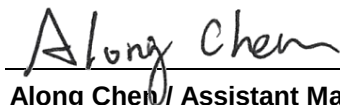


FCC Test Report

FCC ID : MCLGPE810U
Equipment : LoRa Express Gateway
Model No. : GPE810U
Brand Name : ufiSpace
Applicant : HON HAI PRECISION IND.CO., LTD.
Address : 5F-1, 5 Hsin-An Road, Hsinchu, Science
Industrial Park, Taiwan, R.O.C.
Standard : 47 CFR FCC Part 15.247
Received Date : Mar. 28, 2017
Tested Date : Apr. 28 ~ May 04, 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
FR732802AC	Rev. 01	Initial issue	May 10, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.343MHz 31.09 (Margin -18.04dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2390.00MHz 72.99 (Margin -1.01dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 21.41	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	Data Rate / MCS
2400-2483.5	b	2412-2462	1-11 [11]	1	1-11 Mbps
2400-2483.5	g	2412-2462	1-11 [11]	1	6-54 Mbps
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	1	MCS 0-7
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	1	MCS 0-7
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.					

1.1.2 Antenna Details

Ant. No.	Model	Type	Connector	Gain (dBi)
1	WA-P-LA-03-216	Dipole	I-PEX	4.77

1.1.3 Power Supply Type of Equipment under Test (EUT)

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

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: DVE Model: DSA-18PFM-12FUS 120150 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 12Vdc, 1.5A Power Line: 1.5m non-shielded without core

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	Tera Term, V4.8		
Duty Cycle and Duty Factor	Mode	Duty cycle (%)	Duty factor (dB)
	11b	100.00%	0.00
	11g	96.96%	0.13
	HT20	96.38%	0.16
	HT40	92.18%	0.35

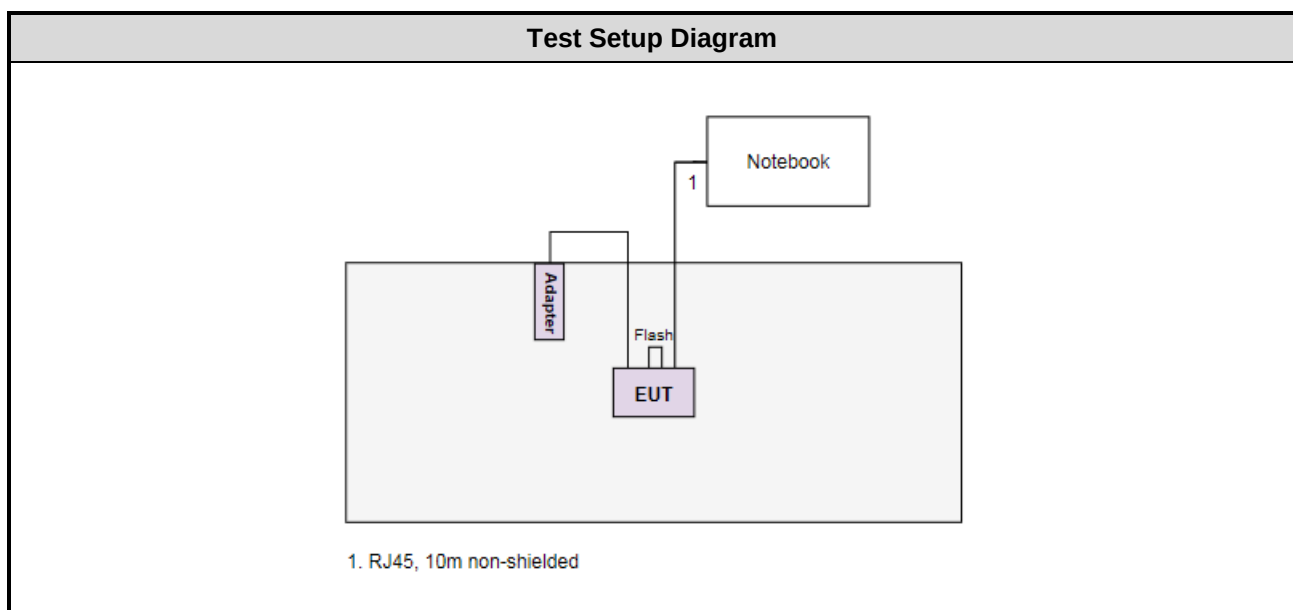
1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)	Power Set
11b	2412	16000
11b	2437	16000
11b	2462	16000
11g	2412	13500
11g	2437	16000
11g	2462	13500
HT20	2412	13500
HT20	2437	15000
HT20	2462	13500
HT40	2422	14500
HT40	2437	16500
HT40	2452	15000

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	USB, 1m shielded.
2	USB 3.0 Flash	SONY	USM16GU	---	---

1.3 Test Setup Chart



1.4 The Equipment List

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

Test Item	Radiated Emission				
Test Site	966 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
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
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-N M-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.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Mar. 15, 2017	Mar. 14, 2018
Power Meter	Anritsu	ML2495A	1241002	Oct. 06, 2016	Oct. 05, 2017
Power Sensor	Anritsu	MA2411B	1207366	Oct. 06, 2016	Oct. 05, 2017
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 v04

1.6 Measurement Uncertainty

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

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	± 34.134 Hz
Conducted power	± 0.808 dB
Power density	± 0.463 dB
Conducted emission	± 2.670 dB
AC conducted emission	± 2.90 dB
Radiated emission ≤ 1 GHz	± 3.66 dB
Radiated emission > 1 GHz	± 5.63 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	21°C / 57%	Howard Huang
Radiated Emissions	03CH01-WS	24°C / 62%	Kevin Lee Vincent Yeh
RF Conducted	TH01-WS	22°C / 64%	Brad Wu

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

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	11g	2437	6 Mbps	---
Radiated Emissions ≤1GHz	11g	2437	6 Mbps	---
Radiated Emissions >1GHz	11b	2412 / 2437 / 2462	1 Mbps	---
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	

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

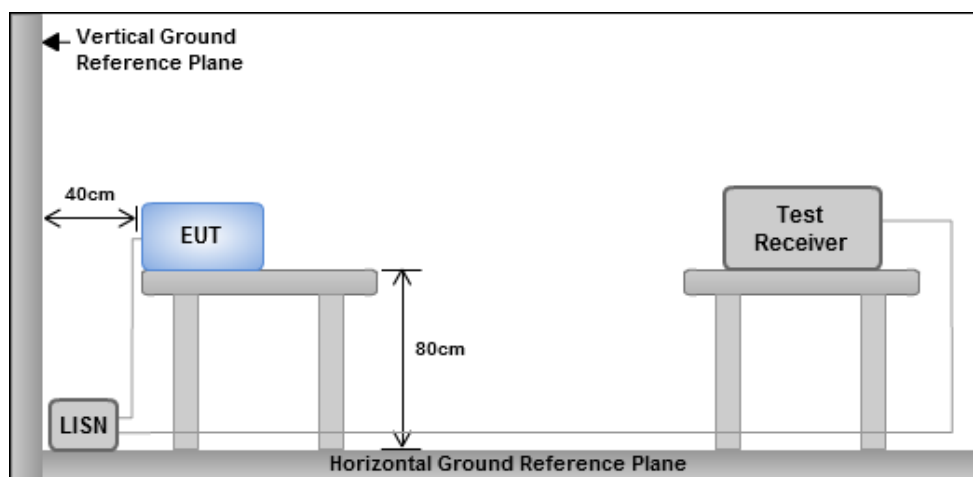
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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.

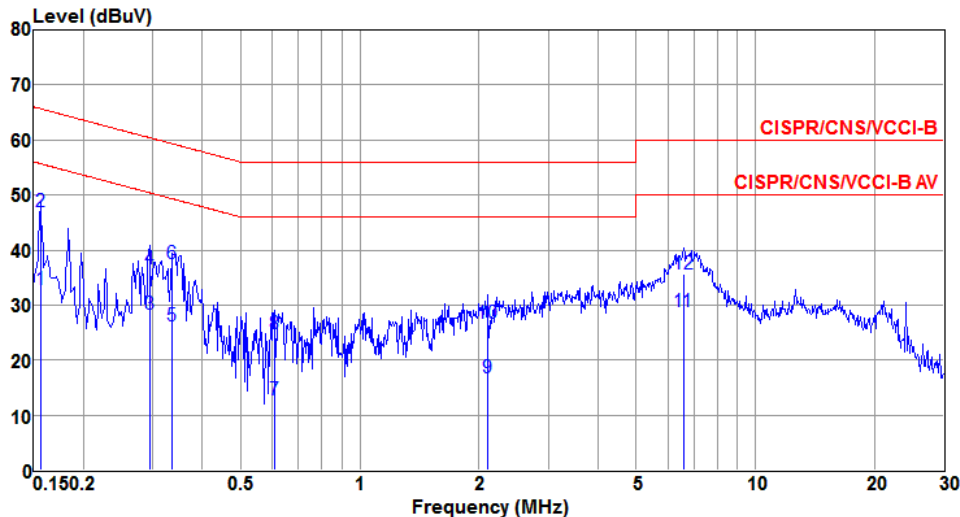
3.1.3 Test Setup



- 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	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.156	32.84	55.69	-22.85	32.42	0.38	0.04	Average
2	0.156	47.05	65.69	-18.64	46.63	0.38	0.04	QP
3	0.294	28.33	50.41	-22.08	27.93	0.36	0.04	Average
4	0.294	36.55	60.41	-23.86	36.15	0.36	0.04	QP
5	0.336	26.19	49.31	-23.12	25.80	0.35	0.04	Average
6	0.336	37.47	59.31	-21.84	37.08	0.35	0.04	QP
7	0.608	12.74	46.00	-33.26	12.36	0.34	0.04	Average
8	0.608	24.68	56.00	-31.32	24.30	0.34	0.04	QP
9	2.099	16.66	46.00	-29.34	16.15	0.46	0.05	Average
10	2.099	26.59	56.00	-29.41	26.08	0.46	0.05	QP
11	6.592	28.85	50.00	-21.15	27.81	0.85	0.19	Average
12	6.592	35.58	60.00	-24.42	34.54	0.85	0.19	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		

The graph displays the measured level in dBUV across a frequency range from 0.150 to 30 MHz. Two red limit lines are shown: CISPR/CNS/VCCI-B (upper) and CISPR/CNS/VCCI-B AV (lower). The blue trace represents the measured signal, with several peaks labeled 1 through 12. The signal generally stays below the limits, with a notable peak at 0.343 MHz (labeled 5@) that is close to the CISPR/CNS/VCCI-B AV limit.

