

TEST REPORT

Reference No..... : WTD21D09098668W001
FCC ID : 2ADCSIFC67X1
Applicant..... : SMART Wireless Computing Inc.
Address..... : 39870 Eureka Dr, Newark, CA 94560, United States of America
Manufacturer : SMART Wireless Computing Inc.
Address..... : 39870 Eureka Dr, Newark, CA 94560, United States of America
Product..... : System on Module-IFC67X1
Model(s). : IFC67X1
Standards..... : FCC CFR47 Part 15.247
Date of Receipt sample : 2021-09-16
Date of Test : 2021-09-16 to 2021-11-12
Date of Issue..... : 2021-11-12
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD21D09098668 W001	2021-09-16	2021-09-16 to 2021-11-12	2021-11-12	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	System on Module-IFC67X1
Model(s):	IFC67X1
Wi-Fi Specification:	2.4G-802.11b/g/n HT20/n HT40 5G-802.11a/n/ac HT20 /n/ac HT40 / ac HT80/ ac HT80+ HT80
GNSS:	Support
Bluetooth Version:	Bluetooth v5.0 with BLE
Hardware Version:	IFC67X1-XX-PX
Software Version:	Android 9.0

4.2 Details of E.U.T.

Operation Frequency:	WiFi: 802.11b/g/n HT20: 2412~2462MHz 802.11n HT40: 2422~2452MHz BLE:2402-2480MHz
Max. RF output power:	WiFi(2.4G): ANT 0: 17.97dBm ANT 1: 18.05dBm Total:21.02dBm BLE: 4.43 dBm
Type of Modulation:	WiFi: DSSS, OFDM BLE:GFSK
Antenna installation:	WiFi/BLE: Stamped Metal Antenna,PCB printed antenna
Antenna Gain:	PCB printed antenna (2.1dBi), Stamped Metal Antenna (0.6dBi)
Ratings:	DC 3.3V

4.3 Channel List

WIFI

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462	12	-

BT BLE

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

4.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Power Spectral Density	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
6dB Bandwidth	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Band Edge	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Transmitter Spurious Emissions	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX

Table 2 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	BT BLE	1 Mbps	0/19/39	TX
Power Spectral Density	BT BLE	1 Mbps	0/19/39	TX
6dB Bandwidth	BT BLE	1 Mbps	0/19/39	TX
Band Edge	BT BLE	1 Mbps	0/19/39	TX
Transmitter Spurious Emissions	BT BLE	1 Mbps	0/19/39	TX

Note :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product .

5 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.247(d) 15.205(a) 15.209(a)	PASS
Conducted Spurious Emissions	15.247(d)	PASS
Conducted Emissions	15.207(a)	N/A
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

6 Equipment Used during Test

6.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP30	100091	2021-04-26	2022-04-25
2	Amplifier	Agilent	8447D	2944A10178	2021-04-26	2022-04-25
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2021-08-23	2022-08-22
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2021-04-26	2022-04-25
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2021-04-26	2022-04-25
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2021-07-30	2022-07-29
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2021-07-26	2022-07-25
8	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	NA	2021-04-26	2022-04-25
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2021-04-26	2022-04-25
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2020-10-31 2021-10-28	2021-10-29 2022-10-27
3	Active Loop Antenna	Com-Power Corp.	AL-130R	10160007	2021-04-26	2022-04-25
4	Amplifier	ANRITSU	MH648A	M43381	2021-04-26	2022-04-25
5	Cable	HUBER+SUHNER	CBL2	525178	2021-04-26	2022-04-25
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2021-04-26	2022-04-25
2.	Spectrum Analyzer	R&S	FSP30	100091	2021-04-26	2022-04-25
3.	EXA Signal Analyzer	Malaysia Keysight	N9010A	MY50520207	2021-04-26	2022-04-25

6.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
Computer	Dell	K053	/
Mouse	Lenovo	AP01	/
Transfer/carrier board	SMART Wireless Computing Inc.	/	/

6.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Conducted Spurious Emissions test	± 3.12 dB (9kHz~30MHz)
	± 4.21 dB (30M~1000MHz)
	± 5.14 dB (1000M~26500MHz)

6.4 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Testing Group Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476. Certificate Number: 4243.01

Waltek Testing Group Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

6.5 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
 ANSI C63.10:2013
 Test Result: PASS
 Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C
 Humidity: 52.1 % RH
 Atmospheric Pressure: 101.2kPa

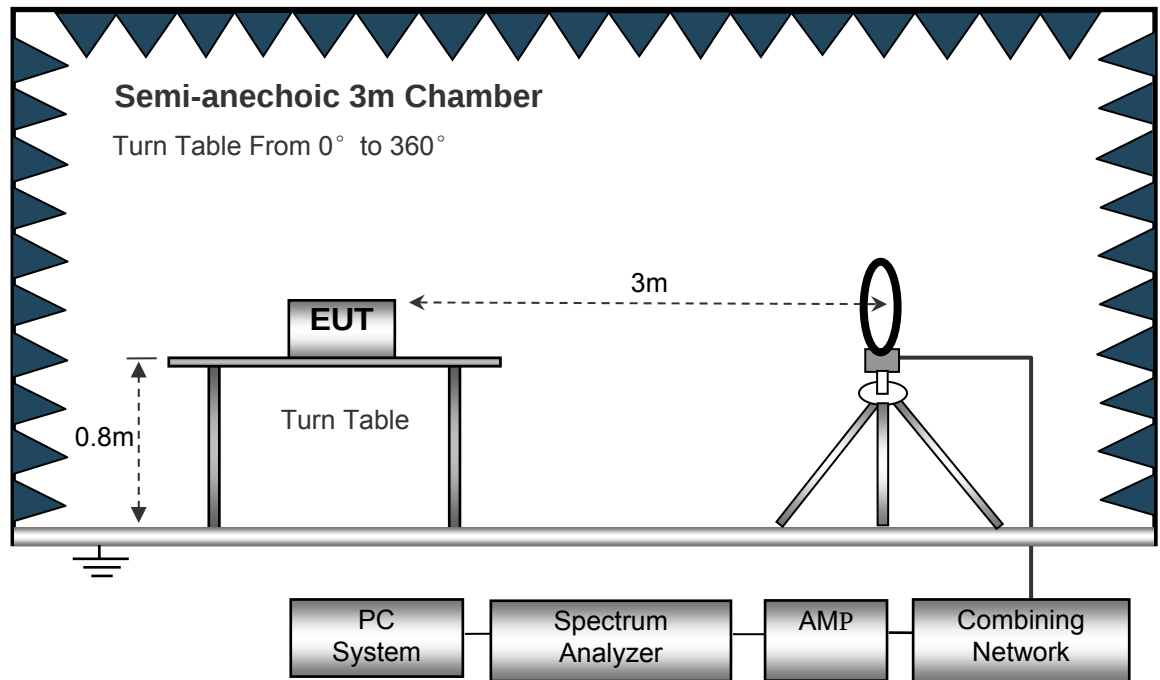
EUT Operation :

The test was performed in WIFI link and BLE link mode, the test data were shown in the report.

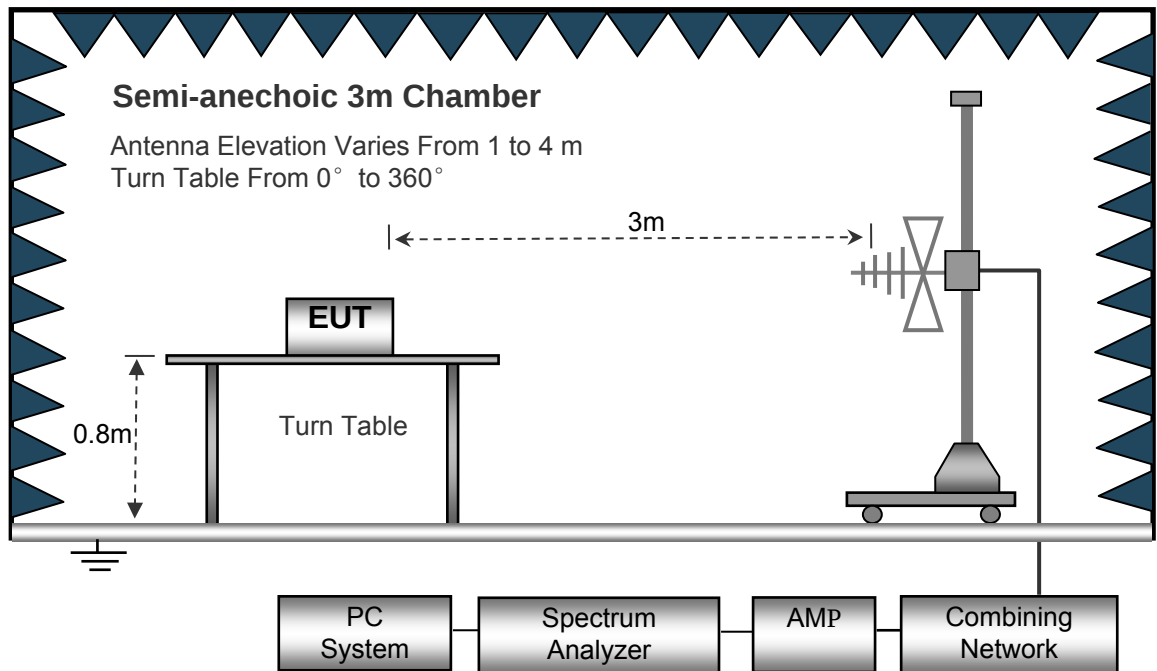
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10.

