Test Report

FCC ID: 2AYC2-CPC200

Date of issue: Nov. 20, 2020

Report Number:	MTi20091717-2E1
Sample Description:	Car OEM Wired CarPlay to Wireless CarPlay
Model(s):	CPC200-AutoKit, CPC200-CCPW, CPC200-C2W, CPC200-U2W, CPC200-U2W Plus, CPC200-CCPA, CPC200-CP2A
Applicant:	Huizhou Veelink Technology Co., Ltd.
Address:	1504-1506, Finance Building, 23 Xiapu Road, Huicheng District, Huizhou City, Guangdong Province China.
Date of Test:	Oct. 19, 2020 - Nov. 11, 2020

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

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Address: 101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.

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Test Result Certification

Applicant's name:	Huizhou Veelink Technology Co., Ltd.
Address:	1504-1506, Finance Building, 23 Xiapu Road, Huicheng District, Huizhou City, Guangdong Province China.
Manufacture's Name:	Huizhou Veelink Technology Co., Ltd.
Address:	1504-1506, Finance Building, 23 Xiapu Road, Huicheng District, Huizhou City, Guangdong Province China.
Product name:	Car OEM Wired CarPlay to Wireless CarPlay
Trademark:	CalinKit
Model name:	CPC200-AutoKit, CPC200-CCPW, CPC200-C2W, CPC200-U2W, CPC200-U2W Plus, CPC200-CCPA, CPC200-CP2A
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 Nov. 11, 2020

Reviewed by: Leo Su Nov. 20, 2020

Approved by: Tom Xue Nov. 20, 2020

1 General information

1.1 Description of EUT

Product name	Car OEM Wired CarPlay to Wireless CarPlay
Model name	CPC200-AutoKit
Series model:	CPC200-CCPW, CPC200-C2W, CPC200-U2W, CPC200-U2W Plus, CPC200-CCPA, CPC200-CP2A
Difference of series model:	All the models are of the same circuit and RF module, except the run the software and model No..
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	FPC Antenna
Antenna Gain (dBi)	For 802.11b/g, working in SISO mode, then the antenna gain as below: 802.11b/g: Antenna A :1dBi 802.11b/g: Antenna B :1dBi
	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 = 1 dBi + 10*Log(2) dBi = 4.01 dBi
Max. Output Power:	12.91dBm
Hardware Version:	A15
Software Version:	AutoKit, C2W, U2W
Power Supply:	DC 5V from PC
Battery information:	N/A
Adapter information:	N/A

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
Mobile phone	S9+	/	SAMSUNG	/
Laptop	E485	/	Lenovo	/

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
/	/	/	/	/	/

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	

3 Test Facilities and Accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, 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-E043	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2020/06/04	2021/06/03
MTI-E044	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-1338	2020/06/05	2021/06/04
MTI-E047	Amplifier	Hewlett-Packard	8447F	3113A06150	2020/06/04	2021/06/03
MTI-E089	ESG Vector Signal Generator	Agilent	N5182A	MY49060455	2020/06/03	2021/06/02
MTI-E058	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2020/07/03	2021/07/04
MTI-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2020/06/04	2021/06/03
MTI-E066	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2020/06/04	2021/06/03
MTI-E078	Synthesized Sweeper	Agilent	83752A	3610A01957	2020/06/04	2021/06/03
MTI-E079	DC Power Supply	Agilent	E3632A	MY40027695	2020/06/04	2021/06/03
MTI-E045	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	9120D-2278	2020/06/05	2021/06/04
MTI-E021	EMI Test Receiver	Rohde&schwarz	ESCS30	100210	2020/06/04	2021/06/03
MTI-E022	Pulse Limiter	Schwarzbeck	VSTD 9561-F	00679	2020/06/03	2021/06/02
MTI-E023	Artificial mains network	Schwarzbeck	NSLK 8127	NSLK 8127 #841	2020/06/04	2021/06/03
MTI-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	2020/06/05	2021/06/04
MTI-E048	Amplifier	Agilent	8449B	3008A02400	2020/07/03	2021/07/04
MTI-E072	Thermometer Clock Humidity Monitor	-	HTC-1	/	2020/06/07	2021/06/06
Note: the calibration interval of the above test instruments is 12 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

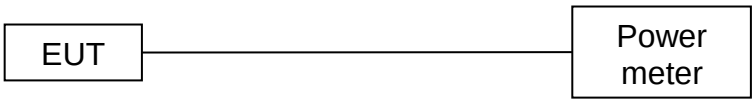
The EUT antenna is FPC antenna. It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.

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	12.61	18.24	12.18	16.52	30	1000
06	2437	12.91	19.54	12.77	18.92		
11	2462	12.52	17.86	12.54	17.95		

802.11g

Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW
01	2412	11.68	14.72	10.10	10.23	30	1000
06	2437	11.96	15.70	10.27	10.64		
11	2462	11.67	14.69	10.31	10.74		

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	9.27	8.45	13.68	23.31	30	1000
06	2437	10.12	10.28	9.54	8.99	12.85	19.28		
11	2462	9.80	9.55	11.68	14.72	13.85	24.27		
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.									

802.11n40

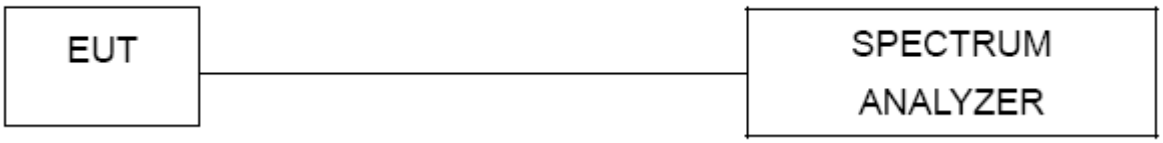
Test Channel	Frequency (MHz)	Output Power (ANT A)		Output Power (ANT B)		Total Power (ANT A + ANT B)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW	dBm	mW
03	2422	11.63	14.55	11.71	14.83	14.68	29.38	30	1000
06	2437	11.82	15.21	11.87	15.38	14.86	30.59		
09	2452	11.72	14.86	11.51	14.16	14.63	29.02		
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.									

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.

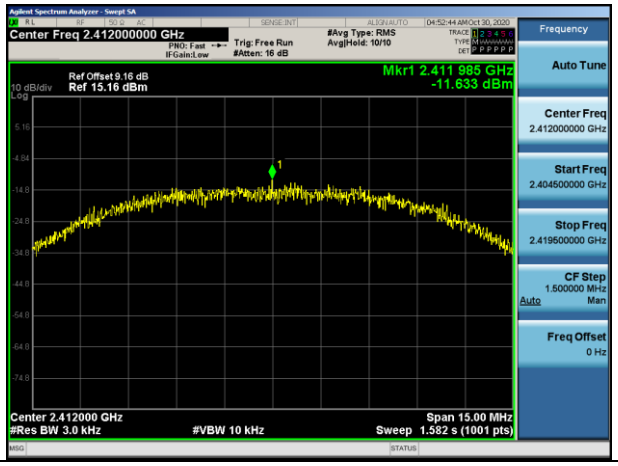
5.3.4 Test Results

802.11b

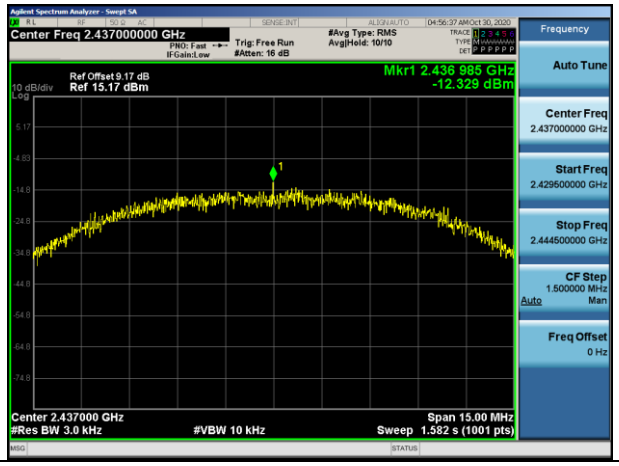
ANT A:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-11.633	8	Pass
CH06	2437	-12.329	8	Pass
CH11	2462	-12.271	8	Pass

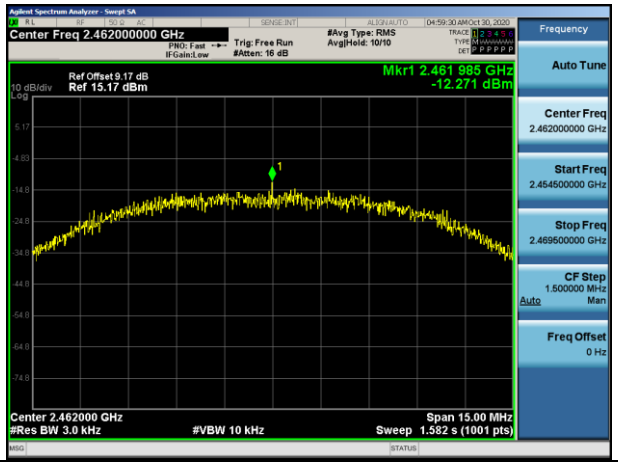
TX CH01



TX CH06



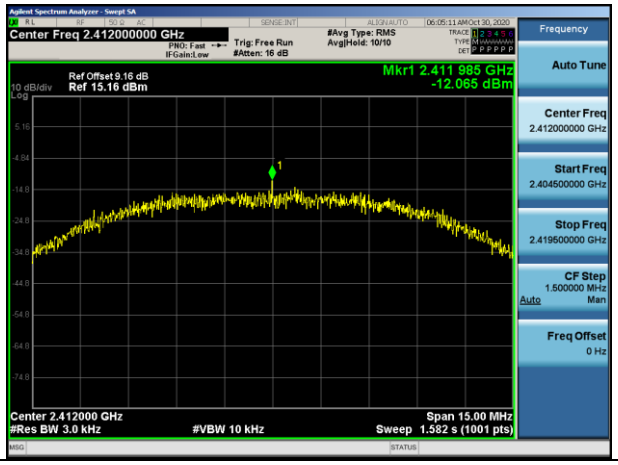
TX CH11



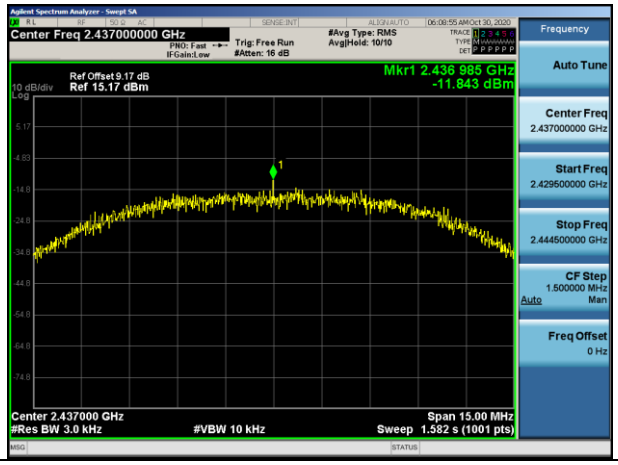
ANT B:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-12.065	8	Pass
CH06	2437	-11.843	8	Pass
CH11	2462	-11.978	8	Pass

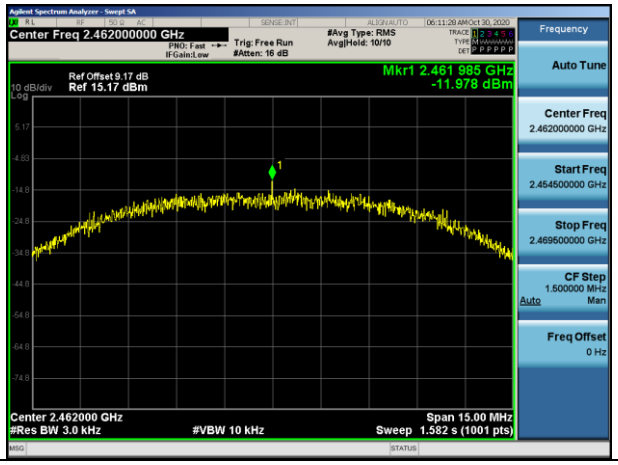
TX CH01



TX CH06



TX CH11

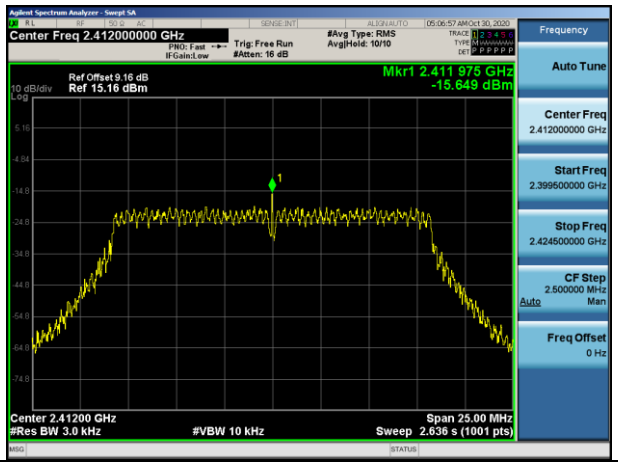


802.11g

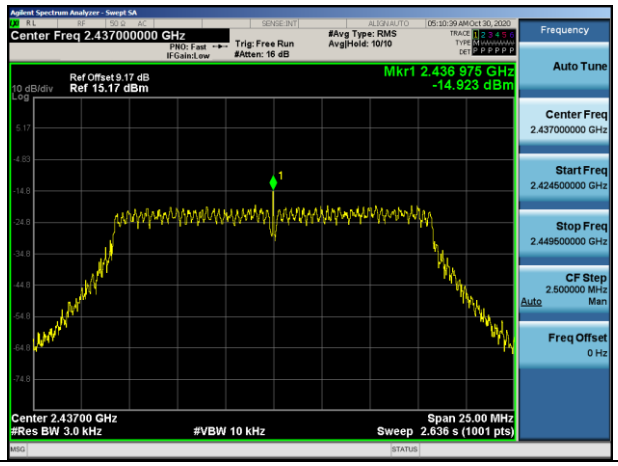
ANT A:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-15.649	8	Pass
CH06	2437	-14.923	8	Pass
CH11	2462	-15.340	8	Pass