	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.177	27.99	54.64	-26.65	27.61	0.34	0.04	Average
2	0.177	42.24	64.64	-22.40	41.86	0.34	0.04	QP
3	0.291	27.02	50.50	-23.48	26.62	0.36	0.04	Average
4	0.291	38.10	60.50	-22.40	37.70	0.36	0.04	QP
5@	0.343	31.09	49.13	-18.04	30.68	0.37	0.04	Average
6	0.343	40.24	59.13	-18.89	39.83	0.37	0.04	QP
7	0.943	15.91	46.00	-30.09	15.51	0.36	0.04	Average
8	0.943	24.97	56.00	-31.03	24.57	0.36	0.04	QP
9	3.074	19.82	46.00	-26.18	19.18	0.53	0.11	Average
10	3.074	28.24	56.00	-27.76	27.60	0.53	0.11	QP
11	6.454	29.26	50.00	-20.74	28.45	0.62	0.19	Average
12	6.454	35.90	60.00	-24.10	35.09	0.62	0.19	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

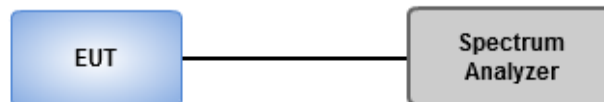
6dB Bandwidth

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.

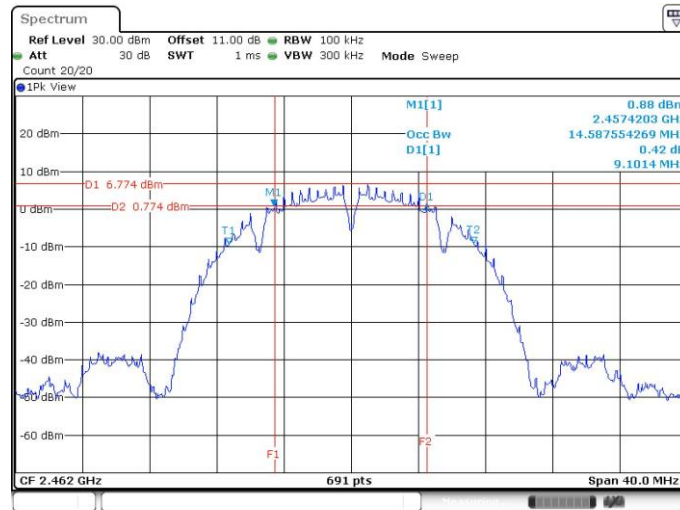
3.2.3 Test Setup



3.2.4 Test Result of 6dB and Occupied Bandwidth

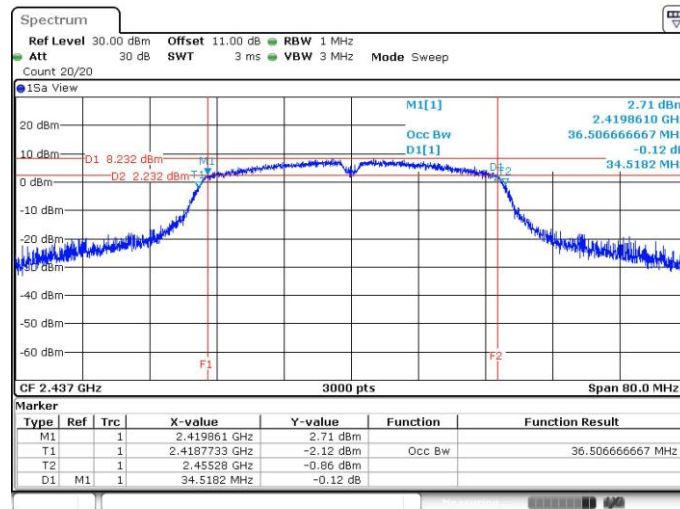
Modulation Mode	N _{TX}	Freq. (MHz)	6dB Bandwidth (MHz)				Limit (kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
11b	1	2412	10.03	---	---	---	500
11b	1	2437	9.62	---	---	---	500
11b	1	2462	9.10	---	---	---	500
11g	1	2412	12.87	---	---	---	500
11g	1	2437	12.64	---	---	---	500
11g	1	2462	14.43	---	---	---	500
HT20	1	2412	13.80	---	---	---	500
HT20	1	2437	14.49	---	---	---	500
HT20	1	2462	14.49	---	---	---	500
HT40	1	2422	35.01	---	---	---	500
HT40	1	2437	35.13	---	---	---	500
HT40	1	2452	35.01	---	---	---	500

Worst Plot



Modulation Mode	N _{TX}	Freq. (MHz)	99% Occupied Bandwidth (MHz)			
			Chain 0	Chain 1	Chain 2	Chain 3
11b	1	2412	14.63	---	---	---
11b	1	2437	14.71	---	---	---
11b	1	2462	14.68	---	---	---
11g	1	2412	16.41	---	---	---
11g	1	2437	17.23	---	---	---
11g	1	2462	16.40	---	---	---
HT20	1	2412	17.60	---	---	---
HT20	1	2437	18.05	---	---	---
HT20	1	2462	17.59	---	---	---
HT40	1	2422	35.95	---	---	---
HT40	1	2437	36.51	---	---	---
HT40	1	2452	35.97	---	---	---

Worst Plots



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

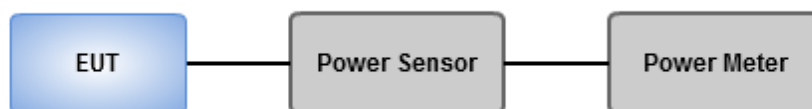
- ☒ Antenna gain $\leq 6\text{dBi}$, no any corresponding reduction is in output power limit.
- ☐ Antenna gain $> 6\text{dBi}$
 - ☐ Non Fixed, point to point operations.
The conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna 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	1	2412	18.70	---	---	---	74.131	18.70	30.00	4.77	23.47	36.00
11b	1	2437	18.77	---	---	---	75.336	18.77	30.00	4.77	23.54	36.00
11b	1	2462	18.75	---	---	---	74.989	18.75	30.00	4.77	23.52	36.00
11g	1	2412	21.38	---	---	---	137.404	21.38	30.00	4.77	26.15	36.00
11g	1	2437	21.41	---	---	---	138.357	21.41	30.00	4.77	26.18	36.00
11g	1	2462	21.05	---	---	---	127.350	21.05	30.00	4.77	25.82	36.00
HT20	1	2412	21.34	---	---	---	136.144	21.34	30.00	4.77	26.11	36.00
HT20	1	2437	21.34	---	---	---	136.144	21.34	30.00	4.77	26.11	36.00
HT20	1	2462	21.38	---	---	---	137.404	21.38	30.00	4.77	26.15	36.00
HT40	1	2422	20.76	---	---	---	119.124	20.76	30.00	4.77	25.53	36.00
HT40	1	2437	20.96	---	---	---	124.738	20.96	30.00	4.77	25.73	36.00
HT40	1	2452	19.54	---	---	---	89.950	19.54	30.00	4.77	24.31	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	1	2412	16.82	---	---	---	48.084	16.82	---
11b	1	2437	16.96	---	---	---	49.659	16.96	---
11b	1	2462	16.93	---	---	---	49.317	16.93	---
11g	1	2412	13.61	---	---	---	22.961	13.61	---
11g	1	2437	16.16	---	---	---	41.305	16.16	---
11g	1	2462	13.74	---	---	---	23.659	13.74	---
HT20	1	2412	13.62	---	---	---	23.014	13.62	---
HT20	1	2437	15.21	---	---	---	33.189	15.21	---
HT20	1	2462	13.75	---	---	---	23.714	13.75	---
HT40	1	2422	11.63	---	---	---	14.555	11.63	---
HT40	1	2437	13.66	---	---	---	23.227	13.66	---
HT40	1	2452	12.16	---	---	---	16.444	12.16	---

Note: Conducted average output power is for reference only.

3.4 Power Spectral Density

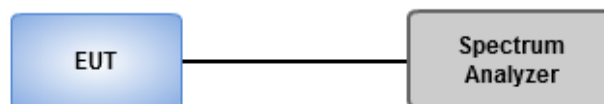
3.4.1 Limit of Power Spectral Density

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.

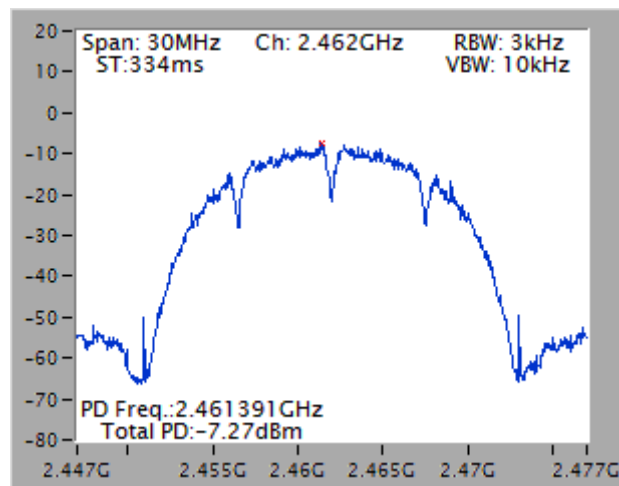
3.4.3 Test Setup



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	1	2412	-8.11	8.00
11b	1	2437	-7.99	8.00
11b	1	2462	-7.27	8.00
11g	1	2412	-12.36	8.00
11g	1	2437	-9.15	8.00
11g	1	2462	-11.79	8.00
HT20	1	2412	-11.36	8.00
HT20	1	2437	-10.30	8.00
HT20	1	2462	-10.81	8.00
HT40	1	2422	-17.39	8.00
HT40	1	2437	-15.48	8.00
HT40	1	2452	-16.07	8.00

Worst Plot



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

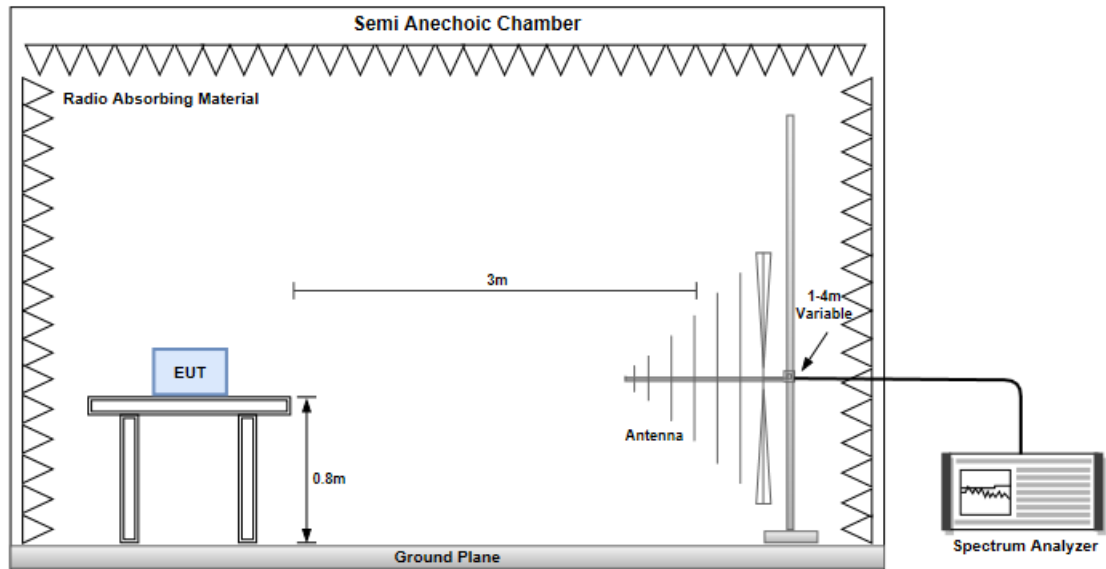
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