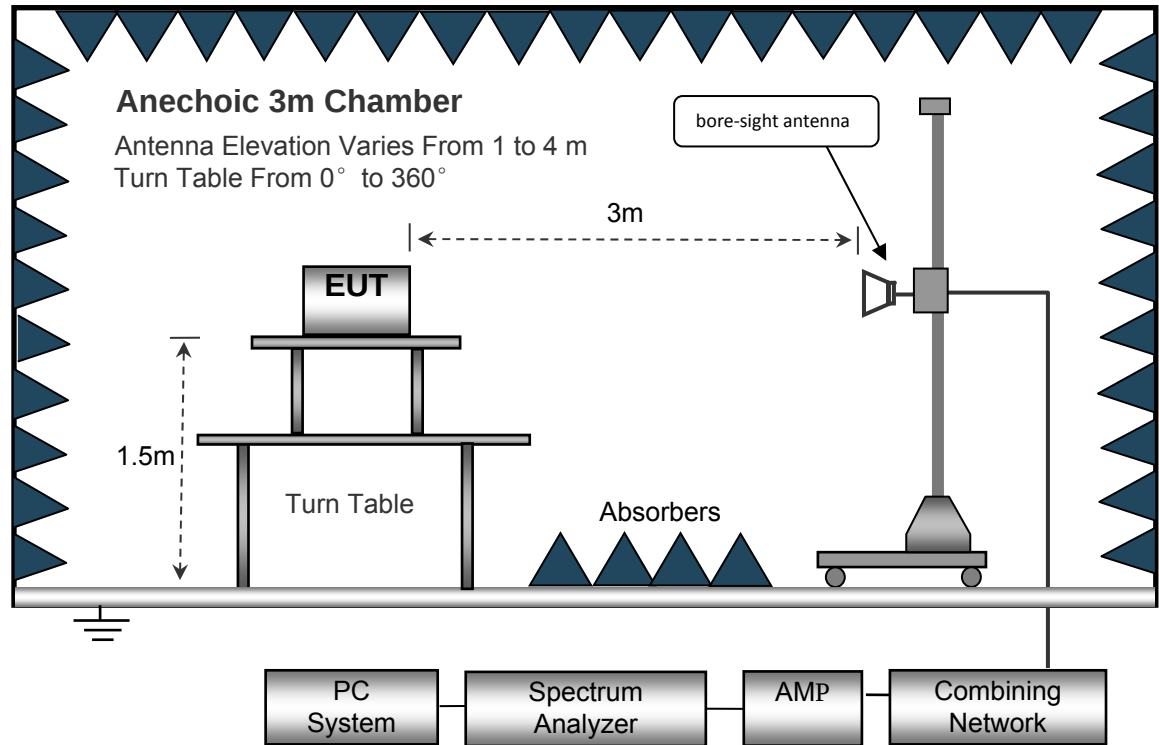
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz
Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in Z axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used during radiated emissions above 1GHz measurement.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

7.6 Summary of Test Results

Remark: Both ANT0 and ANT1 have tests, For 802.11b/g, Only record the Middle channel data of the worst case ANT0, and 802.11n worst case is MIMO(record the Middle channel data)

Wifi:

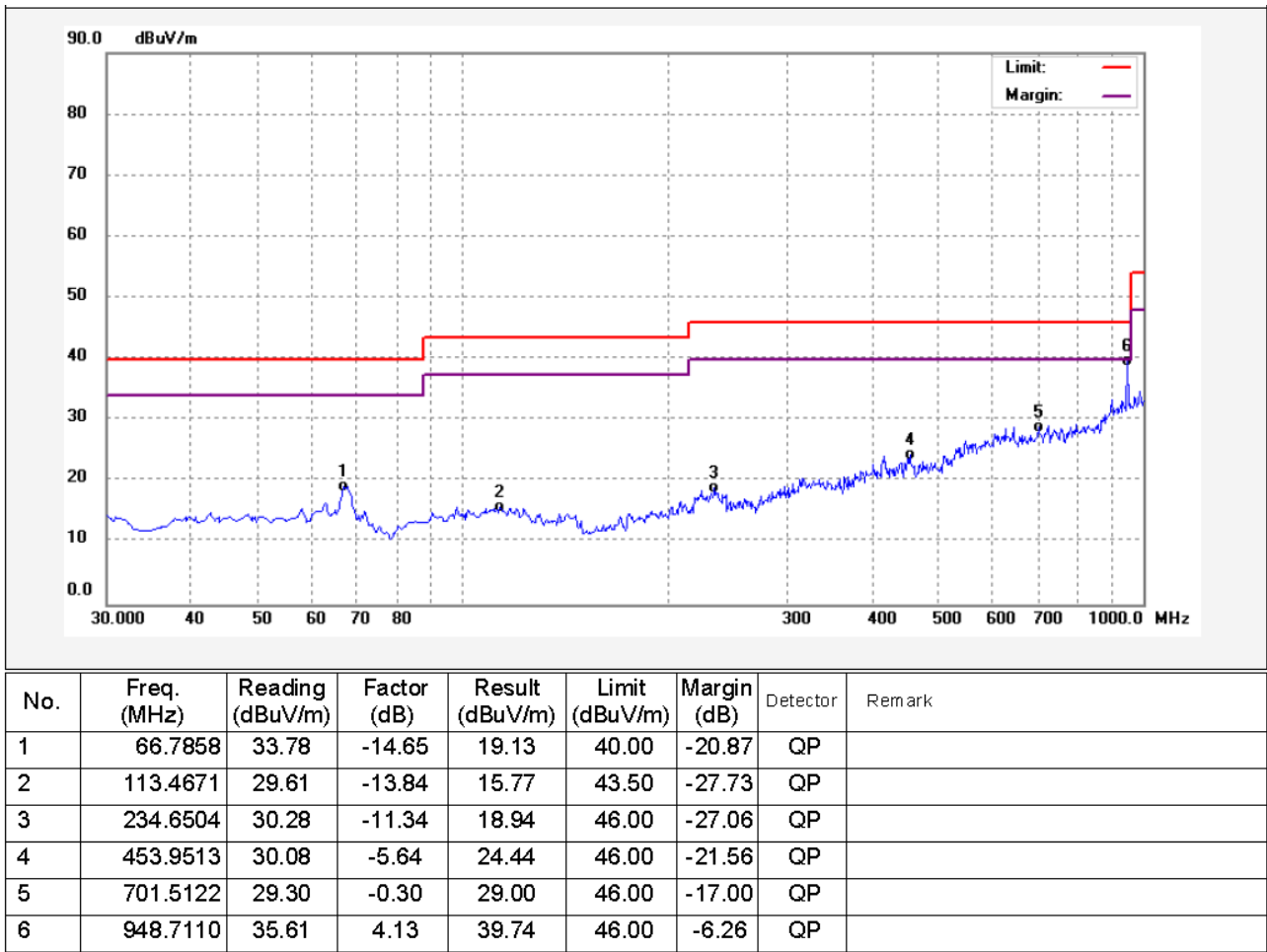
Test Frequency: 9KHz~30MHz

The measurements were more than 20 dB below the limit and not reported.