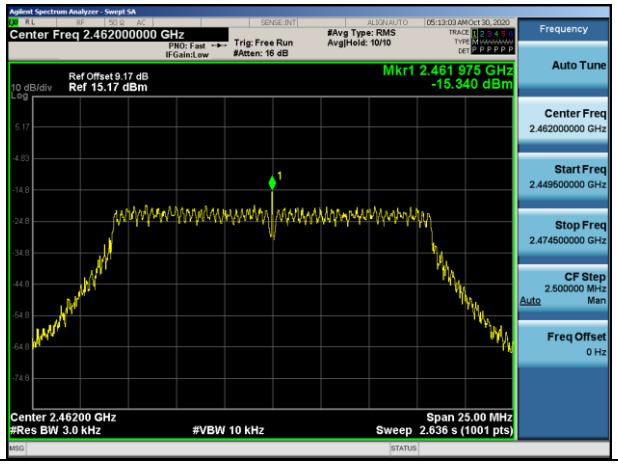
TX CH01



TX CH06



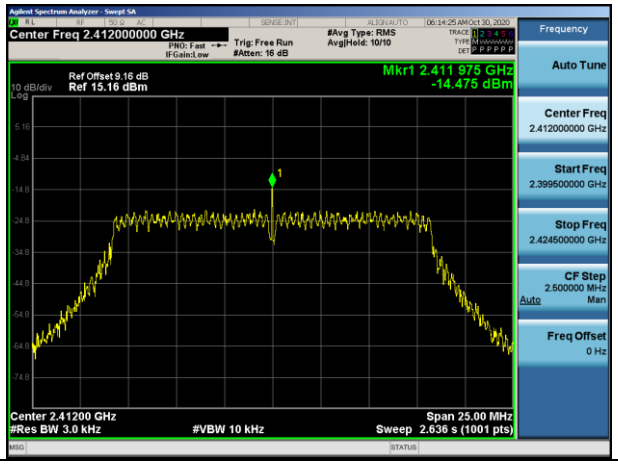
TX CH11



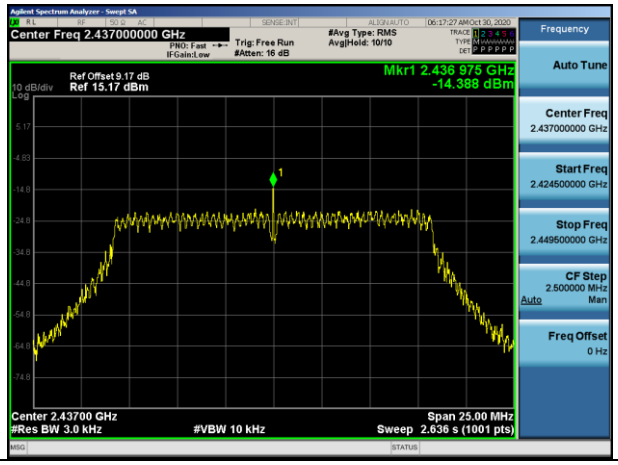
ANT B:

Test Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-14.475	8	Pass
CH06	2437	-14.388	8	Pass
CH11	2462	-14.681	8	Pass

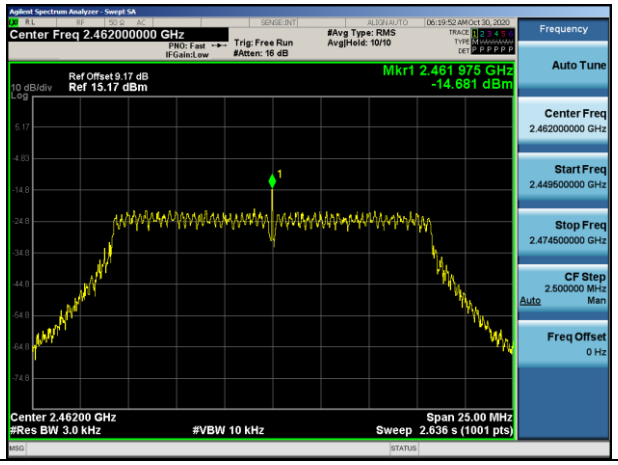
TX CH01



TX CH06



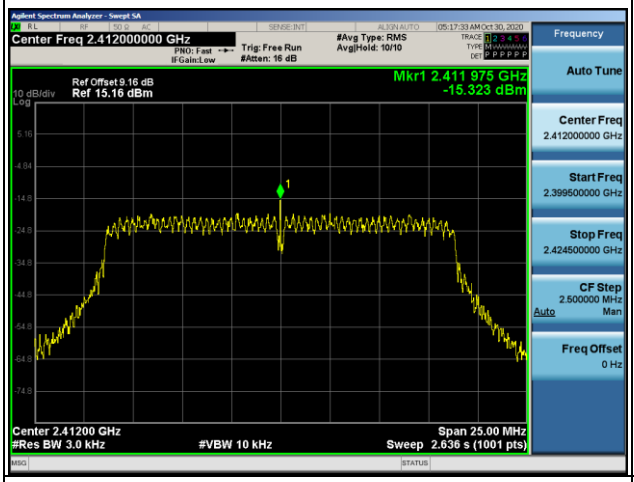
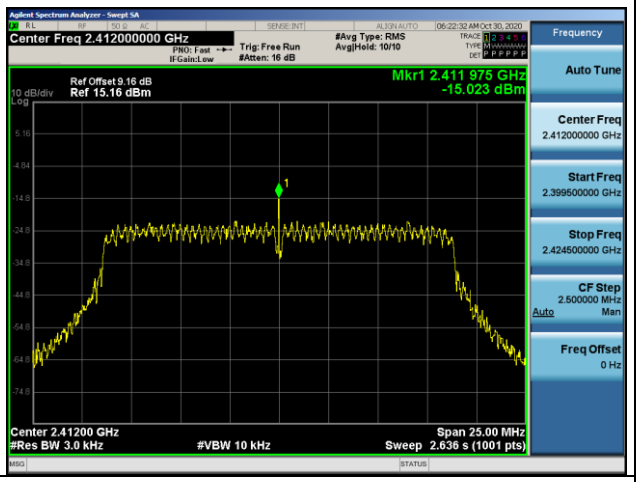
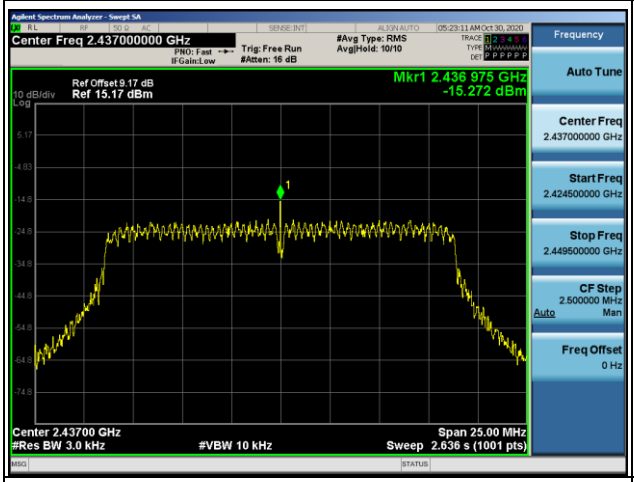
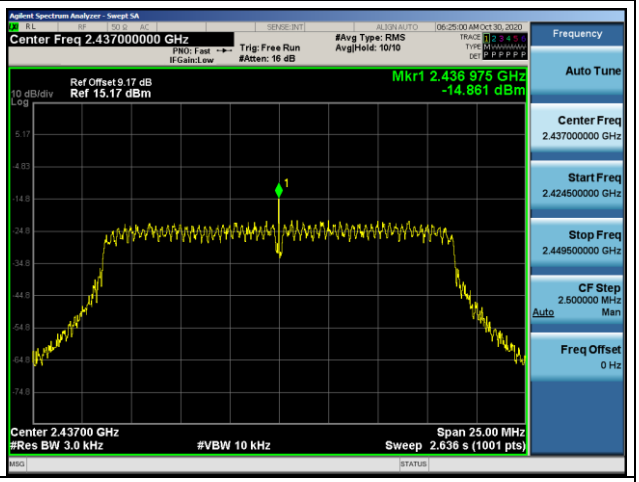
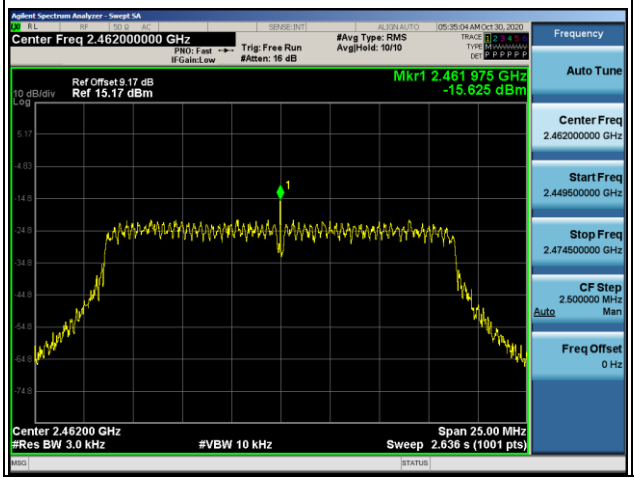
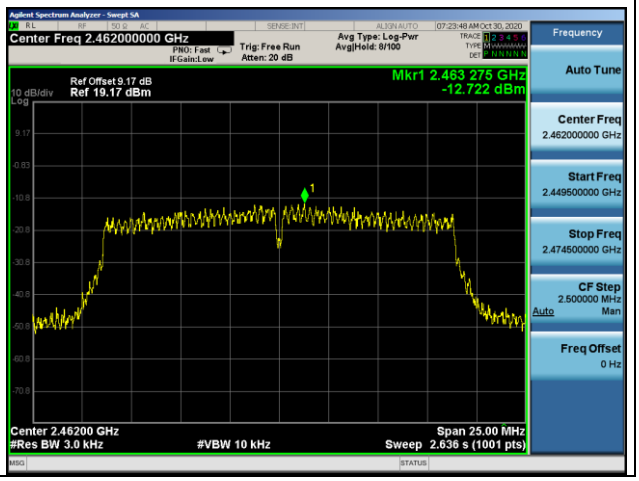
TX CH11