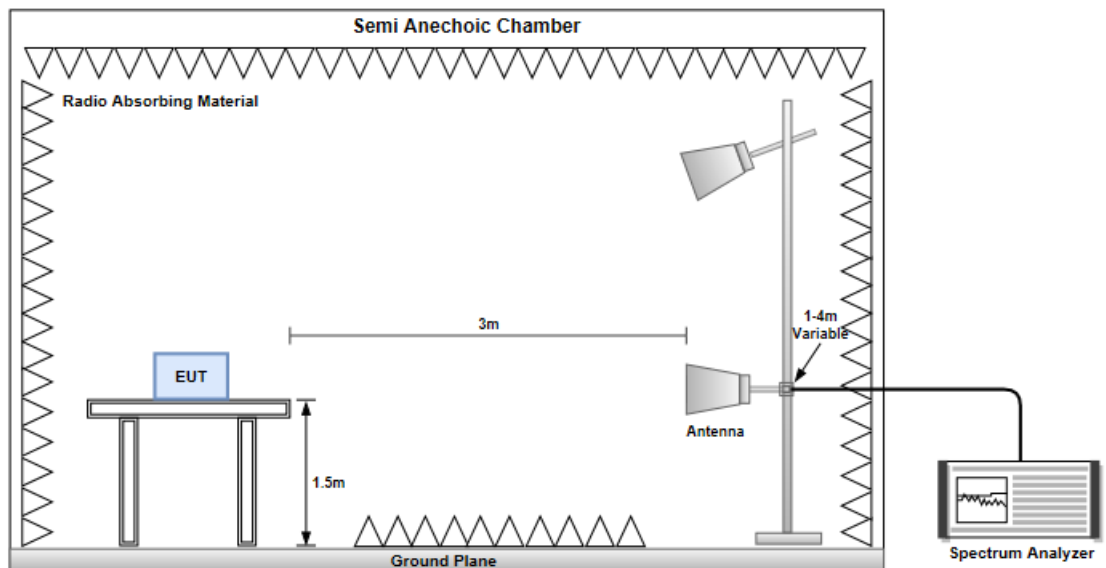
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

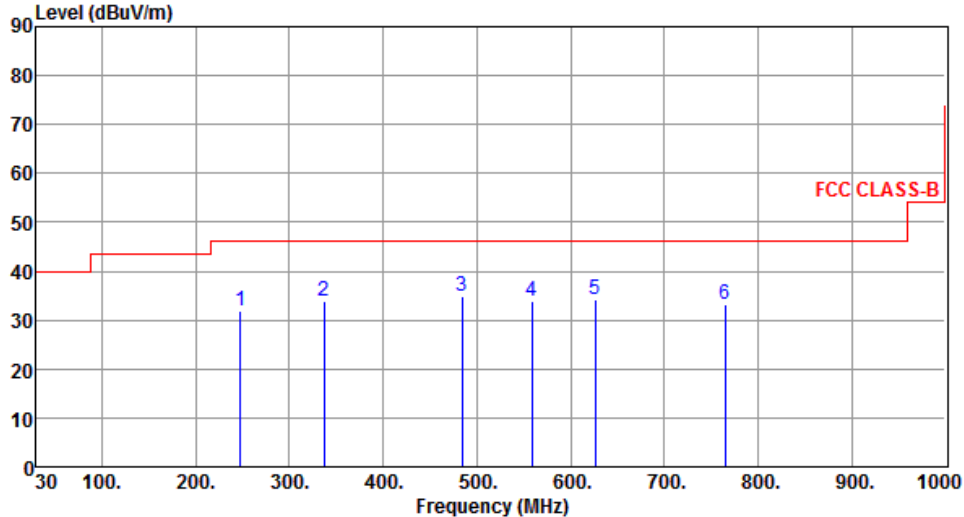


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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



The graph displays the radiated unwanted emissions for a transmitter. The y-axis represents the Level in dBuV/m, ranging from 0 to 90. The x-axis represents the Frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBuV/m from 30 to 100 MHz, 45 dBuV/m from 100 to 900 MHz, and 55 dBuV/m from 900 to 1000 MHz. Six measured peaks are labeled 1 through 6, with their corresponding data provided in the table below.

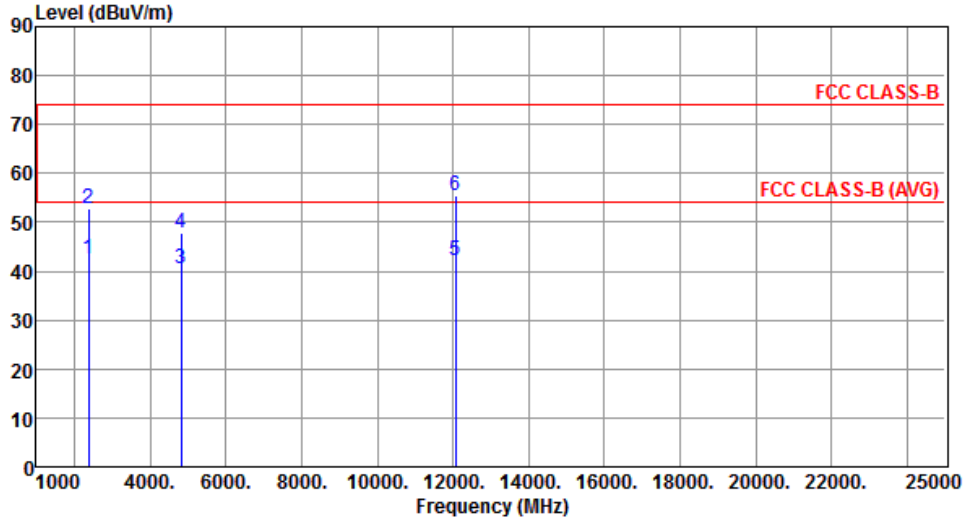
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	247.35	31.75	46.00	-14.25	41.02	-9.27	Peak	---	---
2	336.84	33.93	46.00	-12.07	40.51	-6.58	Peak	---	---
3	484.59	34.83	46.00	-11.17	37.93	-3.10	Peak	---	---
4	558.71	33.96	46.00	-12.04	35.61	-1.65	Peak	---	---
5	626.07	34.29	46.00	-11.71	34.62	-0.33	Peak	---	---
6	764.75	33.09	46.00	-12.91	31.10	1.99	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
 *Factor includes antenna factor , cable loss and amplifier gain
 Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
 Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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

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

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	42.47	54.00	-11.53	45.65	-3.18	Average	291	278
2	2390.00	52.67	74.00	-21.33	55.85	-3.18	Peak	291	278
3	4824.00	40.58	54.00	-13.42	36.80	3.78	Average	128	294
4	4824.00	47.77	74.00	-26.23	43.99	3.78	Peak	128	294
5	12060.00	42.31	54.00	-11.69	28.73	13.58	Average	100	228
6	12060.00	55.33	74.00	-18.67	41.75	13.58	Peak	100	228

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

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

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

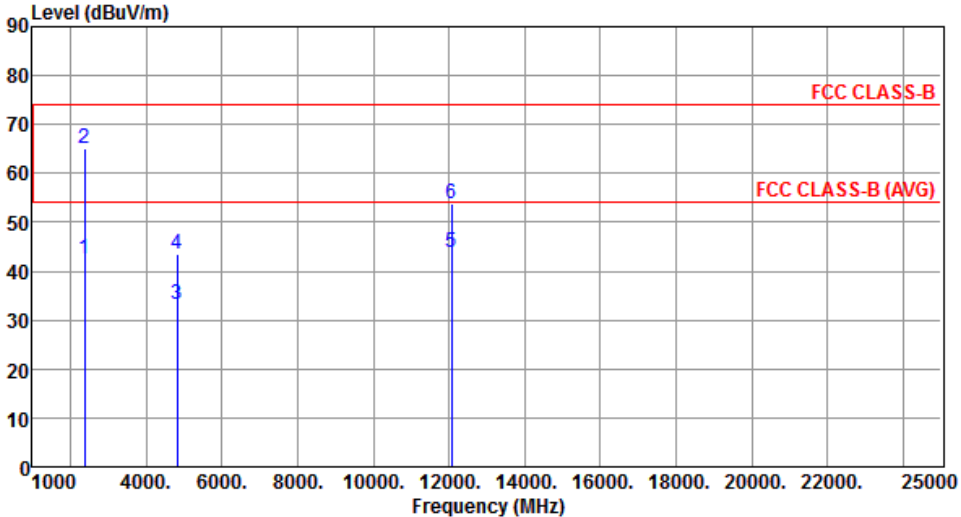
Modulation	11b	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) </			

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

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

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

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



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	42.50	54.00	-11.50	45.68	-3.18	Average	195	288
2	2390.00	65.12	74.00	-8.88	68.30	-3.18	Peak	195	288
3	4824.00	33.22	54.00	-20.78	29.44	3.78	Average	100	243
4	4824.00	43.63	74.00	-30.37	39.85	3.78	Peak	100	243
5	12060.00	43.95	54.00	-10.05	30.37	13.58	Average	175	161
6	12060.00	53.85	74.00	-20.15	40.27	13.58	Peak	175	161

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

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

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

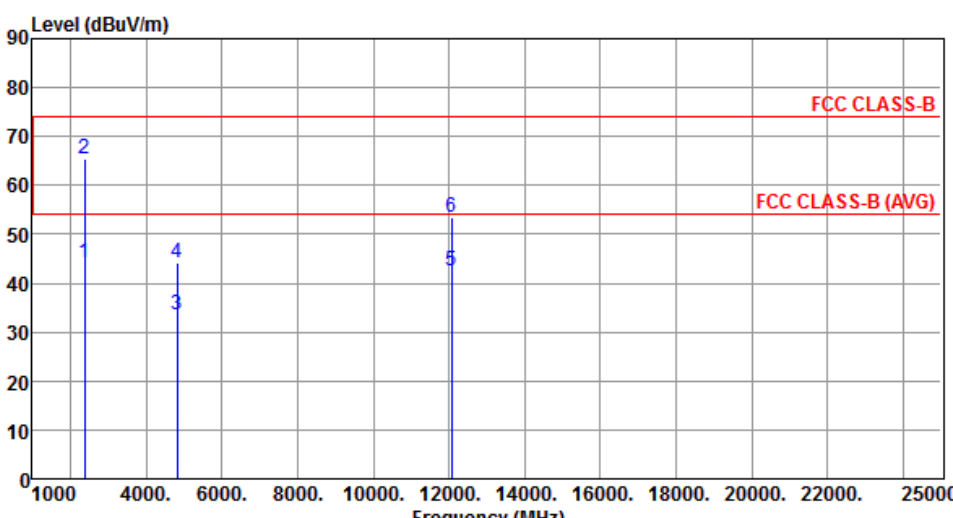
Modulation	11g	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) </			

