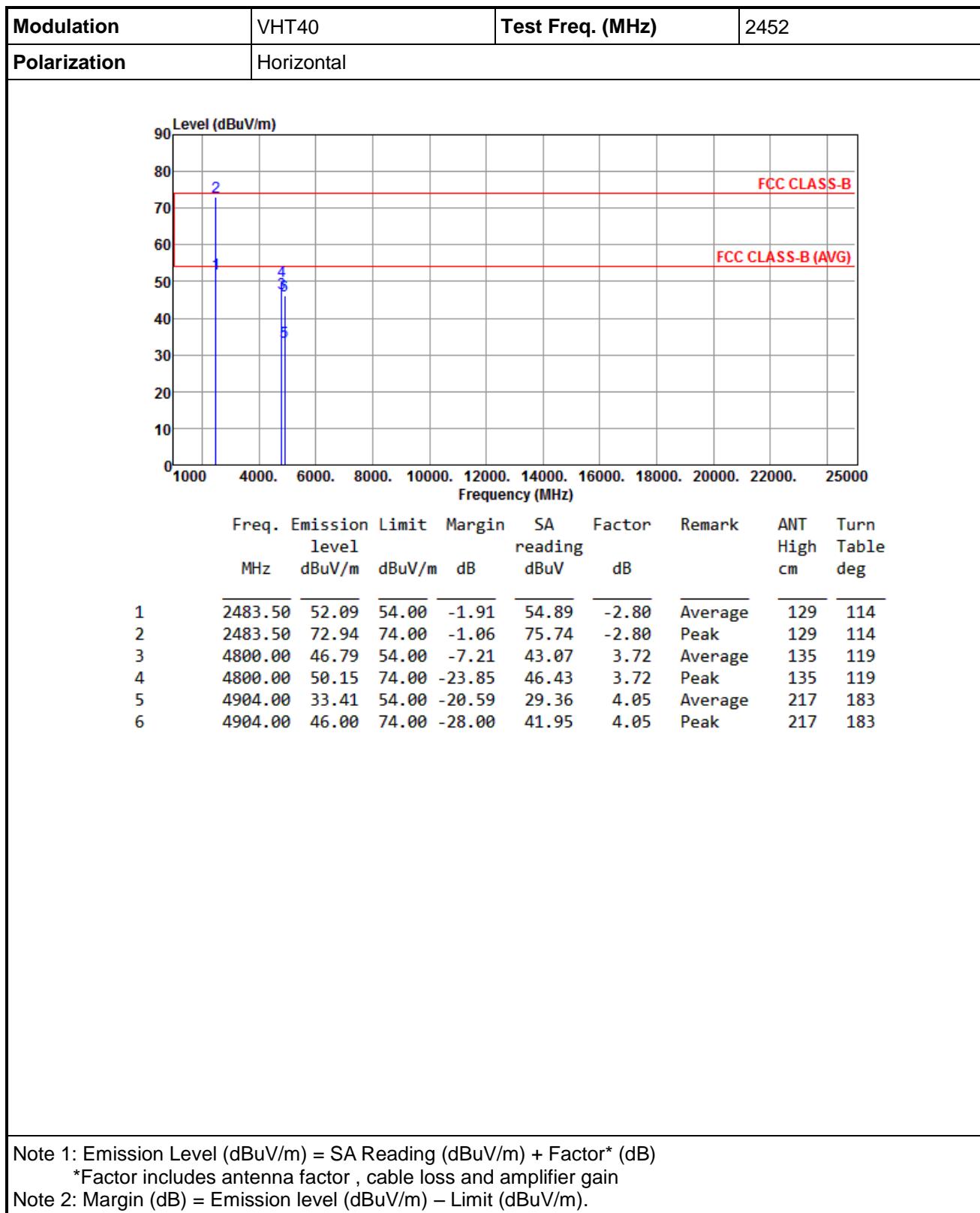
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

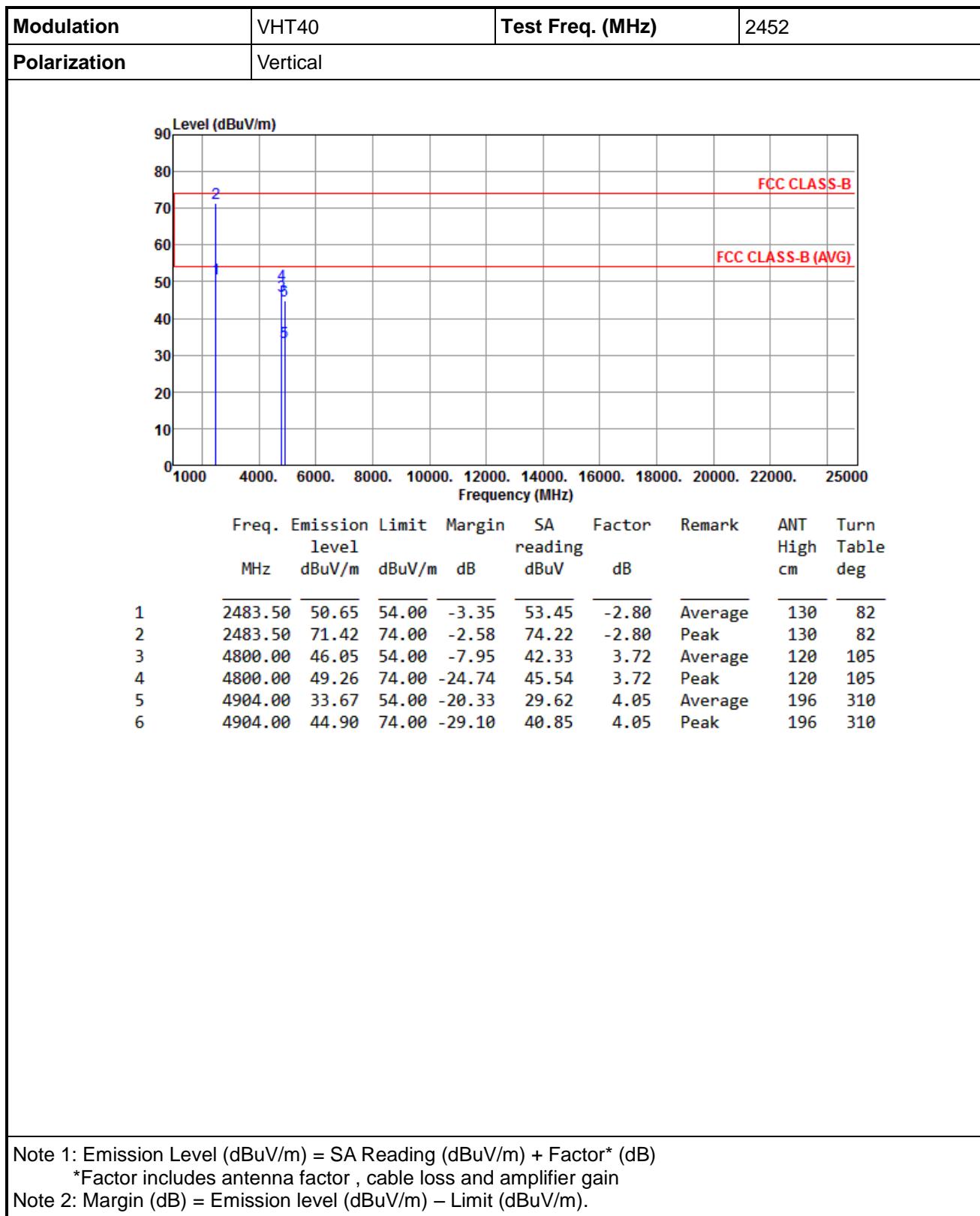
\*Factor includes antenna factor , cable loss and amplifier gain

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



<b>Modulation</b>	VHT40	<b>Test Freq. (MHz)</b>	2437																																																																																																																						
<b>Polarization</b>	Vertical																																																																																																																								
																																																																																																																									
<table border="1"> <thead> <tr> <th>Freq.</th> <th>Emission level</th> <th>Limit</th> <th>Margin</th> <th>SA reading</th> <th>Factor</th> <th>Remark</th> <th>ANT High</th> <th>Turn Table deg</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB</th> <th></th> <th>cm</th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2390.00</td> <td>49.08</td> <td>54.00</td> <td>-4.92</td> <td>52.26</td> <td>-3.18</td> <td>Average</td> <td>134</td> <td>77</td> </tr> <tr> <td>2</td> <td>2390.00</td> <td>72.60</td> <td>74.00</td> <td>-1.40</td> <td>75.78</td> <td>-3.18</td> <td>Peak</td> <td>134</td> <td>77</td> </tr> <tr> <td>3</td> <td>2483.50</td> <td>44.76</td> <td>54.00</td> <td>-9.24</td> <td>47.56</td> <td>-2.80</td> <td>Average</td> <td>134</td> <td>77</td> </tr> <tr> <td>4</td> <td>2483.50</td> <td>64.48</td> <td>74.00</td> <td>-9.52</td> <td>67.28</td> <td>-2.80</td> <td>Peak</td> <td>134</td> <td>77</td> </tr> <tr> <td>5</td> <td>4800.00</td> <td>44.18</td> <td>54.00</td> <td>-9.82</td> <td>40.46</td> <td>3.72</td> <td>Average</td> <td>137</td> <td>118</td> </tr> <tr> <td>6</td> <td>4800.00</td> <td>48.39</td> <td>74.00</td> <td>-25.61</td> <td>44.67</td> <td>3.72</td> <td>Peak</td> <td>137</td> <td>118</td> </tr> <tr> <td>7</td> <td>4874.00</td> <td>32.79</td> <td>54.00</td> <td>-21.21</td> <td>28.85</td> <td>3.94</td> <td>Average</td> <td>159</td> <td>255</td> </tr> <tr> <td>8</td> <td>4874.00</td> <td>43.89</td> <td>74.00</td> <td>-30.11</td> <td>39.95</td> <td>3.94</td> <td>Peak</td> <td>159</td> <td>255</td> </tr> <tr> <td>9</td> <td>7311.00</td> <td>37.22</td> <td>54.00</td> <td>-16.78</td> <td>28.81</td> <td>8.41</td> <td>Average</td> <td>179</td> <td>208</td> </tr> <tr> <td>10</td> <td>7311.00</td> <td>48.32</td> <td>74.00</td> <td>-25.68</td> <td>39.91</td> <td>8.41</td> <td>Peak</td> <td>179</td> <td>208</td> </tr> </tbody> </table>				Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table deg	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm		1	2390.00	49.08	54.00	-4.92	52.26	-3.18	Average	134	77	2	2390.00	72.60	74.00	-1.40	75.78	-3.18	Peak	134	77	3	2483.50	44.76	54.00	-9.24	47.56	-2.80	Average	134	77	4	2483.50	64.48	74.00	-9.52	67.28	-2.80	Peak	134	77	5	4800.00	44.18	54.00	-9.82	40.46	3.72	Average	137	118	6	4800.00	48.39	74.00	-25.61	44.67	3.72	Peak	137	118	7	4874.00	32.79	54.00	-21.21	28.85	3.94	Average	159	255	8	4874.00	43.89	74.00	-30.11	39.95	3.94	Peak	159	255	9	7311.00	37.22	54.00	-16.78	28.81	8.41	Average	179	208	10	7311.00	48.32	74.00	-25.68	39.91	8.41	Peak	179	208
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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).																																																																																																																									