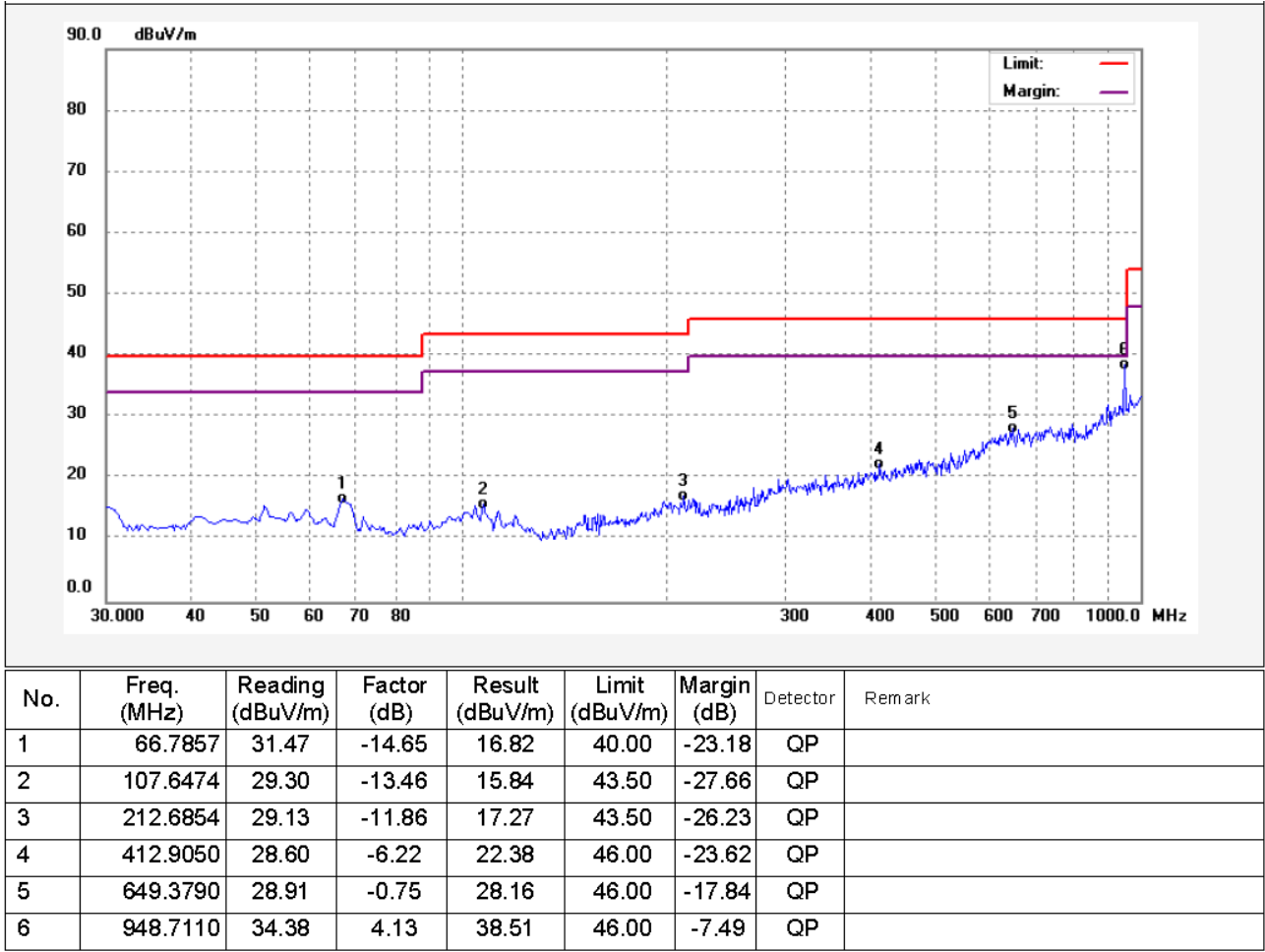
Test Frequency : 30MHz ~ 1GHz (only the worst-case plots for each mode)

WIFI: PCB printed antenna

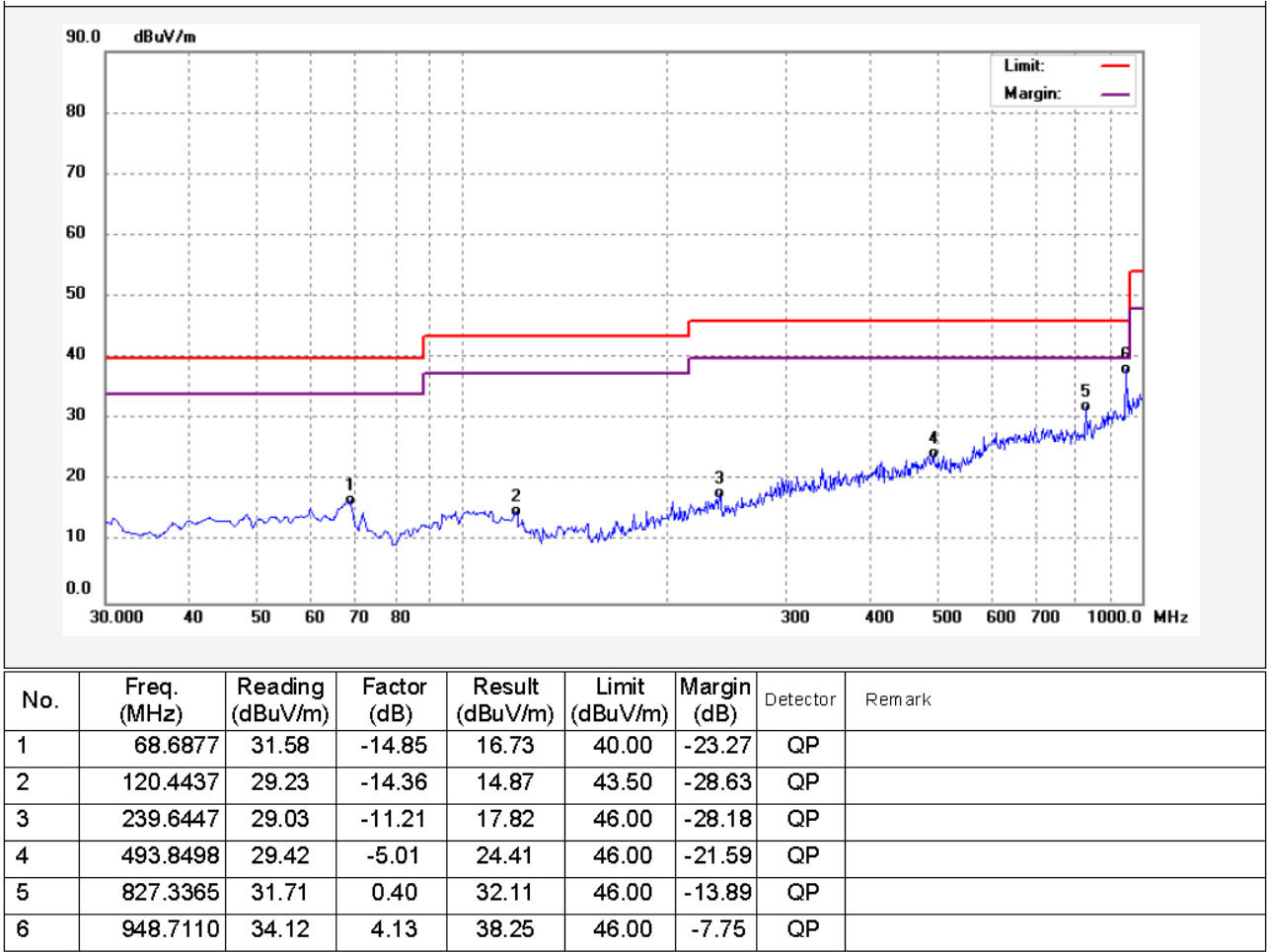
802.11b: Middle Channel 2437MHz (Vertical)