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		

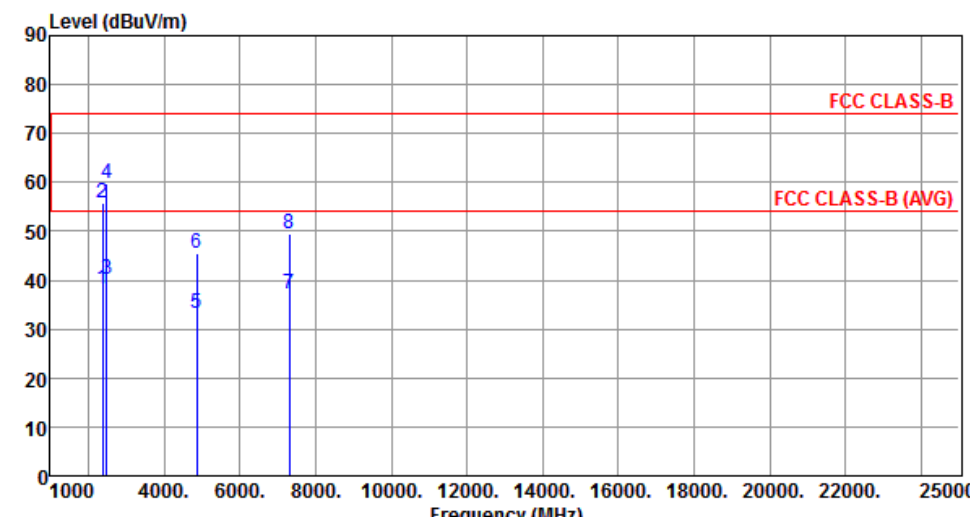


	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	44.06	54.00	-9.94	47.24	-3.18	Average	196	290
2	2390.00	65.32	74.00	-8.68	68.50	-3.18	Peak	196	290
3	4824.00	33.52	54.00	-20.48	29.74	3.78	Average	128	253
4	4824.00	44.20	74.00	-29.80	40.42	3.78	Peak	128	253
5	12060.00	42.55	54.00	-11.45	28.97	13.58	Average	175	104
6	12060.00	53.44	74.00	-20.56	39.86	13.58	Peak	175	104

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	38.14	54.00	-15.86	41.32	-3.18	Average	219	294
2	2390.00	55.92	74.00	-18.08	59.10	-3.18	Peak	219	294
3	2483.50	40.09	54.00	-13.91	42.89	-2.80	Average	219	294
4	2483.50	59.64	74.00	-14.36	62.44	-2.80	Peak	219	294
5	4874.00	33.21	54.00	-20.79	29.27	3.94	Average	125	197
6	4874.00	45.63	74.00	-28.37	41.69	3.94	Peak	125	197
7	7311.00	37.14	54.00	-16.86	28.73	8.41	Average	125	103
8	7311.00	49.43	74.00	-24.57	41.02	8.41	Peak	125	103

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).

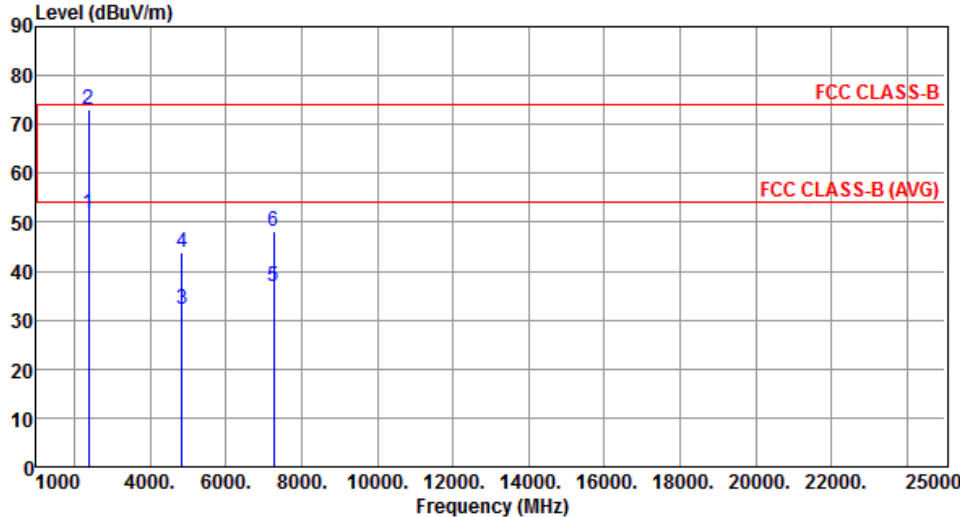
Modulation	HT20	Test Freq. (MHz)	2437
Polarization	Vertical		
Level (dBuV/m) <			

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

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

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

Modulation	HT40	Test Freq. (MHz)	2422
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	51.74	54.00	-2.26	54.92	-3.18	Average	262	280
2	2390.00	72.99	74.00	-1.01	76.17	-3.18	Peak	262	280
3	4844.00	32.09	54.00	-21.91	28.24	3.85	Average	120	93
4	4844.00	43.74	74.00	-30.26	39.89	3.85	Peak	120	93
5	7266.00	36.70	54.00	-17.30	28.31	8.39	Average	277	118
6	7266.00	48.32	74.00	-25.68	39.93	8.39	Peak	277	118

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

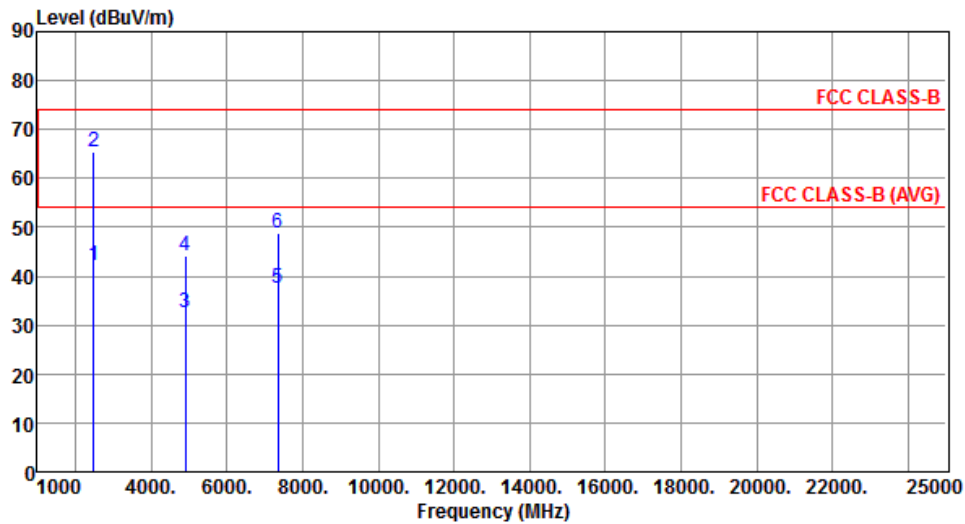
Modulation	HT40		Test Freq. (MHz)		2422	
Polarization	Vertical					
Level (dBuV/m) <						

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

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

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

Modulation	HT40	Test Freq. (MHz)	2452
Polarization	Vertical		



	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	42.28	54.00	-11.72	45.08	-2.80	Average	361	343
2	2483.50	65.54	74.00	-8.46	68.34	-2.80	Peak	361	343
3	4904.00	32.61	54.00	-21.39	28.56	4.05	Average	100	173
4	4904.00	44.31	74.00	-29.69	40.26	4.05	Peak	100	173
5	7356.00	37.45	54.00	-16.55	29.02	8.43	Average	208	164
6	7356.00	48.75	74.00	-25.25	40.32	8.43	Peak	208	164

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 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

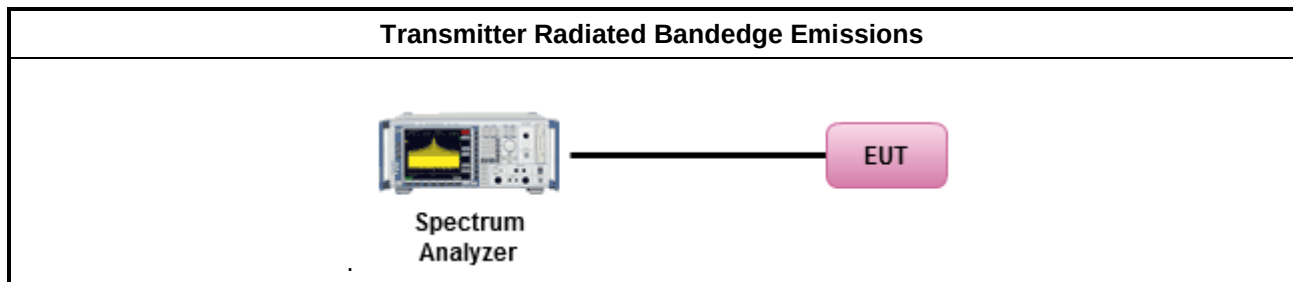
Reference level measurement

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

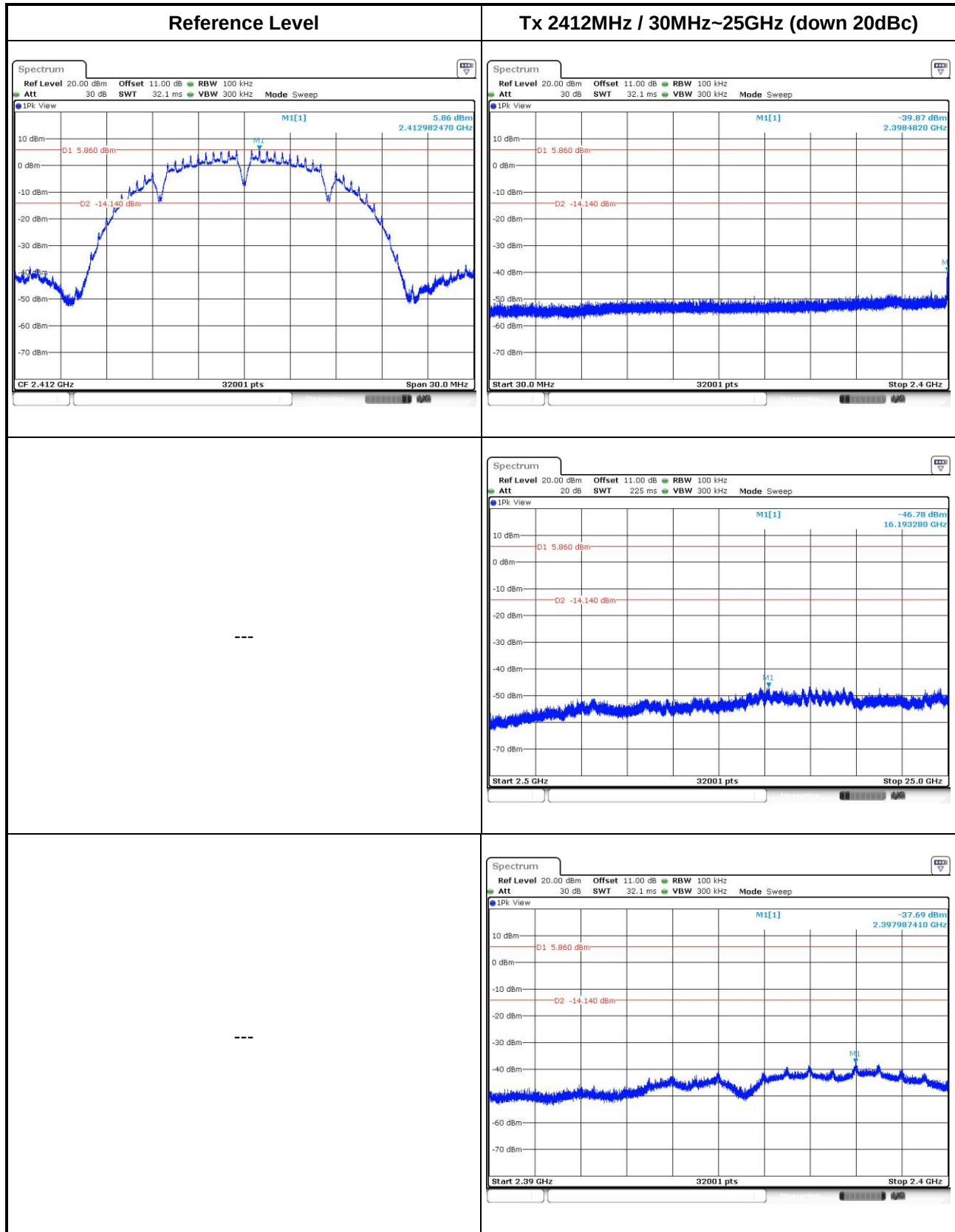
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

