Test Report

FCC ID: 2AT35-P21

Date of issue: Sept. 05, 2019

Report Number:	MTi19071025-1E1
Sample Description:	LTE Wireless Router
Model(s):	P21, P21B, P22, P25, P11, S10, S12
Applicant:	Xiamen Yifan Communication Technology Co., Ltd.
Address:	G612-2, Room601, Building 2, No. 151, YueHua Road, Huli District, Xiamen, 361006
Date of Test:	July 07, 2019 to Sept. 05, 2019

Shenzhen Microtest Co., Ltd.
http://www.mtitest.com

Tel:(86-755)88850135 Fax: (86-755) 88850136 Web: http://www.mtitest.com E-mail: mti@51mti.com
Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

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Test Result Certification

Applicant's name:	Xiamen Yifan Communication Technology Co., Ltd.
Address:	G612-2, Room601, Building 2, No. 151, YueHua Road, Huli District, Xiamen, 361006
Manufacture's Name:	Xiamen Yifan Communication Technology Co., Ltd.
Address:	G612-2, Room601, Building 2, No. 151, YueHua Road, Huli District, Xiamen, 361006
Product name:	LTE Wireless Router
Trademark:	Yeacomm
Model name:	P21, P21B, P22, P25, P11, S10, S12
Standards:	FCC Part 15.247
Test Procedure:	ANSI C63.10-2013 KDB 558074 v05r02 KDB662911 D01 v02r01

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:	Demi Mu	Sept. 05, 2019
Reviewed by:	Blue Zheng	Sept. 05, 2019
Approved by:	Smith Chen	Sept. 05, 2019

1 General information

1.1 Description of EUT

Product name	LTE Wireless Router
Model name	P21
Series model:	P21B, P22, P25, P11, S10, S12
Difference of series model:	All the model are the same circuit and RF module, except the model No. and color.
Operation Frequency	802.11b/g/n20:2412~2462 MHz 802.11n40:2422~2452 MHz
Modulation Type:	11b: DQPSK, DBPSK, DSSS, CCK 11g: BPSK, QPSK, 16QAM, 64QAM, OFDM 11n: BPSK, QPSK, 16QAM, 64QAM with OFDM
Bit Rate of Transmitter	802.11b:11/5.5/2/1 Mbps 802.11g:54/48/36/24/18/12/9/6Mbps 802.11n:65/52/6.5Mbps
Antenna Type	Integral Antenna
Antenna Gain (dBi)	For 802.11b/g,working in SISO mode, then the antenna gain as below: 802.11b/g: Antenna A :3dBi 802.11b/g: Antenna B :3dBi
	For 802.11n, working in MIMO mode, the antenna gains should be calculated by the formula: Directional Gain = G_{ANT}+10*log(N_{ANT})dBi = 3 dBi + 10*Log(2) dBi = 6.01 dBi
Max. Output Power:	14.63dBm
Hardware Version:	TZ7.823.326
Software Version:	P21 V1.0
Power Supply:	DC 12V from adapter
Battery information:	N/A
Adapter information:	MODEL: KL-AD-120100 INPUT:AC100-240V 50/60Hz 0.5A OUTPUT:DC 12V 1A

1.2 Operation channel list

Channel List for 802.11b/g/n(20)

Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	07	2442
02	2417	08	2447
03	2422	09	2452
04	2427	10	2457
05	2432	11	2462
06	2437	\	\

Channel List for 802.11n(40)

Channel	Frequency (MHz)	Channel	Frequency (MHz)
03	2422	07	2442
04	2427	08	2447
05	2432	09	2452
06	2437	\	\

1.3 Test channel list

Channel List for 802.11b/g/n(20)

Channel	Channel	Frequency (MHz)
Low	01	2412
Middle	06	2437
High	11	2462

Channel List for 802.11n(40)

Channel	Channel	Frequency (MHz)
Low	03	2422
Middle	06	2437
High	09	2452

1.4 Ancillary equipment list

Equipment	Model	S/N	Manufacturer	Certificate type
/	/	/	/	/

1.5 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	Series No.	Note
1	Adapter	/	KL-AD-120100	/	/

Note:
(1)The support equipment was authorized by Declaration of Confirmation.
(2)For detachable type I/O cable should be specified the length in cm in『Length』column.

2 Summary of Test Results

Test procedures according to the technical standards:

No.	Standard Section	Test Item	Result	Remark
1	15.203	Antenna Requirement	Pass	
2	15.247 (b)	Peak Output Power	Pass	
3	15.247 (d)	Power Spectral Density	Pass	
4	15.207	Conducted Emission	Pass	
5	15.247 (c)	Radiated Spurious Emission	Pass	
6	15.205	Band Edge Emission	Pass	
7	15.247 (a)(2)	6dB Bandwidth	Pass	
8	15.247(d)	Spurious RF Conducted Emissions	Pass	

3 Test Facilities and Accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573

3.2 Environmental conditions

Temperature:	15ºC~35ºC
Humidity	20%~75%
Atmospheric pressure	98kPa~101kPa

3.3 Measurement uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %

No.	Item	Uncertainty
1	Conducted Emission Test	±1.38dB
2	RF power, conducted	±0.16dB
3	Spurious emissions, conducted	±0.21dB
4	All emissions, radiated(<1G)	±4.68dB
5	All emissions, radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

3.4 Test software

Software Name	Manufacturer	Model	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscend co,.ltd	JS1120-3	2.5.77.0418

4 Equipment list

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI7	100314	2018/10/09	2019/10/08
MTI-E006	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-872	2018/10/15	2020/10/14
MTI-E014	amplifier	Hewlett-Packard	8447D	3113A06150	2018/10/09	2019/10/08
MTI-E036	Single path vehicle AMN(LISN)	Schwarzbeck	NNBM 8124	01175	2018/10/09	2019/10/08
MTI-E038	Low noise active vertical monopole antenna	Schwarzbeck	VAMP 9243	#565	2018/10/16	2019/10/15
MTI-E039	Biconical antenna	Schwarzbeck	BBA 9106	#164	2018/10/15	2019/10/14
MTI-E041	MXG Vector Signal Generator	Agilent	N5182A	MY49060455	2019/04/16	2020/04/15
MTI-E042	ESG Series Analog signal generator	Agilent	E4421B	GB40051240	2019/05/21	2020/05/20
MTI-E044	Thermometer clock humidity monitor	-	HTC-1	/	2019/04/17	2020/04/16
MTI-E062	Log Periodic Antenna	Schwarzbeck	VUSLP 9111B	#312	2018/04/11	2020/04/10
MTI-E063	Log Periodic Dipole Array Antenna	ETS-LINDGREN	3148B	00224524	2018/04/11	2020/04/10
MTI-E065	Amplifier	EMtrace	RP06A	00117	2019/04/29	2020/04/28
MTI-E066	Comprehensive test instrument	Rohde&schwarz	CMW500	149155	2019/04/16	2020/04/15
MTI-E071	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2018/10/25	2019/10/24
MTI-E076	EMI Test Receiver	Rohde&schwarz	ESIB26	100273	2019/04/16	2020/04/15
MTI-E078	Synthesized Sweeper	Agilent	83752A	3610A01957	2019/04/16	2020/04/15
MTI-E079	DC Power Supply	Agilent	E3632A	MY40027695	2019/04/16	2020/04/15
MTI-E093	Artificial mains network	3ctest	LISN J50	ES3911805	2019/04/16	2020/04/15
MTI-E096	Power amplifier	Space-Dtroniccs	EWLNA0118G-P40	1852001	2019/04/29	2020/04/28
MTI-E097	Current Probe	SOLAR ELECTRONICS CO.	9207-1	220095-1	2019/04/17	2020/04/16
MTI-E098	Loop Sensor	SOLAR ELECTRONICS CO.	7334-1	220095-2	2019/04/21	2020/04/20
Note: the calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to international system unit (SI).						

5 Test Result

5.1 Antenna requirement

5.1.1 Standard requirement

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device

5.1.2 EUT Antenna

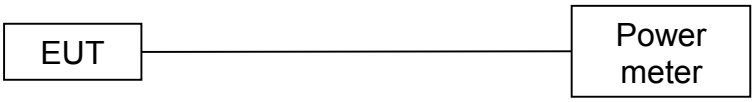
The EUT antenna is External antenna. It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.

5.2 Peak output power

5.2.1 Limit

Section	Test Item	Limit	Frequency Range (MHz)
15.247(b)(3)	Peak output power	1 watt or 30dBm	2400-2483.5

5.2.2 Test setup



5.2.3 Test procedure

The EUT was directly connected to the Power meter.

5.2.4 Test results

802.11b

Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW
01	2412	10.11	10.26	9.33	8.57	30	1000
06	2437	10.17	10.40	9.40	8.71		
11	2462	9.67	9.27	9.69	9.31		

802.11g

Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW
01	2412	11.79	15.10	10.49	11.19	30	1000
06	2437	11.68	14.72	11.21	13.21		
11	2462	10.55	11.35	10.40	10.96		

802.11n20

Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Total Power (ANT A + ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW	dBm	mW
01	2412	11.72	14.86	11.51	14.16	14.63	29.02	29.99	997.70
06	2437	11.09	12.85	11.22	13.24	14.17	26.10		
11	2462	10.48	11.17	10.37	10.89	13.44	22.06		

Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.
Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:
Limit = 30 dBm - (ANT Gain + 10*Log(N=2) - 6dBi)
= 30 dBm - (3 + 3.01 - 6) dBi = 29.99dBm

802.11n40

Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Total Power (ANT A + ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW	dBm	mW
03	2422	6.37	4.34	5.69	3.71	9.05	8.04	29.99	997.70
06	2437	6.40	4.37	5.92	3.91	9.18	8.27		
09	2452	6.13	4.10	6.02	4.00	9.09	8.10		

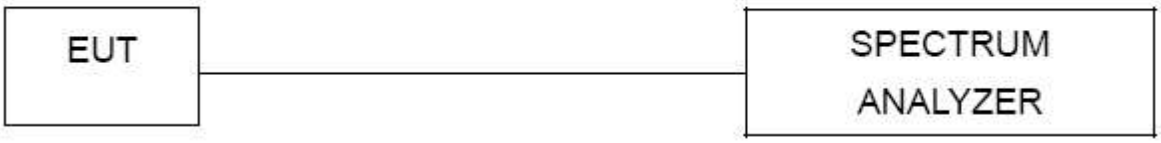
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.
Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:
Limit = 30 dBm - (ANT Gain + 10*Log(N=2) - 6dBi)
= 30 dBm - (3 + 3.01 - 6) dBi = 29.99dBm

5.3 Power spectral density

5.3.1 Limit

Section	Test Item	Limit	Frequency Range (MHz)
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5

5.3.2 Test Setup



5.3.3 Test Procedure

a. The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.
b. Set analyzer center frequency to DTS channel center frequency.
c. Set the span to 1.5 times the DTS channel bandwidth.
d. Set the RBW ≥ 3 kHz.
e. Set the VBW ≥ 3 x RBW.
f. Detector = peak.
g. Sweep time = auto couple.
h. Trace mode = max hold.
i. Allow trace to fully stabilize.
j. Use the peak marker function to determine the maximum amplitude level.
k. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3.4 Test Results

802.11b

ANT A:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-19.542	8	Pass
CH06	2437	-19.512	8	Pass
CH11	2462	-19.965	8	Pass

TX CH01

TX CH06

TX CH11

ANT B:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-20.160	8	Pass
CH06	2437	-20.254	8	Pass
CH11	2462	-19.903	8	Pass

TX CH01

TX CH06

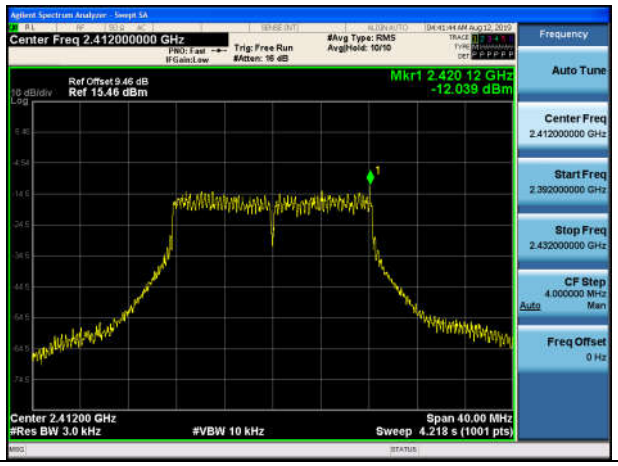
TX CH11

802.11g

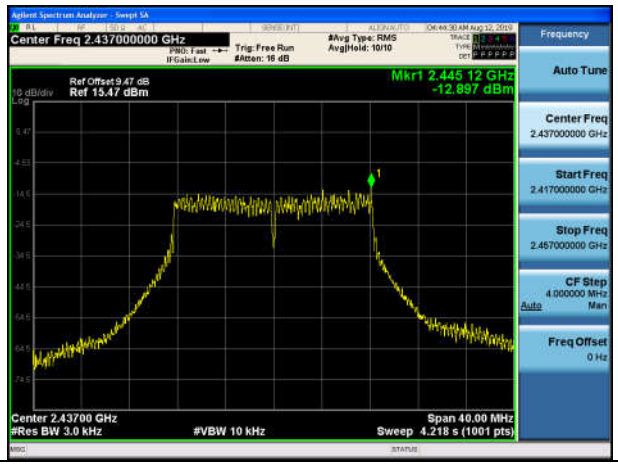
ANT A:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-12.039	8	Pass
CH06	2437	-12.897	8	Pass
CH11	2462	-13.946	8	Pass

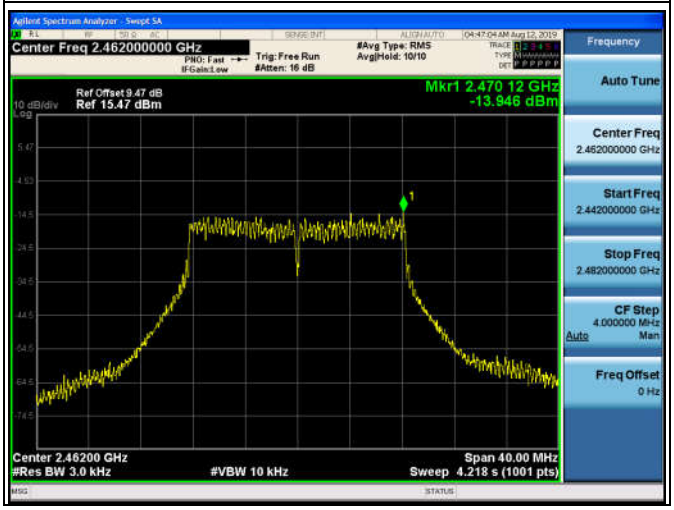
TX CH01



TX CH06



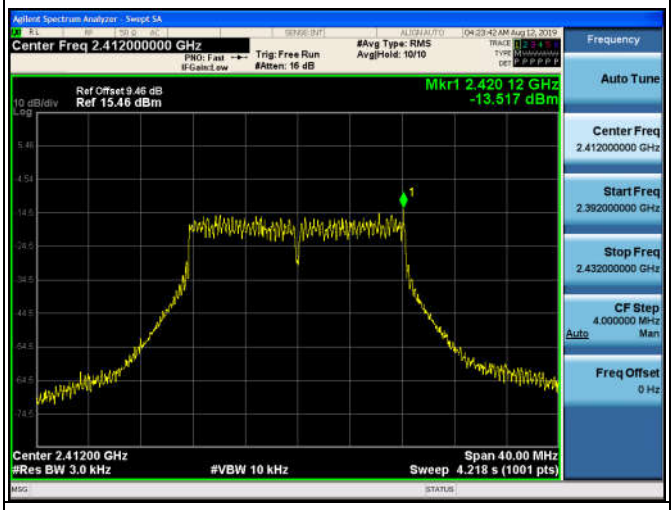
TX CH11



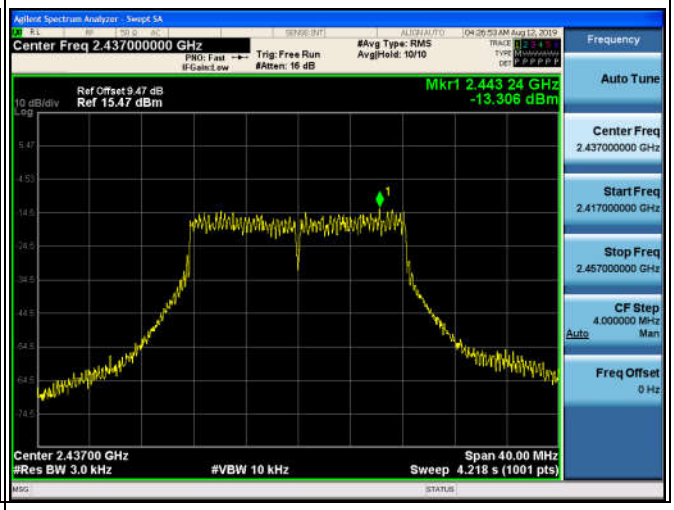
ANT B:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-13.517	8	Pass
CH06	2437	-13.306	8	Pass
CH11	2462	-13.435	8	Pass