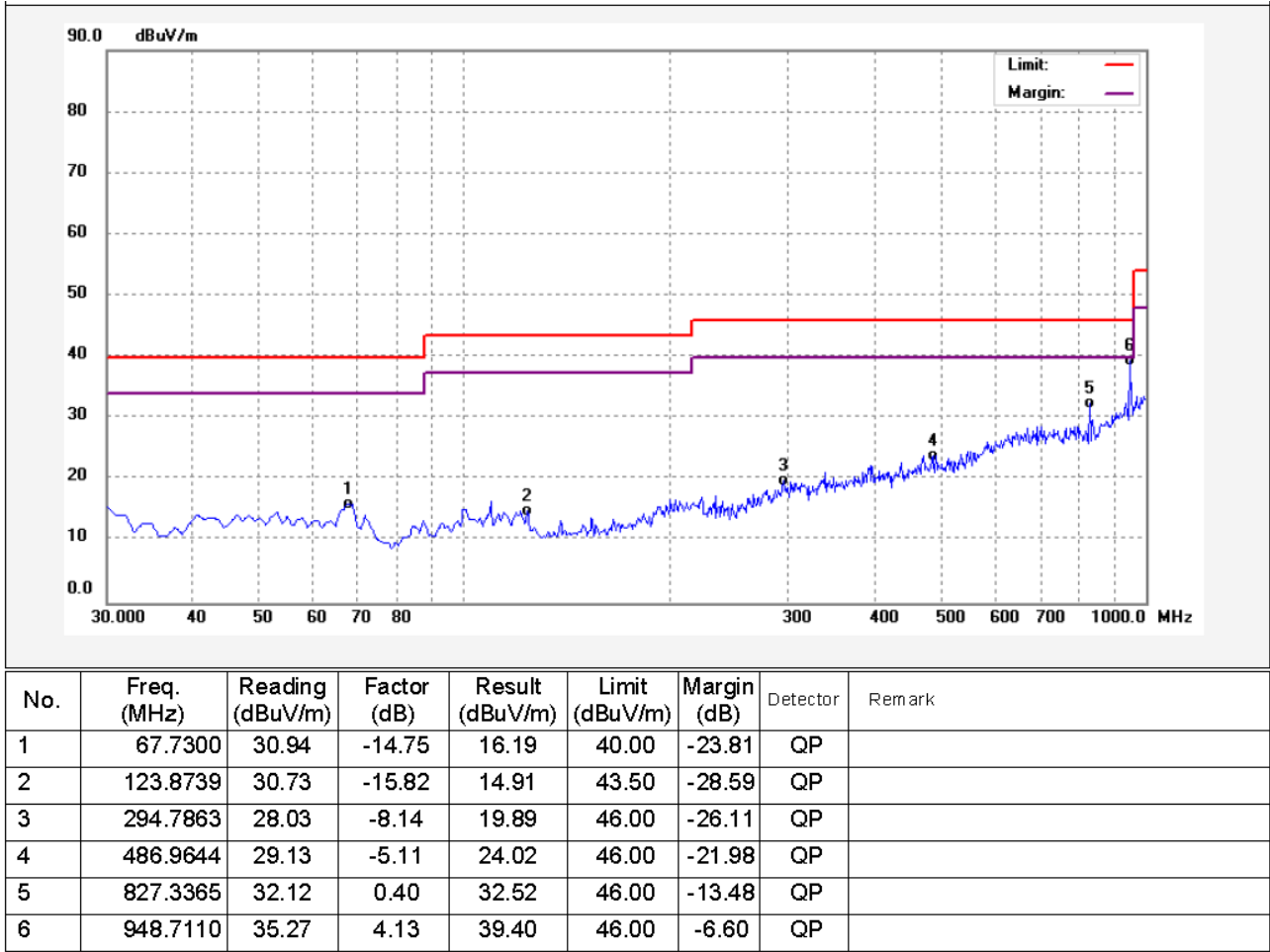
802.11b: Middle Channel 2437MHz (Horizontal)



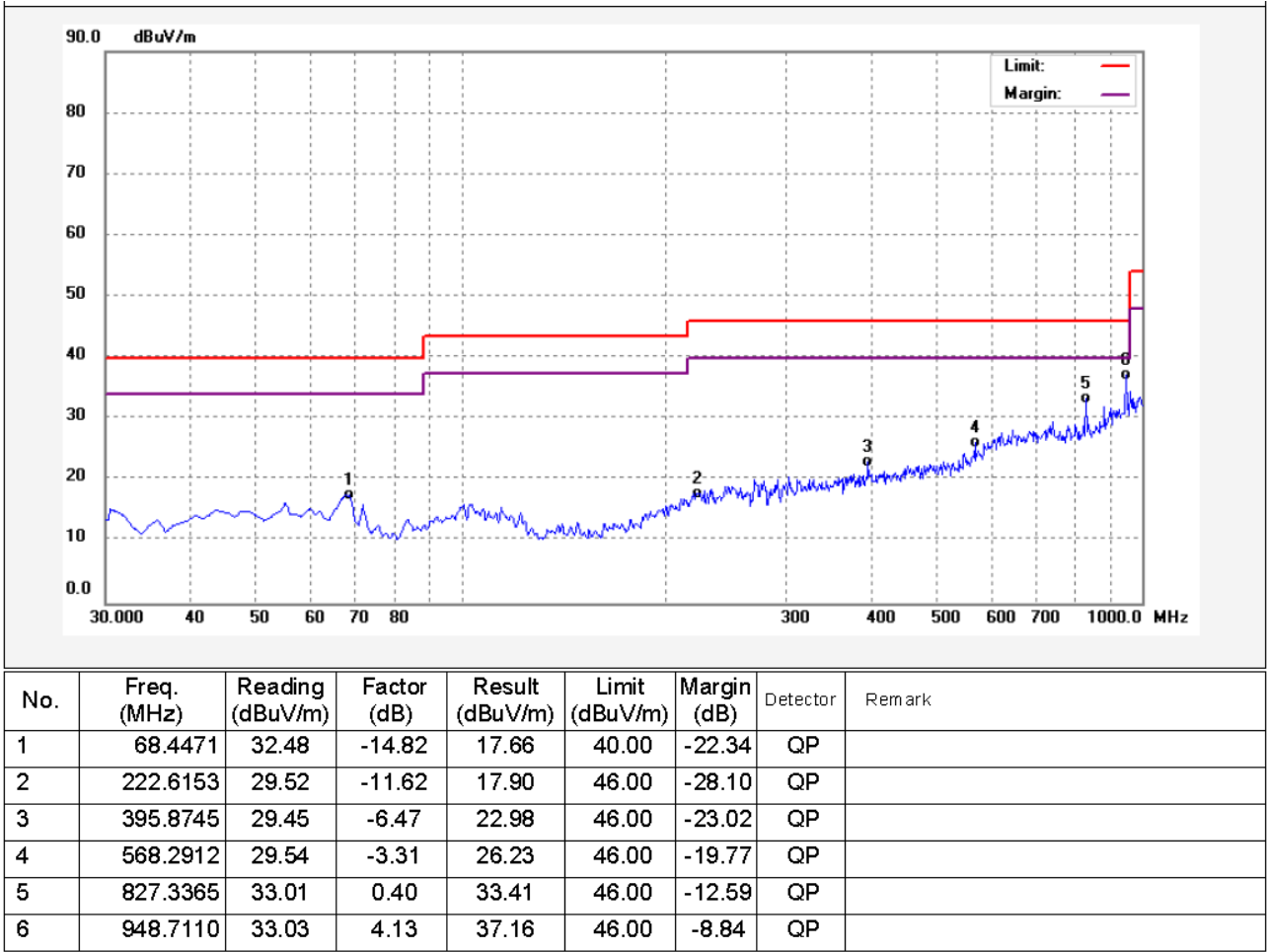
802.11g: Middle Channel 2437MHz (Vertical)