802.11n20

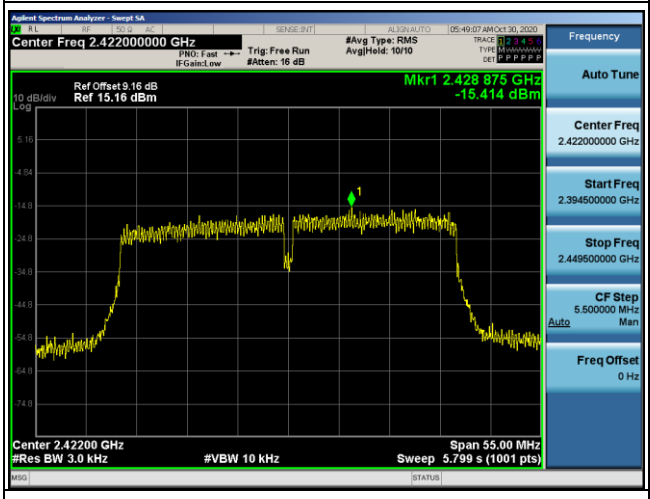
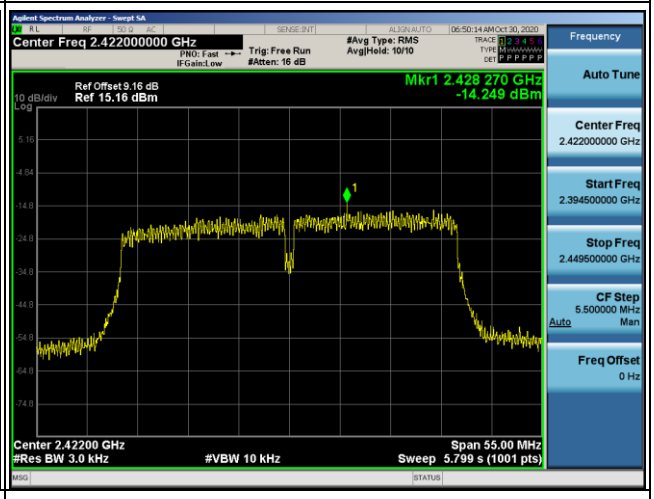
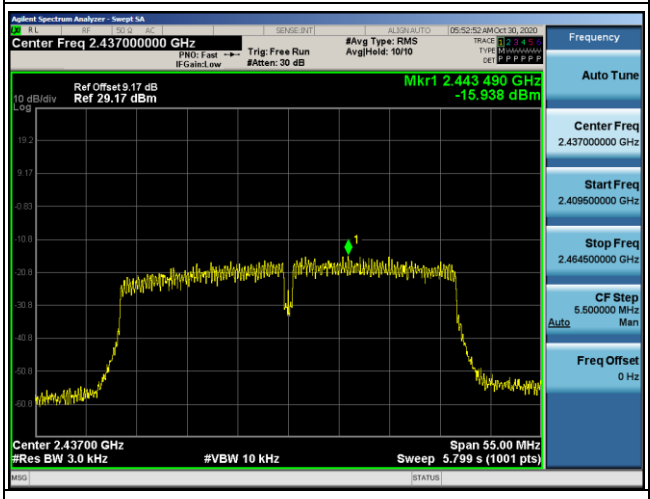
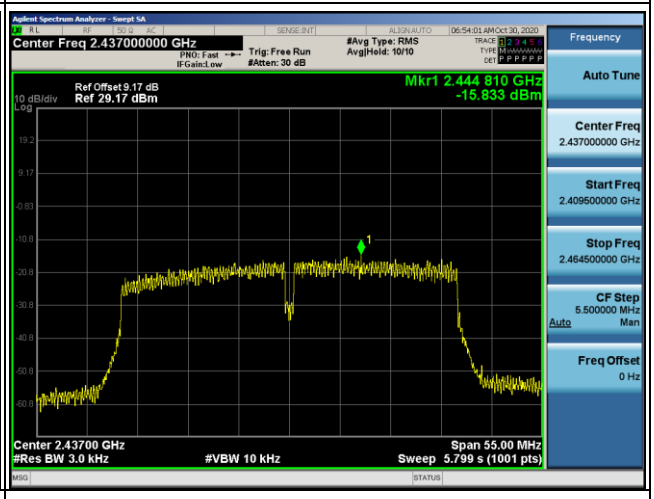
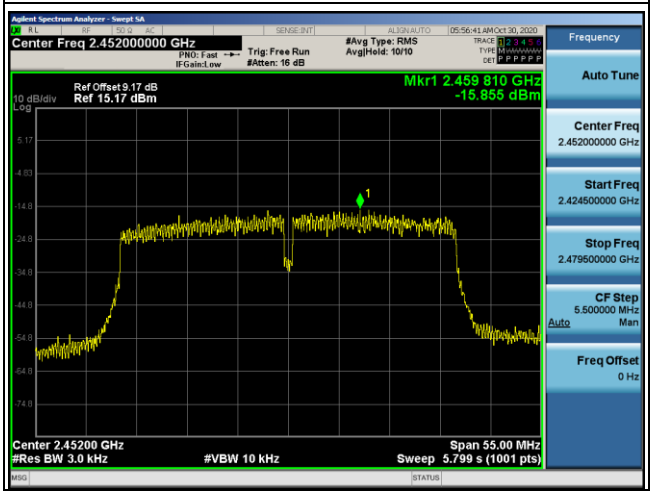
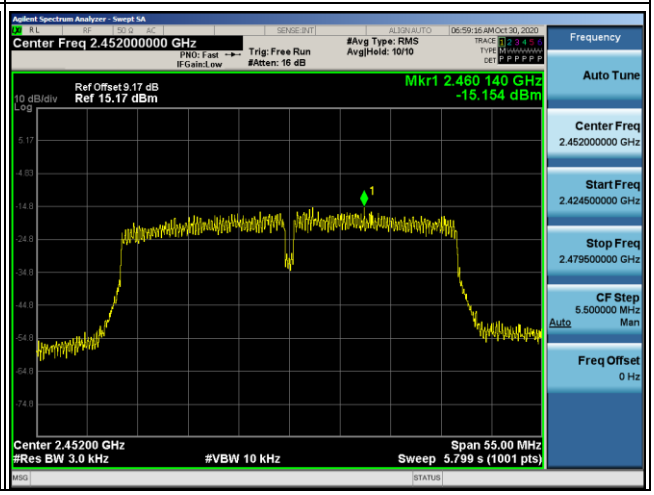
ANT A+ANT B

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	-15.323	-15.023	-12.16	8	Pass
CH06	2437	-15.272	-14.861	-12.05	8	Pass
CH11	2462	-15.625	-12.722	-10.93	8	Pass
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.						

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	-15.414	-14.249	-11.78	8	Pass
CH06	2437	-15.938	-15.833	-12.87	8	Pass
CH09	2452	-15.855	-15.154	-12.48	8	Pass
Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.						

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

5.4 Conducted emission

5.4.1 Limits

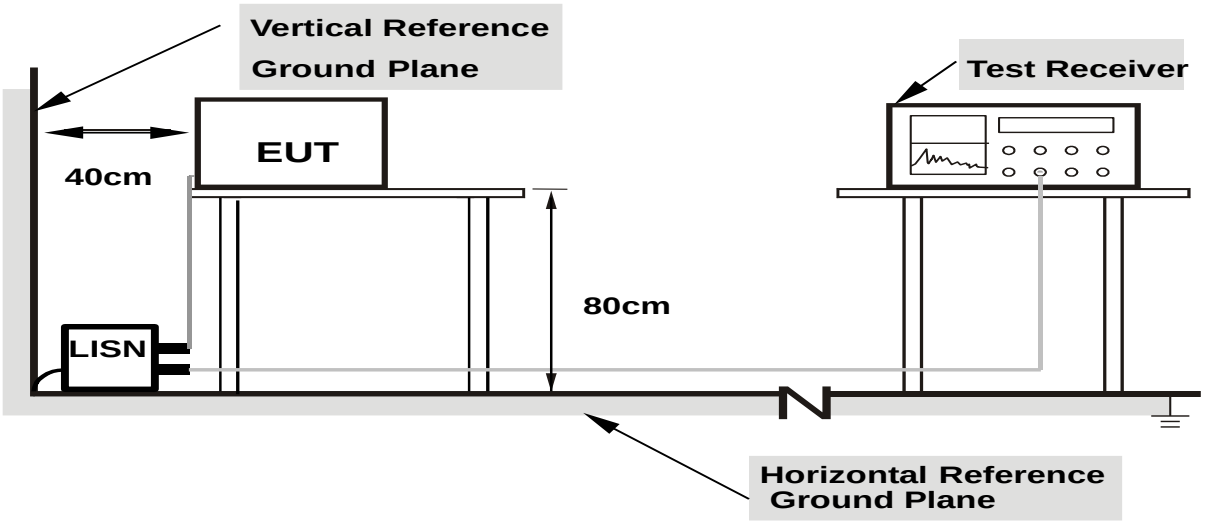
FREQUENCY (MHz)	Class B (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

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.

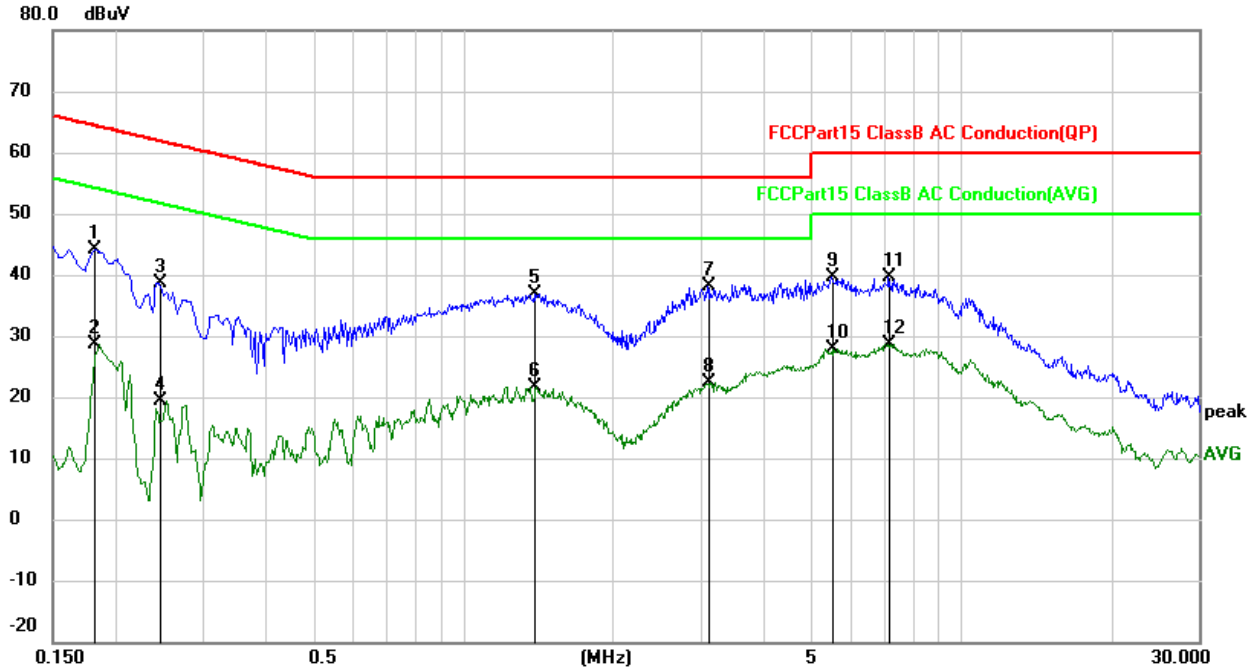
e. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

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.

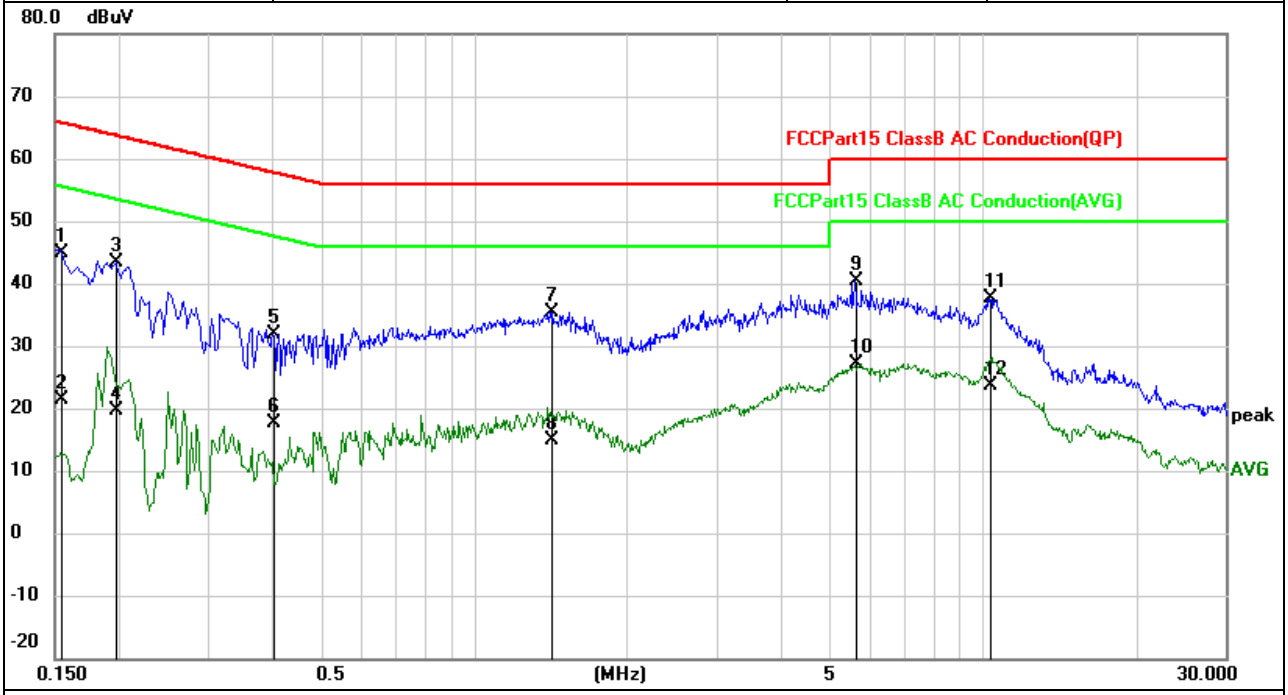
5.4.4 Test results

EUT:	Car OEM Wired CarPlay to Wireless CarPlay	Model Name:	CPC200-AutoKit
Pressure:	1010hPa	Phase :	L
Test Voltage :	DC 5V from PC	Test Mode:	TX



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1819	44.11	0.11	44.22	64.40	-20.18	QP
2		0.1819	28.50	0.11	28.61	54.40	-25.79	AVG
3		0.2460	38.61	0.11	38.72	61.89	-23.17	QP
4		0.2460	19.25	0.11	19.36	51.89	-32.53	AVG
5		1.3940	36.82	0.12	36.94	56.00	-19.06	QP
6		1.3940	21.57	0.12	21.69	46.00	-24.31	AVG
7	*	3.1060	37.98	0.16	38.14	56.00	-17.86	QP
8		3.1060	22.13	0.16	22.29	46.00	-23.71	AVG
9		5.5020	39.29	0.22	39.51	60.00	-20.49	QP
10		5.5020	27.66	0.22	27.88	50.00	-22.12	AVG
11		7.1500	39.30	0.25	39.55	60.00	-20.45	QP
12		7.1500	28.45	0.25	28.70	50.00	-21.30	AVG

EUT:	Car OEM Wired CarPlay to Wireless CarPlay	Model Name:	CPC200-AutoKit
Pressure:	1010hPa	Phase:	N
Test Voltage:	DC 5V from PC	Test Mode:	TX



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1547	44.75	0.11	44.86	65.74	-20.88	QP
2		0.1547	21.16	0.11	21.27	55.74	-34.47	AVG
3		0.1980	43.21	0.11	43.32	63.69	-20.37	QP
4		0.1980	19.47	0.11	19.58	53.69	-34.11	AVG
5		0.4020	31.80	0.11	31.91	57.81	-25.90	QP
6		0.4020	17.41	0.11	17.52	47.81	-30.29	AVG
7		1.4175	35.17	0.12	35.29	56.00	-20.71	QP
8		1.4175	14.79	0.12	14.91	46.00	-31.09	AVG
9	*	5.6177	40.09	0.22	40.31	60.00	-19.69	QP
10		5.6177	26.82	0.22	27.04	50.00	-22.96	AVG
11		10.3300	37.23	0.31	37.54	60.00	-22.46	QP
12		10.3300	23.31	0.31	23.62	50.00	-26.38	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.