## 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 30 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

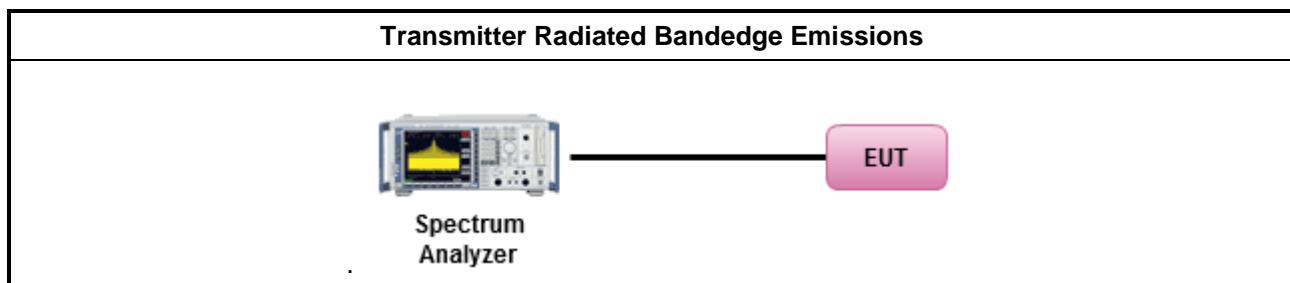
#### Reference level measurement

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



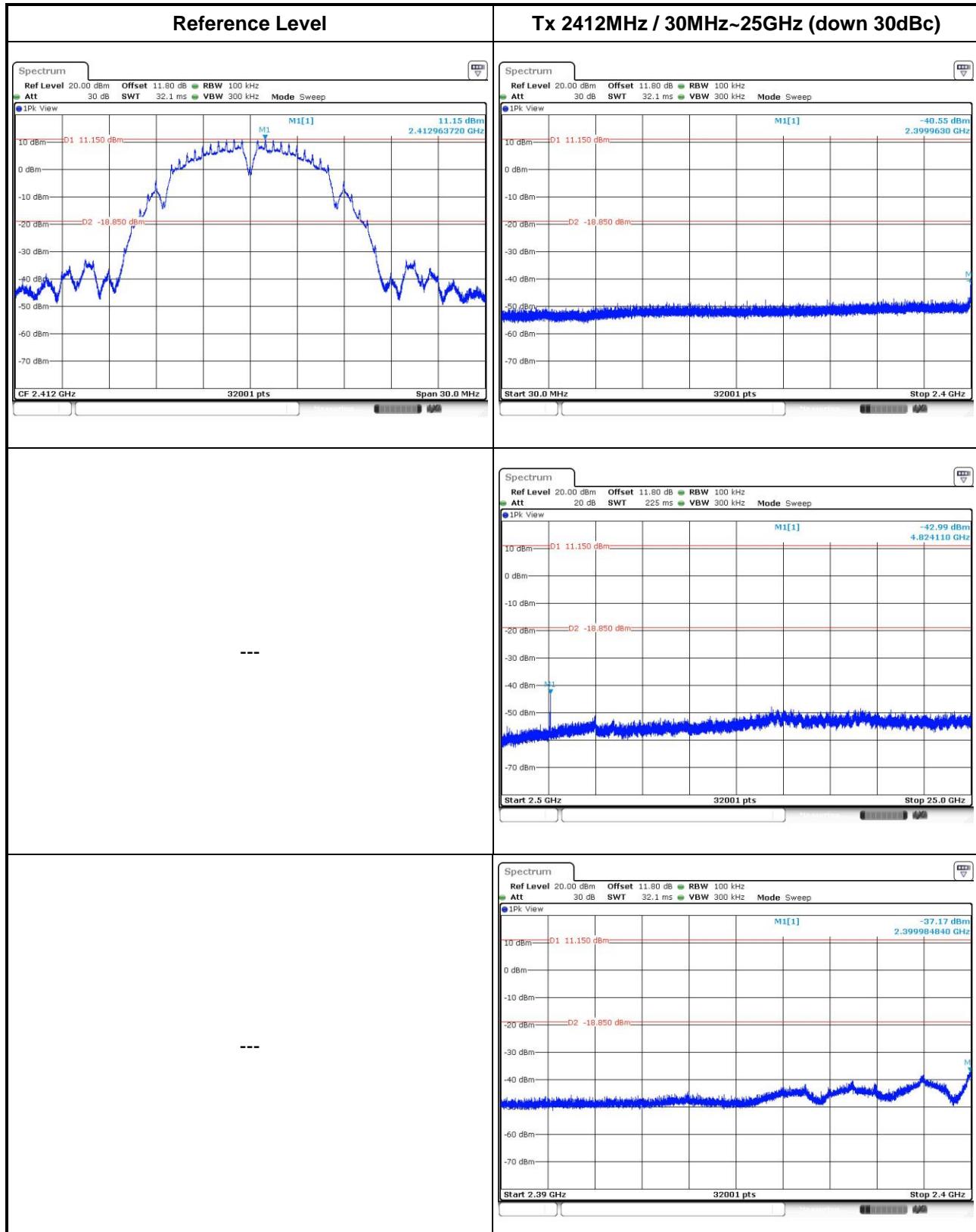
### 3.6.5 Test Result of Emissions in non-restricted frequency bands

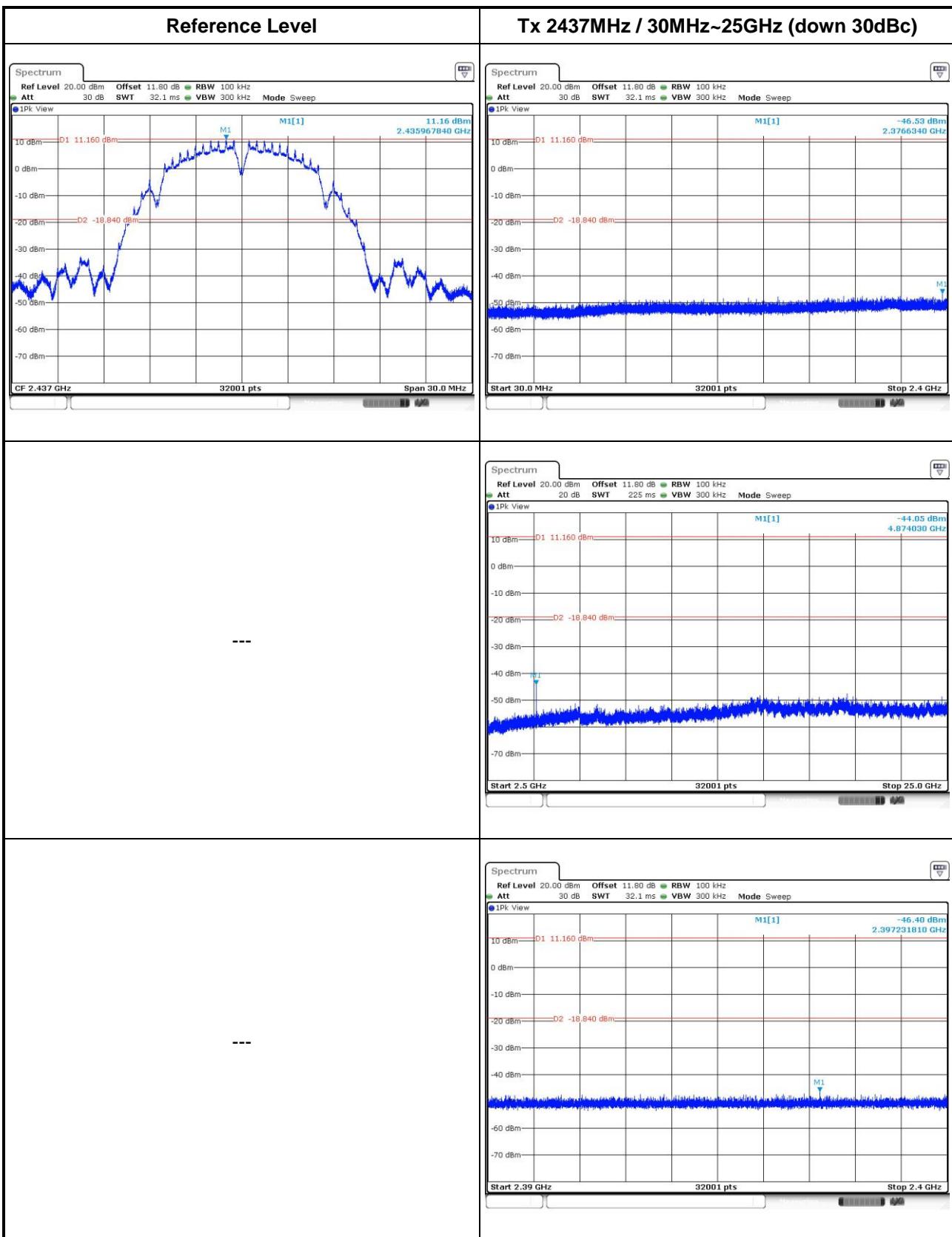
This test item is performed on each TX output individually without summing or adding  $10 \log(N_{ANT})$  since measurements are made relative to the in-band emissions on the individual outputs. Only worst test result of each operating mode is presented.