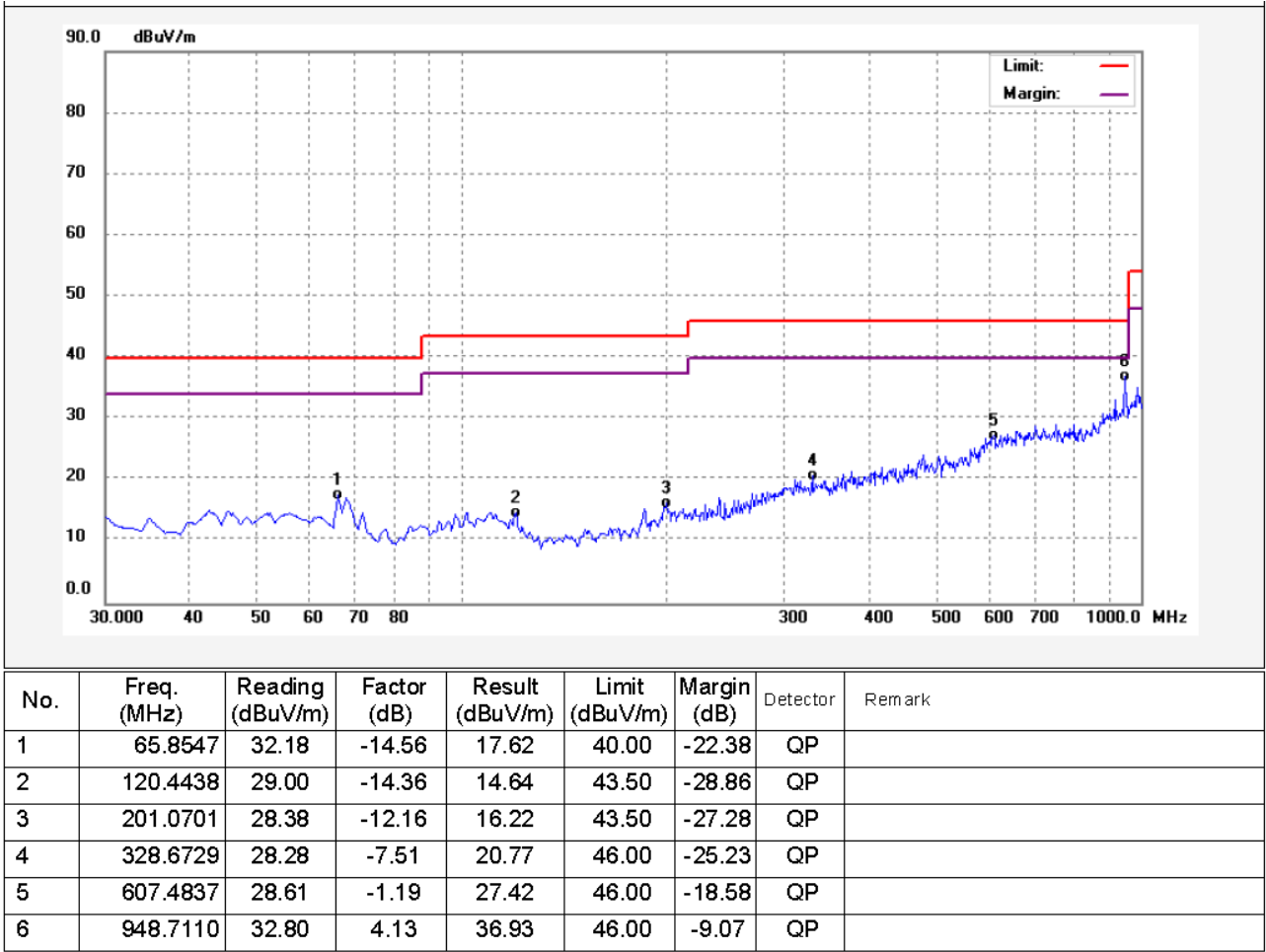
802.11g: Middle Channel 2437MHz (Horizontal)



802.11n: Middle Channel 2437MHz (Vertical)

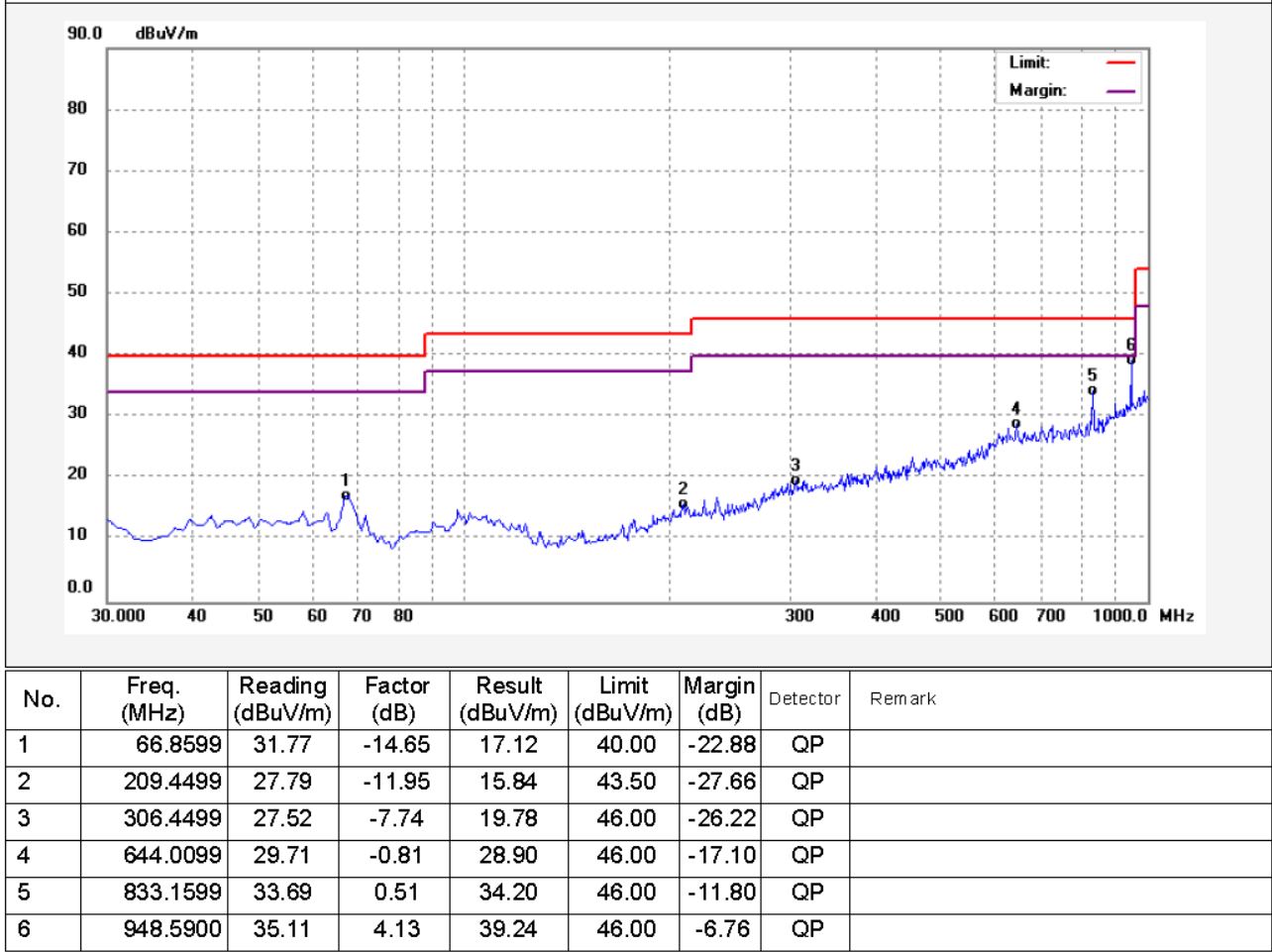


802.11n: Middle Channel 2437MHz (Horizontal)

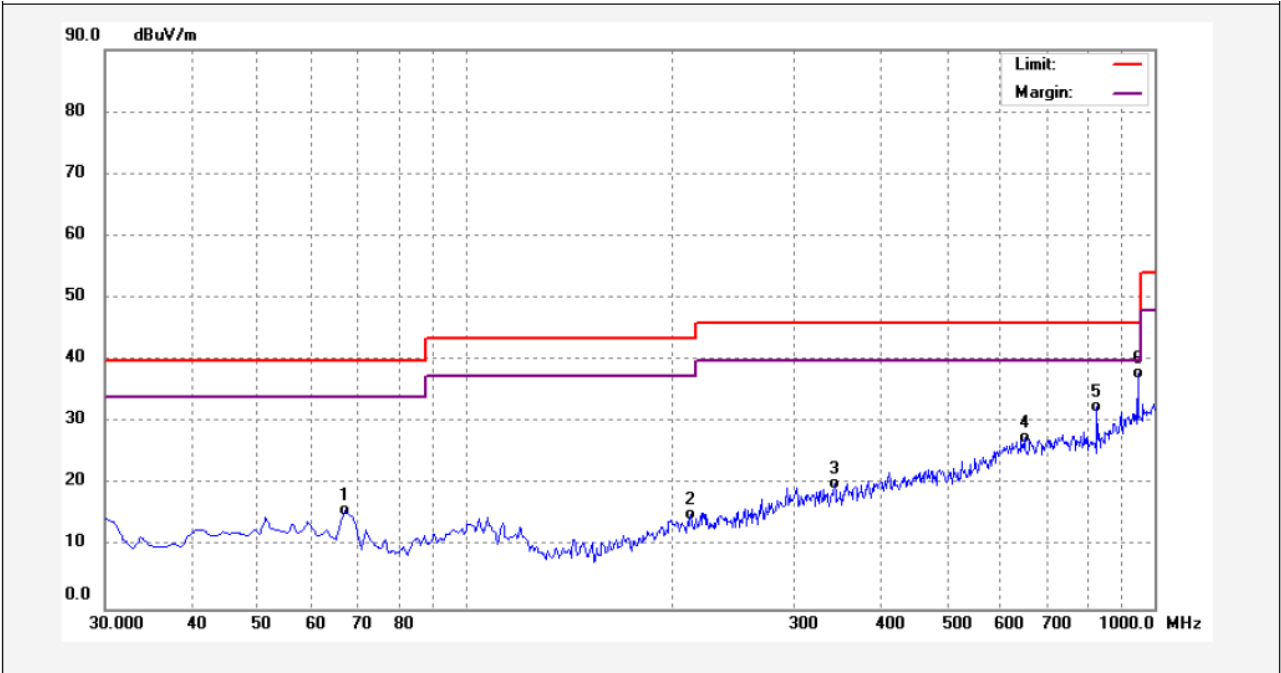


WIFI: Stamped Metal Antenna

802.11b: Middle Channel 2437MHz (Vertical)