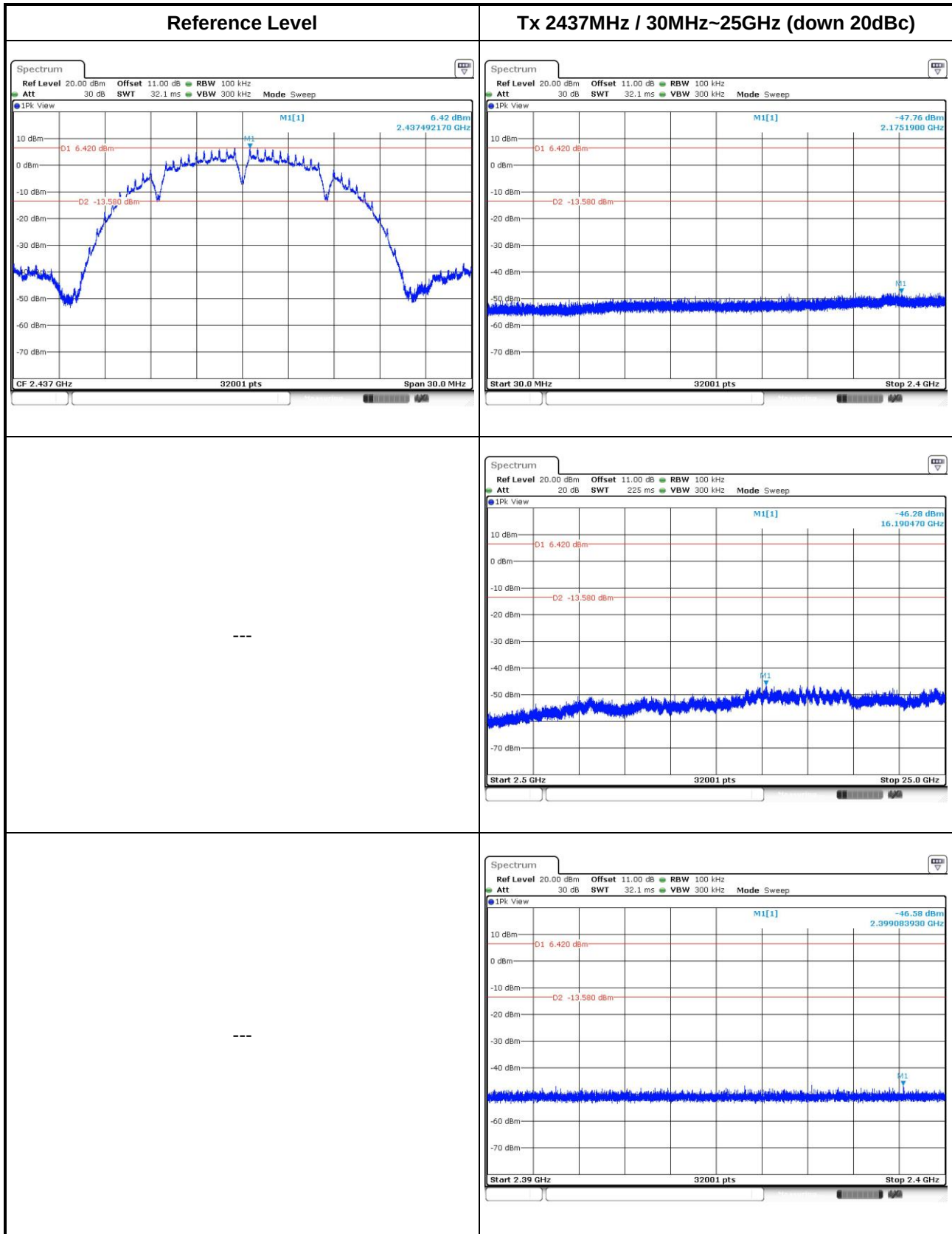
3.6.4 Test Setup



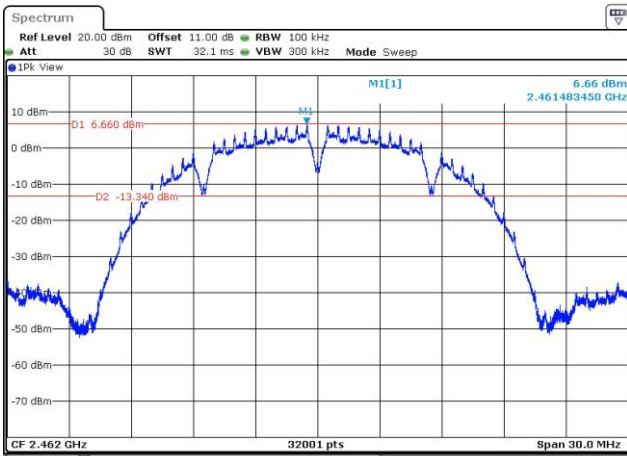
3.6.5 Unwanted Emissions into Non-Restricted Frequency Bands