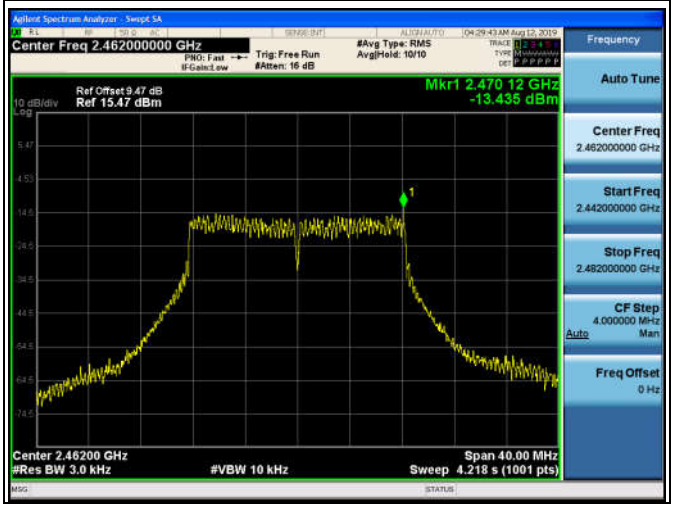
TX CH01



TX CH06



TX CH11

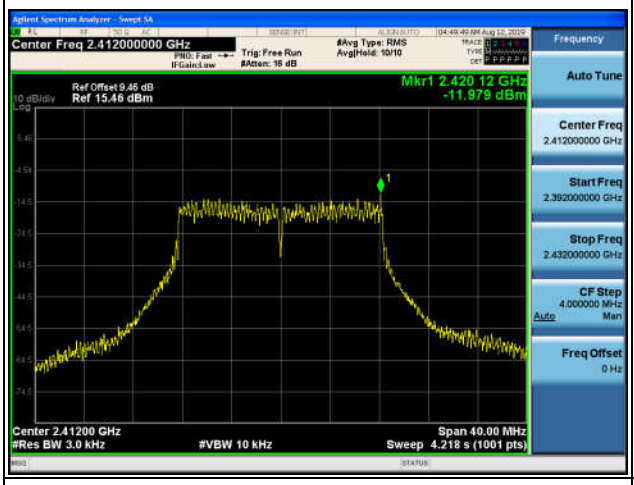
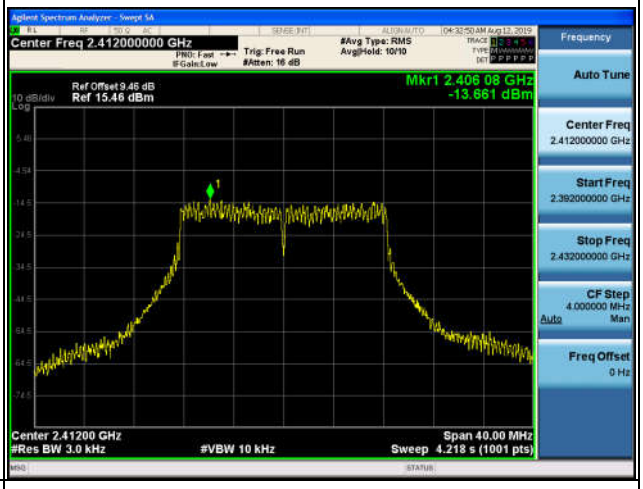
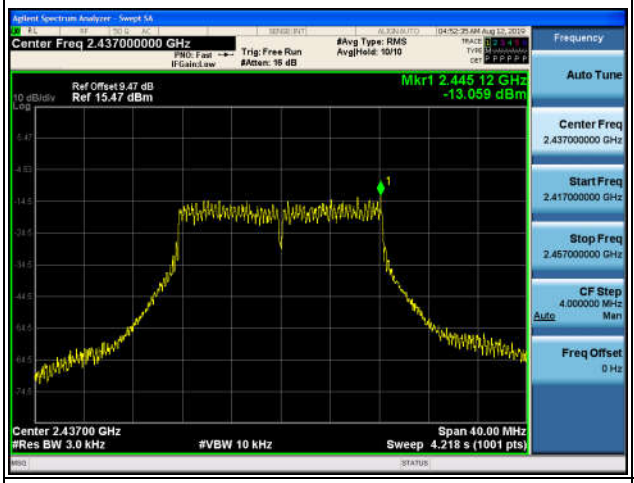
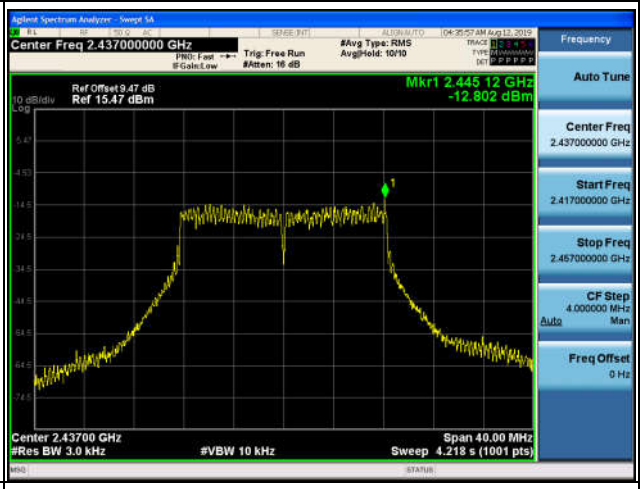
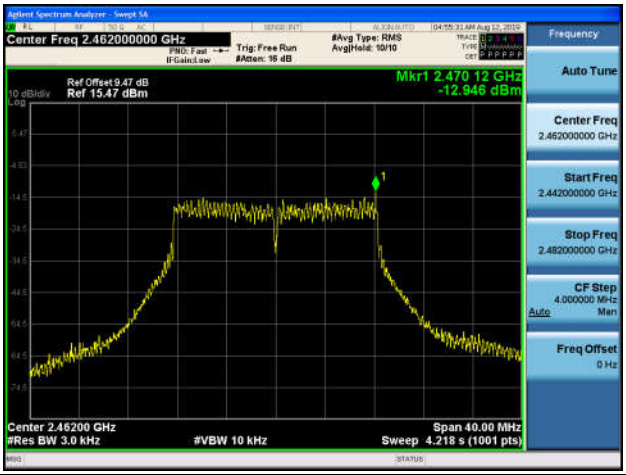
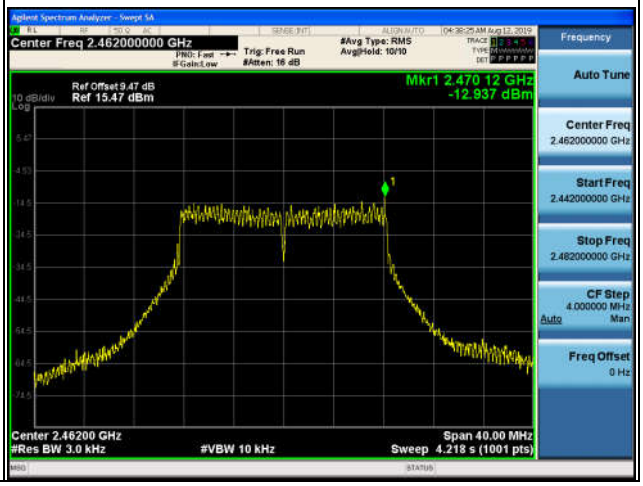


802.11n20

ANT A+ANT B

Test Channel	Frequency (MHz)	Power Density of ANT A (dBm/3kHz)	Power Density of ANT B (dBm/3kHz)	Total Power Density of (ANT A + ANT B) (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-11.979	-13.661	-9.73	7.99	Pass
CH06	2437	-13.059	-12.802	-9.92	7.99	Pass
CH11	2462	-12.946	-12.937	-9.93	7.99	Pass

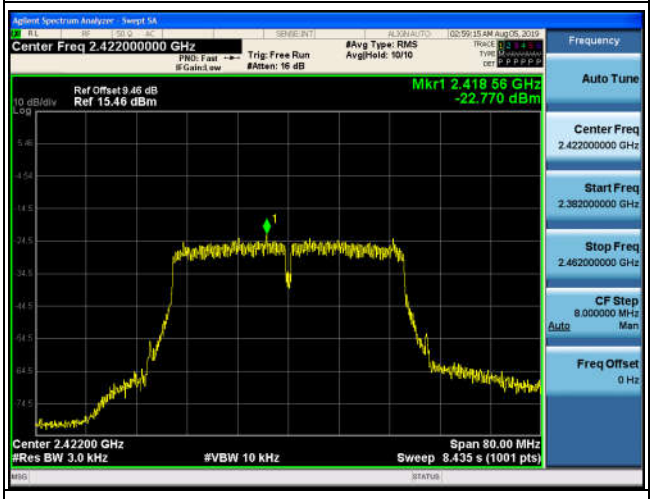
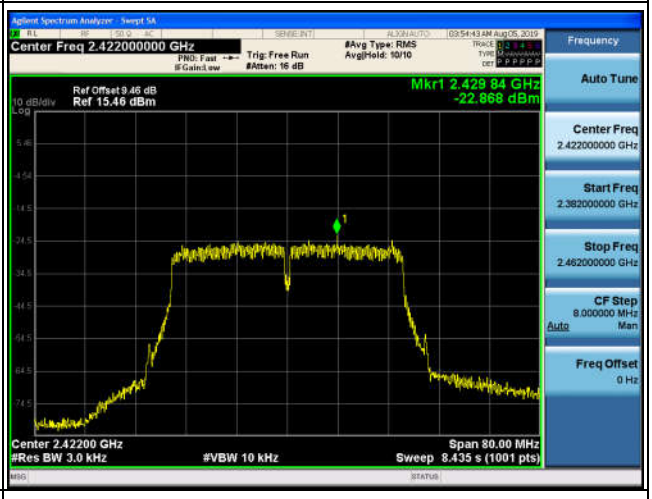
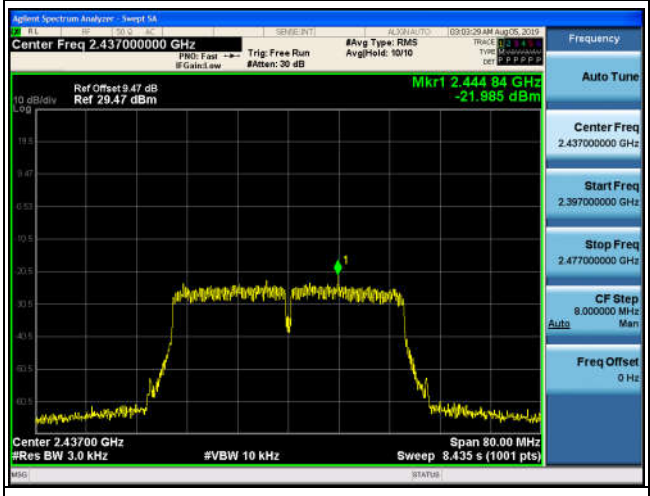
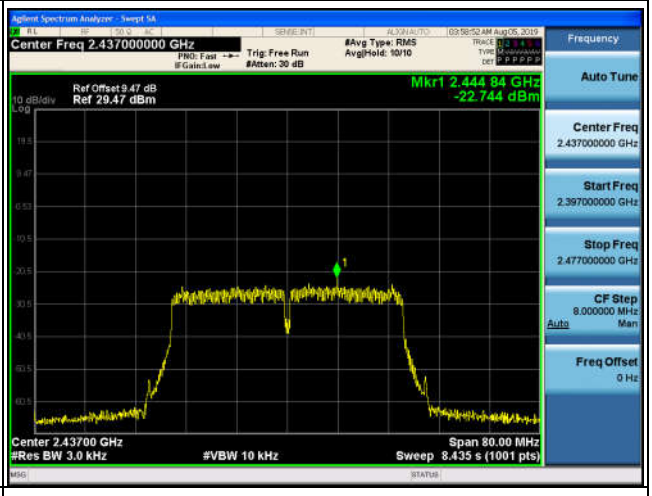
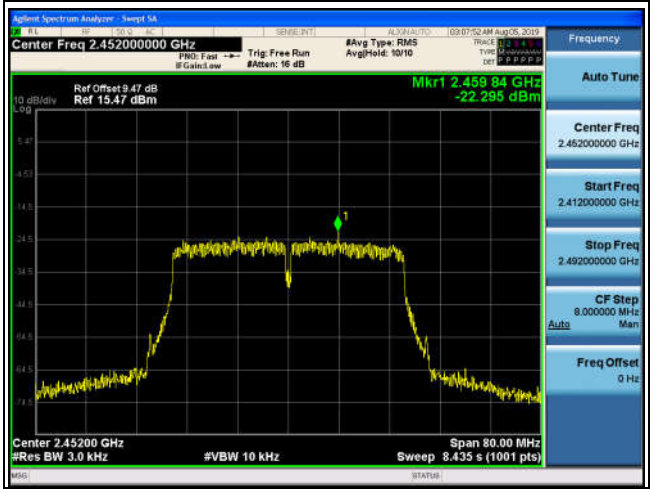
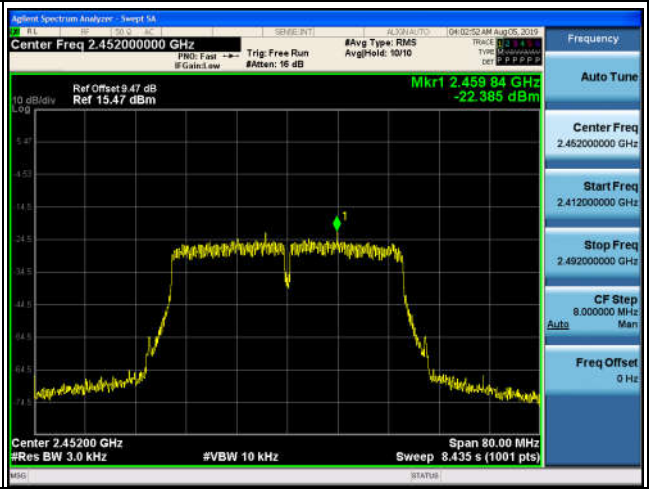
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.
Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:
Limit = 8 dBm/3kHz - (ANT Gain + 10*Log(N=2) - 6dBi)
= 8 dBm/3kHz - (3 + 3.01 - 6) dBi = 7.99 dBm/3kHz