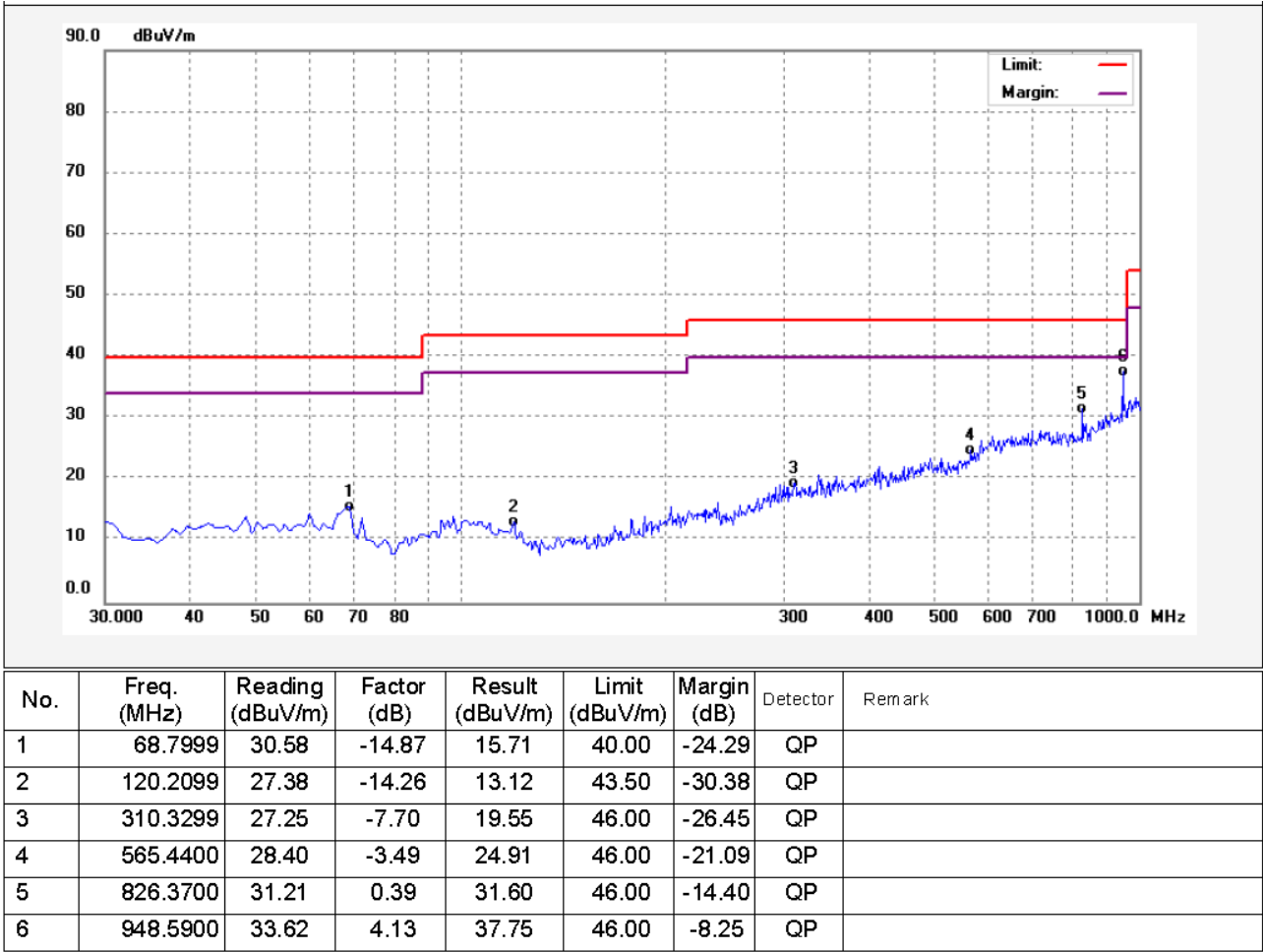


802.11b: Middle Channel 2437MHz (Horizontal)

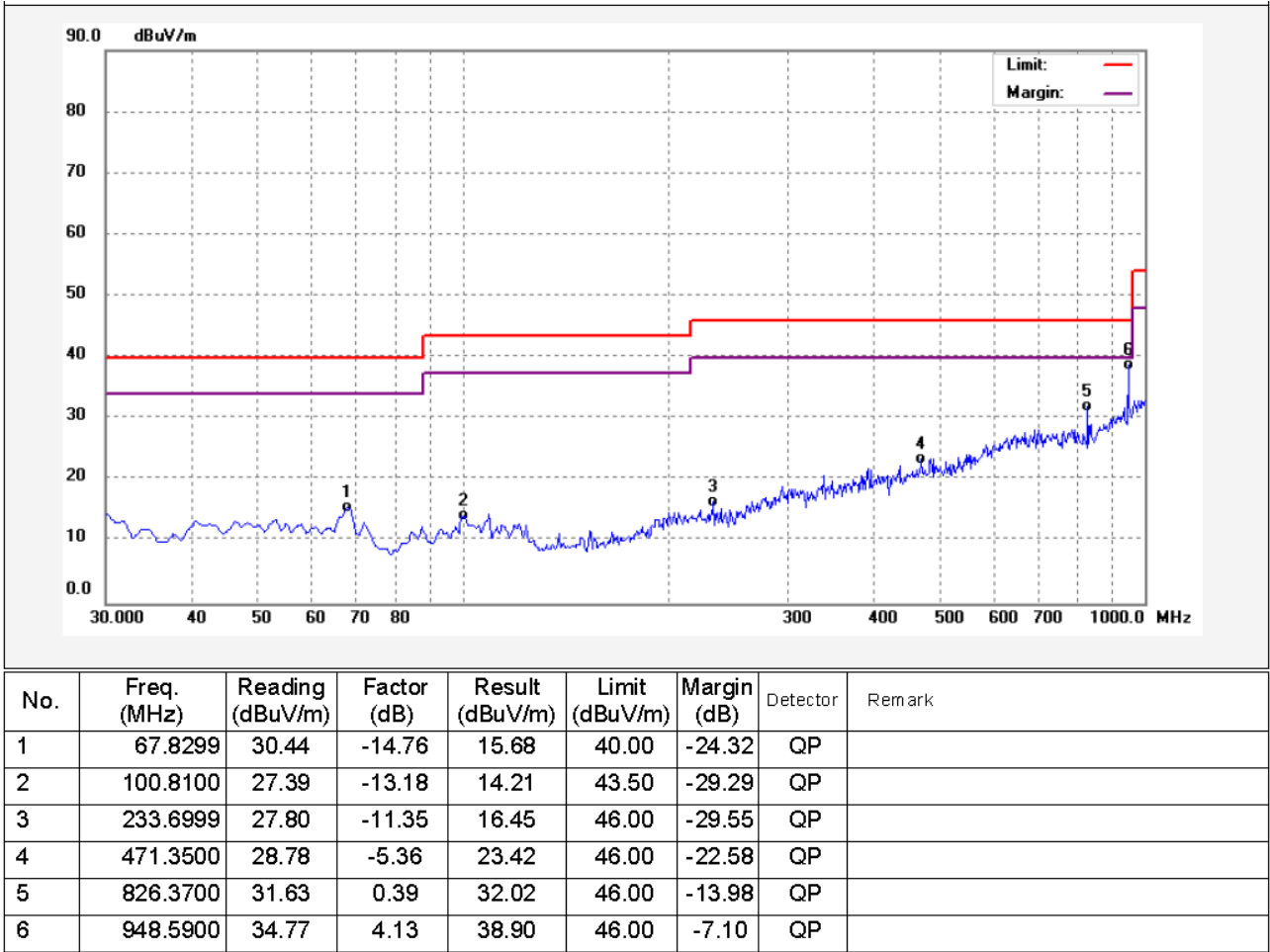


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	66.8599	30.46	-14.65	15.81	40.00	-24.19	QP	
2	212.3600	27.13	-11.88	15.25	43.50	-28.25	QP	
3	344.2799	27.54	-7.36	20.18	46.00	-25.82	QP	
4	648.8600	28.41	-0.76	27.65	46.00	-18.35	QP	
5	826.3700	32.09	0.39	32.48	46.00	-13.52	QP	
6	948.5900	33.88	4.13	38.01	46.00	-7.99	QP	