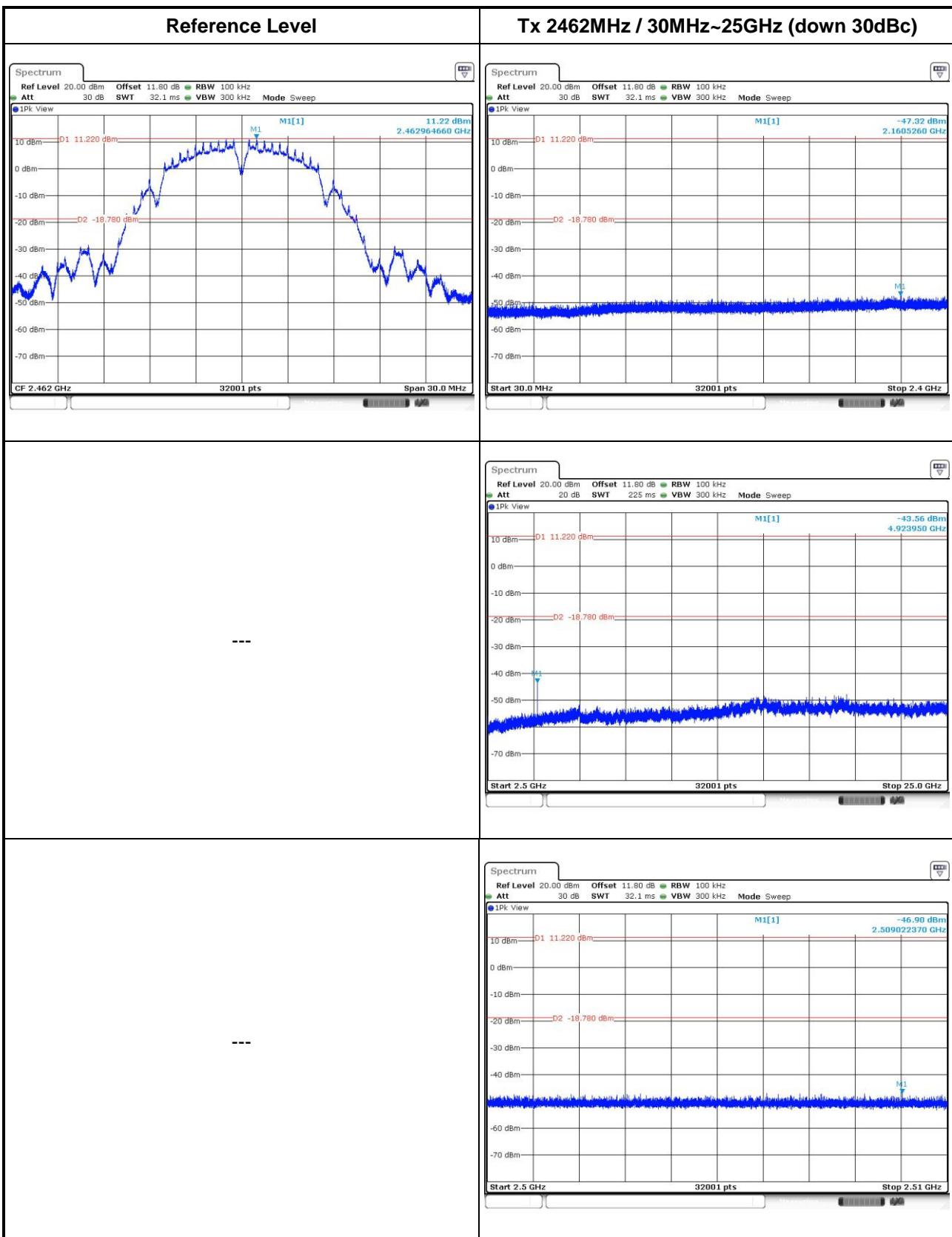
### Non-beamforming mode

#### 3.6.6 Unwanted Emissions into Non-Restricted Frequency Bands

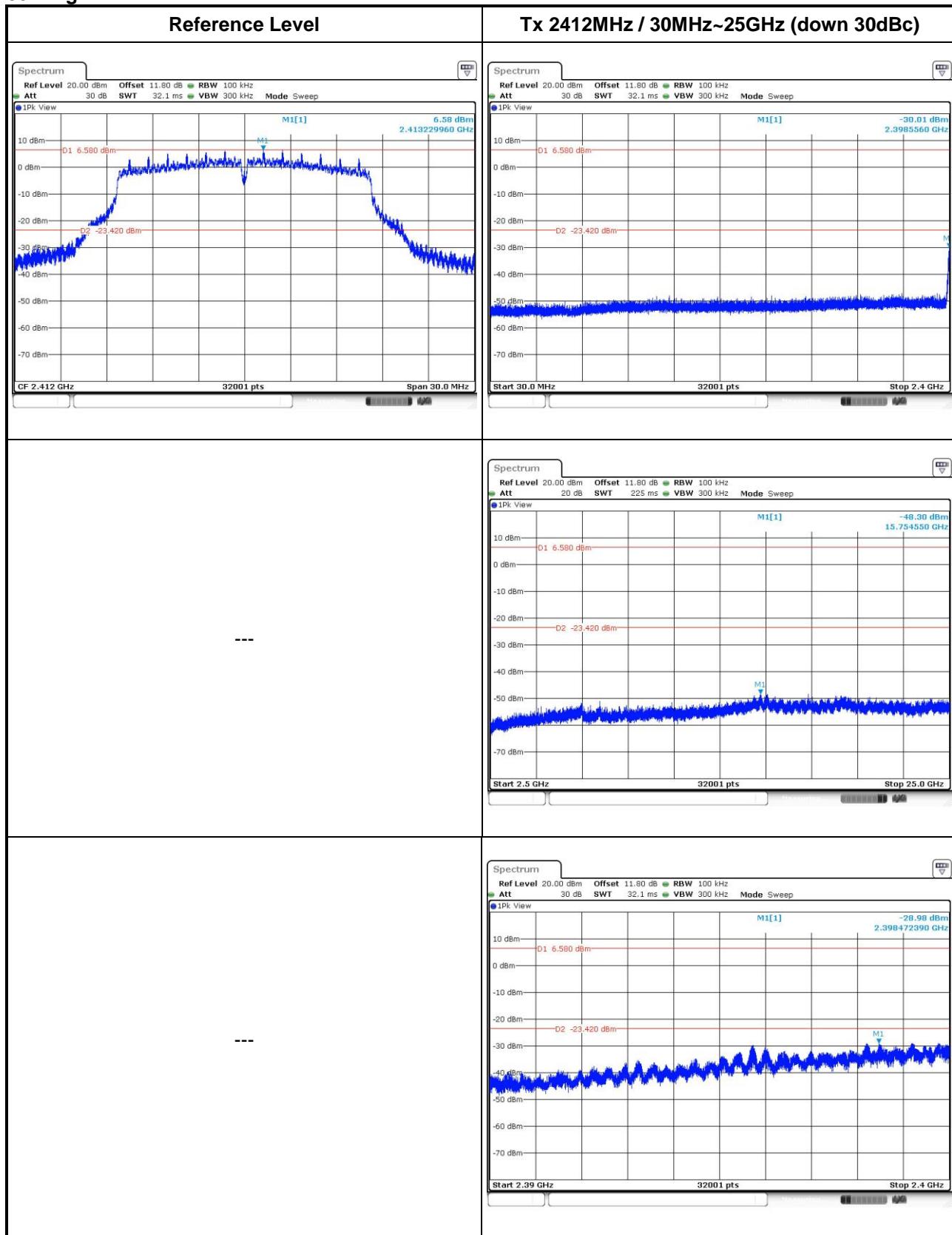
802.11b

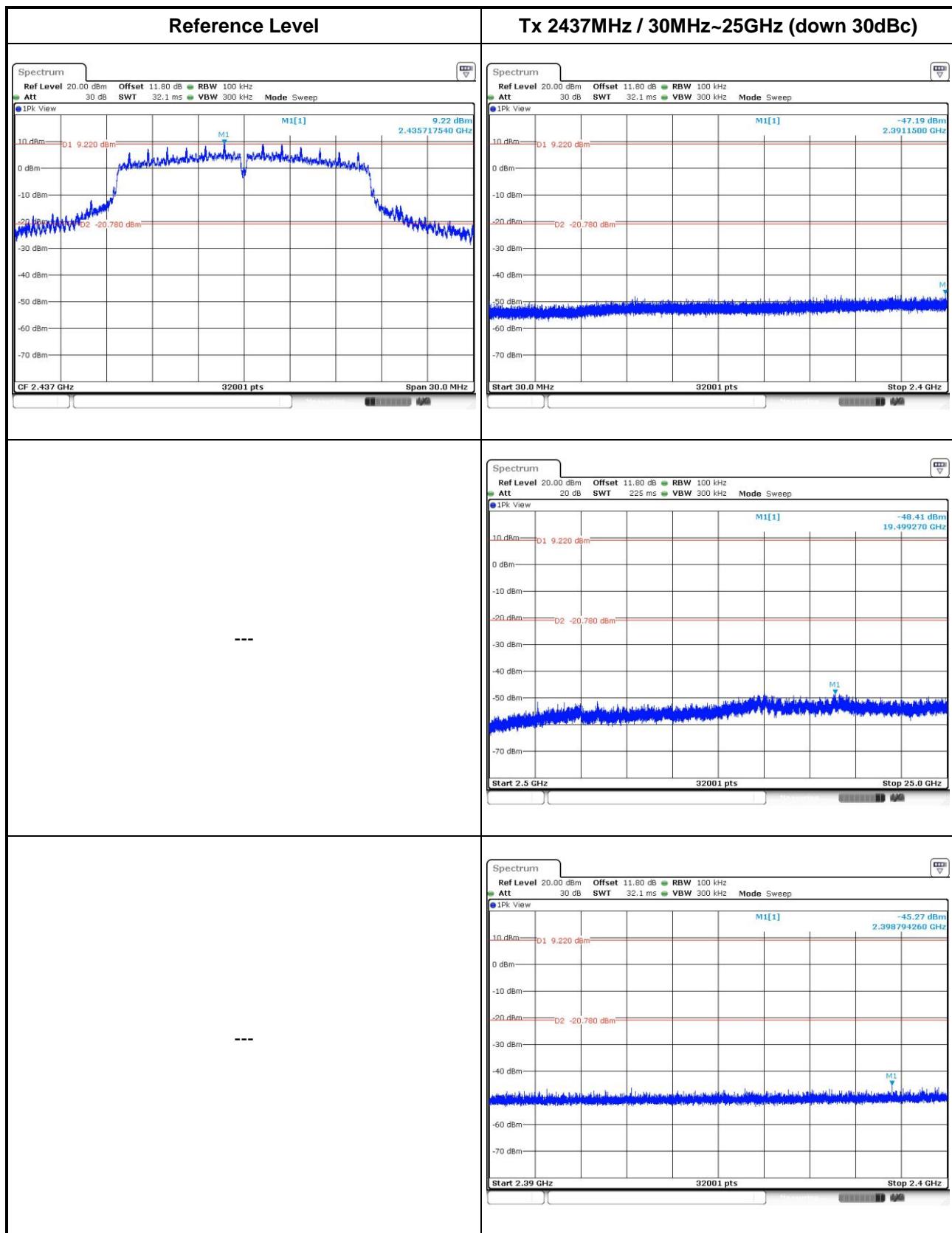