802.11b

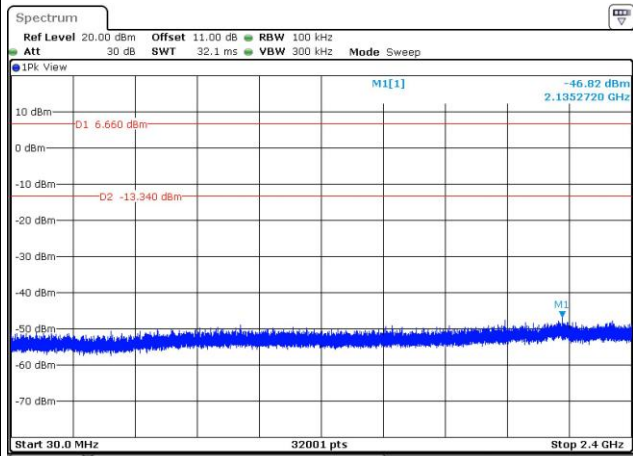


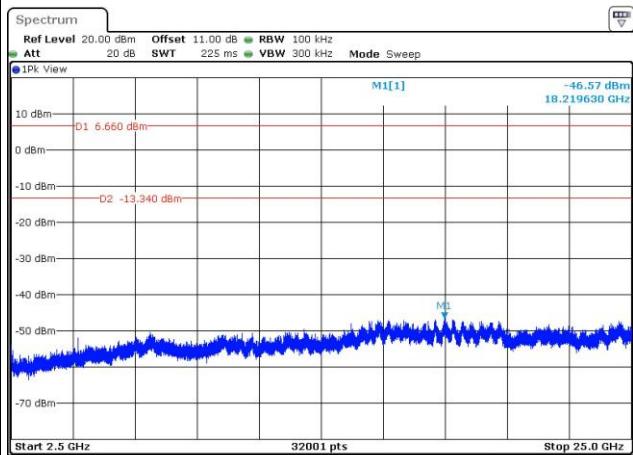


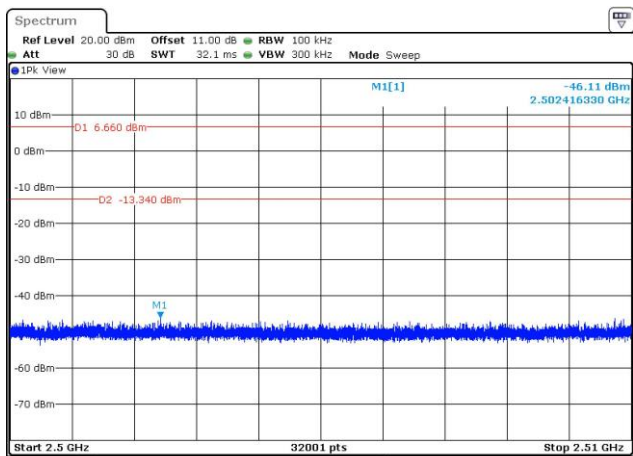
Reference Level



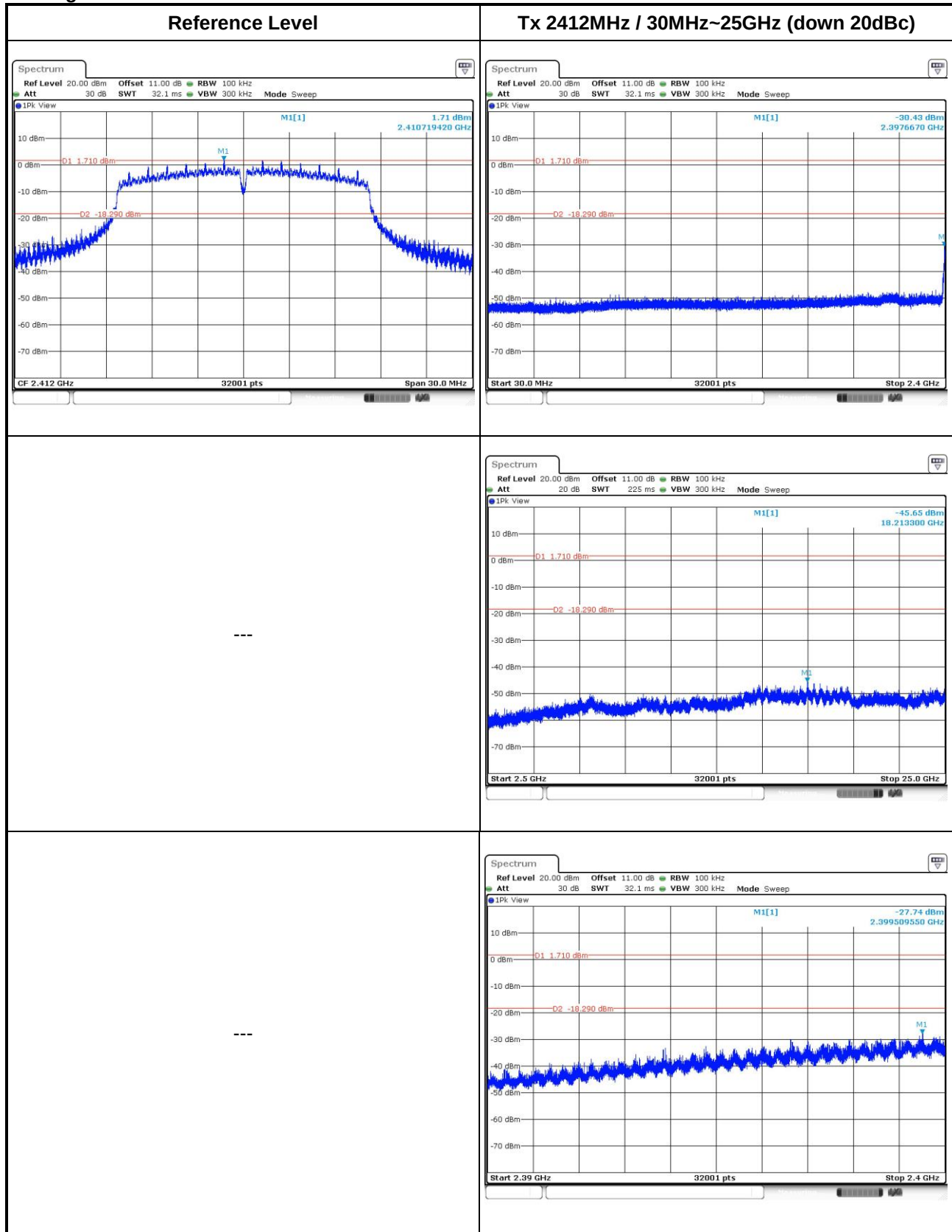
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



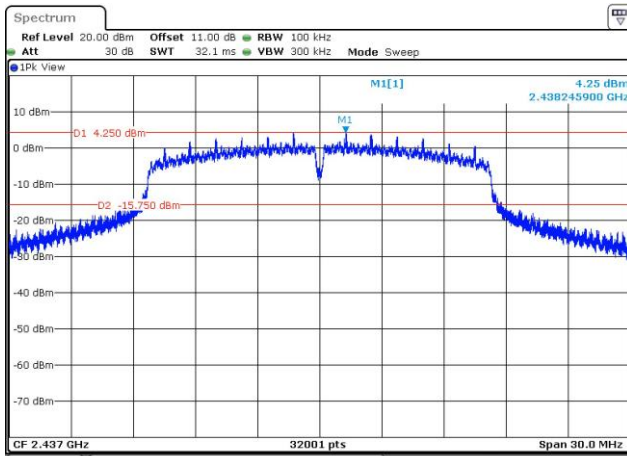




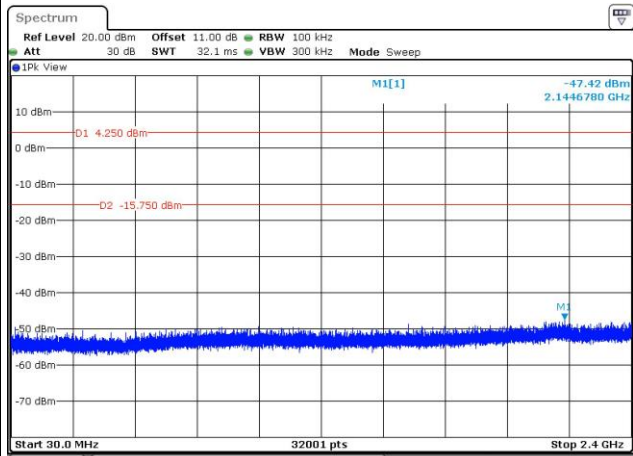
802.11g

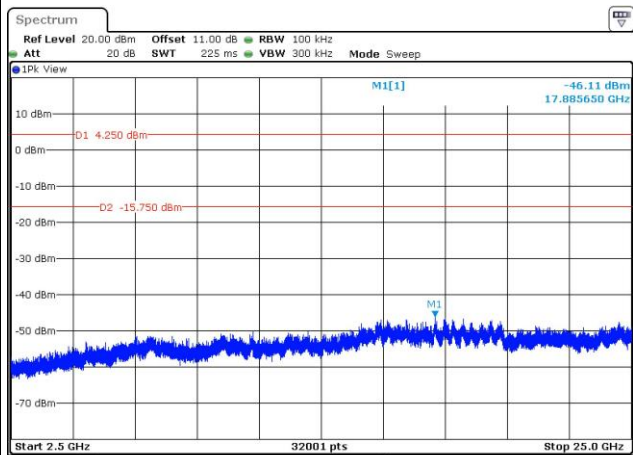


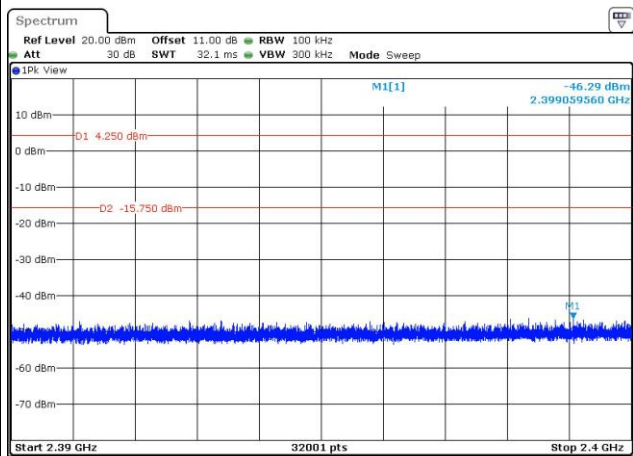
Reference Level



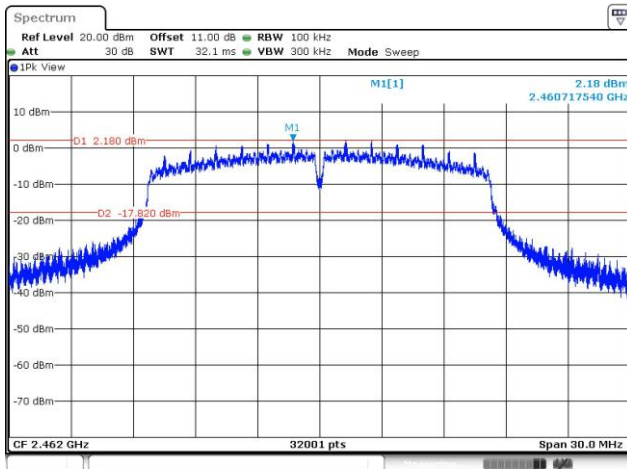
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