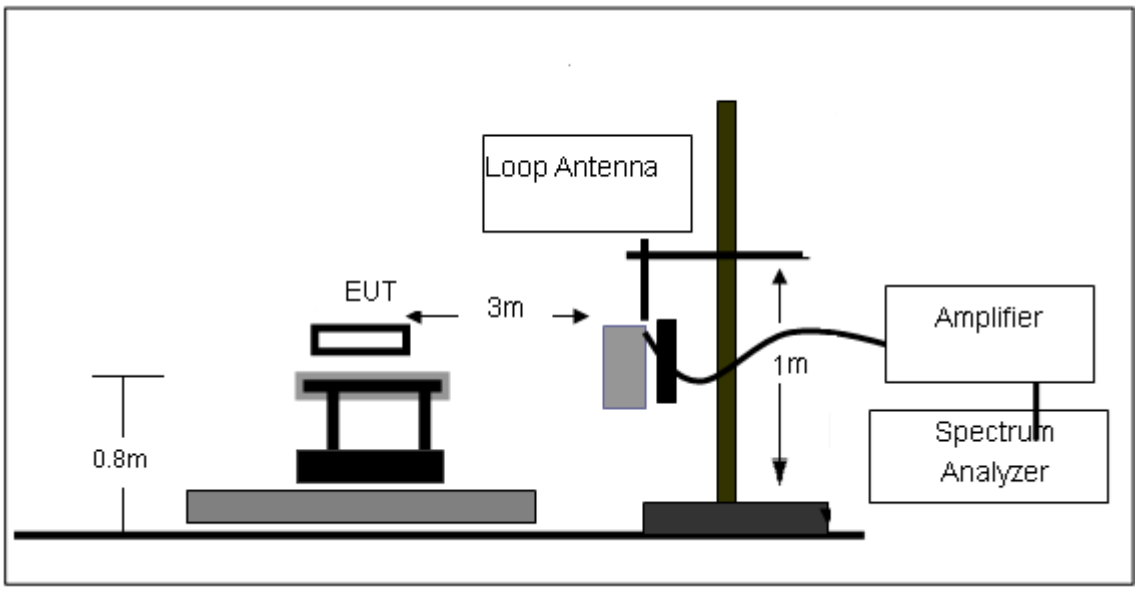
Frequency (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

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

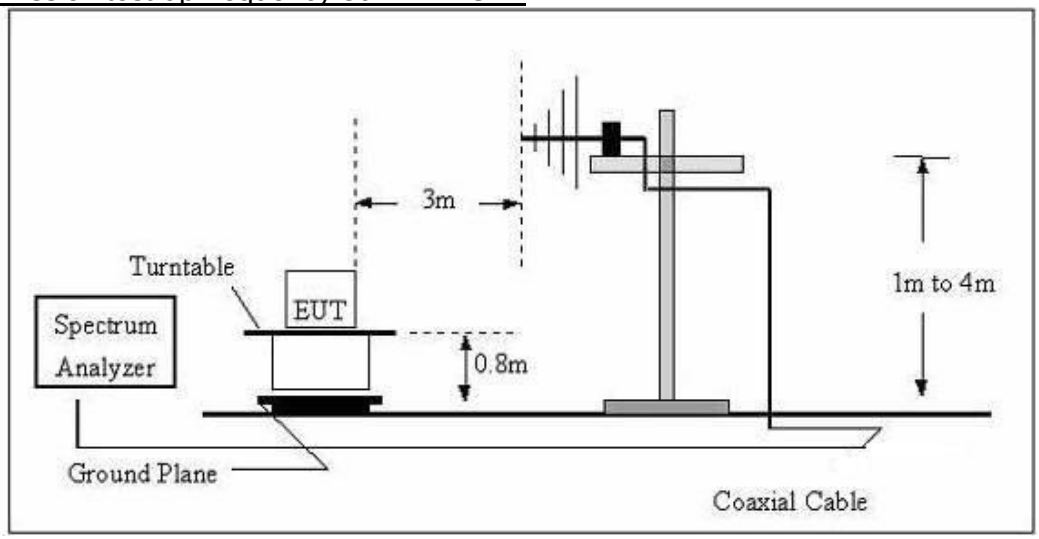
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

5.5.2 Test setup

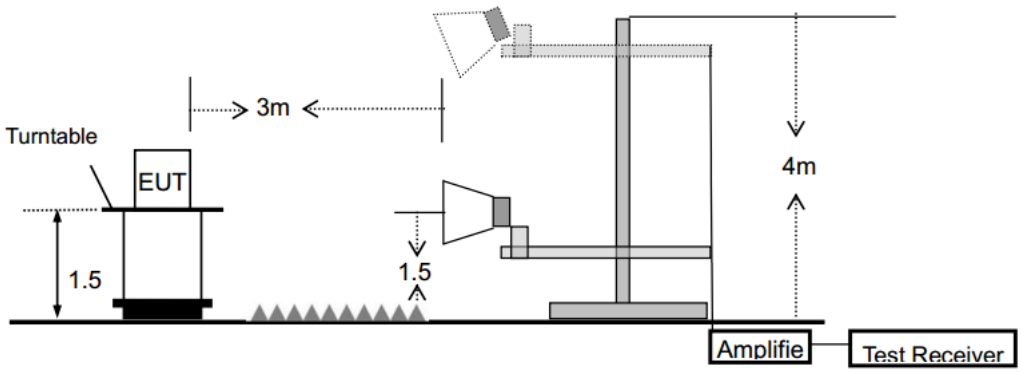
Radiated emission test-up frequency below 30MHz



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

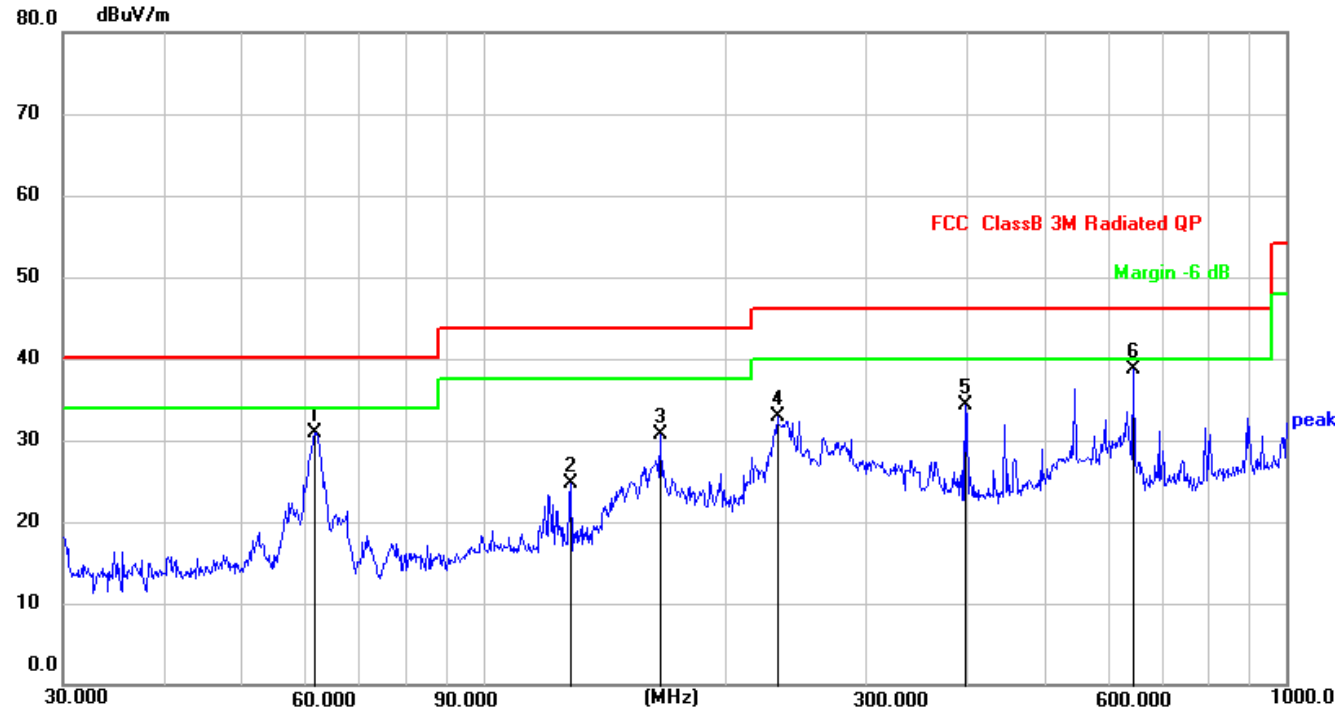
5.5.4 Test results

Between 30MHz – 1GHz

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

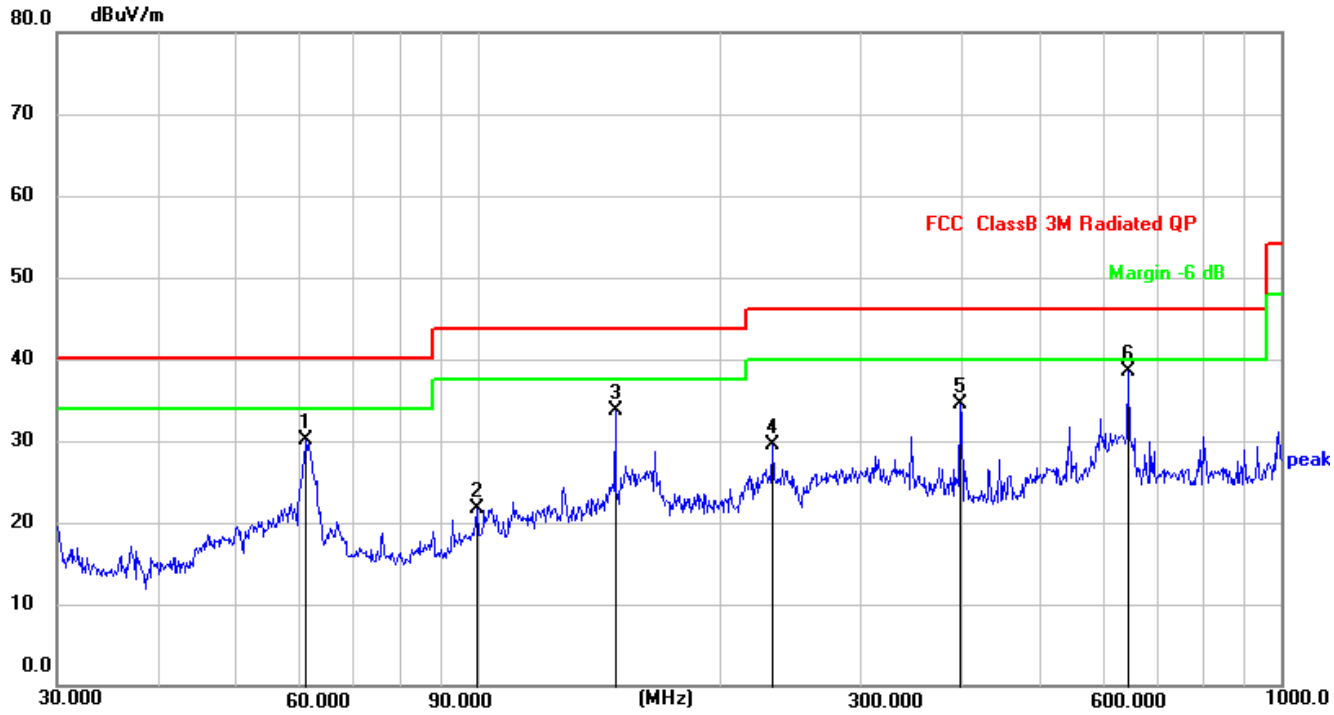
Note2: The following data is the worst mode. The worst data is antenna B 802.11 b 2462MHz.