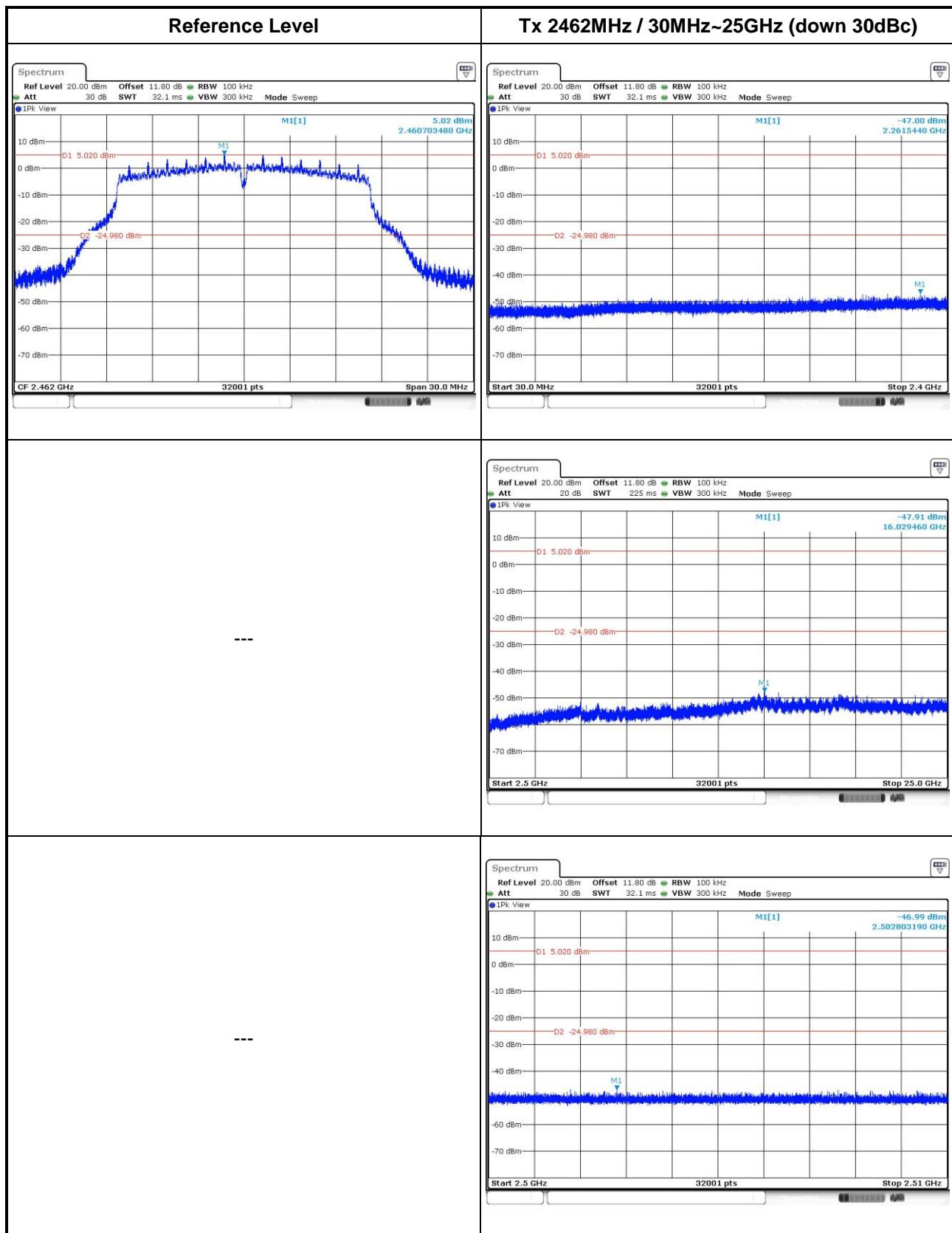




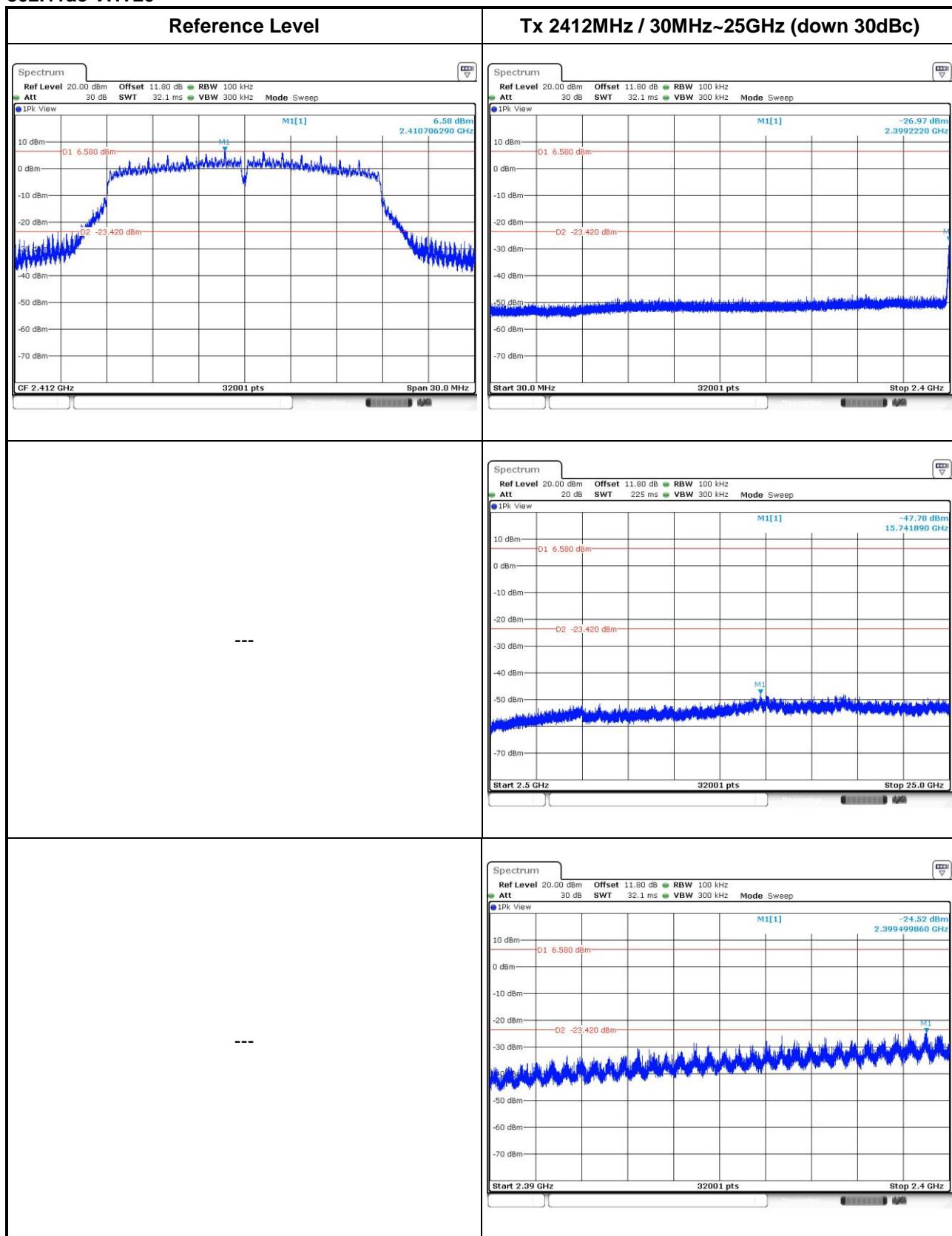
## 802.11g

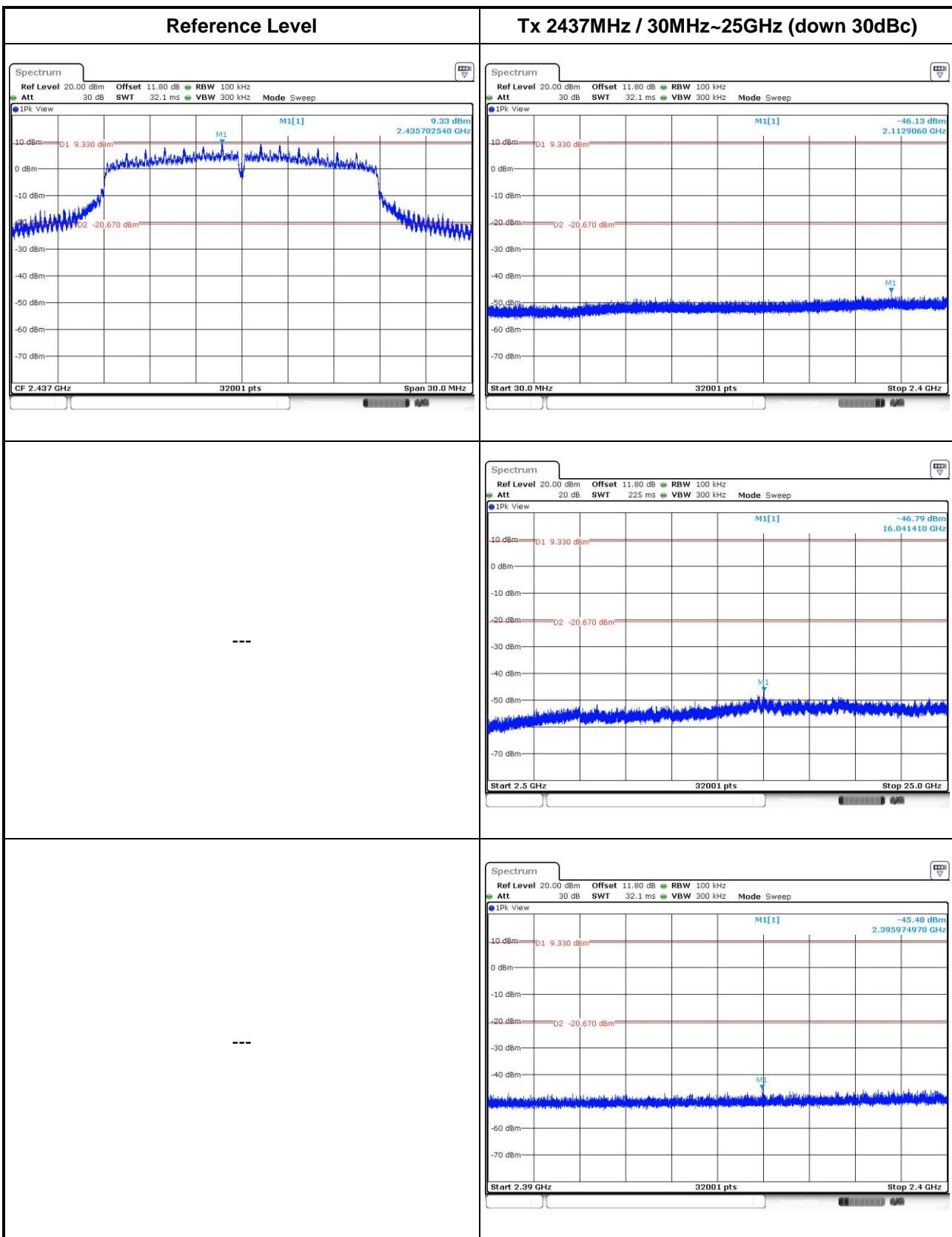


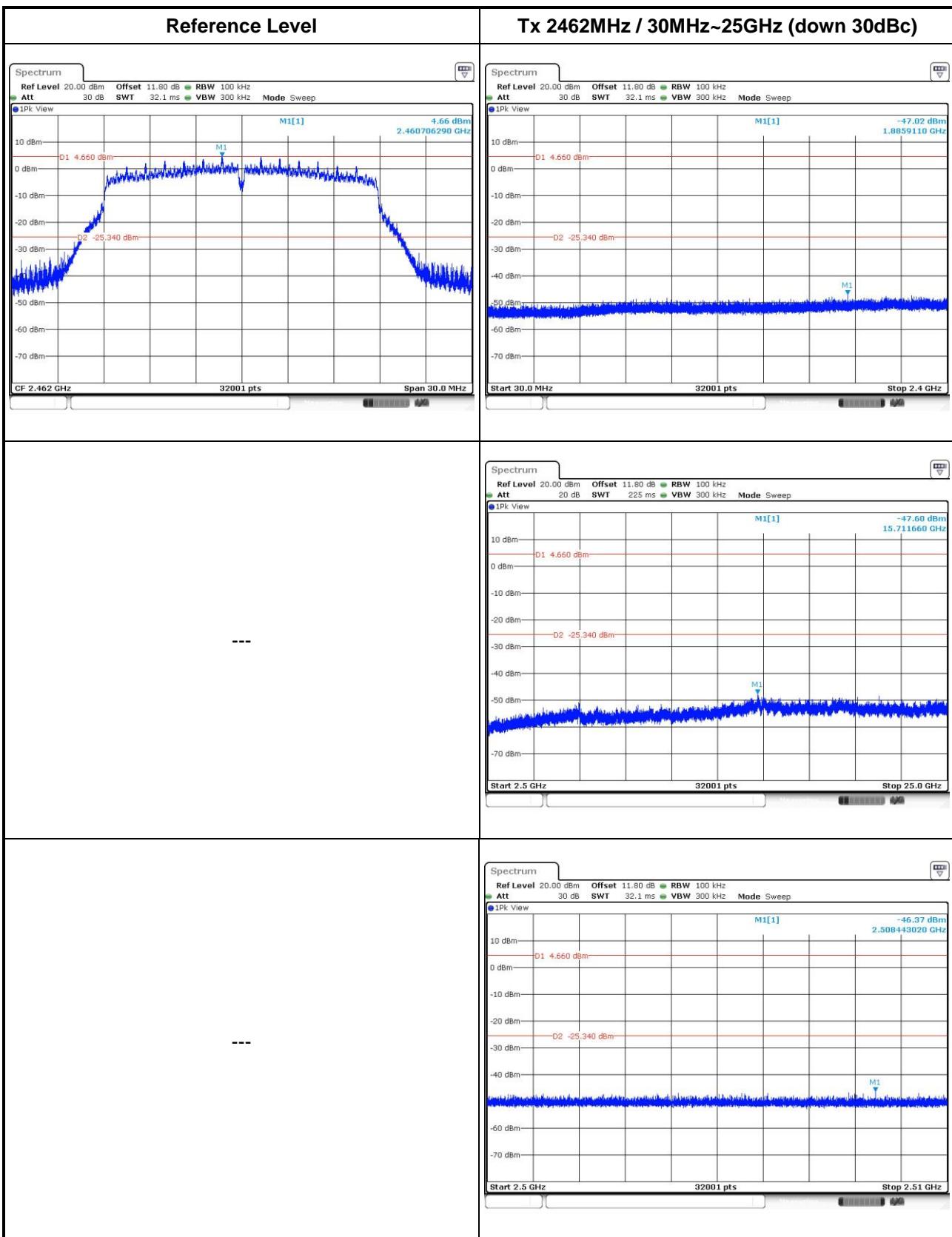




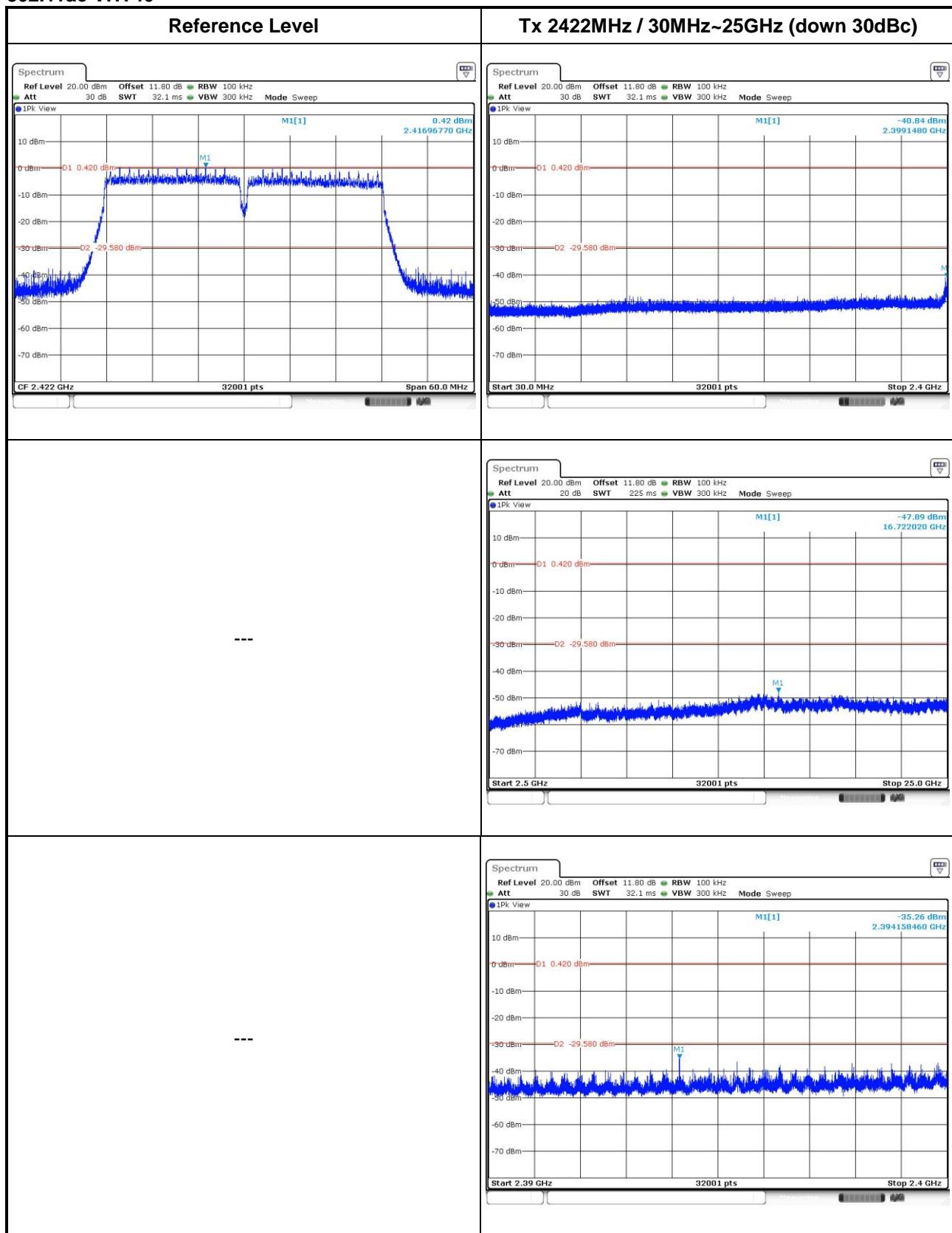