ANTA	ANTB
TX CH01	TX CH01
	
TX CH06	TX CH06
	
TX CH11	TX CH11
	

802.11n40

Test Channel	Frequency (MHz)	Power Density of ANTA (dBm/3kHz)	Power Density of ANTB (dBm/3kHz)	Total Power Density of (ANTA + ANTB) (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH03	2422	-22.77	-22.868	-19.81	7.99	Pass
CH06	2437	-21.985	-22.744	-19.34	7.99	Pass
CH09	2452	-22.295	-22.385	-19.33	7.99	Pass

Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.
Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:
Limit = 8 dBm/3kHz - (ANT Gain + 10*Log(N=2) - 6dBi)
= 8 dBm/3kHz - (3 + 3.01 - 6) dBi = 7.99 dBm/3kHz

ANT A	ANT B
TX CH03	TX CH03
	
TX CH06	TX CH06
	
TX CH09	TX CH09
	

5.4 Conducted emission

5.4.1 Limits

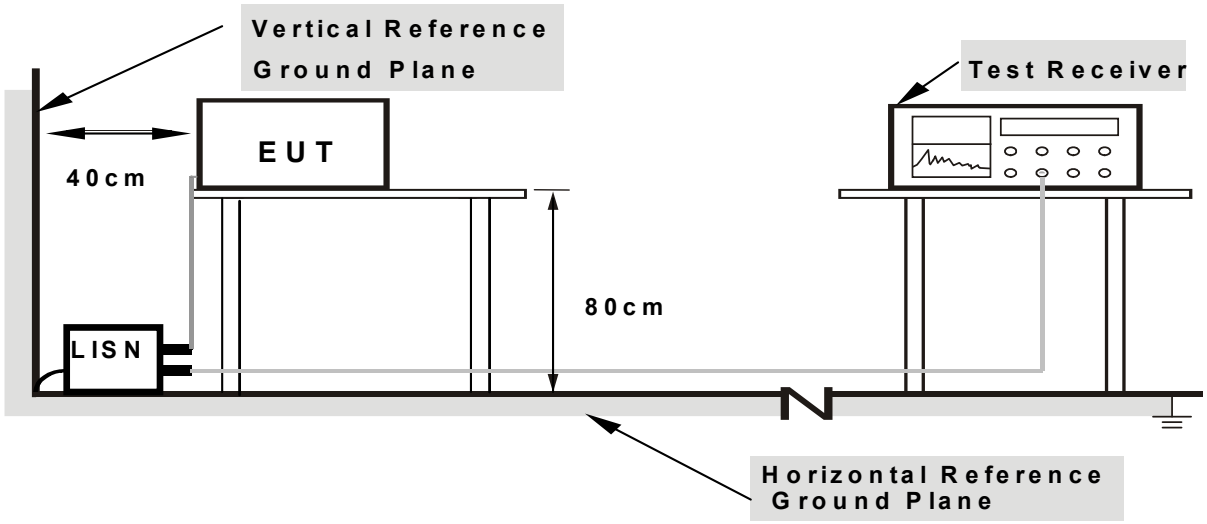
FREQUENCY (MHz)	Class B (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note

(1)The tighter limit applies at the band edges.

(2)The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

5.4.2 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 from other units and other metal planes

5.4.3 Test procedure

a. EUT Operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

b. The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

c. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

d. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

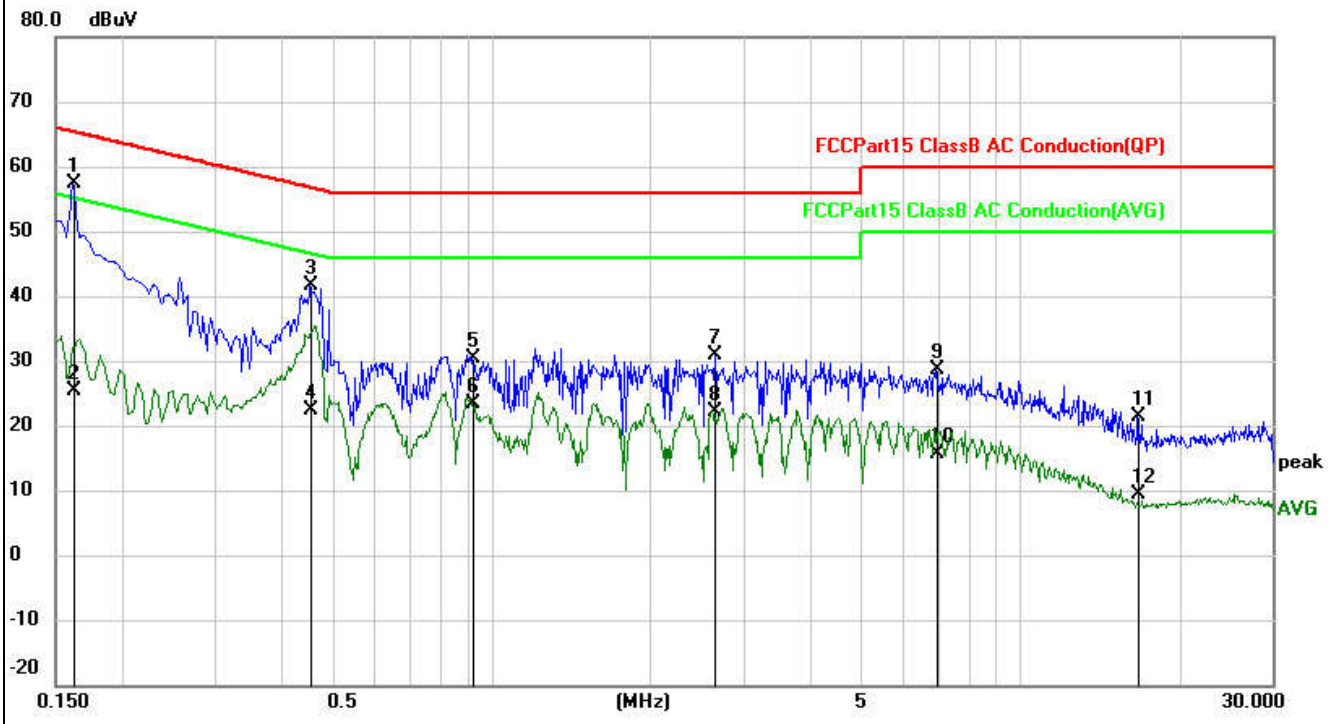
e. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

f. LISN at least 80 cm from nearest part of EUT chassis.

For the actual test configuration, please refer to the related Item –EUT Test Photos.

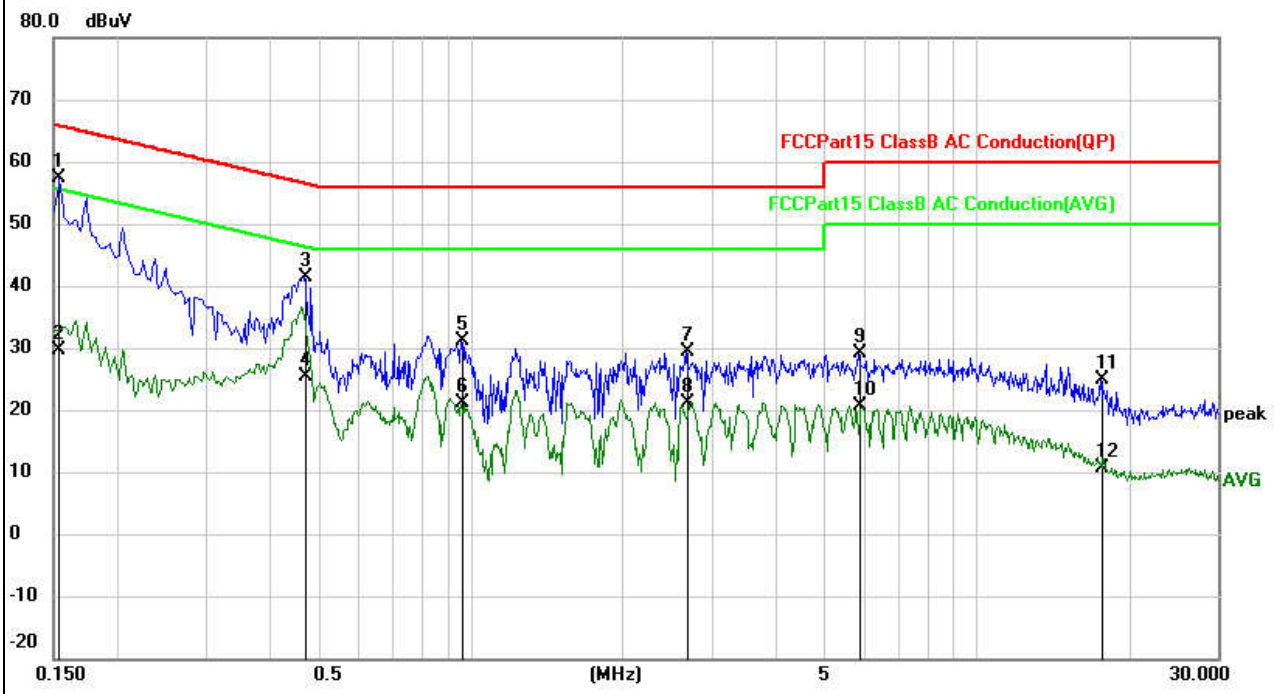
5.4.4 Test results

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase :	L
Test Voltage :	DC 12V from adapter AC 120V/60Hz	Test Mode:	TX Mode



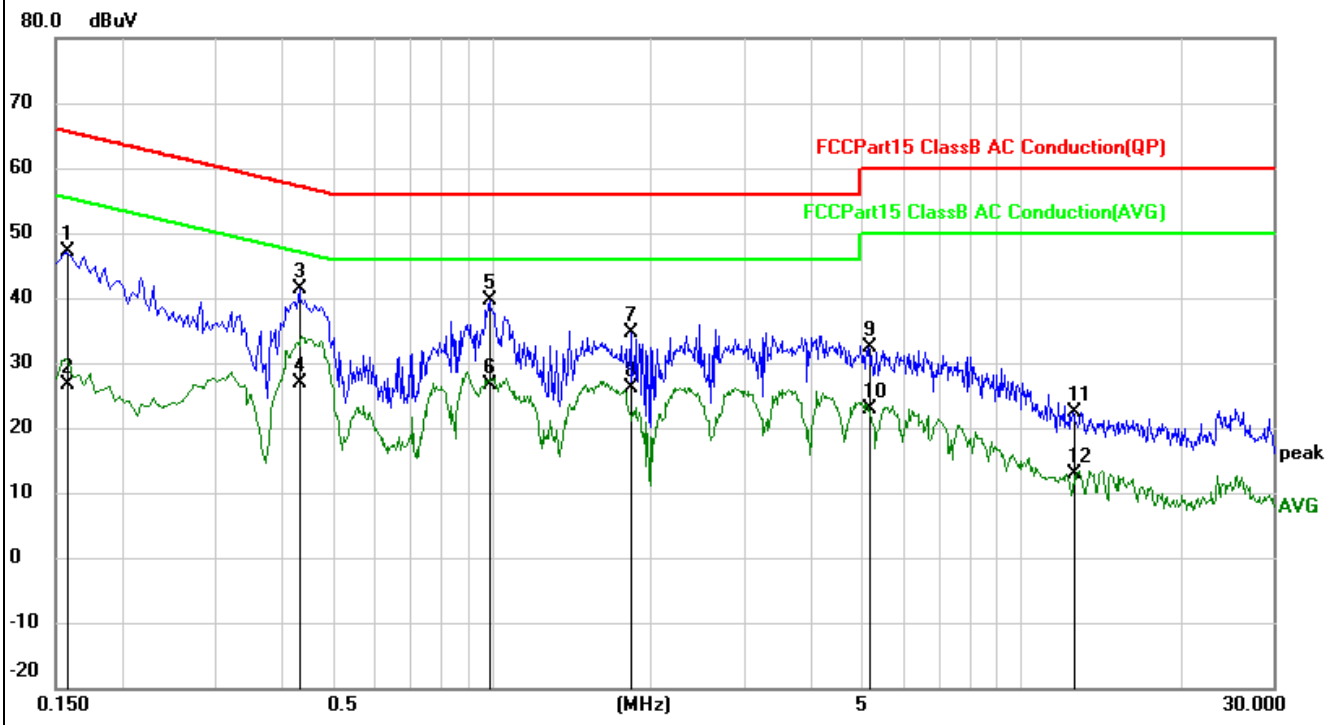
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1620	47.59	9.73	57.32	65.36	-8.04	QP
2		0.1620	15.73	9.73	25.46	55.36	-29.90	AVG
3		0.4540	31.87	9.86	41.73	56.80	-15.07	QP
4		0.4540	12.41	9.86	22.27	46.80	-24.53	AVG
5		0.9220	20.47	9.94	30.41	56.00	-25.59	QP
6		0.9220	13.50	9.94	23.44	46.00	-22.56	AVG
7		2.6500	20.91	9.99	30.90	56.00	-25.10	QP
8		2.6500	12.19	9.99	22.18	46.00	-23.82	AVG
9		6.9420	18.54	10.14	28.68	60.00	-31.32	QP
10		6.9420	5.38	10.14	15.52	50.00	-34.48	AVG
11		16.7060	11.21	10.16	21.37	60.00	-38.63	QP
12		16.7060	-0.90	10.16	9.26	50.00	-40.74	AVG

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase :	N
Test Voltage :	DC 12V from adapter AC 120V/60Hz	Test Mode:	TX Mode