EUT:	Car OEM Wired CarPlay to Wireless CarPlay	Model Name:	CPC200-AutoKit
Pressure:	1010hPa	Phase:	H
Test Voltage：	DC 5V from PC	Test Mode:	TX



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	61.7779	46.12	-15.17	30.95	40.00	-9.05	QP
2	128.5629	41.53	-16.87	24.66	43.50	-18.84	QP
3	166.0680	46.89	-16.28	30.61	43.50	-12.89	QP
4	232.5318	45.65	-12.67	32.98	46.00	-13.02	QP
5	399.0300	43.31	-9.02	34.29	46.00	-11.71	QP
6 *	645.1194	42.98	-4.22	38.76	46.00	-7.24	QP

EUT:	Car OEM Wired CarPlay to Wireless CarPlay	Model Name：	CPC200-AutoKit
Pressure:	1010hPa	Phase ：	V
Test Voltage:	DC 5V from PC	Test Mode：	TX



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	61.1315	45.02	-14.98	30.04	40.00	-9.96	QP
2	99.8777	36.46	-14.78	21.68	43.50	-21.82	QP
3	148.4410	51.10	-17.48	33.62	43.50	-9.88	QP
4	232.5318	42.24	-12.67	29.57	46.00	-16.43	QP
5	399.0300	43.55	-9.02	34.53	46.00	-11.47	QP
6 *	645.1194	42.74	-4.22	38.52	46.00	-7.48	QP

1G-25GHz
Note1: Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Note2: Both antenna A and antenna B have been tested and the report only shows the worst mode. The worst case data is Antenna B 802.11b.

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)(802.11b)--Above 1G									
4824.161	63.01	4.36	32.92	45.53	54.76	74.00	-19.24	Pk	Vertical
4824.161	43.28	4.36	32.92	45.53	35.03	54.00	-18.97	AV	Vertical
7236.396	60.36	5.02	37.63	45.56	57.45	74.00	-16.55	Pk	Vertical
7236.396	41.13	5.02	37.63	45.56	38.22	54.00	-15.78	AV	Vertical
4824.154	62.70	4.36	32.92	45.53	54.45	74.00	-19.55	Pk	Horizontal
4824.154	42.53	4.36	32.92	45.53	34.28	54.00	-19.72	AV	Horizontal
7236.168	63.74	5.02	37.63	45.56	60.83	74.00	-13.17	Pk	Horizontal
7236.168	42.98	5.02	37.63	45.56	40.07	54.00	-13.93	AV	Horizontal
Middle Channel (2437 MHz)(802.11b)--Above 1G									
4874.112	62.94	4.41	33.01	45.76	54.60	74.00	-19.40	Pk	Vertical
4874.112	43.47	4.41	33.01	45.76	35.13	54.00	-18.87	AV	Vertical
7311.247	59.84	5.02	37.68	45.59	56.95	74.00	-17.05	Pk	Vertical
7311.247	41.37	5.02	37.68	45.59	38.48	54.00	-15.52	AV	Vertical
4874.132	63.37	4.41	33.01	45.76	55.03	74.00	-18.97	Pk	Horizontal
4874.132	44.28	4.41	33.01	45.76	35.94	54.00	-18.06	AV	Horizontal
7311.085	61.72	5.02	37.68	45.59	58.83	74.00	-15.17	Pk	Horizontal
7311.085	43.13	5.02	37.68	45.59	40.24	54.00	-13.76	AV	Horizontal
High Channel (2462 MHz)(802.11b)--Above 1G									
4924.169	64.06	4.50	33.26	46.07	55.75	74.00	-18.25	Pk	Vertical
4924.169	43.48	4.50	33.26	46.07	35.17	54.00	-18.83	AV	Vertical
7386.215	60.81	5.02	37.78	45.77	57.84	74.00	-16.16	Pk	Vertical
7386.215	41.12	5.02	37.78	45.77	38.15	54.00	-15.85	AV	Vertical
4924.045	64.28	4.50	33.26	46.07	55.97	74.00	-18.03	Pk	Horizontal
4924.045	44.83	4.50	33.26	46.07	36.52	54.00	-17.48	AV	Horizontal
7386.132	60.81	5.02	37.78	45.77	57.84	74.00	-16.16	Pk	Horizontal
7386.132	43.14	5.02	37.78	45.77	40.17	54.00	-13.83	AV	Horizontal

802.11n40:

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 (2422 MHz)(802.11b)--Above 1G									
4844.102	64.18	5.21	35.59	44.3	60.68	74	-13.32	Pk	Vertical
4844.102	43.35	5.21	35.59	44.3	39.85	54	-14.15	AV	Vertical
7266.319	61.16	6.48	36.27	44.6	59.31	74	-14.69	Pk	Vertical
7266.319	40.81	6.48	36.27	44.6	38.96	54	-15.04	AV	Vertical
4844.354	63.97	5.21	35.55	44.3	60.43	74	-13.57	Pk	Horizontal
4844.354	45.48	5.21	35.55	44.3	41.94	54	-12.06	AV	Horizontal
7266.257	61.35	6.48	36.27	44.52	59.58	74	-14.42	Pk	Horizontal
7266.257	43.19	6.48	36.27	44.52	41.42	54	-12.58	AV	Horizontal
Low Channel (2437 MHz)(802.11b)--Above 1G									
4874.112	64.21	5.21	35.66	44.2	60.88	74	-13.12	Pk	Vertical
4874.112	43.26	5.21	35.66	44.2	39.93	54	-14.07	AV	Vertical
7311.247	60.87	7.1	36.5	44.43	60.04	74	-13.96	Pk	Vertical
7311.247	41.04	7.1	36.5	44.43	40.21	54	-13.79	AV	Vertical
4874.132	63.68	5.21	35.66	44.2	60.35	74	-13.65	Pk	Horizontal
4874.132	45.35	5.21	35.66	44.2	42.02	54	-11.98	AV	Horizontal
7311.085	61.01	7.1	36.5	44.43	60.18	74	-13.82	Pk	Horizontal
7311.085	42.63	7.1	36.5	44.43	41.80	54	-12.20	AV	Horizontal
Low Channel (2452 MHz)(802.11b)--Above 1G									
4904.139	63.76	5.21	35.52	44.21	60.28	74	-13.72	Pk	Vertical
4904.139	43.91	5.21	35.52	44.21	40.43	54	-13.57	AV	Vertical
7356.211	60.71	7.1	36.53	44.6	59.74	74	-14.26	Pk	Vertical
7356.211	40.68	7.1	36.53	44.6	39.71	54	-14.29	AV	Vertical
4904.147	64.21	5.21	35.52	44.21	60.73	74	-13.27	Pk	Horizontal
4904.147	44.64	5.21	35.52	44.21	41.16	54	-12.84	AV	Horizontal
7356.162	61.31	7.1	36.53	44.6	60.34	74	-13.66	Pk	Horizontal
7356.162	42.41	7.1	36.53	44.6	41.44	54	-12.56	AV	Horizontal

5.5.4.1 Band edge - radiated

Note1: Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Note2: Both antenna A and antenna B have been tested and the report only shows the worst mode. The worst case data is the antenna A & B MIMO mode.

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	59.13	2.40	27.70	40.40	48.83	74	-25.17	Pk	Horizontal
2310.00	43.99	2.40	27.70	40.40	33.69	54	-20.31	AV	Horizontal
2310.00	59.07	2.40	27.70	40.40	48.77	74	-25.23	Pk	Vertical
2310.00	41.86	2.40	27.70	40.40	31.56	54	-22.44	AV	Vertical
2390.00	57.61	2.44	28.30	40.10	48.25	74	-25.75	Pk	Vertical
2390.00	41.73	2.44	28.30	40.10	32.37	54	-21.63	AV	Vertical
2390.00	56.78	2.44	28.30	40.10	47.42	74	-26.58	Pk	Horizontal
2390.00	41.74	2.44	28.30	40.10	32.38	54	-21.62	AV	Horizontal
2483.50	57.71	2.48	28.70	39.80	49.09	74	-24.91	Pk	Vertical
2483.50	42.96	2.48	28.70	39.80	34.34	54	-19.66	AV	Vertical
2483.50	58.89	2.48	28.70	39.80	50.27	74	-23.73	Pk	Horizontal
2483.50	41.78	2.48	28.70	39.80	33.16	54	-20.84	AV	Horizontal
2500.00	58.83	2.48	29.05	39.80	50.56	74	-23.44	Pk	Vertical
2500.00	41.88	2.48	29.05	39.80	33.61	54	-20.39	AV	Vertical
2500.00	59.03	2.48	29.05	39.80	50.76	74	-23.24	Pk	Horizontal
2500.00	41.29	2.48	29.05	39.80	33.02	54	-20.98	AV	Horizontal

802.11g									
2310.00	59.17	2.40	27.70	40.40	48.87	74	-25.13	Pk	Horizontal
2310.00	44.27	2.40	27.70	40.40	33.97	54	-20.03	AV	Horizontal
2310.00	56.89	2.40	27.70	40.40	46.59	74	-27.41	Pk	Vertical
2310.00	42.46	2.40	27.70	40.40	32.16	54	-21.84	AV	Vertical
2390.00	58.20	2.44	28.30	40.10	48.84	74	-25.16	Pk	Vertical
2390.00	41.67	2.44	28.30	40.10	32.31	54	-21.69	AV	Vertical
2390.00	58.36	2.44	28.30	40.10	49.00	74	-25.00	Pk	Horizontal
2390.00	43.57	2.44	28.30	40.10	34.21	54	-19.79	AV	Horizontal
2483.50	58.84	2.48	28.70	39.80	50.22	74	-23.78	Pk	Vertical
2483.50	43.87	2.48	28.70	39.80	35.25	54	-18.75	AV	Vertical
2483.50	58.92	2.48	28.70	39.80	50.30	74	-23.70	Pk	Horizontal
2483.50	42.19	2.48	28.70	39.80	33.57	54	-20.43	AV	Horizontal
2500.00	59.21	2.48	29.05	39.80	50.94	74	-23.06	Pk	Vertical
2500.00	41.60	2.48	29.05	39.80	33.33	54	-20.67	AV	Vertical
2500.00	58.80	2.48	29.05	39.80	50.53	74	-23.47	Pk	Horizontal
2500.00	41.65	2.48	29.05	39.80	33.38	54	-20.62	AV	Horizontal
802.11n20									
2310.00	58.24	2.40	27.70	40.40	47.94	74	-26.06	Pk	Horizontal
2310.00	44.30	2.40	27.70	40.40	34.00	54	-20.00	AV	Horizontal
2310.00	58.83	2.40	27.70	40.40	48.53	74	-25.47	Pk	Vertical
2310.00	42.32	2.40	27.70	40.40	32.02	54	-21.98	AV	Vertical
2390.00	57.70	2.44	28.30	40.10	48.34	74	-25.66	Pk	Vertical
2390.00	41.83	2.44	28.30	40.10	32.47	54	-21.53	AV	Vertical
2390.00	56.32	2.44	28.30	40.10	46.96	74	-27.04	Pk	Horizontal
2390.00	42.15	2.44	28.30	40.10	32.79	54	-21.21	AV	Horizontal
2483.50	58.14	2.48	28.70	39.80	49.52	74	-24.48	Pk	Vertical
2483.50	42.97	2.48	28.70	39.80	34.35	54	-19.65	AV	Vertical
2483.50	59.31	2.48	28.70	39.80	50.69	74	-23.31	Pk	Horizontal
2483.50	41.92	2.48	28.70	39.80	33.30	54	-20.70	AV	Horizontal
2500.00	59.26	2.48	29.05	39.80	50.99	74	-23.01	Pk	Vertical
2500.00	41.54	2.48	29.05	39.80	33.27	54	-20.73	AV	Vertical
2500.00	58.77	2.48	29.05	39.80	50.50	74	-23.50	Pk	Horizontal
2500.00	41.72	2.48	29.05	39.80	33.45	54	-20.55	AV	Horizontal

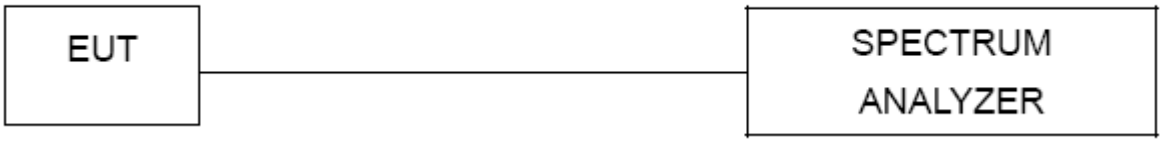
802.11n40									
2310.00	59.59	2.40	27.70	40.40	49.29	74	-24.71	Pk	Horizontal
2310.00	44.69	2.40	27.70	40.40	34.39	54	-19.61	AV	Horizontal
2310.00	57.47	2.40	27.70	40.40	47.17	74	-26.83	Pk	Vertical
2310.00	42.93	2.40	27.70	40.40	32.63	54	-21.37	AV	Vertical
2390.00	57.95	2.44	28.30	40.10	48.59	74	-25.41	Pk	Vertical
2390.00	42.51	2.44	28.30	40.10	33.15	54	-20.85	AV	Vertical
2390.00	58.72	2.44	28.30	40.10	49.36	74	-24.64	Pk	Horizontal
2390.00	43.33	2.44	28.30	40.10	33.97	54	-20.03	AV	Horizontal
2483.50	58.91	2.48	28.70	39.80	50.29	74	-23.71	Pk	Vertical
2483.50	44.57	2.48	28.70	39.80	35.95	54	-18.05	AV	Vertical
2483.50	58.89	2.48	28.70	39.80	50.27	74	-23.73	Pk	Horizontal
2483.50	42.55	2.48	28.70	39.80	33.93	54	-20.07	AV	Horizontal
2500.00	58.91	2.48	29.05	39.80	50.64	74	-23.36	Pk	Vertical
2500.00	42.15	2.48	29.05	39.80	33.88	54	-20.12	AV	Vertical
2500.00	59.33	2.48	29.05	39.80	51.06	74	-22.94	Pk	Horizontal
2500.00	41.84	2.48	29.05	39.80	33.57	54	-20.43	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