## 802.11ac VHT20

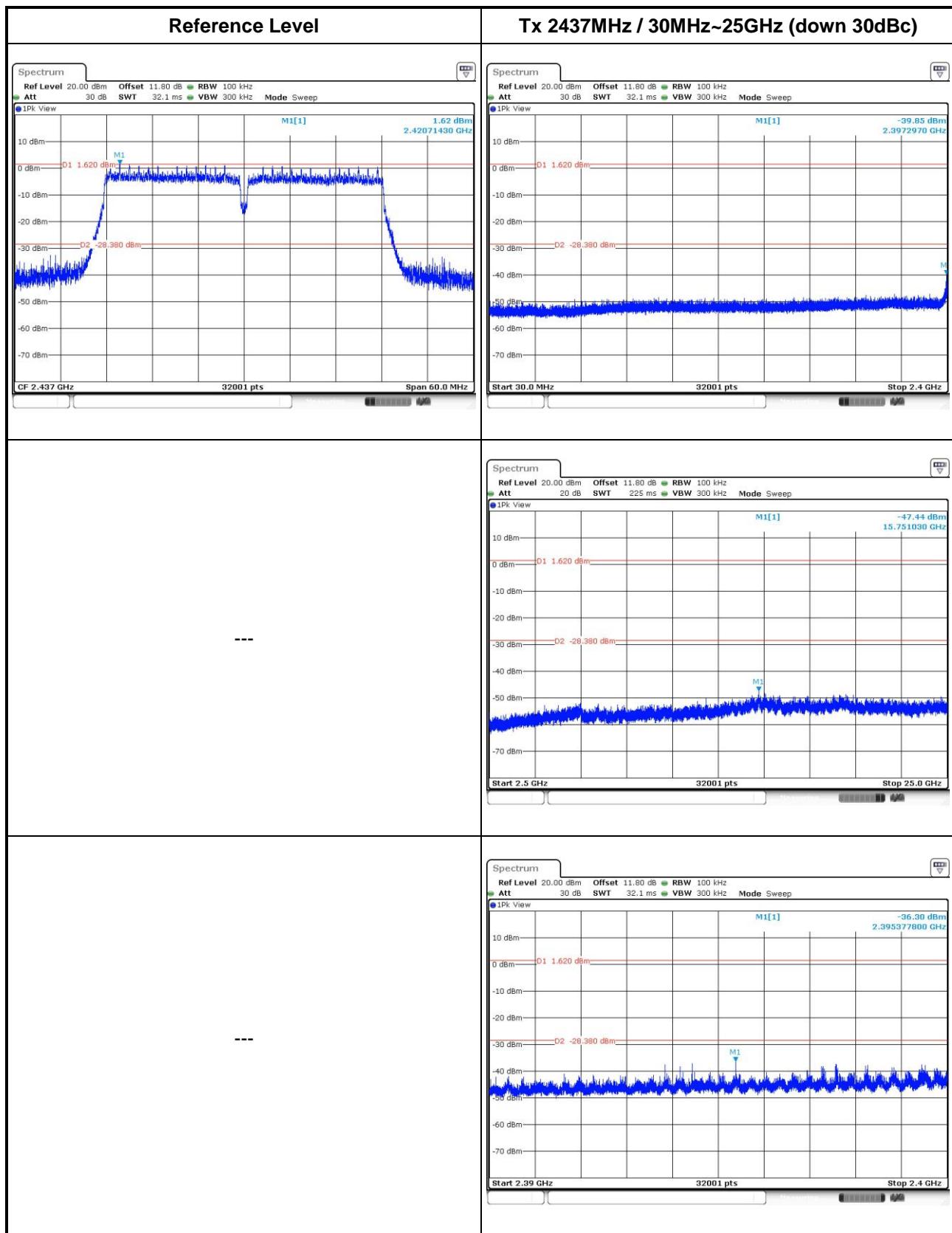


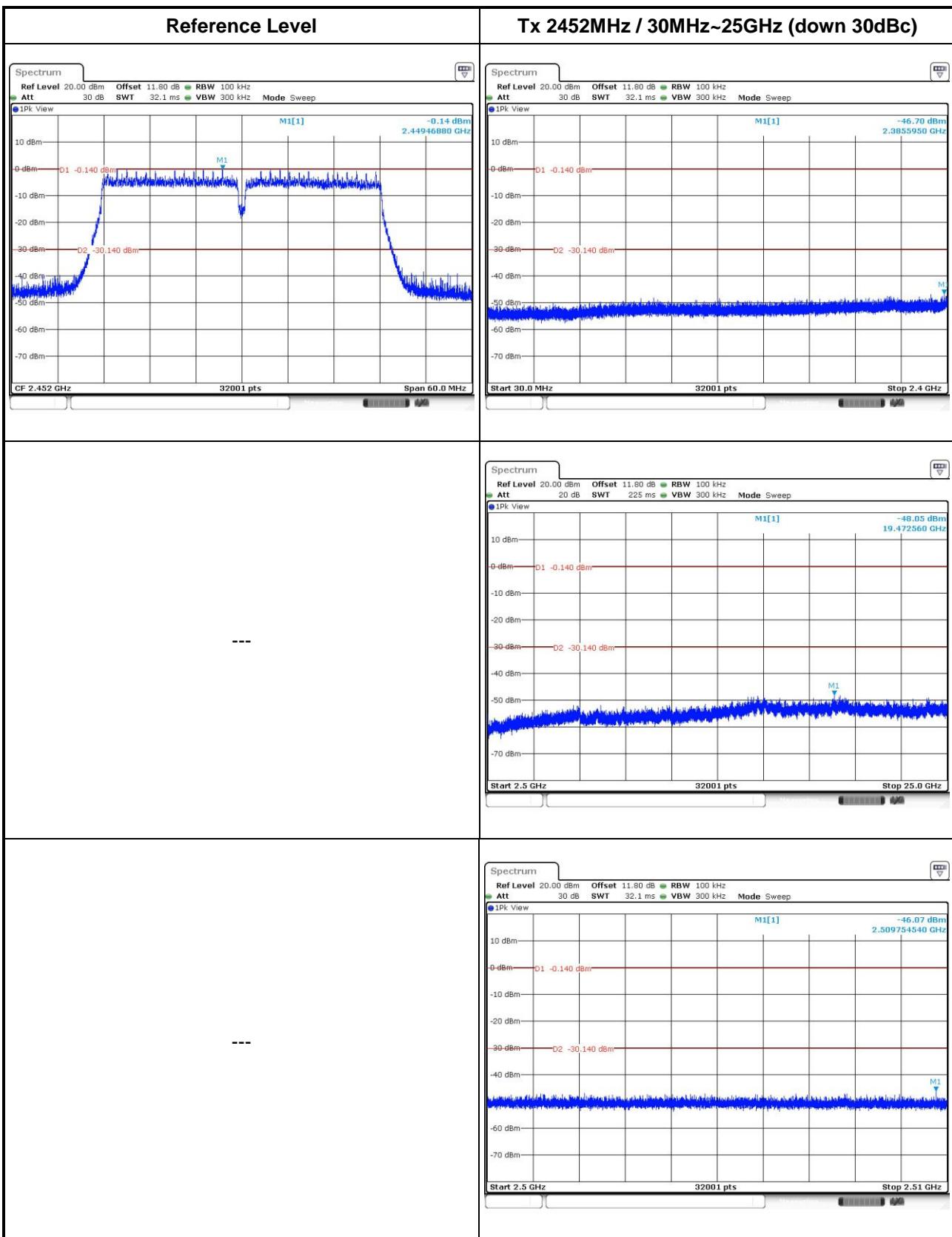




## 802.11ac VHT40

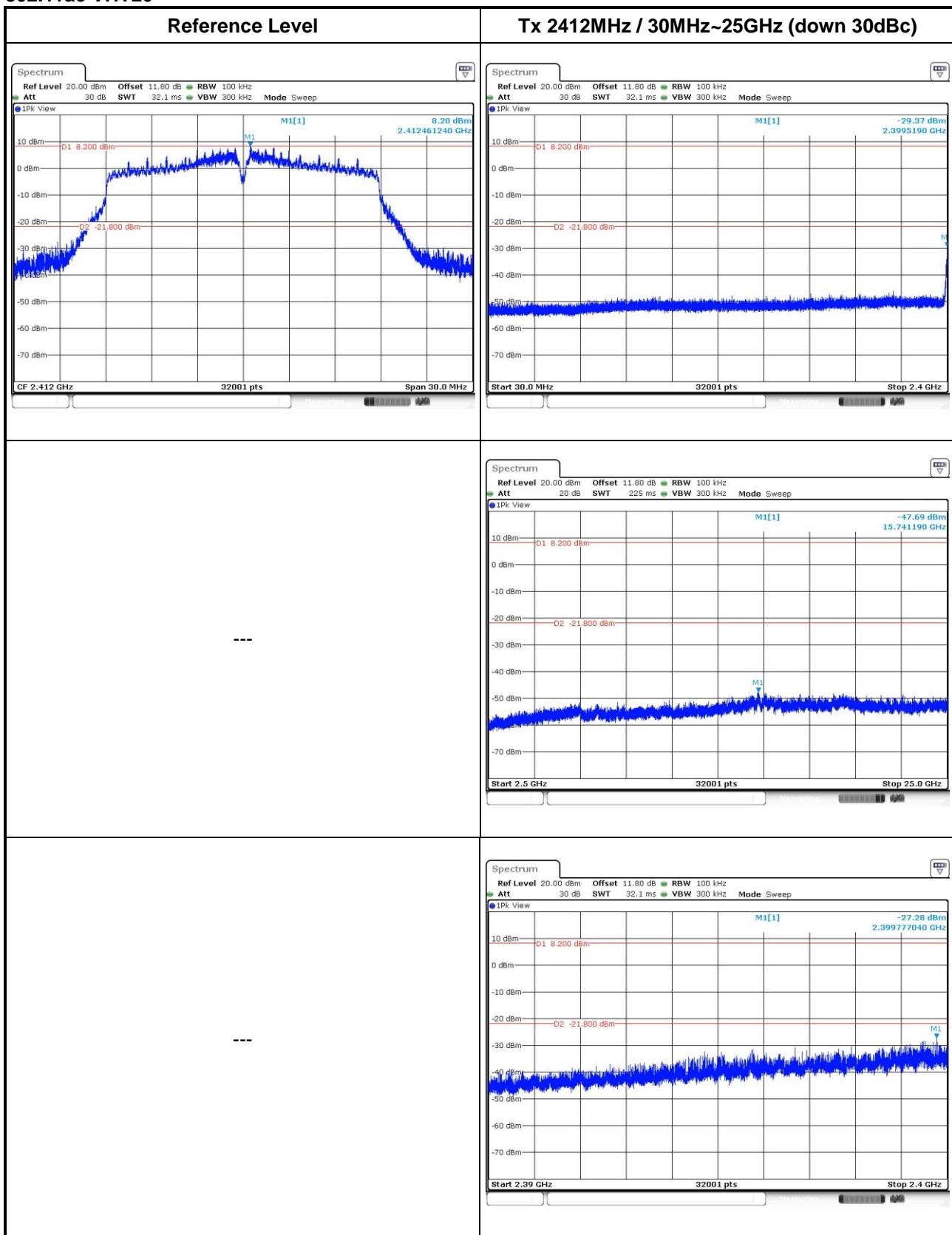


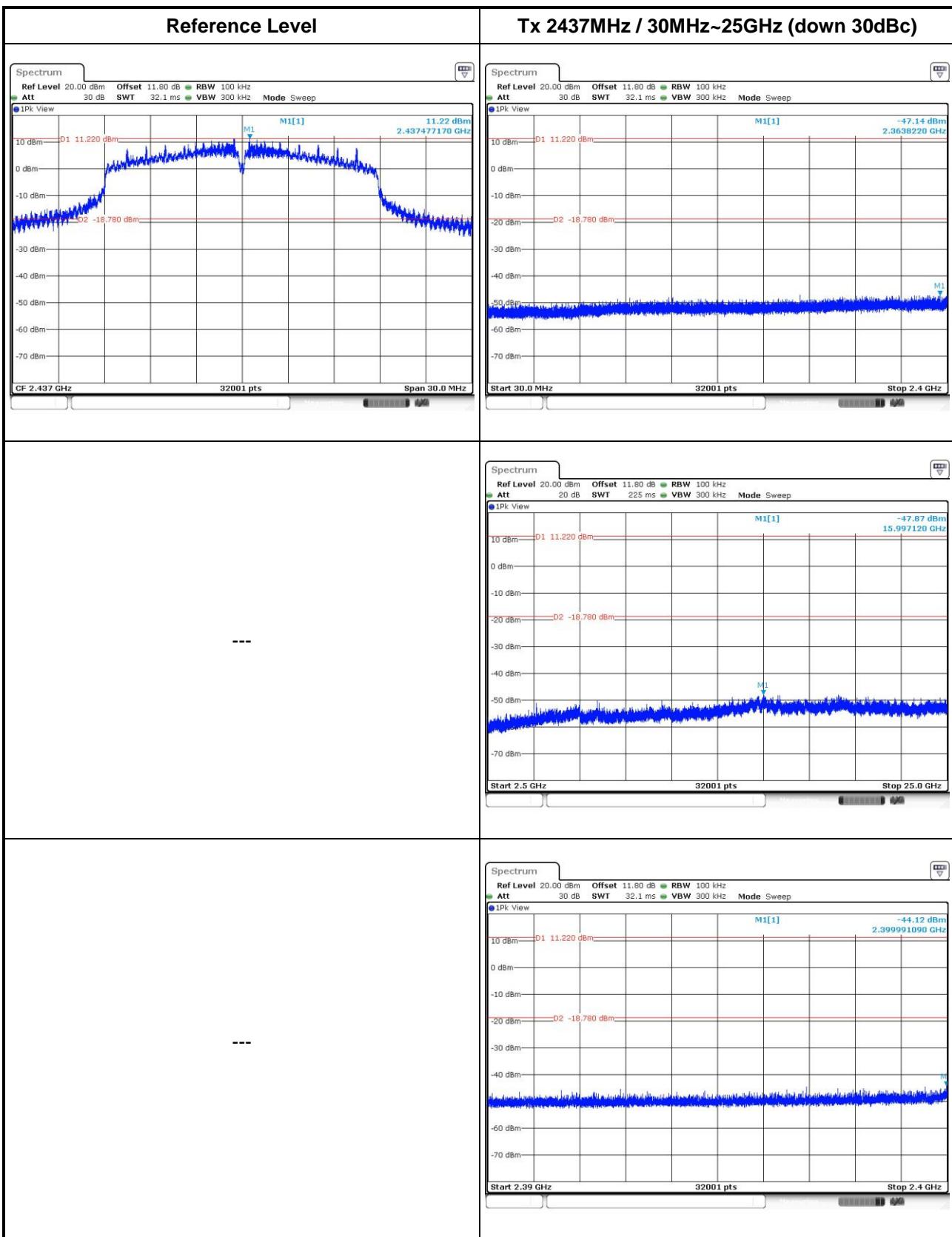


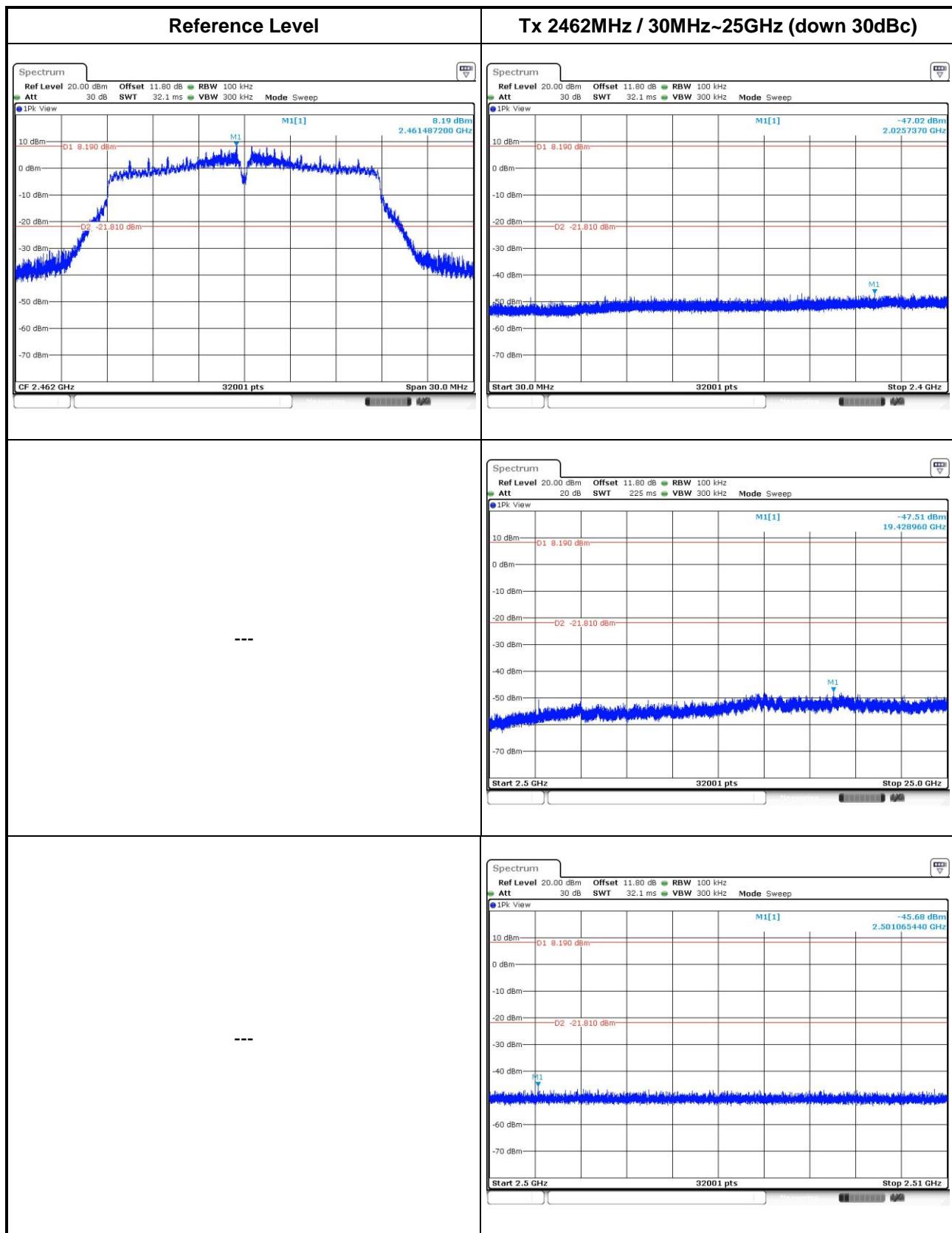