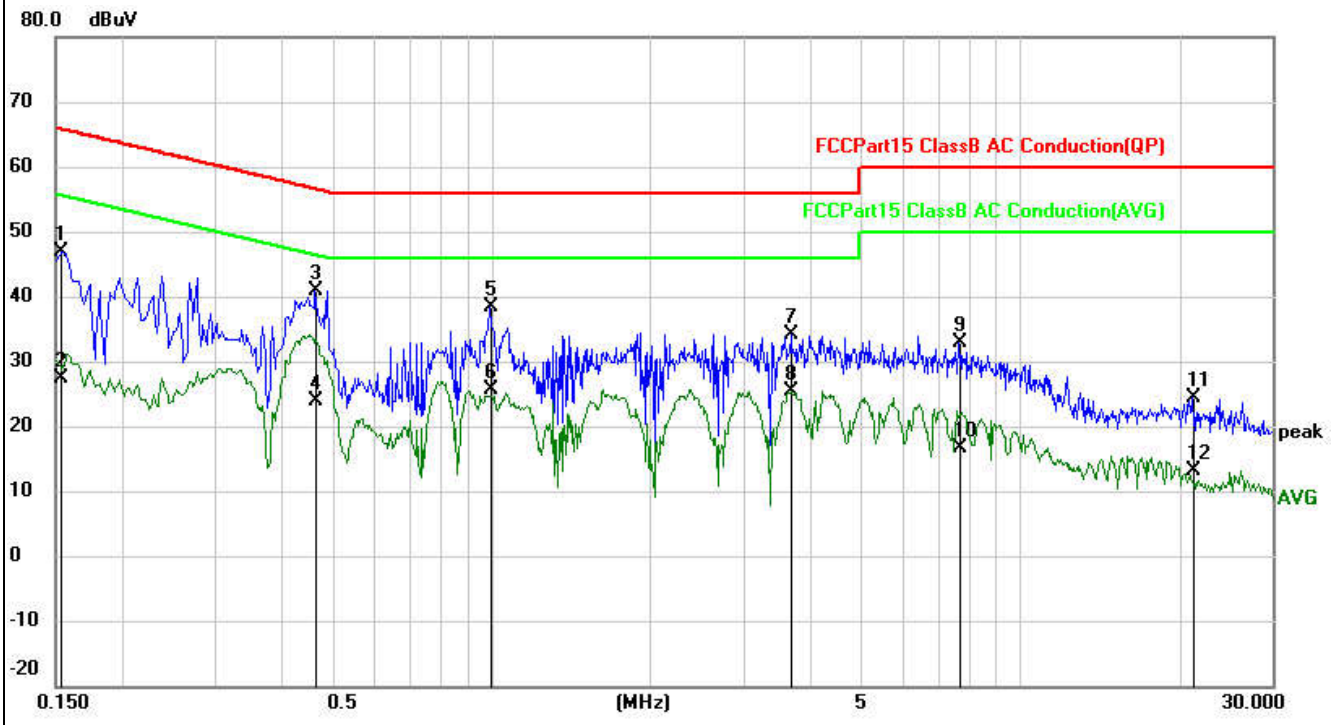
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1539	47.57	9.73	57.30	65.79	-8.49	QP
2		0.1539	19.89	9.73	29.62	55.79	-26.17	AVG
3		0.4700	31.58	9.86	41.44	56.51	-15.07	QP
4		0.4700	15.63	9.86	25.49	46.51	-21.02	AVG
5		0.9620	21.12	9.95	31.07	56.00	-24.93	QP
6		0.9620	11.18	9.95	21.13	46.00	-24.87	AVG
7		2.6780	19.49	9.99	29.48	56.00	-26.52	QP
8		2.6780	11.24	9.99	21.23	46.00	-24.77	AVG
9		5.8619	19.09	10.09	29.18	60.00	-30.82	QP
10		5.8619	10.46	10.09	20.55	50.00	-29.45	AVG
11		17.6379	14.77	10.13	24.90	60.00	-35.10	QP
12		17.6379	0.40	10.13	10.53	50.00	-39.47	AVG

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase :	L
Test Voltage :	DC 12V from adapter AC 240V/60Hz	Test Mode:	TX Mode



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1580	37.40	9.73	47.13	65.57	-18.44	QP
2		0.1580	16.81	9.73	26.54	55.57	-29.03	AVG
3	*	0.4340	31.51	9.84	41.35	57.18	-15.83	QP
4		0.4340	16.94	9.84	26.78	47.18	-20.40	AVG
5		0.9940	29.69	9.95	39.64	56.00	-16.36	QP
6		0.9940	16.64	9.95	26.59	46.00	-19.41	AVG
7		1.8380	24.69	9.97	34.66	56.00	-21.34	QP
8		1.8380	16.22	9.97	26.19	46.00	-19.81	AVG
9		5.1620	22.25	10.06	32.31	60.00	-27.69	QP
10		5.1620	12.72	10.06	22.78	50.00	-27.22	AVG
11		12.5460	12.17	10.23	22.40	60.00	-37.60	QP
12		12.5460	2.70	10.23	12.93	50.00	-37.07	AVG

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase :	N
Test Voltage :	DC 12V from adapter AC 240V/60Hz	Test Mode:	TX Mode



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	37.14	9.73	46.87	65.79	-18.92	QP
2		0.1539	17.68	9.73	27.41	55.79	-28.38	AVG
3	*	0.4660	31.08	9.86	40.94	56.58	-15.64	QP
4		0.4660	13.98	9.86	23.84	46.58	-22.74	AVG
5		0.9980	28.32	9.95	38.27	56.00	-17.73	QP
6		0.9980	15.57	9.95	25.52	46.00	-20.48	AVG
7		3.6980	24.04	10.02	34.06	56.00	-21.94	QP
8		3.6980	15.36	10.02	25.38	46.00	-20.62	AVG
9		7.6780	22.60	10.18	32.78	60.00	-27.22	QP
10		7.6780	6.49	10.18	16.67	50.00	-33.33	AVG
11		21.1580	14.16	10.12	24.28	60.00	-35.72	QP
12		21.1580	2.90	10.12	13.02	50.00	-36.98	AVG

5.5 Radiated spurious

5.5.1 Limits

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

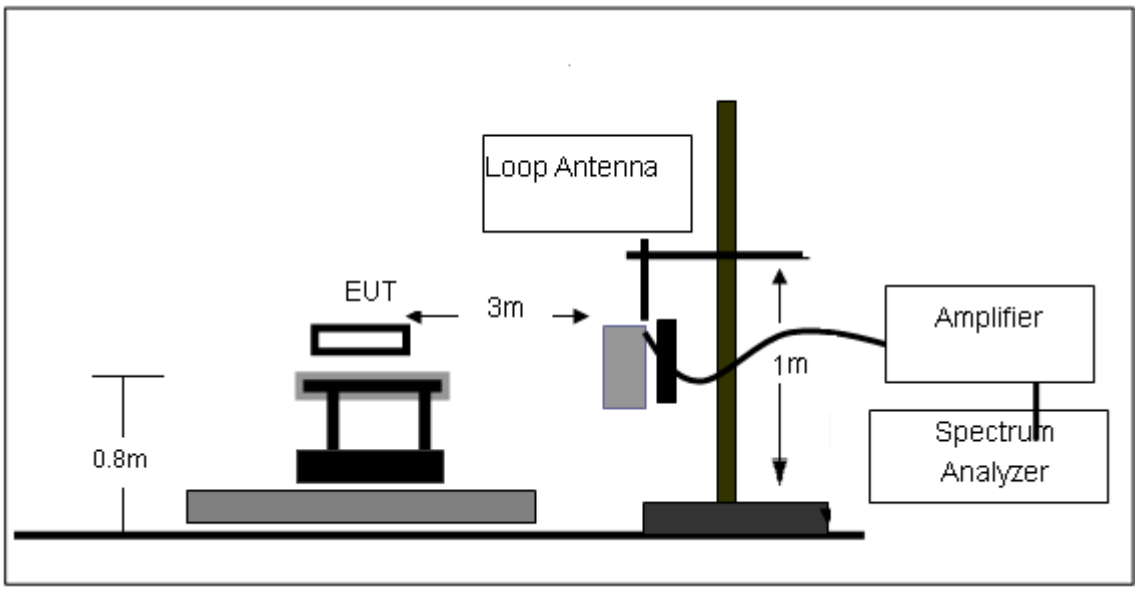
Frequency (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

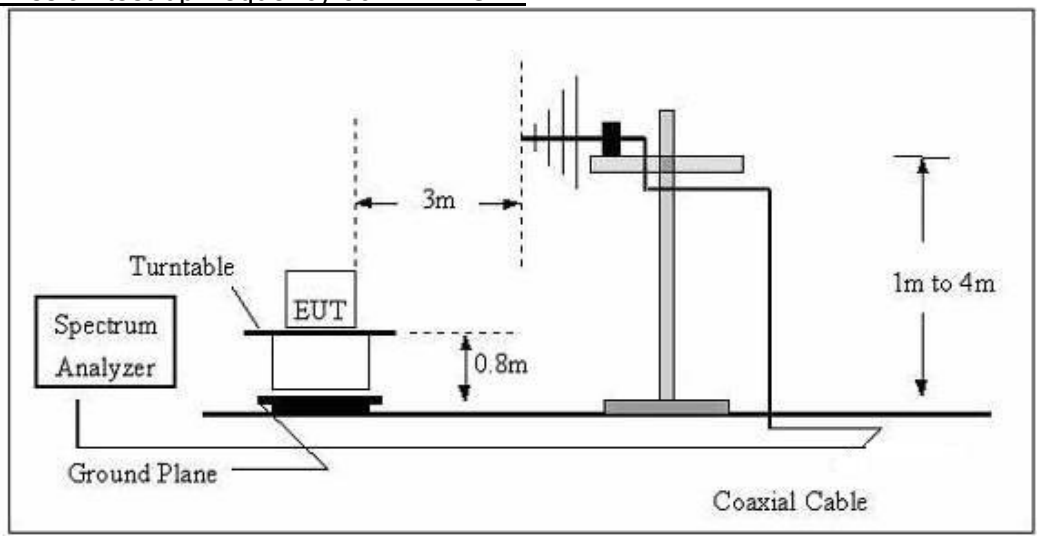
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

5.5.2 Test setup

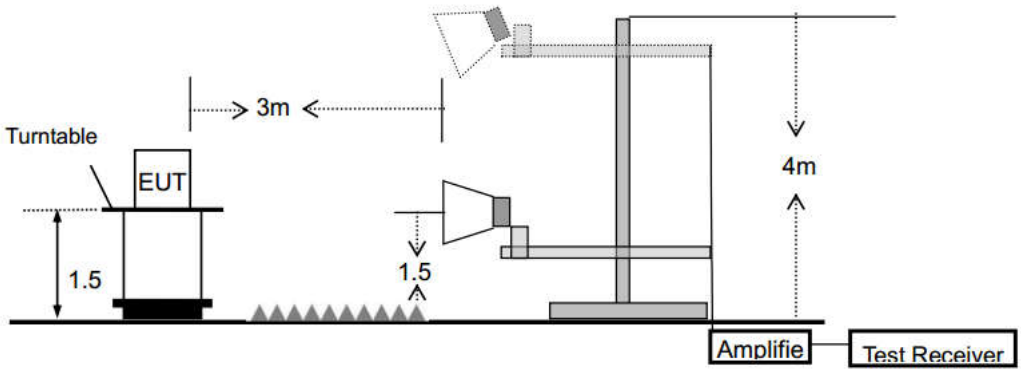
Radiated emission test-up frequency below 30MHz



Radiated emission test-up frequency 30MHz~1GHz



Radiated emission test-up frequency above 1GHz



5.5.3 Test procedure

a. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range belo w 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

b. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the high est emissions.

c. Use the following spectrum analyzer settings:

   Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 10 0 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold.

d. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the em ission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of rec eiving antenna both horizontal and vertical.

e. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the RB W = 1MHz, VBW = 10Hz, Detector = RMS for AV value, while maintaining all of the other instrume nt settings.

f. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.

g. For the actual test configuration, please refer to the related Item –EUT Test photos.

Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

5.5.4 Test results

5.5.4.1 Radiation emission

Below 30MHz

EUT：	LTE Wireless Router	Model Name：	P21
Pressure：	1010 hPa	Test Voltage：	DC 5Vfrom adapter AC 120V/60Hz
Test Mode：	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	Pass
--	--	--	--	Pass

Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

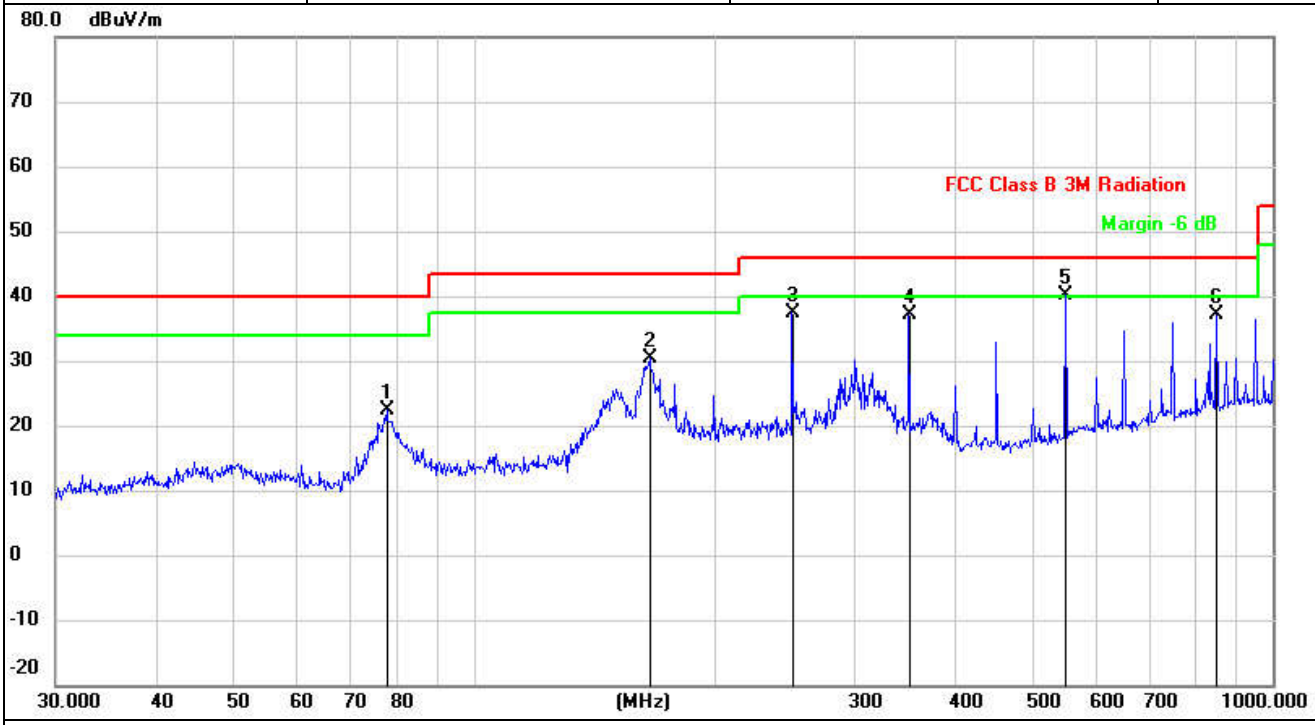
Between 30MHz – 1GHz

Note1: Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Note2: The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.

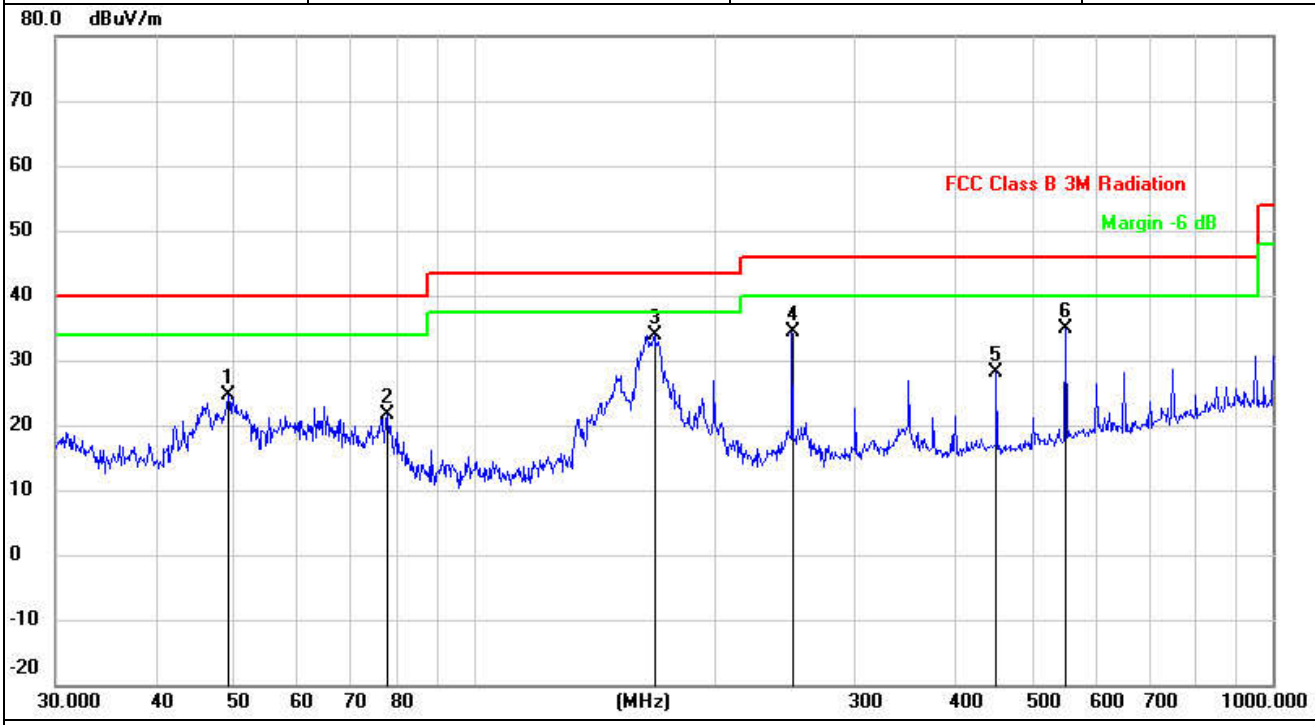
Note3: The following data is the worst mode. The worst data is MIMO mode 802.11n20 CH01.