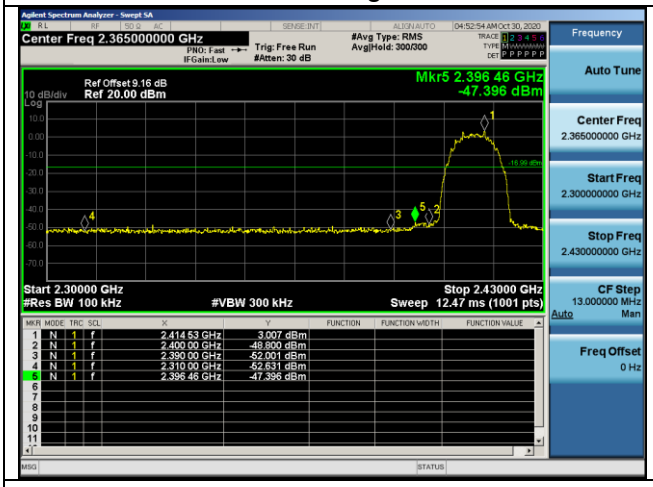
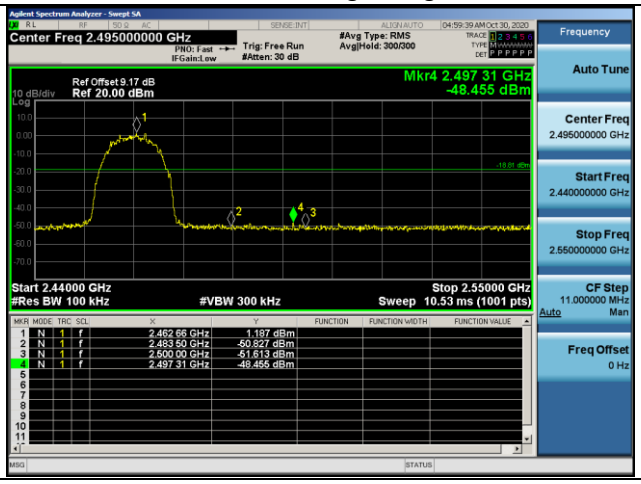
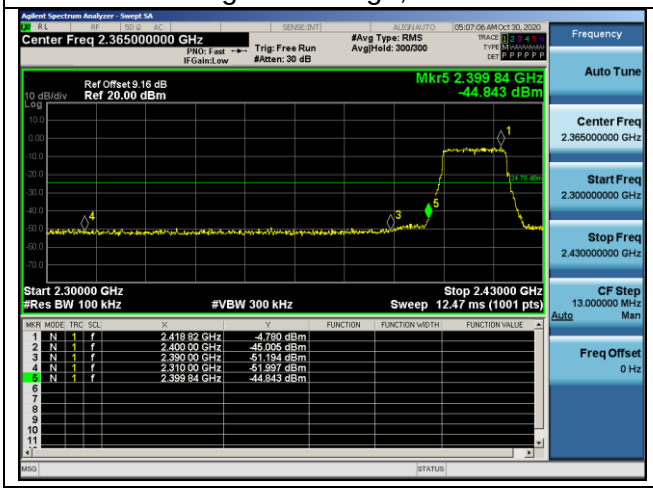
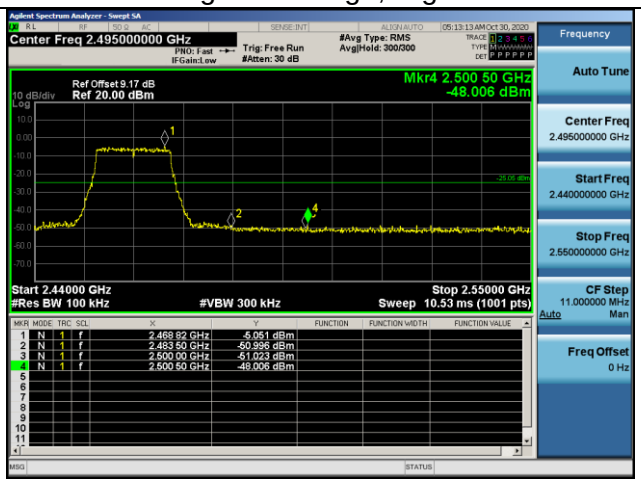


5.6.3 Test procedure

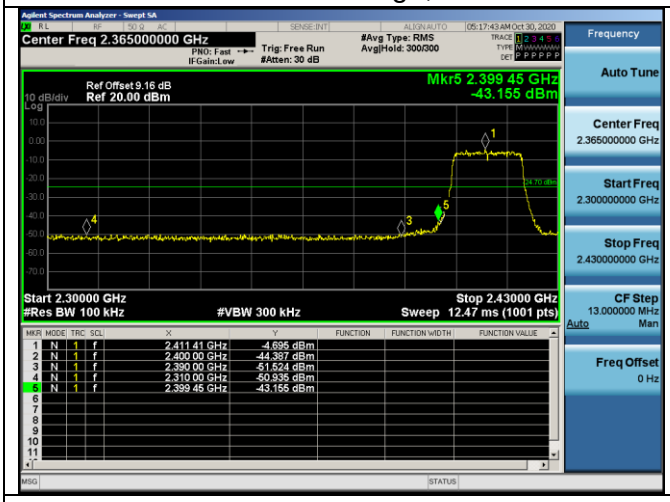
a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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

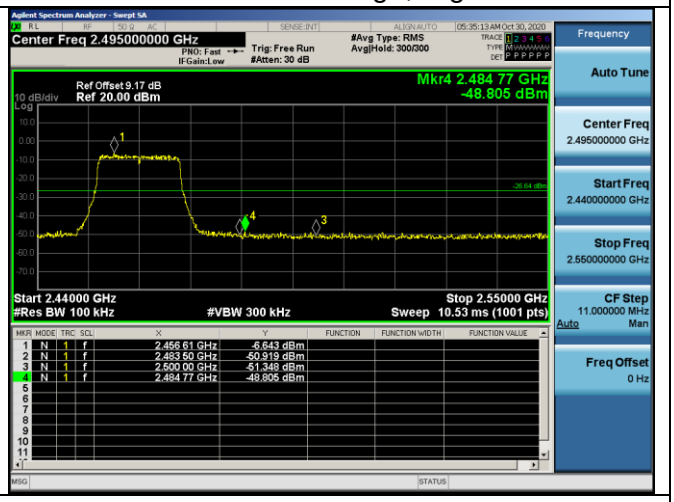
For ANT A

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

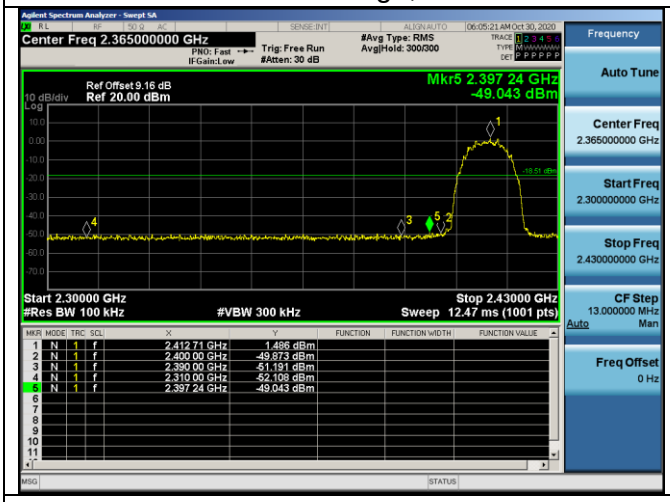


802.11n40: Band Edge, Left Side

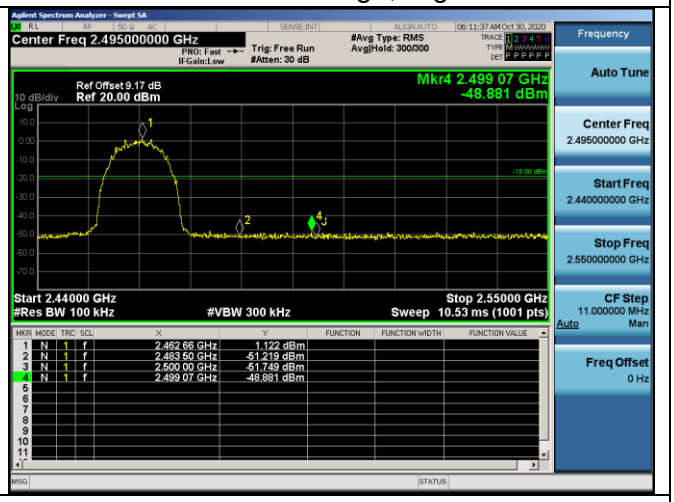
802.11n40: Band Edge, Right Side

For ANT B

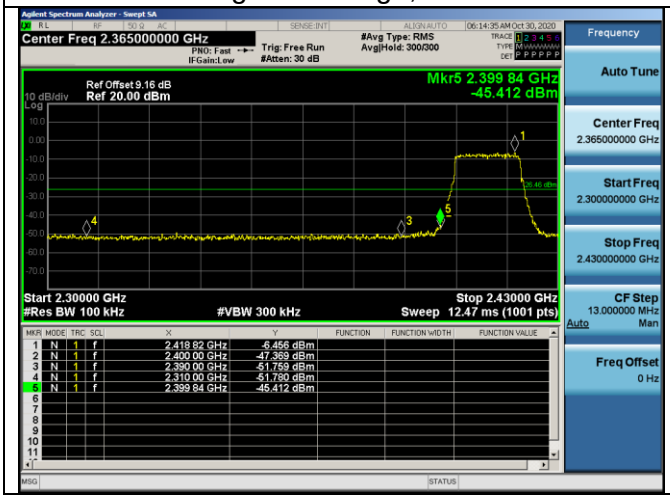
802.11b: Band Edge, Left Side



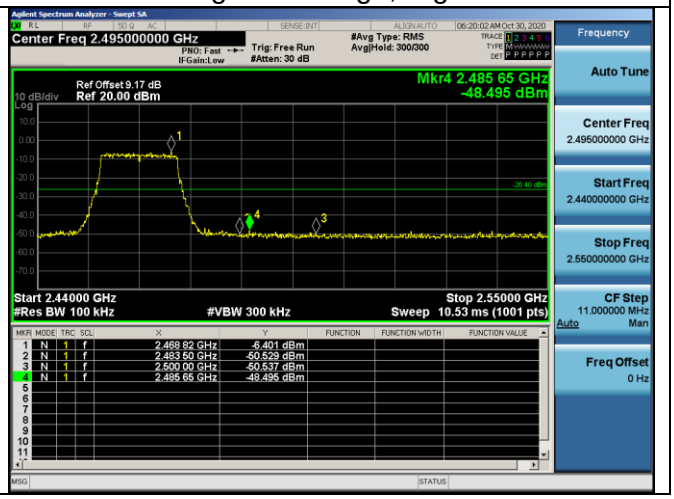
802.11b: Band Edge, Right Side



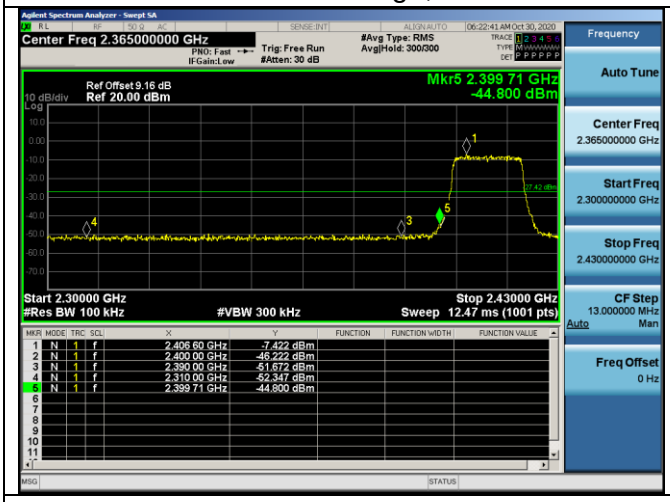
802.11g: Band Edge, Left Side



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.