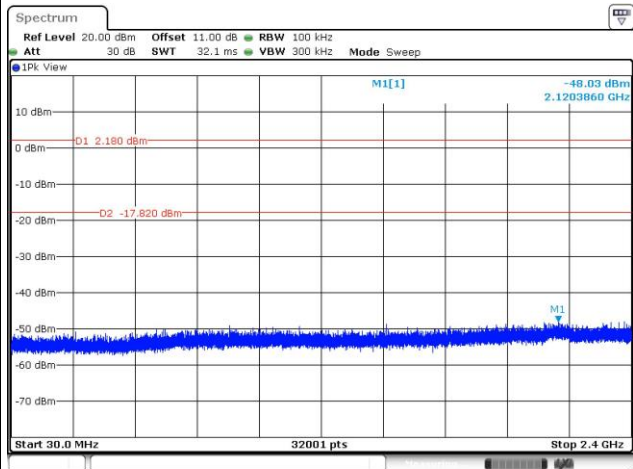


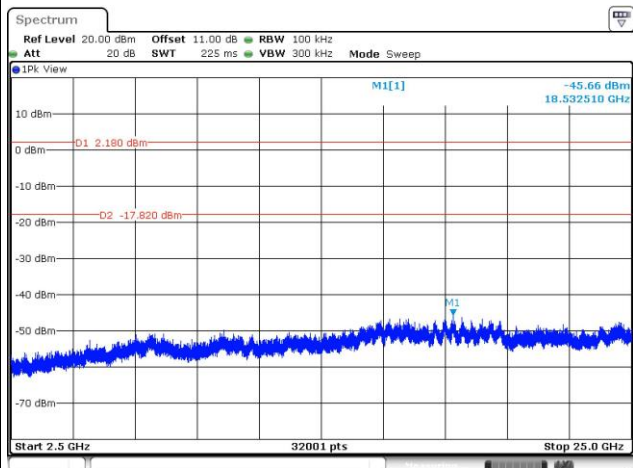


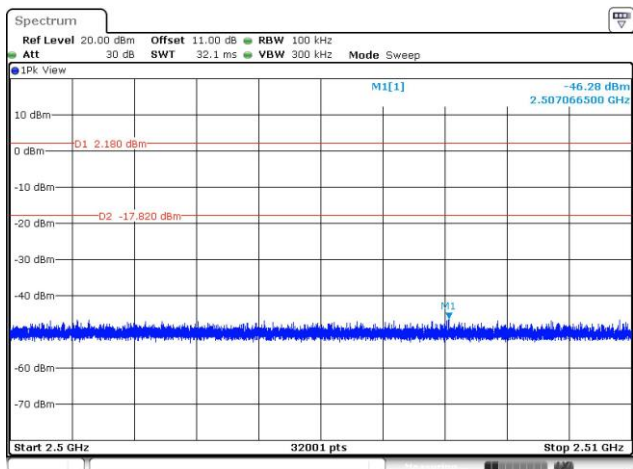
Reference Level



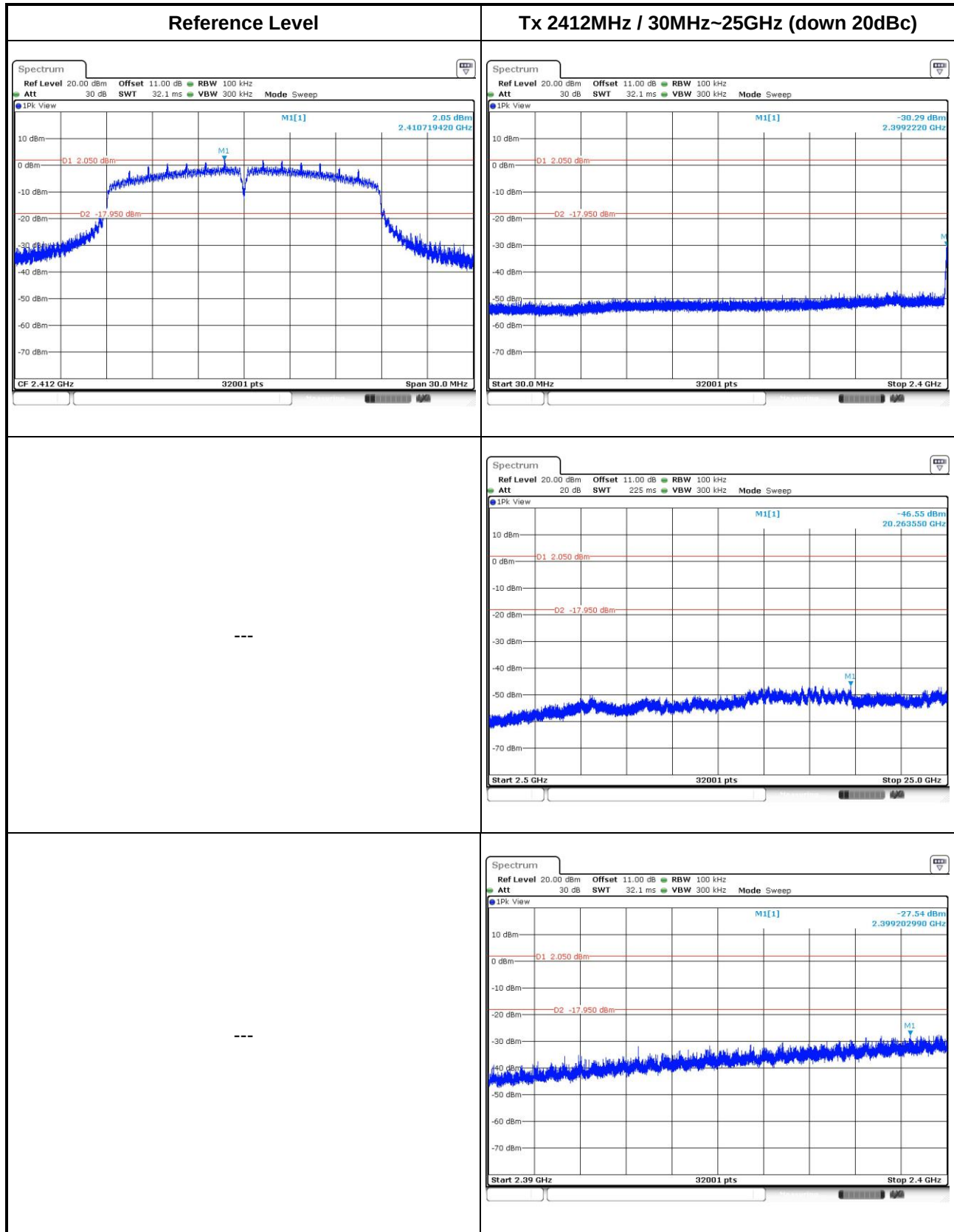
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



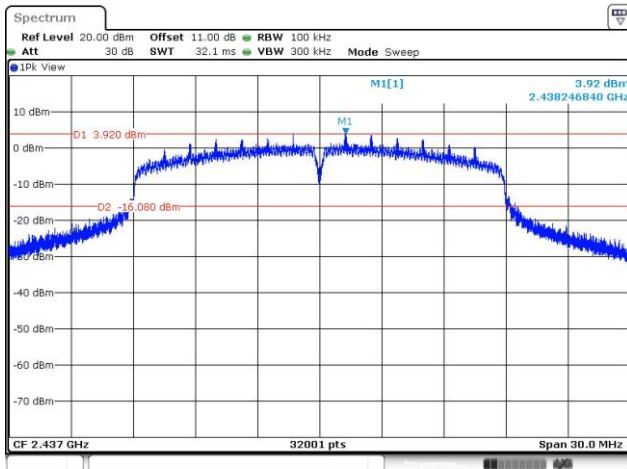




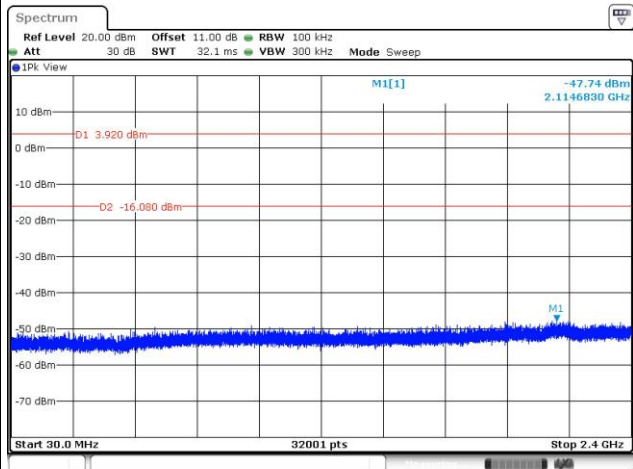
802.11n HT20

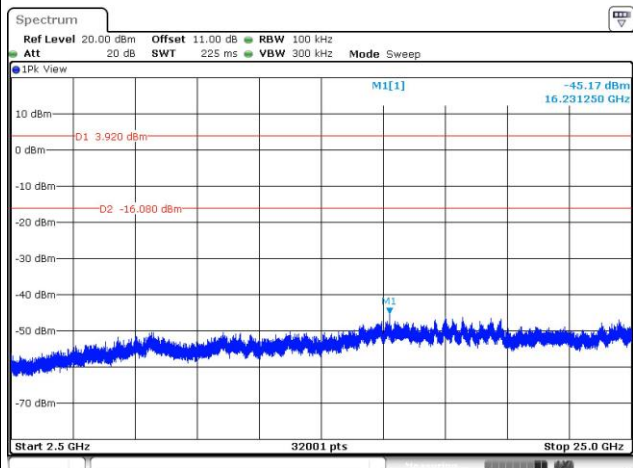


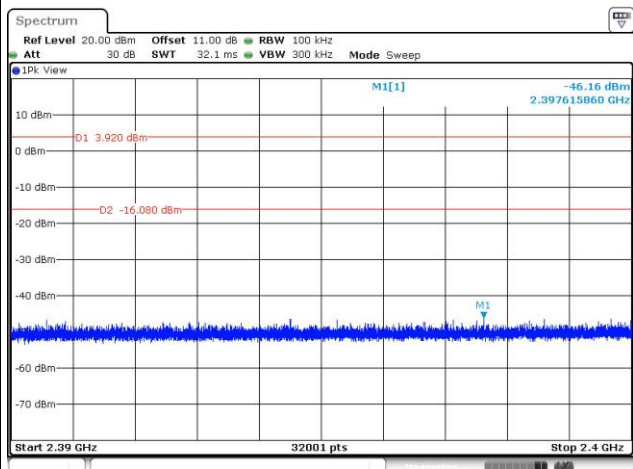
Reference Level



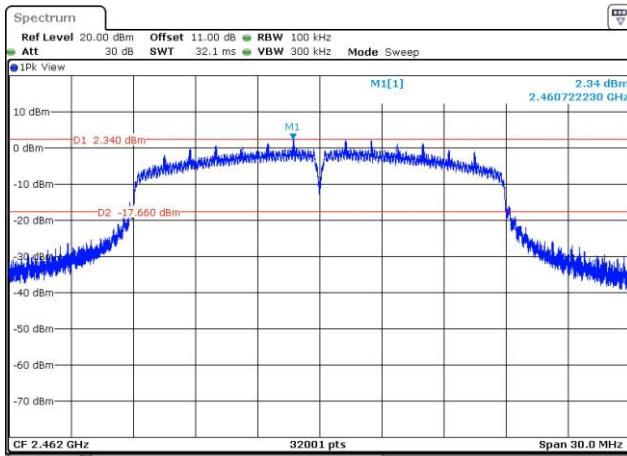
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