## Beamforming mode

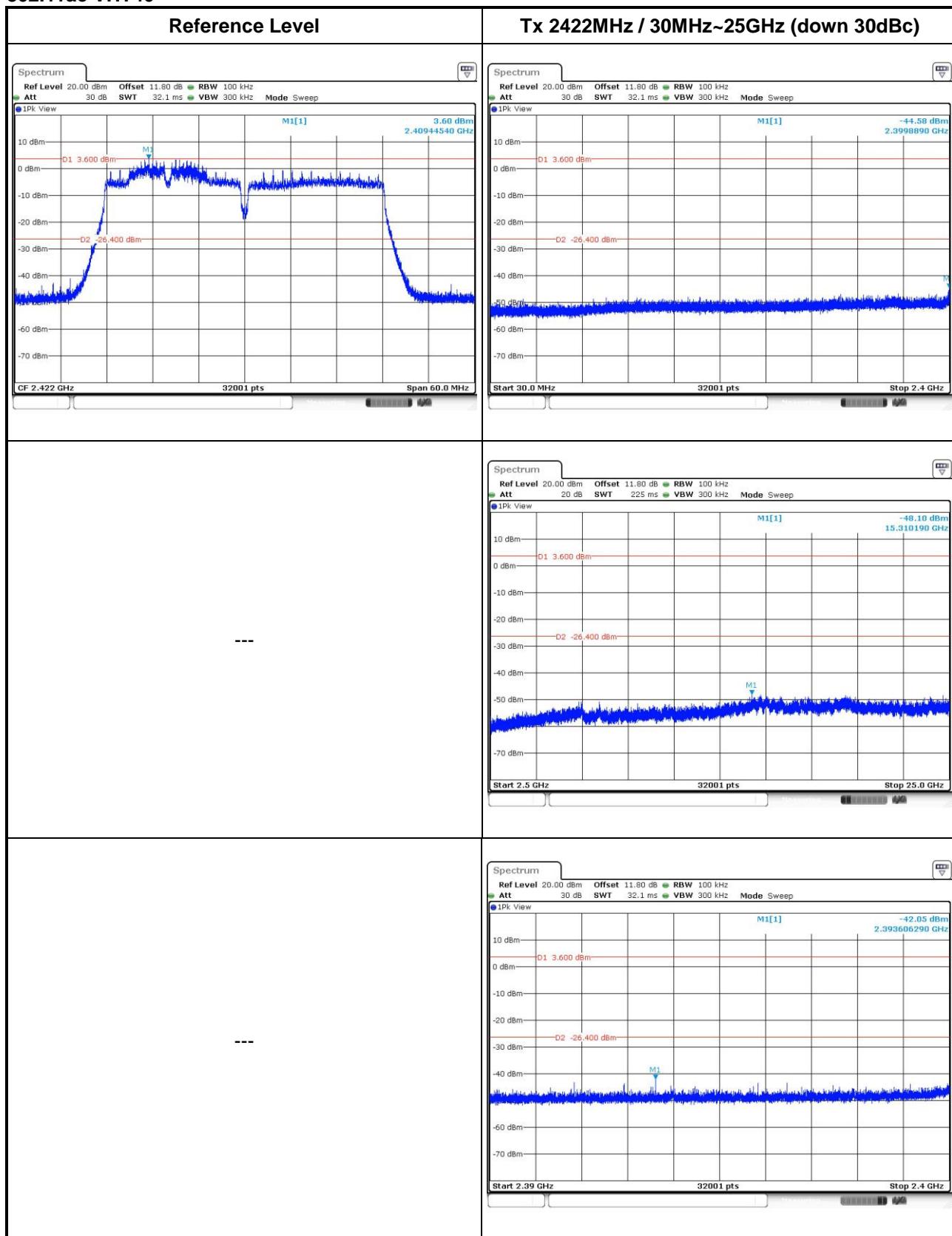
802.11ac VHT20

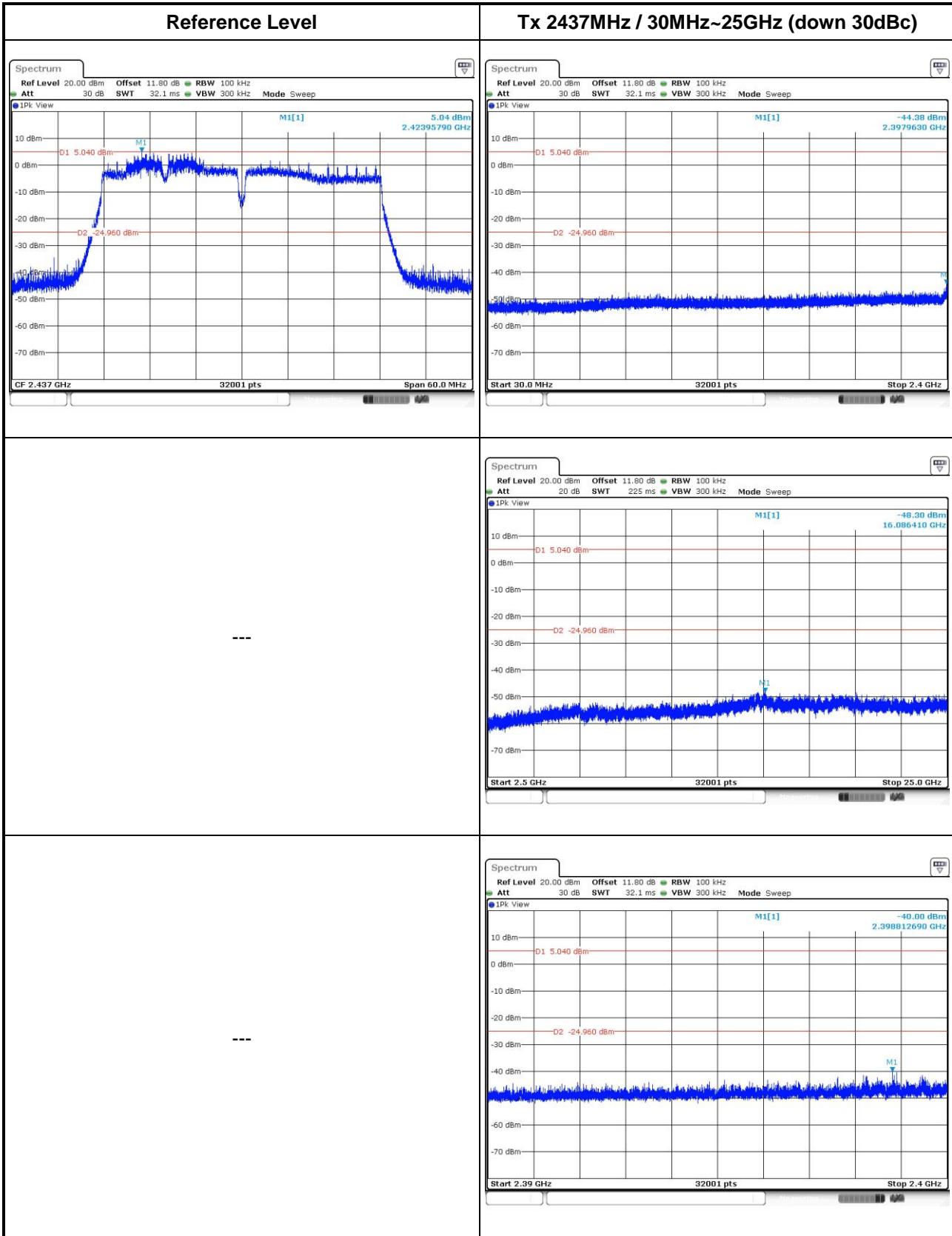


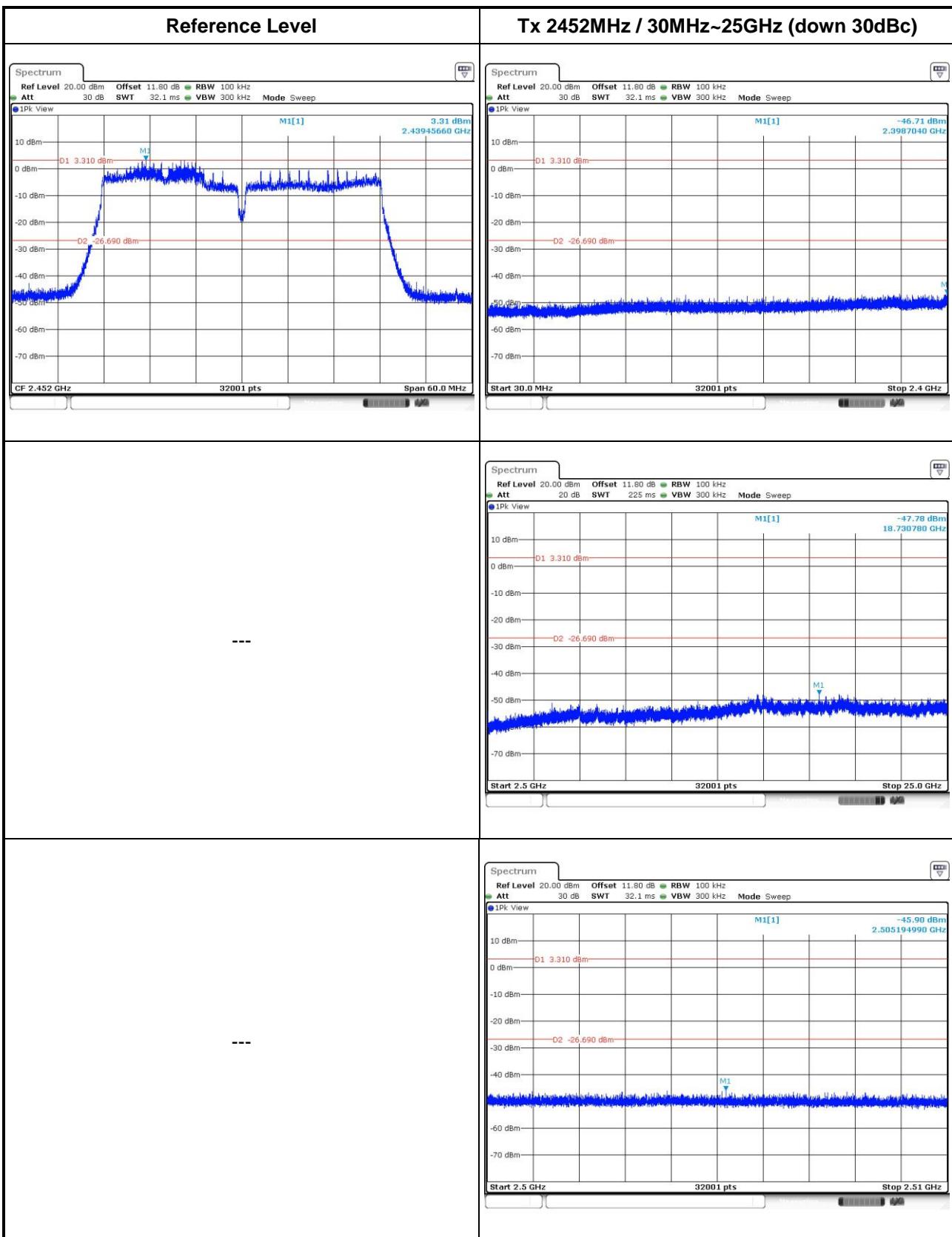




## 802.11ac VHT40







## 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>.

### Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.

### Kwei Shan

Tel: 886-3-271-8666

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

### Kwei Shan Site II

Tel: 886-3-271-8640

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

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

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: [ICC\\_Service@icertifi.com.tw](mailto:ICC_Service@icertifi.com.tw)

—END—