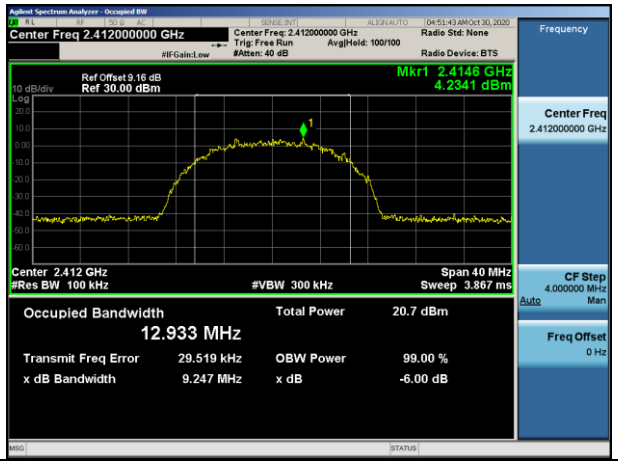
5.7.4 Test results

802.11b

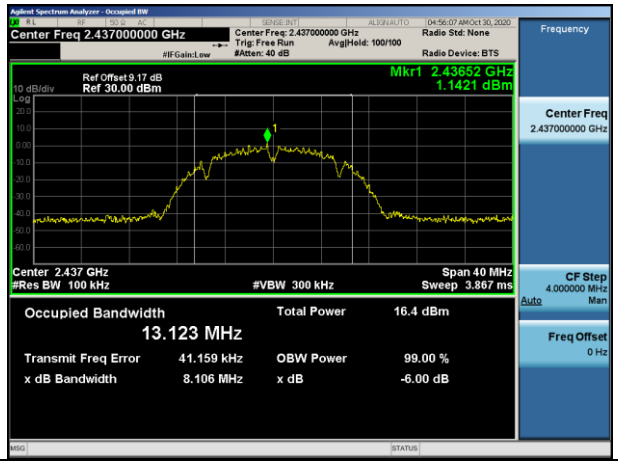
ANT A:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	9.247	500	Pass
CH06	2437	8.106	500	Pass
CH11	2462	10.15	500	Pass

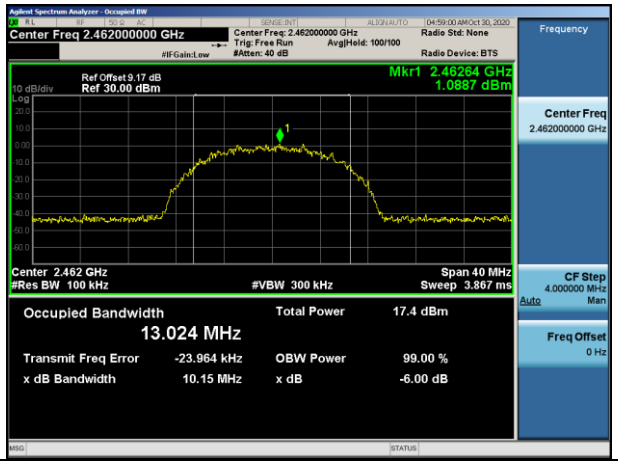
TX CH01



TX CH06



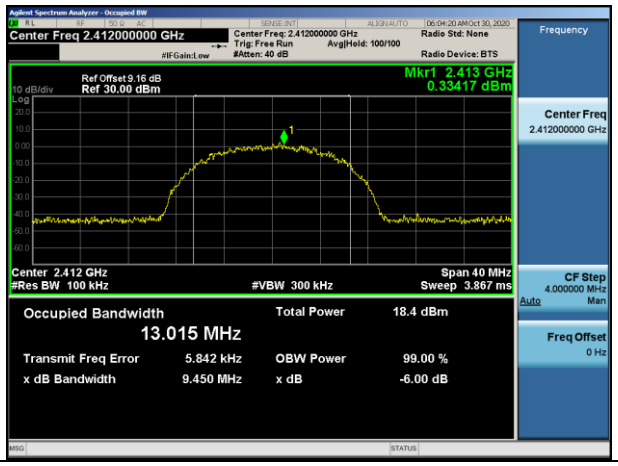
TX CH11



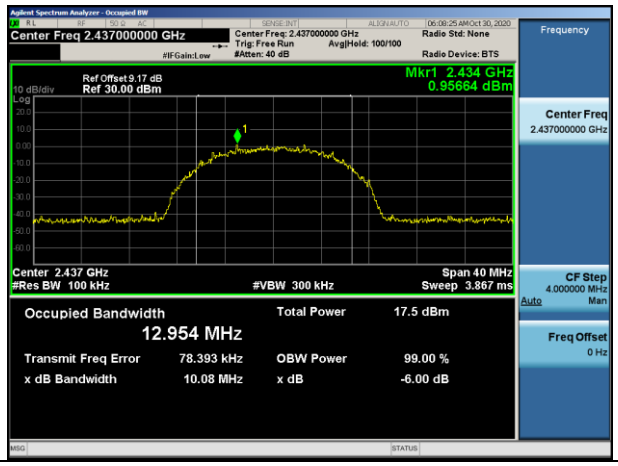
ANT B:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	9.450	500	Pass
CH06	2437	10.08	500	Pass
CH11	2462	10.08	500	Pass

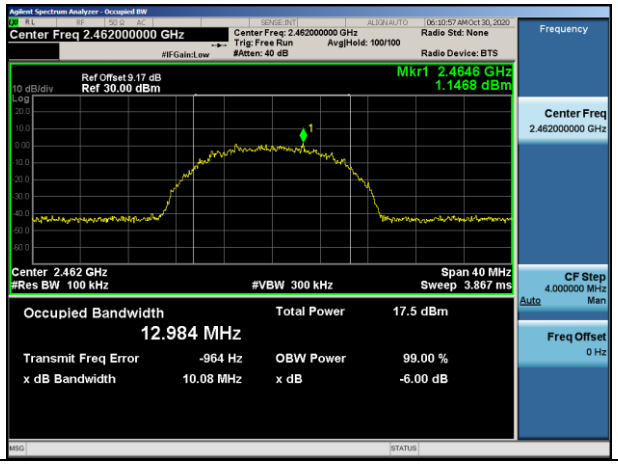
TX CH01



TX CH06



TX CH11

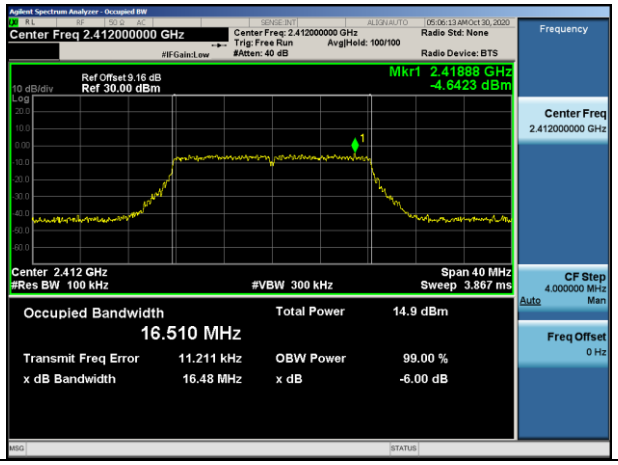


802.11g

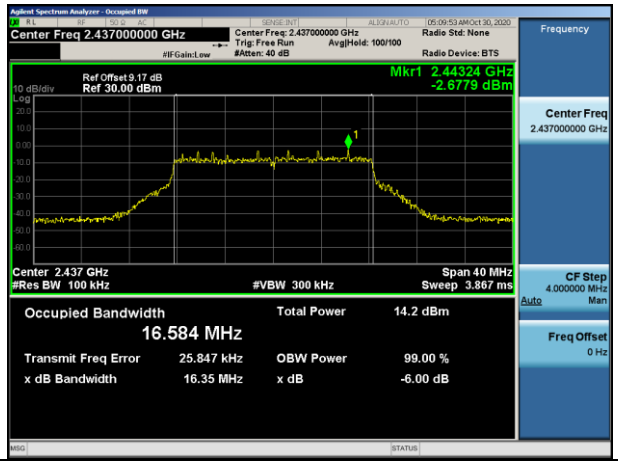
ANT A:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.48	500	Pass
CH06	2437	16.35	500	Pass
CH11	2462	16.51	500	Pass

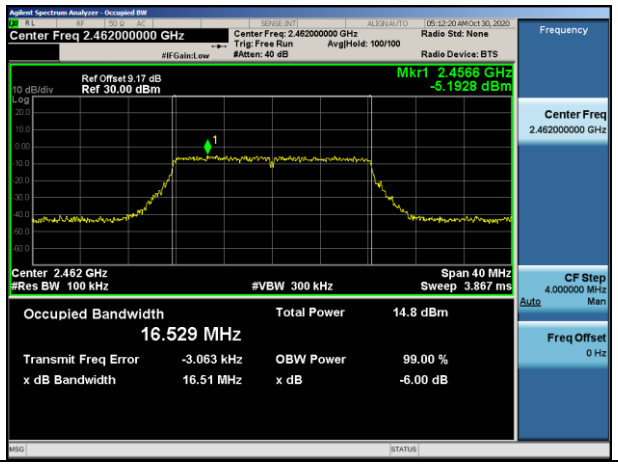
TX CH01



TX CH06



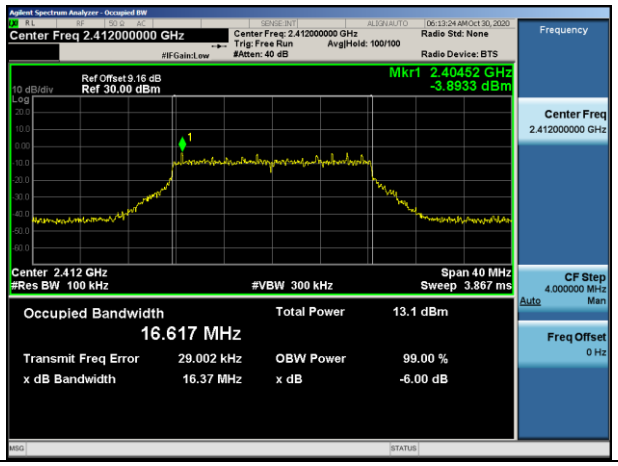
TX CH11



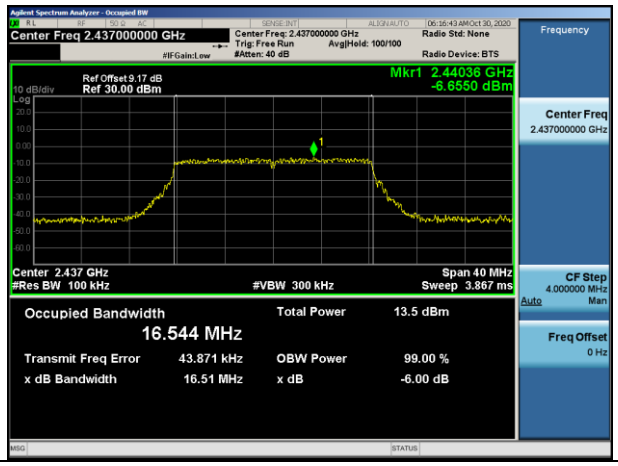
ANT B:

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	16.37	500	Pass
CH06	2437	16.51	500	Pass
CH11	2462	16.50	500	Pass

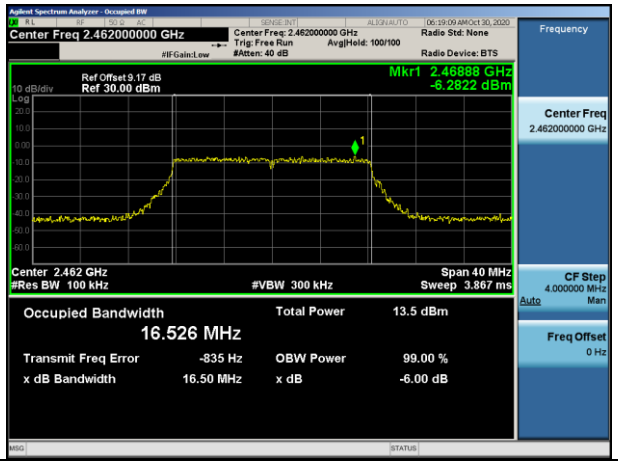
TX CH01



TX CH06



TX CH11

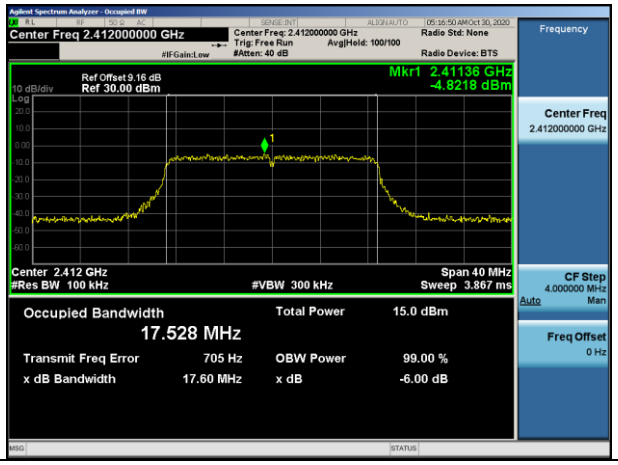


For 802.11n20

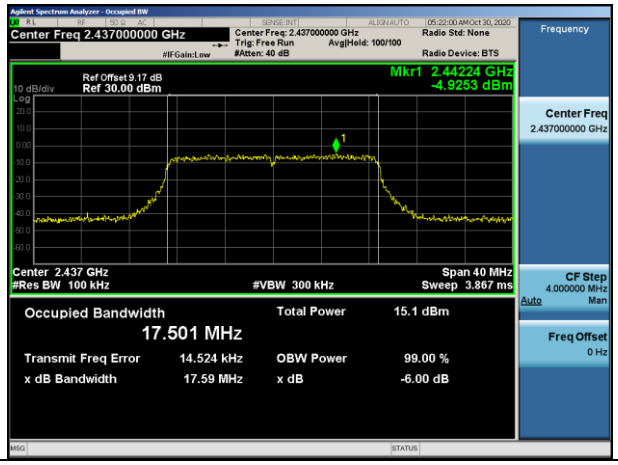
ANTA

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	17.60	500	Pass
CH06	2437	17.59	500	Pass
CH11	2462	17.30	500	Pass