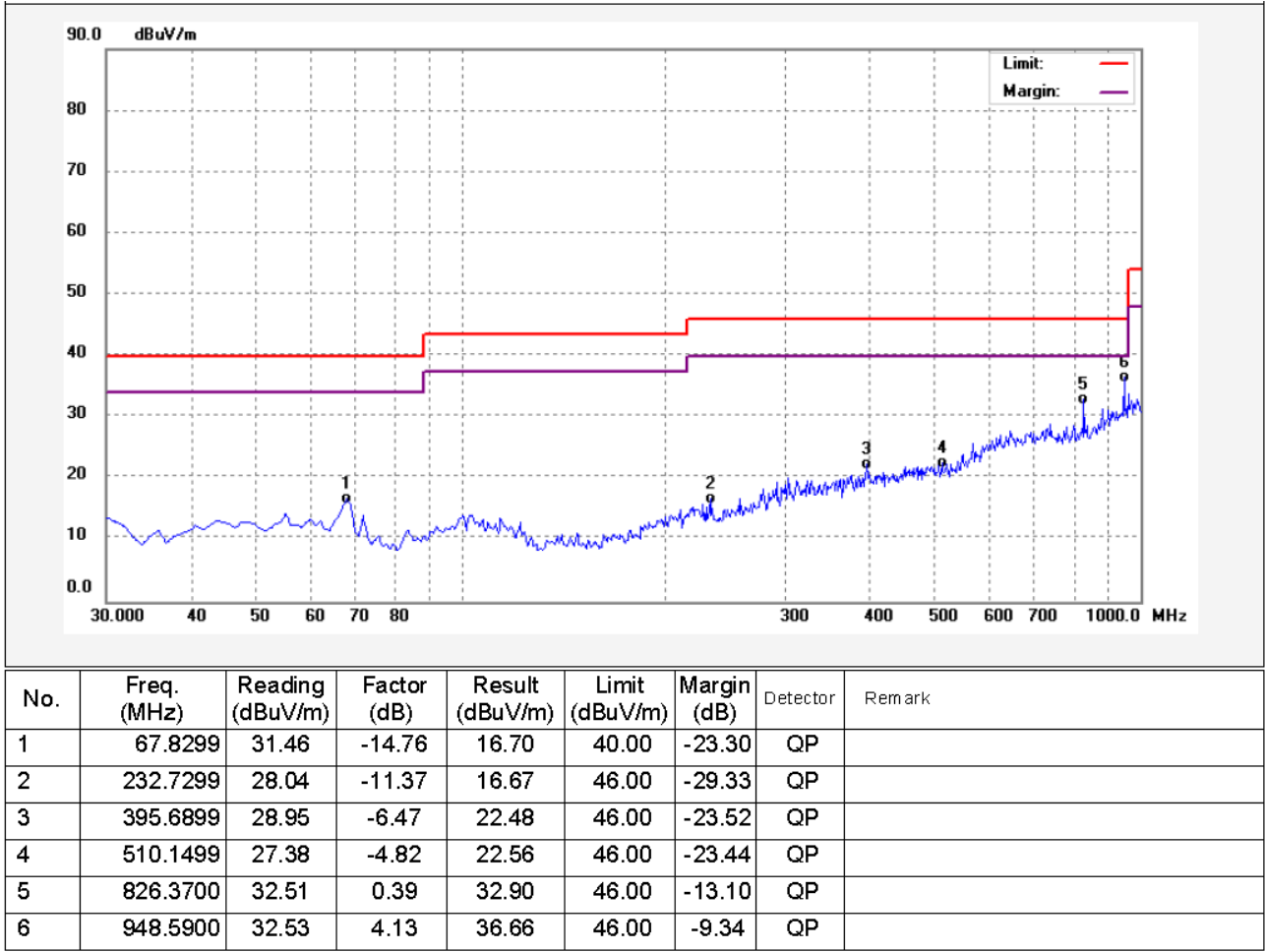
802.11g: Middle Channel 2437MHz (Vertical)



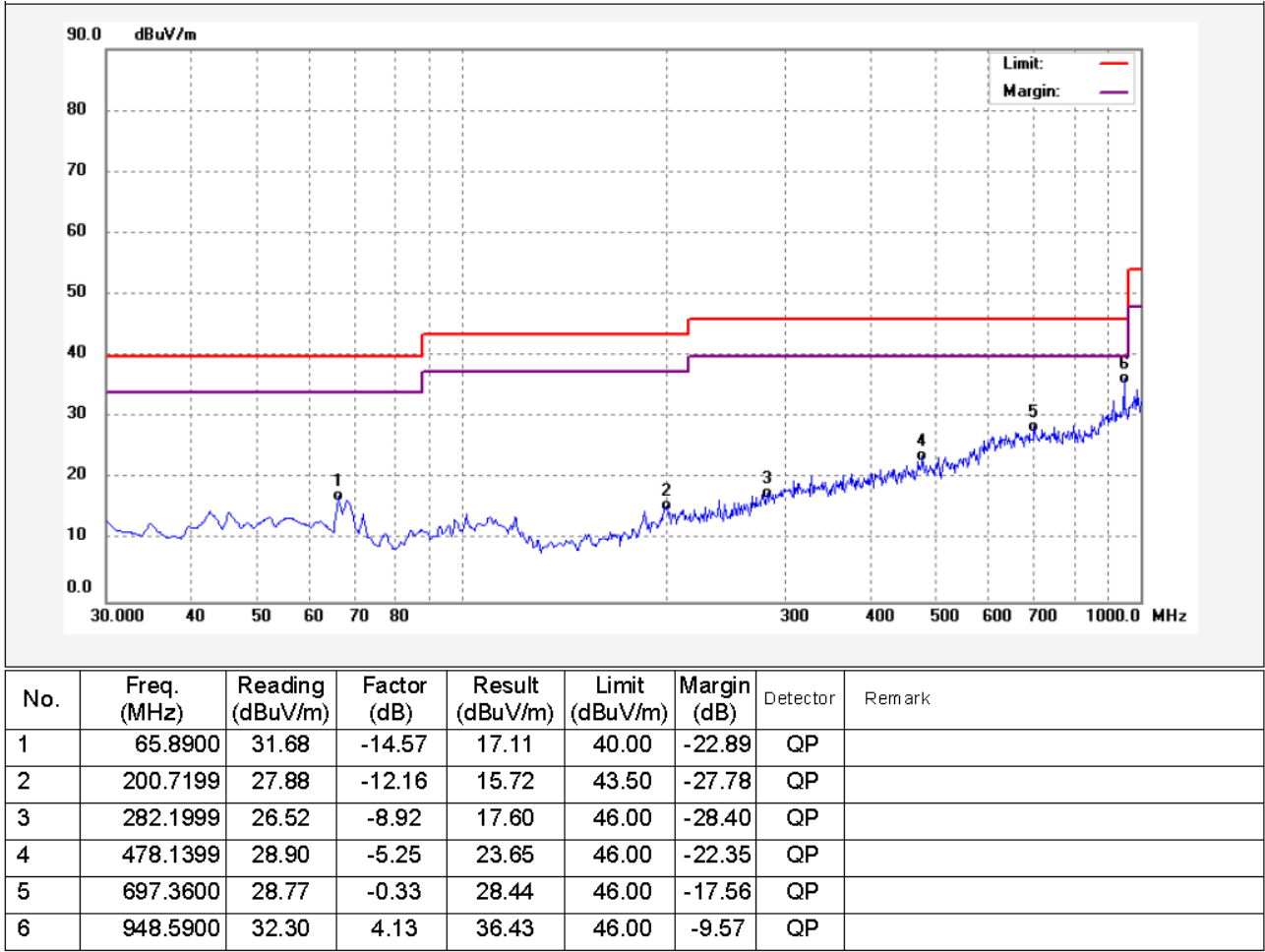
802.11g: Middle Channel 2437MHz (Horizontal)



802.11n: Middle Channel 2437MHz (Vertical)



802.11n: Middle Channel 2437MHz (Horizontal)