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase:	H
Test Voltage :	DC 12V from adapter AC 120V/60Hz	Test Mode:	TX Mode



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector
1		77.8654	39.66	-17.39	22.27	40.00	-17.73	QP
2		166.0680	46.09	-15.80	30.29	43.50	-13.21	QP
3		250.3012	49.02	-11.73	37.29	46.00	-8.71	QP
4		350.4768	46.89	-9.74	37.15	46.00	-8.85	QP
5	*	550.9480	47.75	-7.57	40.18	46.00	-5.82	QP
6		851.0353	40.29	-3.28	37.01	46.00	-8.99	QP

EUT:	LTE Wireless Router	Model Name:	P21
Pressure:	1010hPa	Phase:	V
Test Voltage :	DC 12V from adapter AC 120V/60Hz	Test Mode:	TX Mode



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector
1		49.3594	37.14	-12.52	24.62	40.00	-15.38	QP
2		77.8654	39.12	-17.39	21.73	40.00	-18.27	QP
3	*	168.4138	49.38	-15.61	33.77	43.50	-9.73	QP
4		250.3012	46.06	-11.73	34.33	46.00	-11.67	QP
5		451.1350	37.29	-9.10	28.19	46.00	-17.81	QP
6		550.9480	42.45	-7.57	34.88	46.00	-11.12	QP

1G-25GHz
Note1: Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Note2: The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.
Note3: The following data is the worst mode. The worst data is antenna A

For 802.11g

Frequency	Read Level	Cable loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Remark	Comment
(MHz)	(dBμV)	(dB)	dB/m	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
Low Channel (2412 MHz)(802.11g)--Above 1G									
4824.161	62.80	4.36	32.92	45.53	54.55	74.00	-19.45	Pk	Vertical
4824.161	40.26	4.36	32.92	45.53	32.01	54.00	-21.99	AV	Vertical
7236.396	59.99	5.02	37.63	45.56	57.08	74.00	-16.92	Pk	Vertical
7236.396	43.75	5.02	37.63	45.56	40.84	54.00	-13.16	AV	Vertical
4824.154	60.57	4.36	32.92	45.53	52.32	74.00	-21.68	Pk	Horizontal
4824.154	42.36	4.36	32.92	45.53	34.11	54.00	-19.89	AV	Horizontal
7236.168	62.87	5.02	37.63	45.56	59.96	74.00	-14.04	Pk	Horizontal
7236.168	46.31	5.02	37.63	45.56	43.40	54.00	-10.60	AV	Horizontal
Low Channel (2437 MHz)(802.11g)--Above 1G									
4874.112	62.74	4.41	33.01	45.76	54.40	74.00	-19.60	Pk	Vertical
4874.112	42.43	4.41	33.01	45.76	34.09	54.00	-19.91	AV	Vertical
7311.247	59.51	5.02	37.68	45.59	56.62	74.00	-17.38	Pk	Vertical
7311.247	46.69	5.02	37.68	45.59	43.80	54.00	-10.20	AV	Vertical
4874.132	61.00	4.41	33.01	45.76	52.66	74.00	-21.34	Pk	Horizontal
4874.132	48.26	4.41	33.01	45.76	39.92	54.00	-14.08	AV	Horizontal
7311.085	59.42	5.02	37.68	45.59	56.53	74.00	-17.47	Pk	Horizontal
7311.085	41.95	5.02	37.68	45.59	39.06	54.00	-14.94	AV	Horizontal
Low Channel (2462 MHz)(802.11g)--Above 1G									
4924.169	66.04	4.50	33.26	46.07	57.73	74.00	-16.27	Pk	Vertical
4924.169	43.17	4.50	33.26	46.07	34.86	54.00	-19.14	AV	Vertical
7386.215	61.21	5.02	37.78	45.77	58.24	74.00	-15.76	Pk	Vertical
7386.215	44.44	5.02	37.78	45.77	41.47	54.00	-12.53	AV	Vertical
4924.045	66.41	4.50	33.26	46.07	58.10	74.00	-15.90	Pk	Horizontal
4924.045	46.78	4.50	33.26	46.07	38.47	54.00	-15.53	AV	Horizontal
7386.132	60.89	5.02	37.78	45.77	57.92	74.00	-16.08	Pk	Horizontal
7386.132	45.23	5.02	37.78	45.77	42.26	54.00	-11.74	AV	Horizontal

5.5.4.2 Band edge - radiated

Note1: Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Note2:The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.
Note3: The following data is the worst mode. The worst mode is antenna A

Frequency	Meter Reading	Cable Loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	dB/m	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
802.11b									
2310.00	55.48	2.40	27.70	40.40	45.18	74	-28.82	Pk	Horizontal
2310.00	43.23	2.40	27.70	40.40	32.93	54	-21.07	AV	Horizontal
2310.00	58.55	2.40	27.70	40.40	48.25	74	-25.75	Pk	Vertical
2310.00	42.08	2.40	27.70	40.40	31.78	54	-22.22	AV	Vertical
2390.00	58.15	2.44	28.30	40.10	48.79	74	-25.21	Pk	Vertical
2390.00	42.26	2.44	28.30	40.10	32.90	54	-21.10	AV	Vertical
2390.00	56.96	2.44	28.30	40.10	47.60	74	-26.40	Pk	Horizontal
2390.00	41.88	2.44	28.30	40.10	32.52	54	-21.48	AV	Horizontal
2483.50	58.03	2.48	28.70	39.80	49.41	74	-24.59	Pk	Vertical
2483.50	43.52	2.48	28.70	39.80	34.90	54	-19.10	AV	Vertical
2483.50	58.59	2.48	28.70	39.80	49.97	74	-24.03	Pk	Horizontal
2483.50	41.84	2.48	28.70	39.80	33.22	54	-20.78	AV	Horizontal
802.11g									
2310.00	58.95	2.40	27.70	40.40	48.65	74	-25.35	Pk	Horizontal
2310.00	44.15	2.40	27.70	40.40	33.85	54	-20.15	AV	Horizontal
2310.00	57.08	2.40	27.70	40.40	46.78	74	-27.22	Pk	Vertical
2310.00	43.21	2.40	27.70	40.40	32.91	54	-21.09	AV	Vertical
2390.00	57.76	2.44	28.30	40.10	48.40	74	-25.60	Pk	Vertical
2390.00	41.61	2.44	28.30	40.10	32.25	54	-21.75	AV	Vertical
2390.00	57.76	2.44	28.30	40.10	48.40	74	-25.60	Pk	Horizontal
2390.00	44.27	2.44	28.30	40.10	34.91	54	-19.09	AV	Horizontal
2483.50	58.56	2.48	28.70	39.80	49.94	74	-24.06	Pk	Vertical
2483.50	43.79	2.48	28.70	39.80	35.17	54	-18.83	AV	Vertical
2483.50	58.49	2.48	28.70	39.80	49.87	74	-24.13	Pk	Horizontal
2483.50	41.83	2.48	28.70	39.80	33.21	54	-20.79	AV	Horizontal

Frequency	Meter Reading	Cable Loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	dB/m	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
802.11n20									
2310.00	57.97	2.40	27.70	40.40	47.67	74	-26.33	Pk	Horizontal
2310.00	43.58	2.40	27.70	40.40	33.28	54	-20.72	AV	Horizontal
2310.00	58.88	2.40	27.70	40.40	48.58	74	-25.42	Pk	Vertical
2310.00	42.09	2.40	27.70	40.40	31.79	54	-22.21	AV	Vertical
2390.00	57.74	2.44	28.30	40.10	48.38	74	-25.62	Pk	Vertical
2390.00	42.43	2.44	28.30	40.10	33.07	54	-20.93	AV	Vertical
2390.00	56.99	2.44	28.30	40.10	47.63	74	-26.37	Pk	Horizontal
2390.00	42.41	2.44	28.30	40.10	33.05	54	-20.95	AV	Horizontal
2483.50	57.74	2.48	28.70	39.80	49.12	74	-24.88	Pk	Vertical
2483.50	42.63	2.48	28.70	39.80	34.01	54	-19.99	AV	Vertical
2483.50	59.27	2.48	28.70	39.80	50.65	74	-23.35	Pk	Horizontal
2483.50	42.19	2.48	28.70	39.80	33.57	54	-20.43	AV	Horizontal
802.11n40									
2310.00	59.13	2.40	27.70	40.40	48.83	74	-25.17	Pk	Horizontal
2310.00	44.72	2.40	27.70	40.40	34.42	54	-19.58	AV	Horizontal
2310.00	57.31	2.40	27.70	40.40	47.01	74	-26.99	Pk	Vertical
2310.00	43.57	2.40	27.70	40.40	33.27	54	-20.73	AV	Vertical
2390.00	57.84	2.44	28.30	40.10	48.48	74	-25.52	Pk	Vertical
2390.00	41.98	2.44	28.30	40.10	32.62	54	-21.38	AV	Vertical
2390.00	58.16	2.44	28.30	40.10	48.80	74	-25.20	Pk	Horizontal
2390.00	43.61	2.44	28.30	40.10	34.25	54	-19.75	AV	Horizontal
2483.50	58.63	2.48	28.70	39.80	50.01	74	-23.99	Pk	Vertical
2483.50	43.97	2.48	28.70	39.80	35.35	54	-18.65	AV	Vertical
2483.50	58.25	2.48	28.70	39.80	49.63	74	-24.37	Pk	Horizontal
2483.50	42.83	2.48	28.70	39.80	34.21	54	-19.79	AV	Horizontal

5.6 Band edge - Conducted

5.6.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

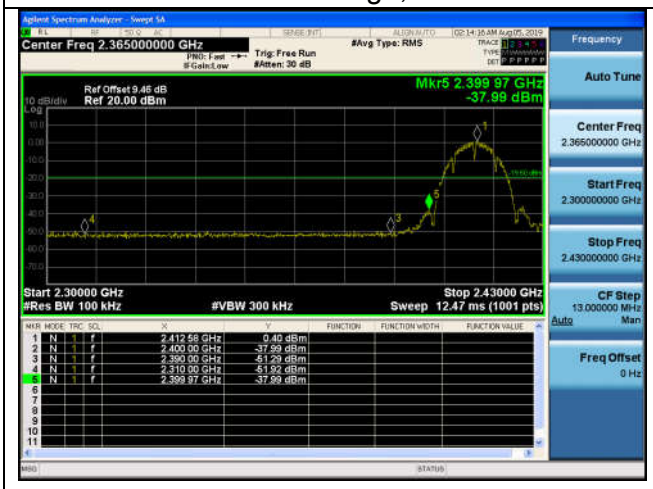
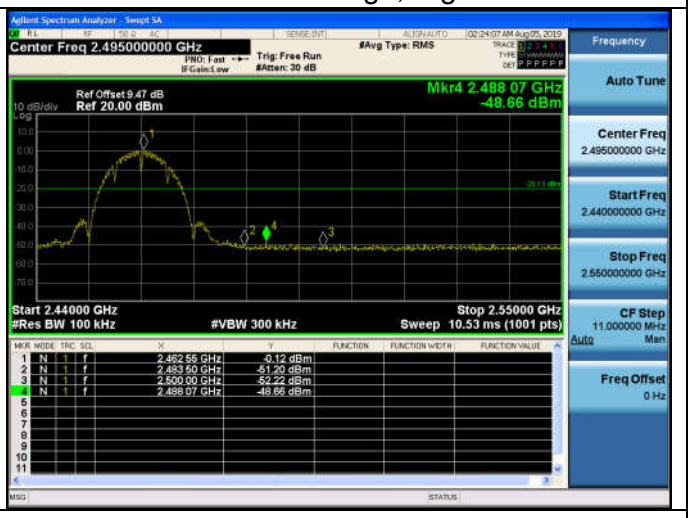
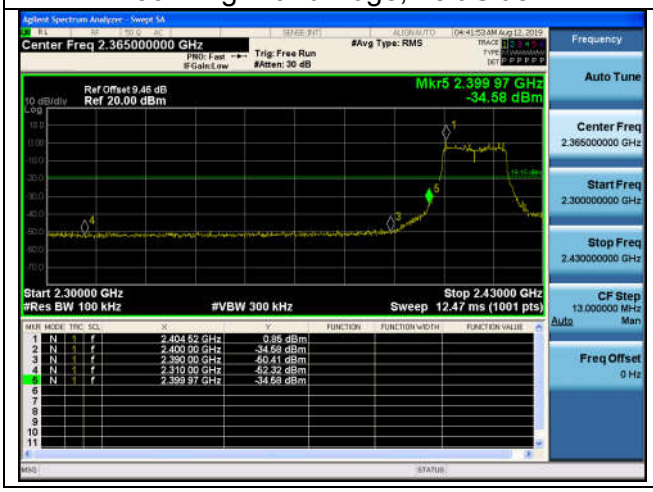
5.6.2 Test setup

5.6.3 Test procedure

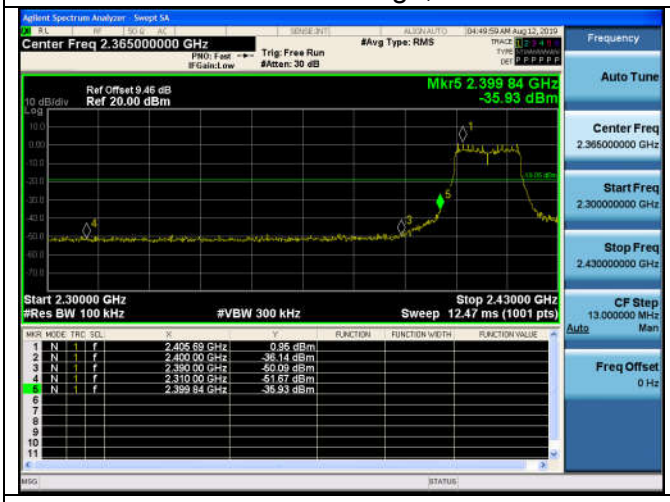
a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e) Repeat above procedures until all measured frequencies were complete.