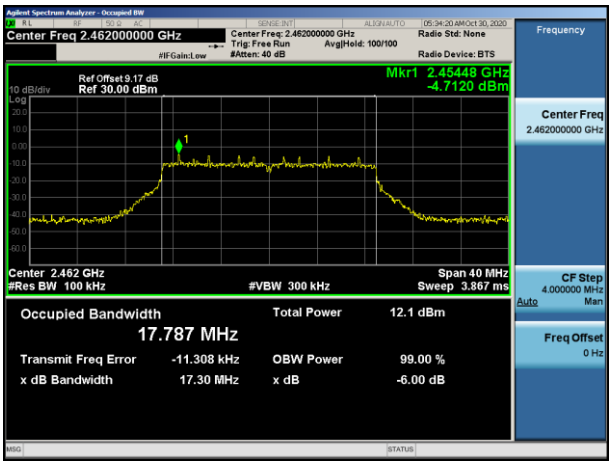
TX CH01



TX CH06



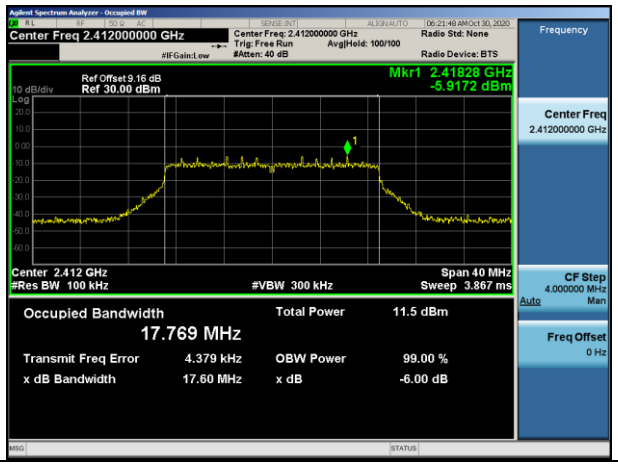
TX CH11



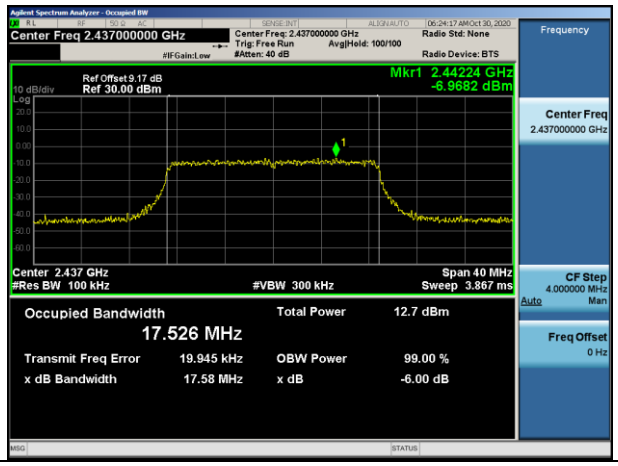
ANTB

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	17.60	500	Pass
CH06	2437	17.58	500	Pass
CH11	2462	17.59	500	Pass

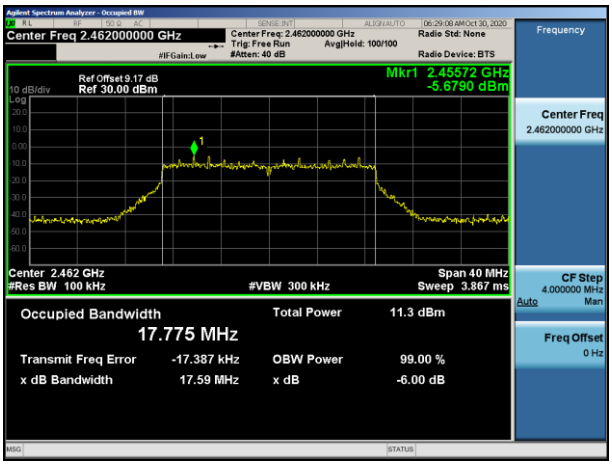
TX CH01



TX CH06



TX CH11

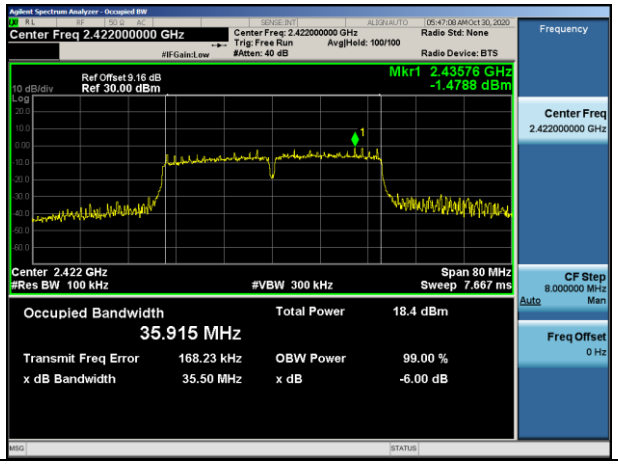


For 802.11n40

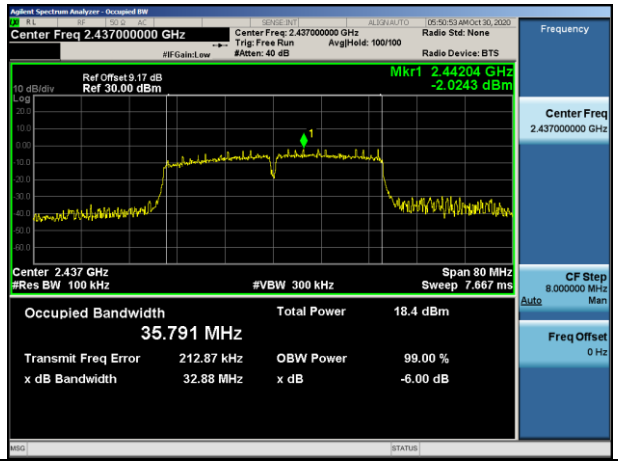
ANTA

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH03	2422	35.50	500	Pass
CH06	2437	32.88	500	Pass
CH09	2452	35.24	500	Pass

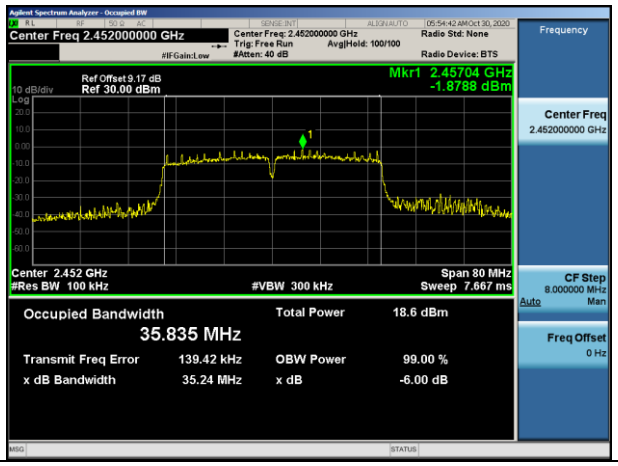
TX CH01



TX CH06



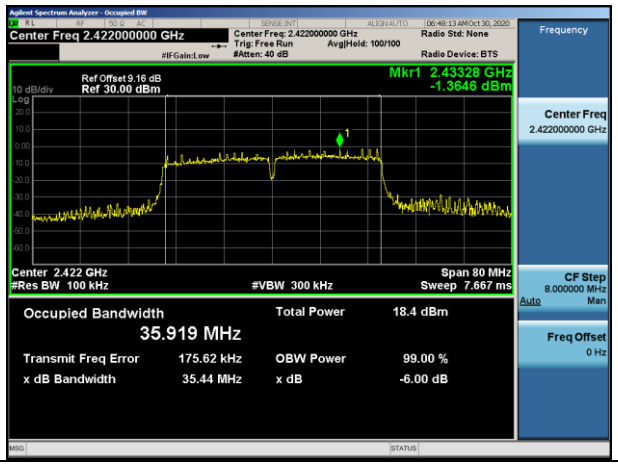
TX CH11



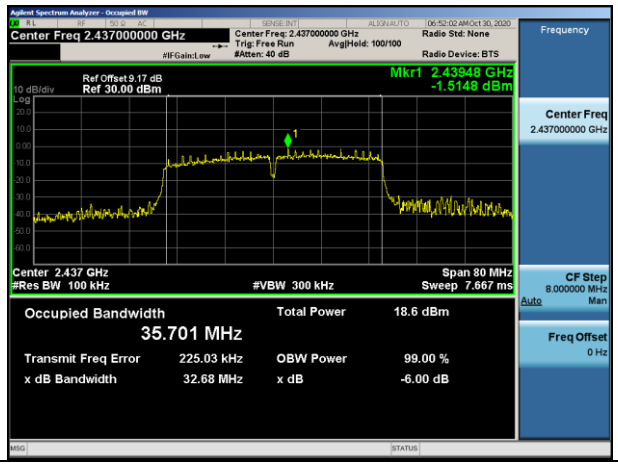
ANTB

Test Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH03	2422	35.44	500	Pass
CH06	2437	32.68	500	Pass
CH09	2452	35.36	500	Pass

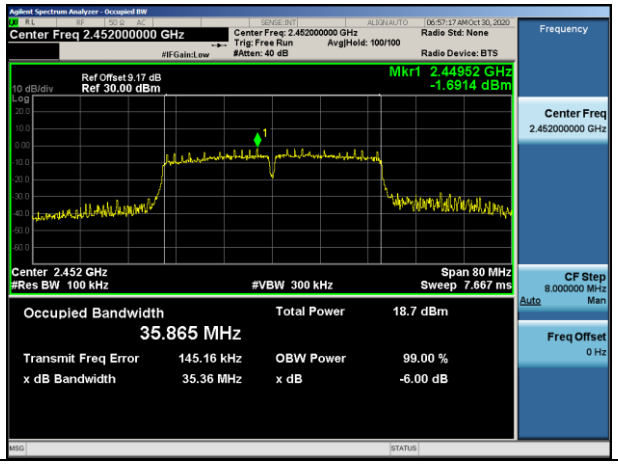
TX CH01



TX CH06



TX CH11



5.8 Duty Cycle

5.8.1 Conformance Limit

No limit requirement.

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 zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

The transmitter output is connected to the Spectrum Analyzer. We tested accroding to the zero-span measurement method, 6.0(b) in KDB 558074

The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/T.

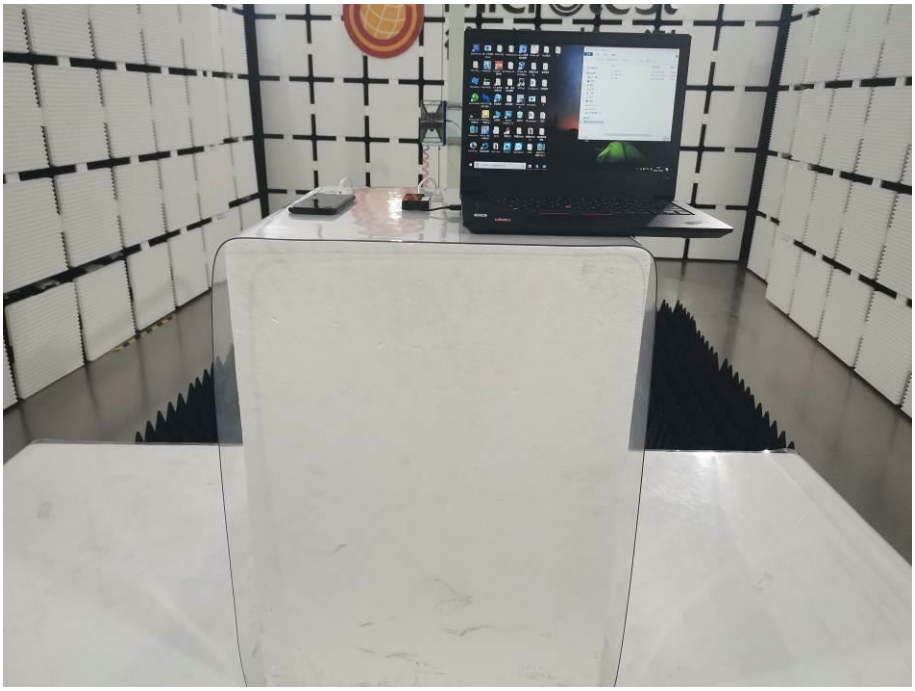
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = Zero Span
RBW = 8MHz (the largest available value)
VBW = 8MHz (≥ RBW)
Number of points in Sweep >100
Detector function = peak
Trace = Clear write
Measure Ttotal and Ton
Calculate Duty Cycle = Ton / Ttotal

5.8.5 Test Results

Mode	Data rate	Channel	Ton	Ttotal	Duty Cycle	Duty Cycle Factor (dB)	VBW Setting
802.11b	1Mbps	6	-	-	100%	0	10Hz
802.11g	6Mbps	6	-	-	100%	0	10Hz
802.11n HT20	MCS0	6	-	-	100%	0	10Hz
802.11n HT40	MCS0	6	-	-	100%	0	10Hz

Photographs of the Test Setup

Radiated emission



Conducted emission


Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi20091717-2E1-1.

----END OF REPORT----