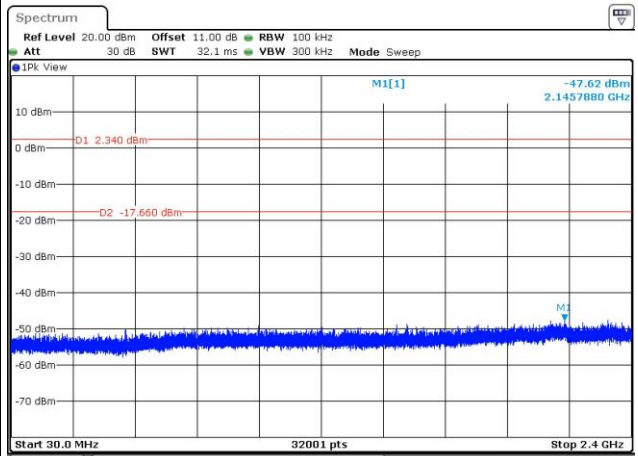


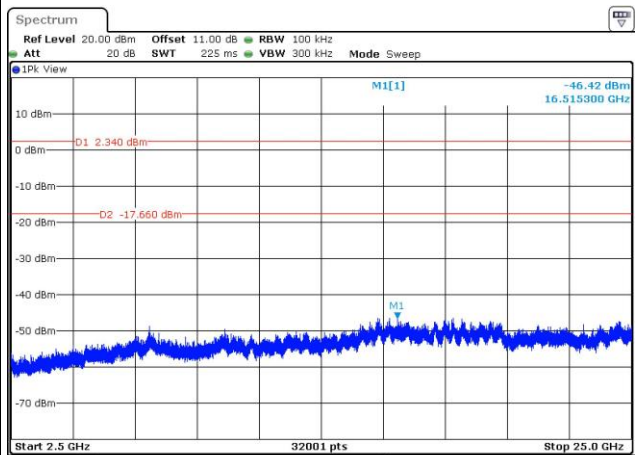


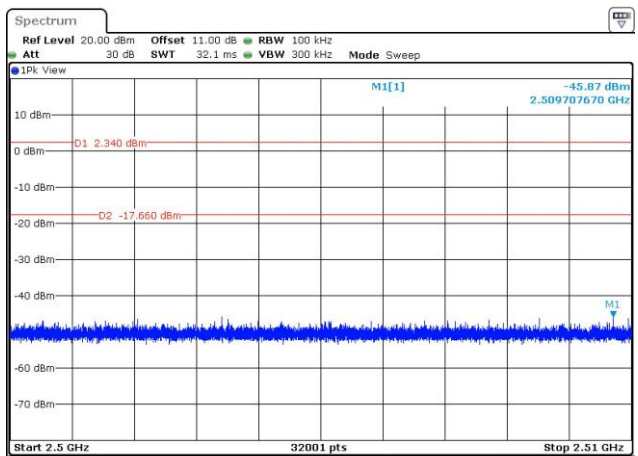
Reference Level



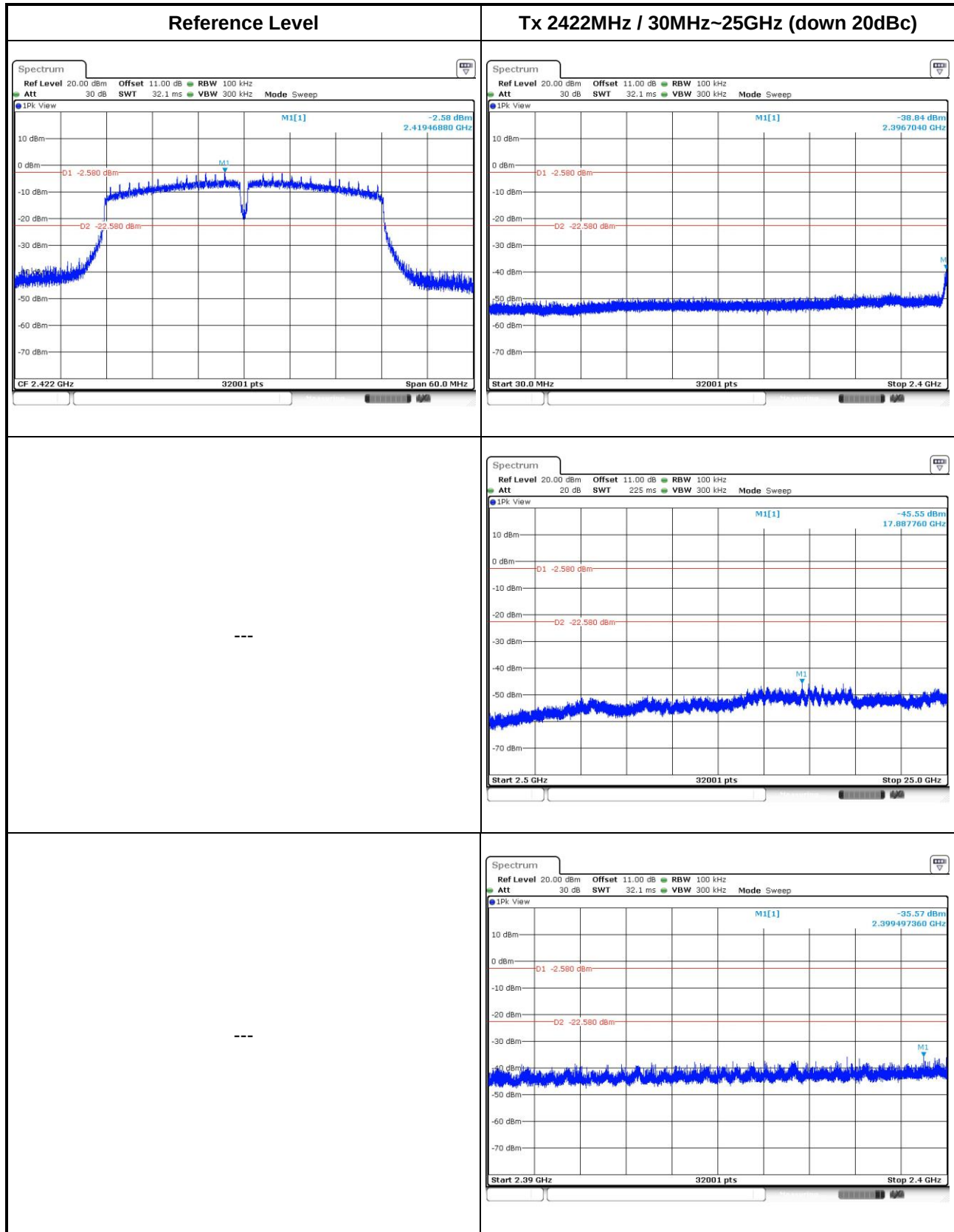
Tx 2462MHz / 30MHz~25GHz (down 20dBc)



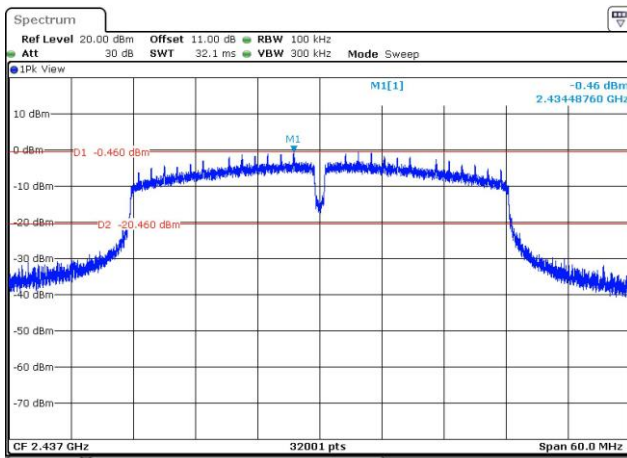




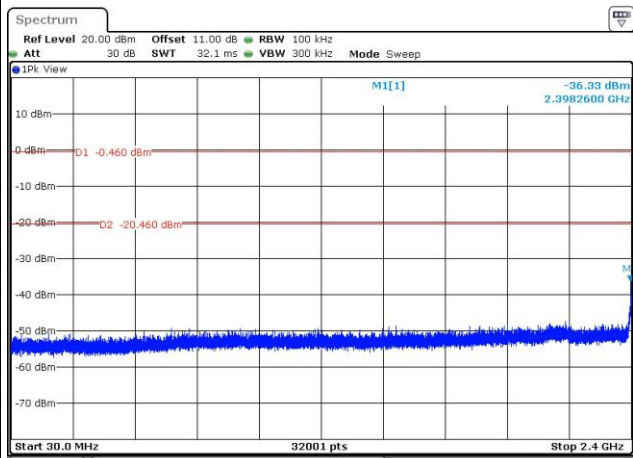
802.11n HT40

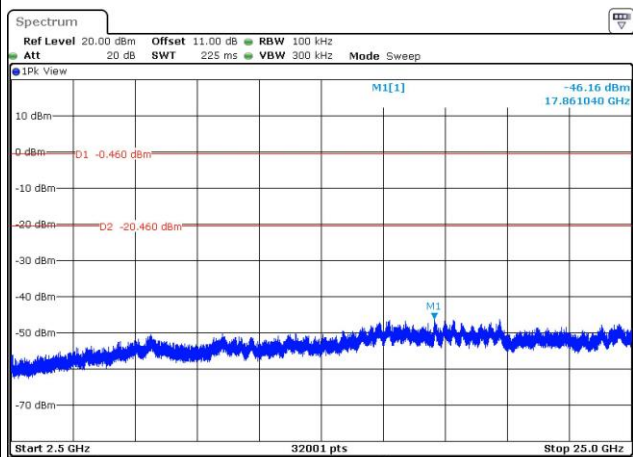


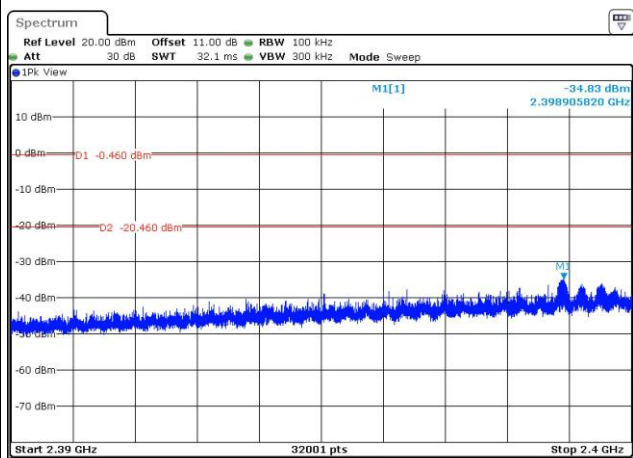
Reference Level



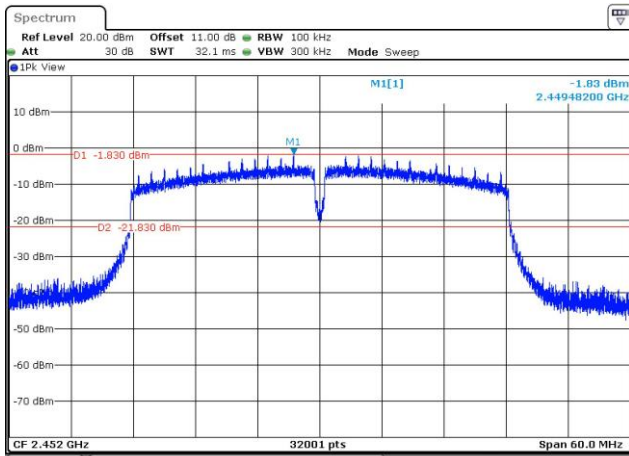
Tx 2437MHz / 30MHz~25GHz (down 20dBc)



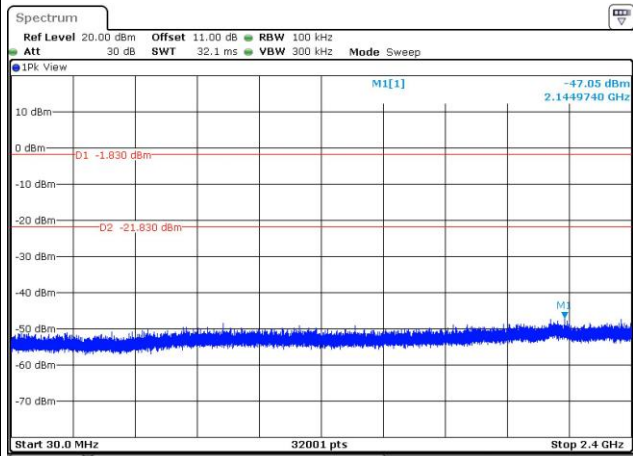


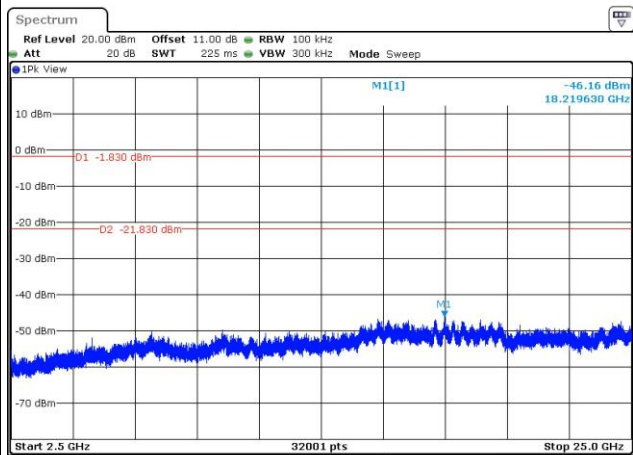


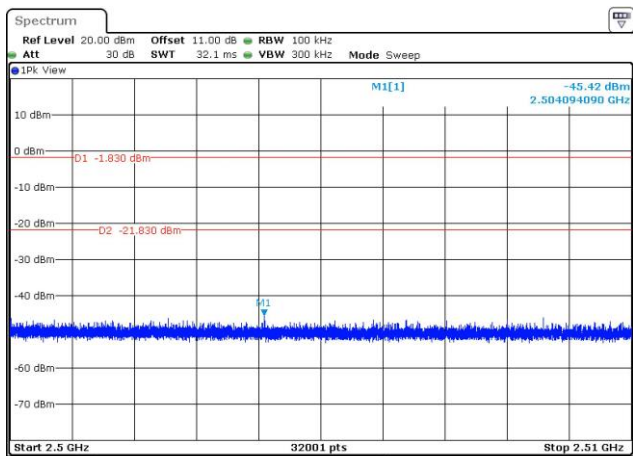
Reference Level



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







4 Test laboratory information

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

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

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

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.

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Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

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