5.6.4 Test results

For ANT A

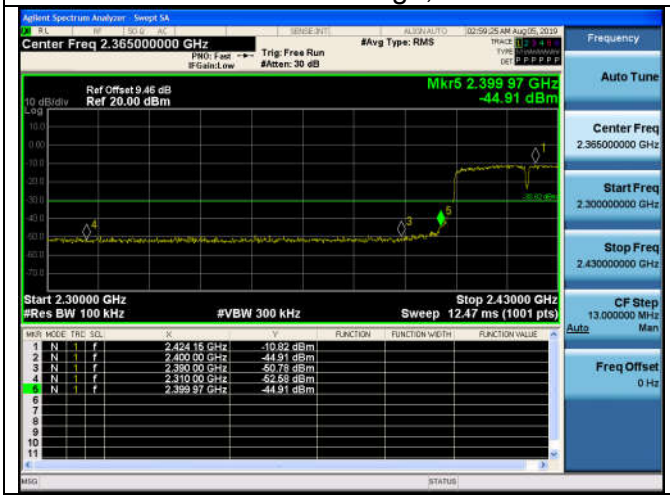
802.11b: Band Edge, Left Side	802.11b: Band Edge, Right Side
	
802.11g: Band Edge, Left Side	**802.11g: Band Edge, Right Side**
	

802.11n20: Band Edge, Left Side



802.11n20: Band Edge, Right Side

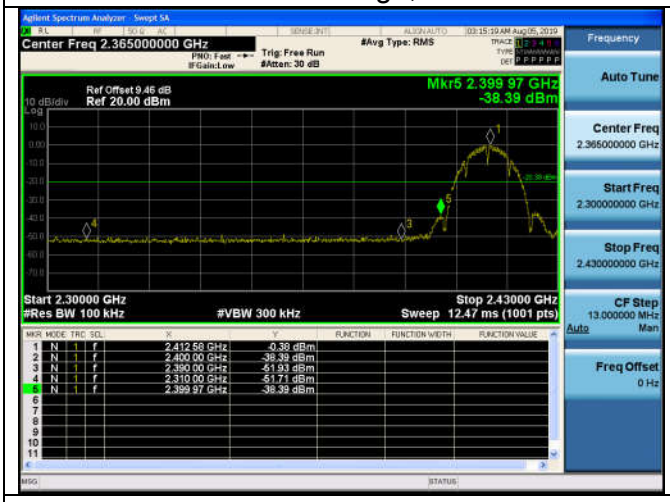
802.11n40: Band Edge, Left Side



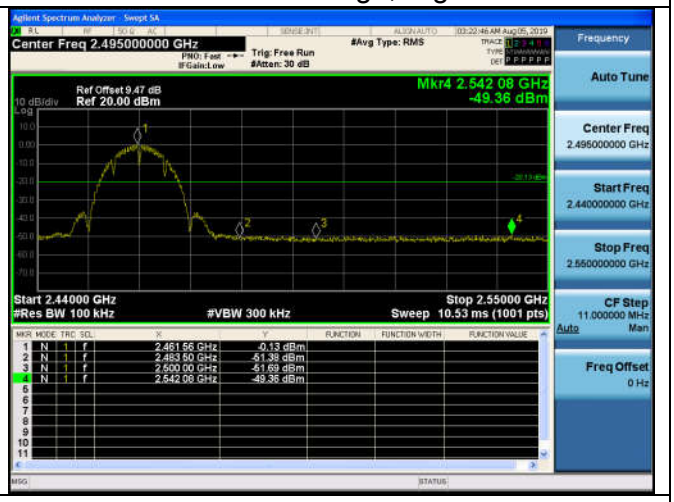
802.11n40: Band Edge, Right Side

For ANT B

802.11b: Band Edge, Left Side



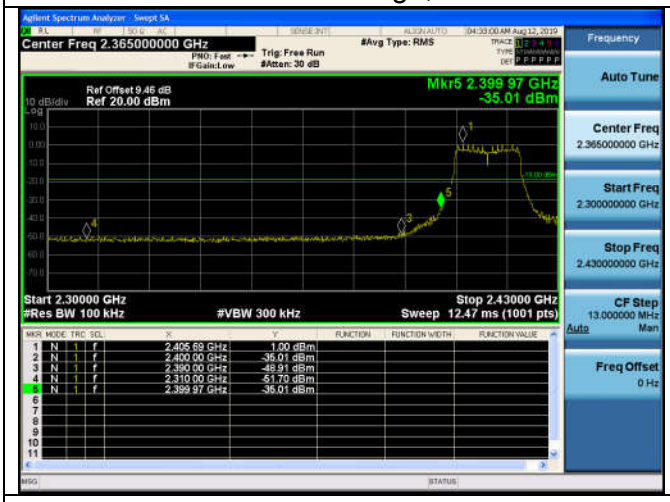
802.11b: Band Edge, Right Side



802.11g: Band Edge, Left Side

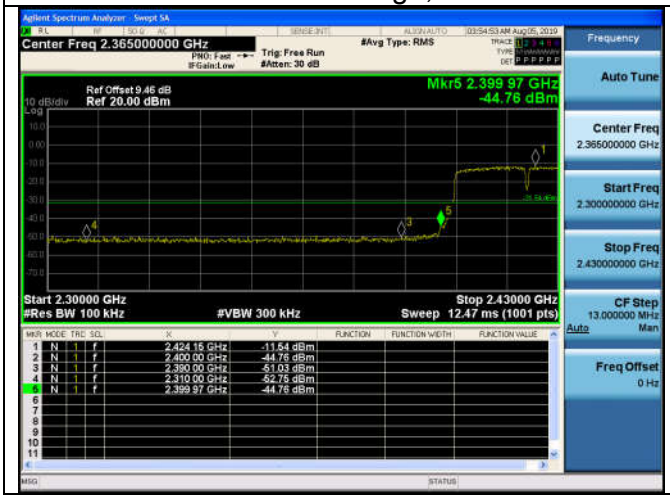
802.11g: Band Edge, Right Side

802.11n20: Band Edge, Left Side



802.11n20: Band Edge, Right Side

802.11n40: Band Edge, Left Side



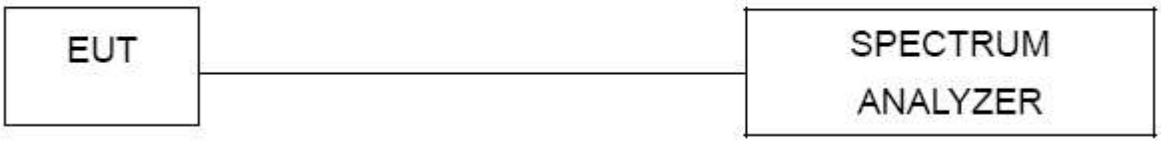
802.11n40: Band Edge, Right Side

5.7 6dB bandwidth

5.7.1 Limit

Section	Test Item	Limit	Frequency Range (MHz)
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5

5.7.2 Test setup



5.7.3 Test procedure

a. Set RBW= 100 kHz.
b. Set the video bandwidth (VBW) ≥ 3 x RBW.
c. Detector = Peak.
d. Trace mode = max hold.
e. Sweep = auto couple.
f. Allow the trace to stabilize.
g. 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 6 dB relative to the maximum level measured in the fundamental emission.

EUT Operation Conditions
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

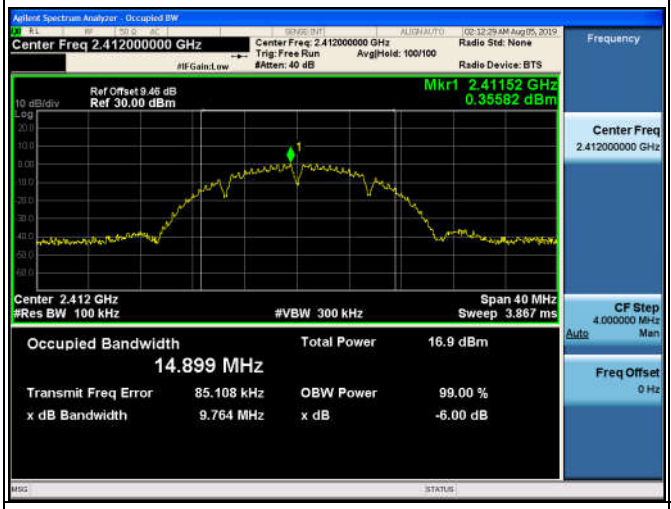
5.7.4 Test results

802.11b

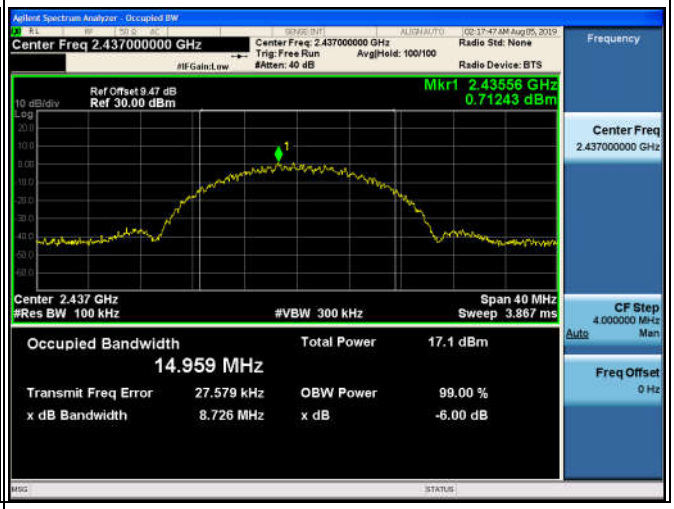
ANT A:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	9.764	500	Pass
CH06	2437	8.726	500	Pass
CH11	2462	10.07	500	Pass

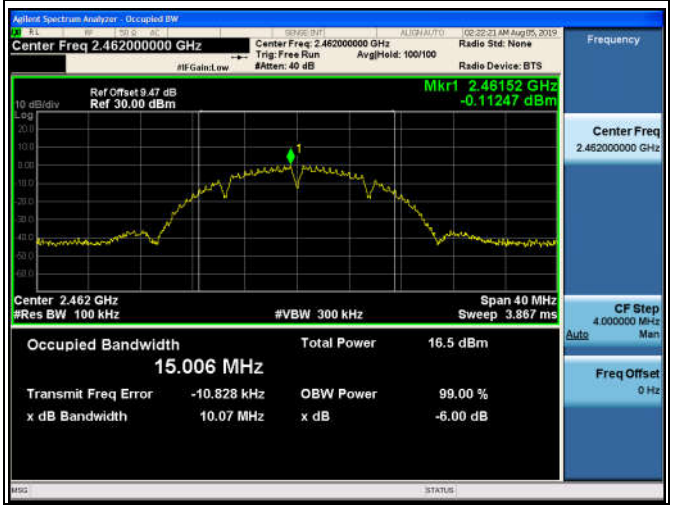
TX CH01



TX CH06



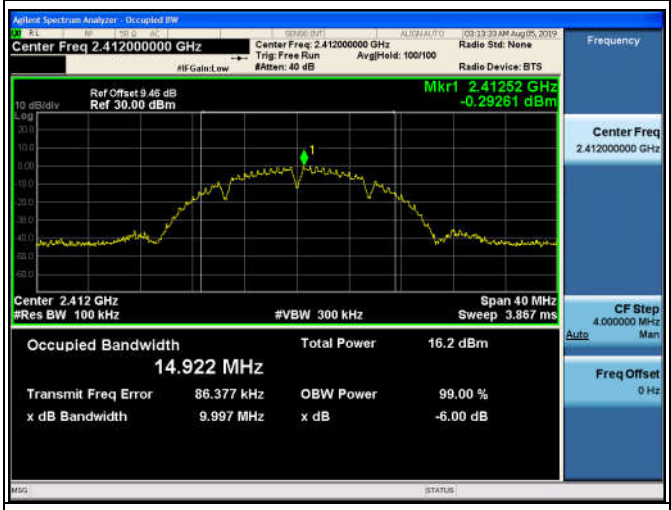
TX CH11



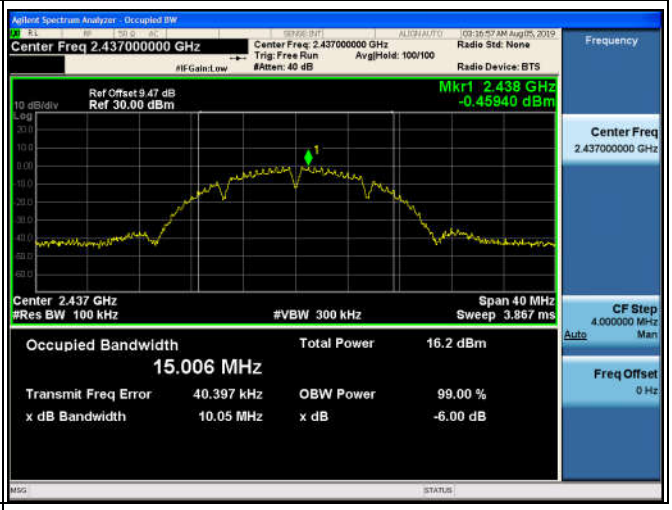
ANT B:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	9.997	500	Pass
CH06	2437	10.05	500	Pass
CH11	2462	9.606	500	Pass

TX CH01



TX CH06



TX CH11

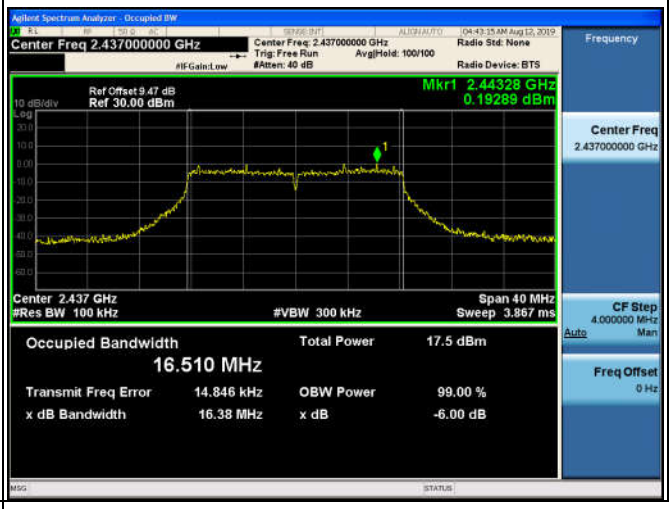
802.11g

ANT A:

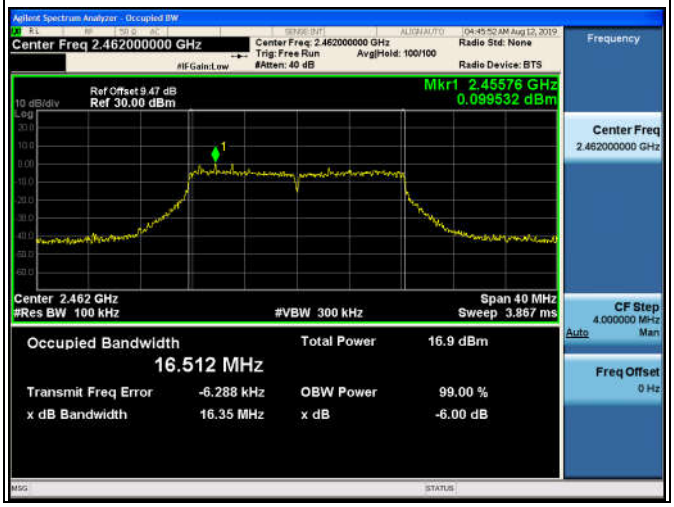
Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.39	500	Pass
CH06	2437	16.38	500	Pass
CH11	2462	16.35	500	Pass

TX CH01

TX CH06



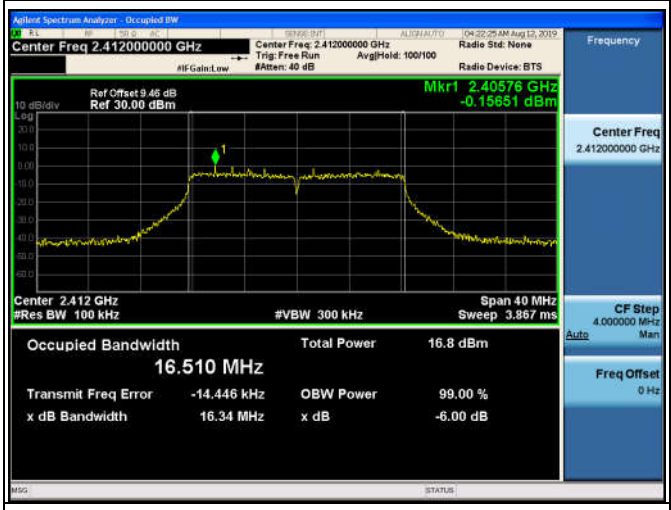
TX CH11



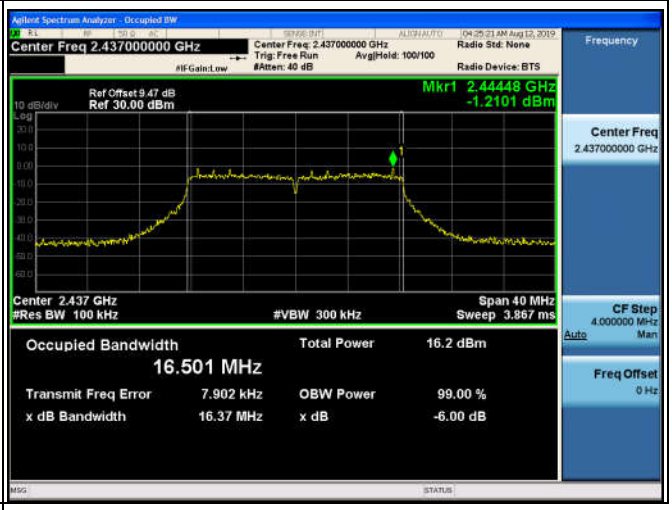
ANT B:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.34	500	Pass
CH06	2437	16.37	500	Pass
CH11	2462	16.42	500	Pass

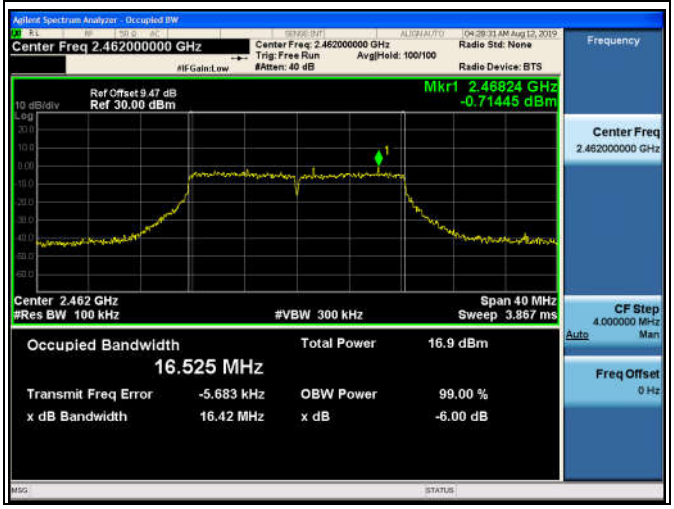
TX CH01



TX CH06



TX CH11

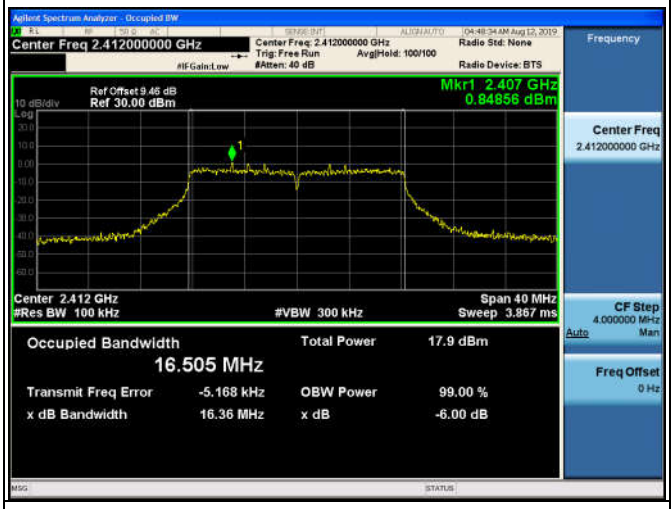


For 802.11n20

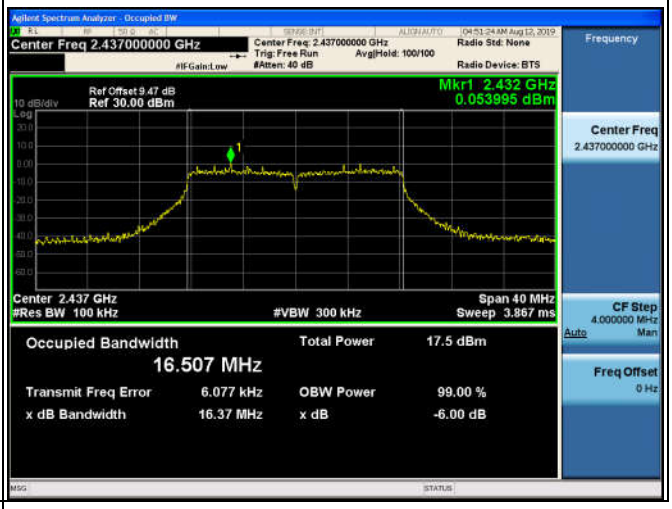
ANTA

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.36	500	Pass
CH06	2437	16.37	500	Pass
CH11	2462	16.50	500	Pass

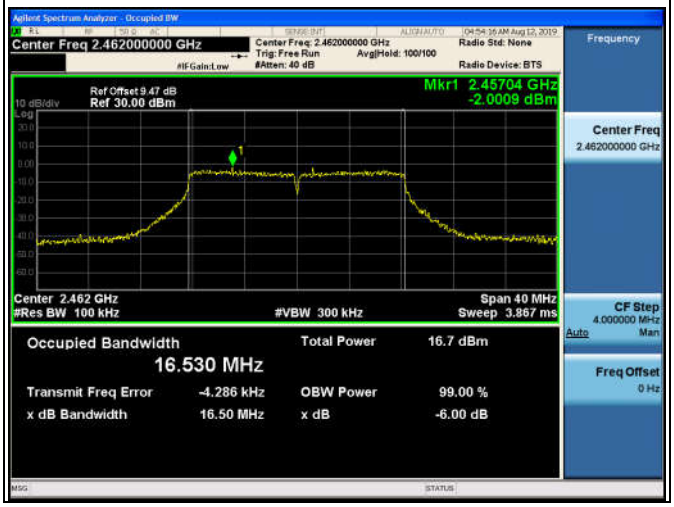
TX CH01



TX CH06



TX CH11

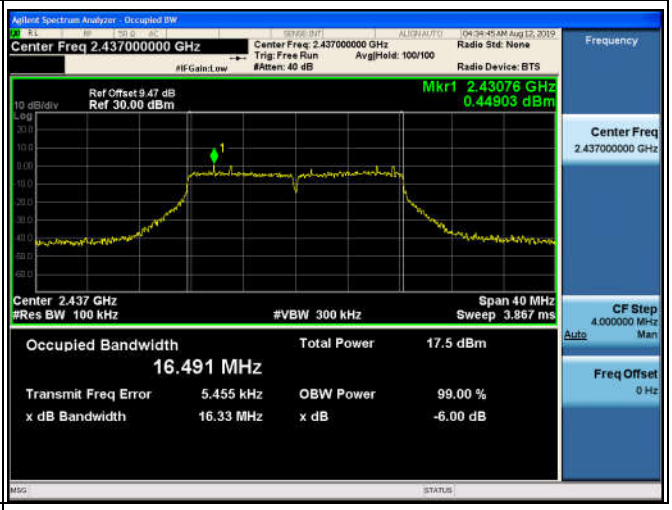


ANTB

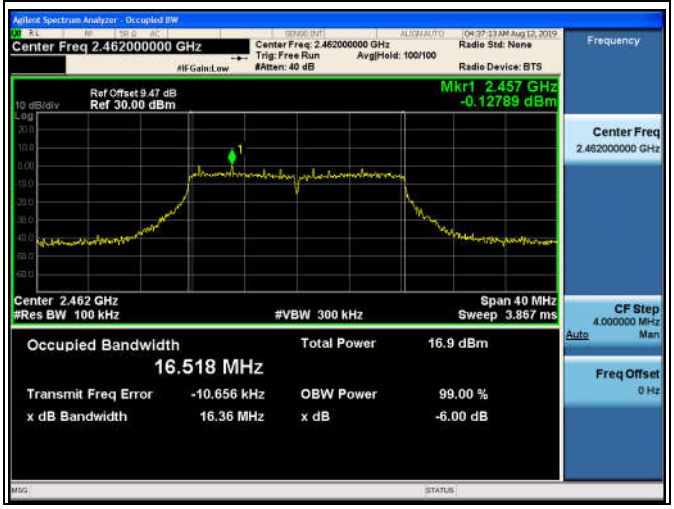
Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.34	500	Pass
CH06	2437	16.33	500	Pass
CH11	2462	16.36	500	Pass

TX CH01

TX CH06



TX CH11

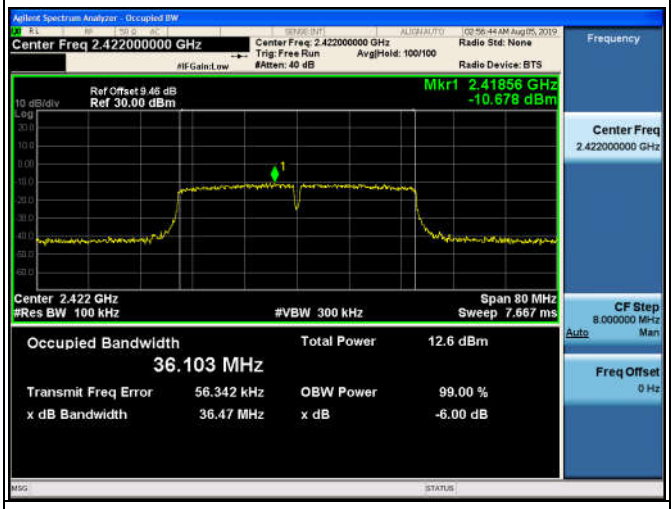


For 802.11n40

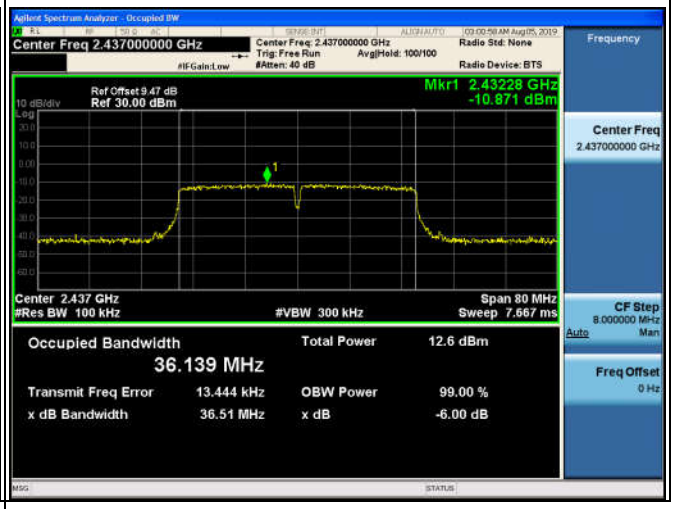
ANTA

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH03	2422	36.47	500	Pass
CH06	2437	36.51	500	Pass
CH09	2452	36.48	500	Pass

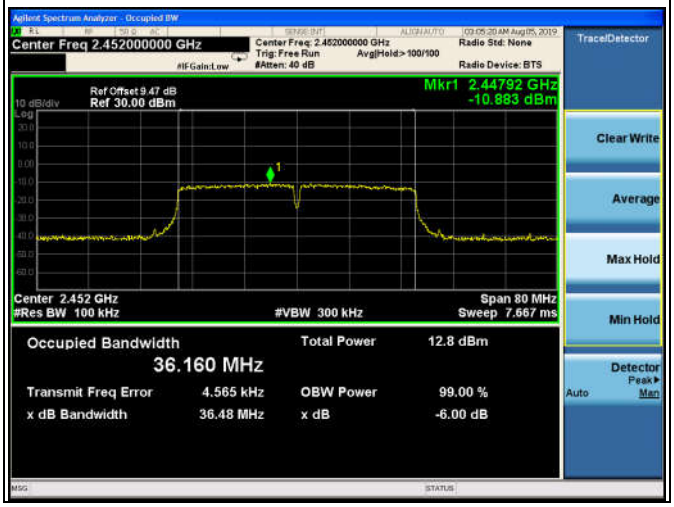
TX CH01



TX CH06



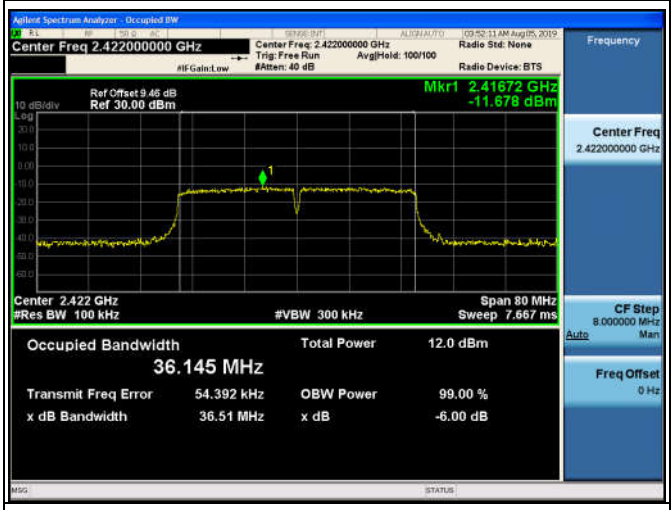
TX CH11



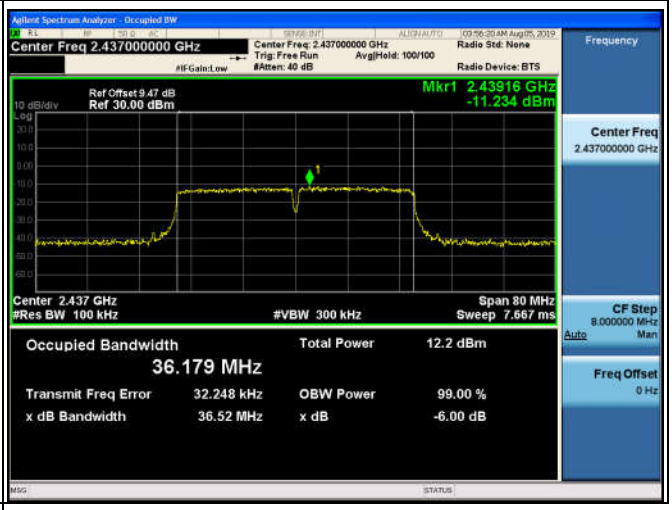
ANTB

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH03	2422	36.51	500	Pass
CH06	2437	36.52	500	Pass
CH09	2452	36.49	500	Pass

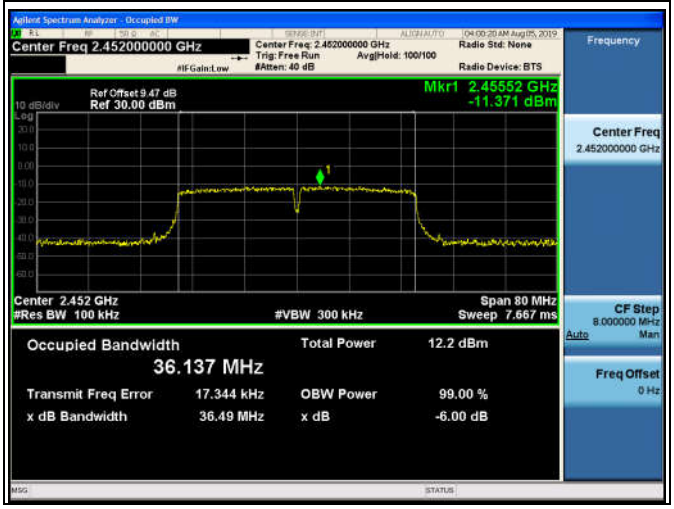
TX CH01



TX CH06



TX CH11



5.8 Spurious RF Conducted Emissions

5.8.1 Limit

Below -20dB of the highest emission level in operating band.

5.8.2 Measuring instruments

The Measuring equipment is listed in the section 4 of this test report.

5.8.3 Test setup

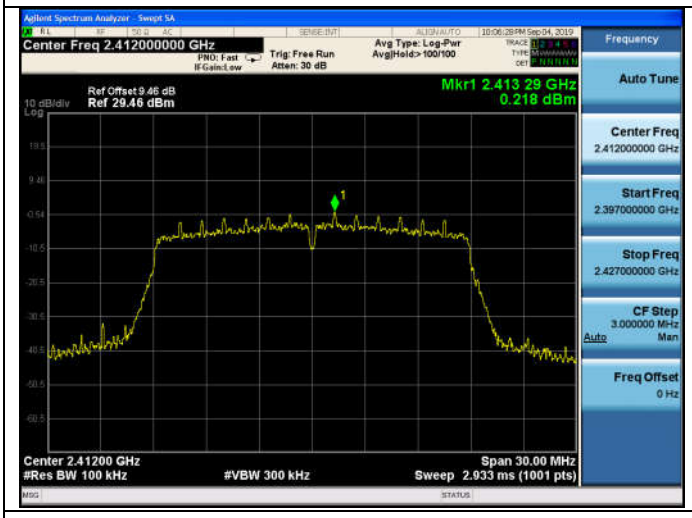
5.8.4 Test procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300kHz to measure the peak field strength, and measure frequency range from 9kHz to 26.5GHz.

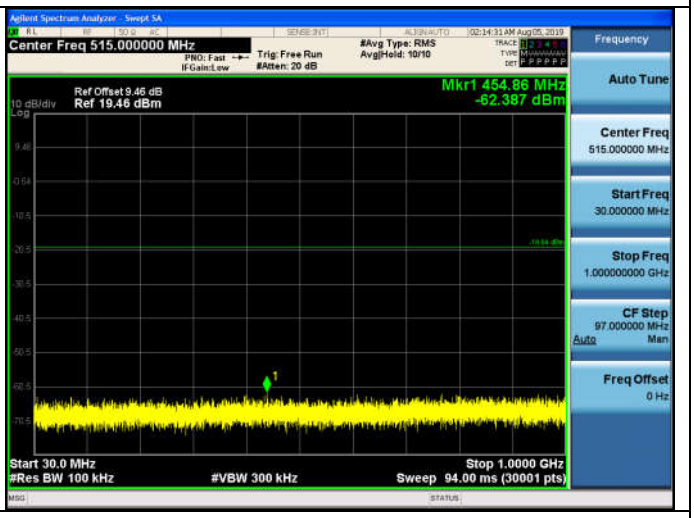
5.8.5 Test results

Remark: The measurement frequency range is from 9kHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.
Note1: The three modulated high, medium and low channels have been tested. The report only shows the worst mode. The worst data is MIMO mode 802.11n20.

802.11n20 on Channel 01

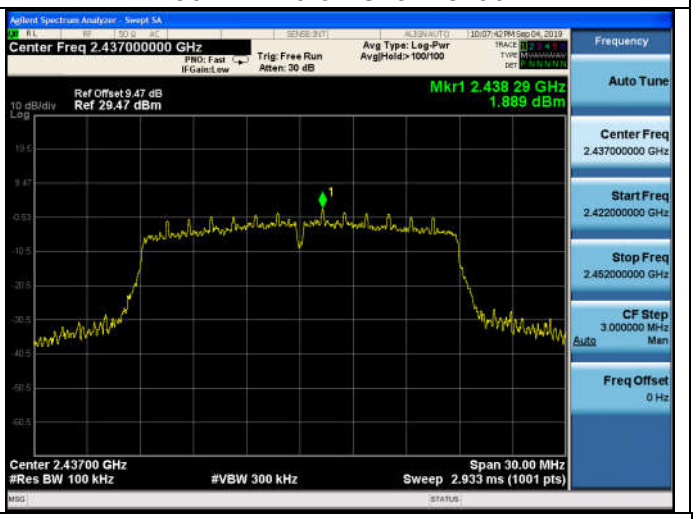


802.11n20 on Channel 01

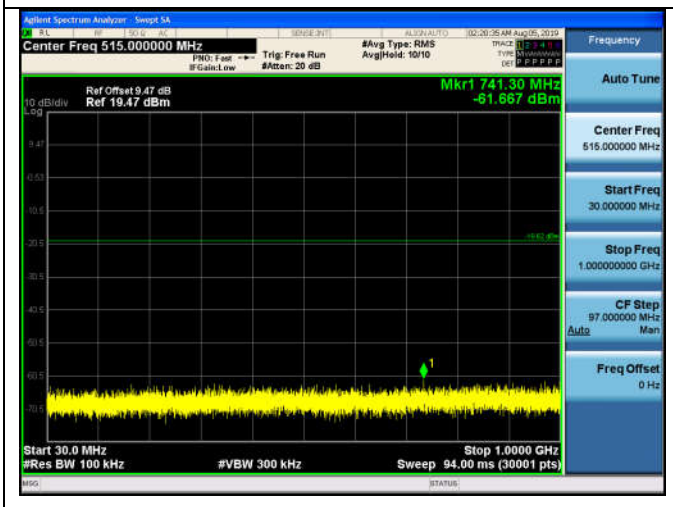


802.11n20 on Channel 01

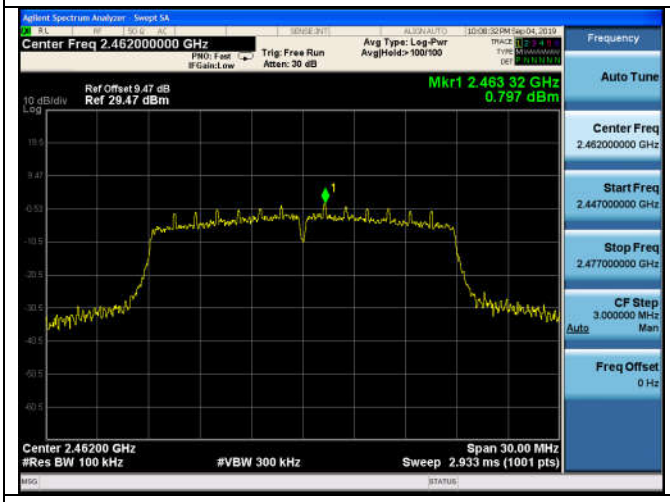
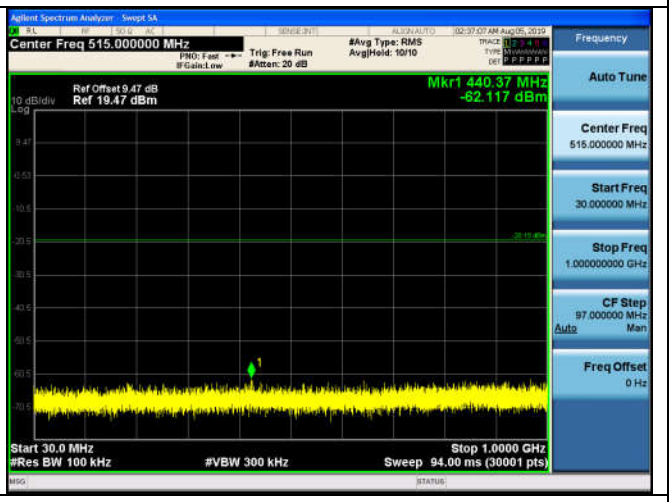
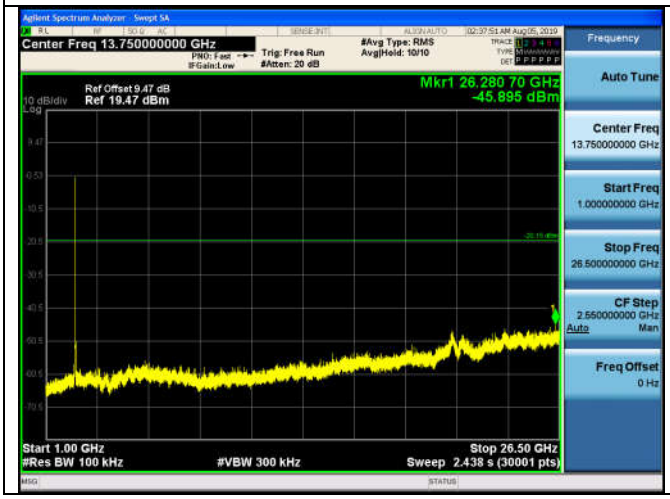
802.11n20 on Channel 06



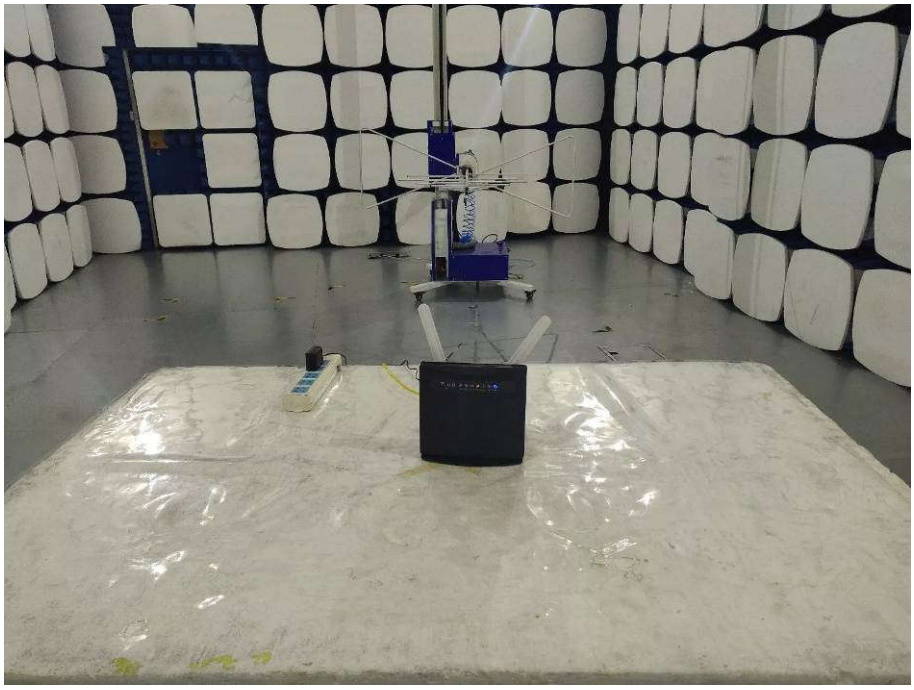
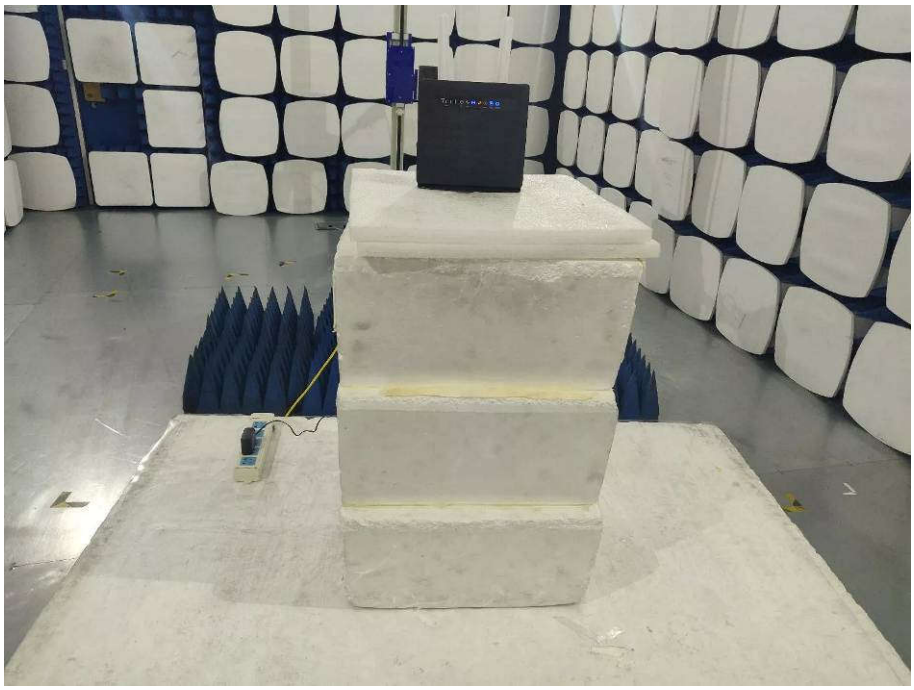
802.11n20 on Channel 06

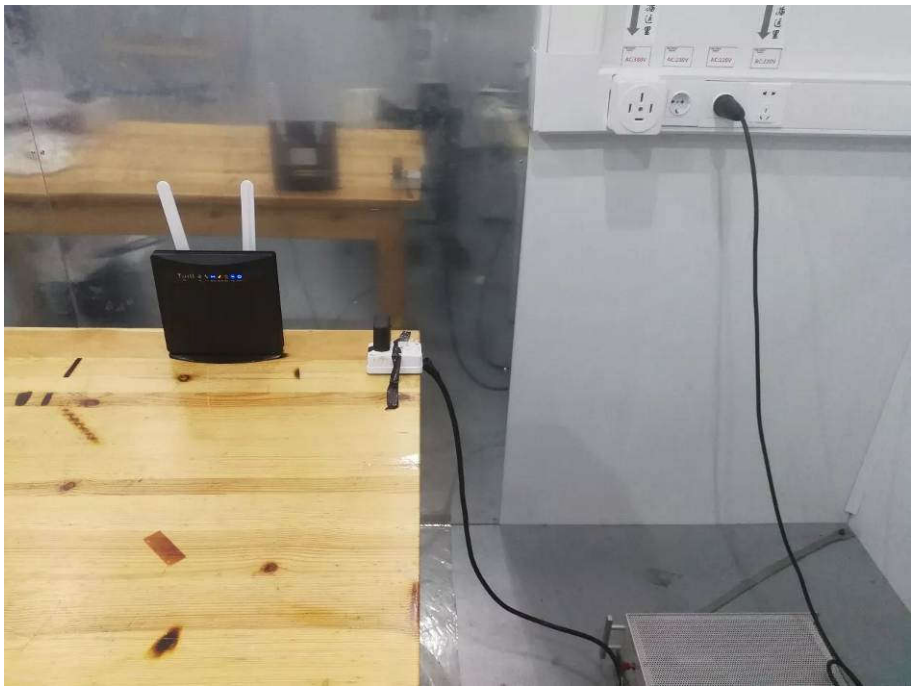


802.11n20 on Channel 06

802.11n20 on Channel 11	802.11n20 on Channel 11
	
802.11n20 on Channel 11	**/**
	

Photographs of the Test Setup

Radiated emission



Conducted emission


Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi19071025-1E1-1.

----END OF REPORT----

Tel:(86-755)88850135 Fax: (86-755) 88850136 Web: http://www.mtitest.com E-mail: mti@51mti.com
Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China