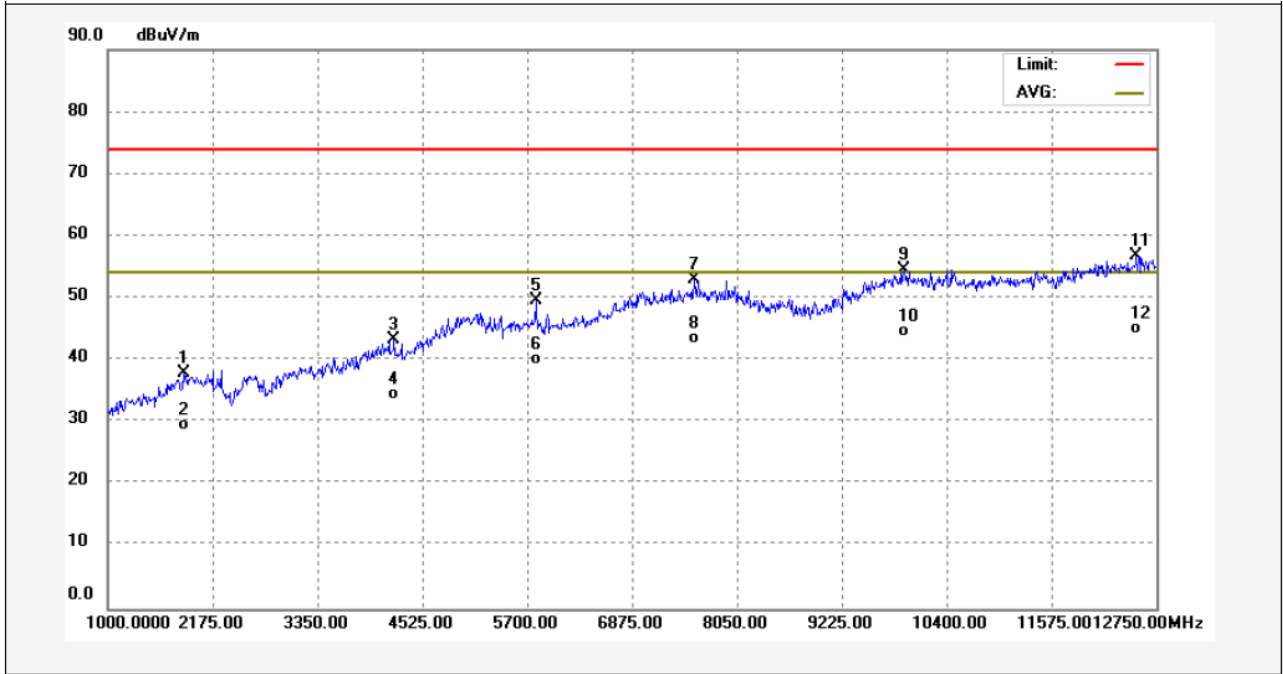


Test Frequency: 1GHz~12.75GHz (only the worst-case plots for each mode)

Remark: The current test plots doesn't have the fundamental signal, It's blocked by the filter

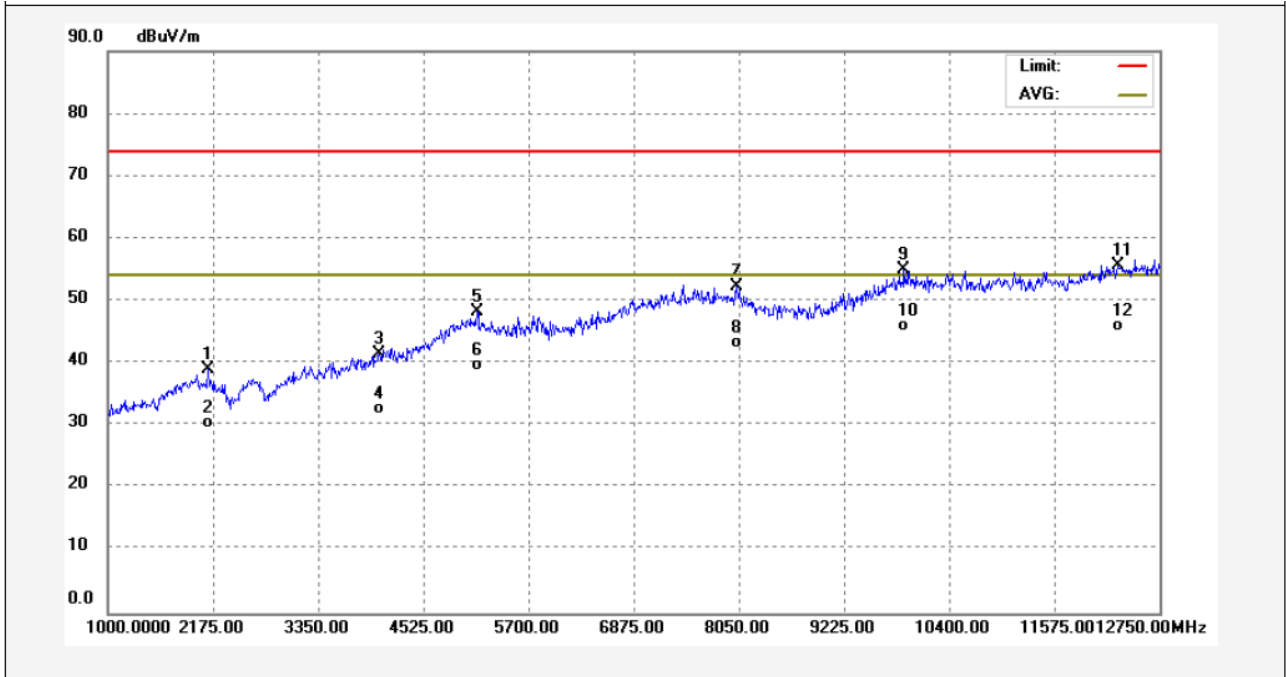
WIFI: PCB printed antenna

802.11b: Middle Channel 2437MHz (Vertical)



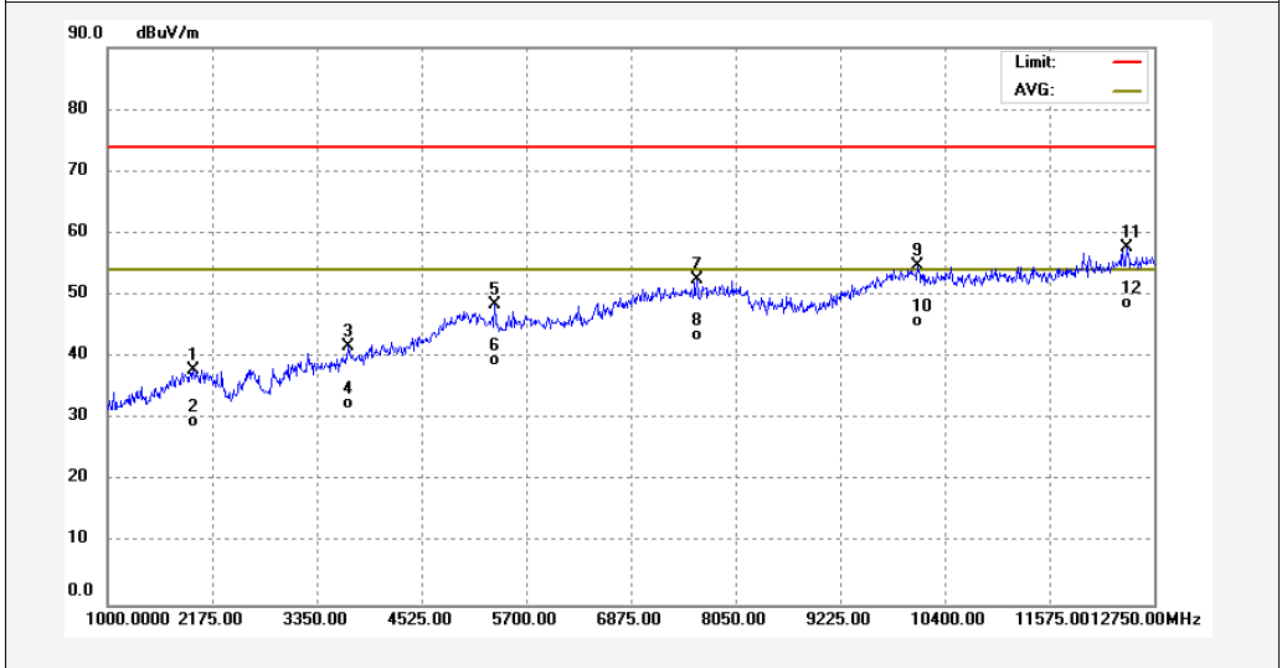
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1846.000	47.35	-9.50	37.85	74.00	-36.15	peak	
2	1846.000	39.08	-9.50	29.58	54.00	-24.42	AVG	
3	4207.750	49.52	-6.12	43.40	74.00	-30.60	peak	
4	4207.750	40.56	-6.12	34.44	54.00	-19.56	AVG	
5	5794.000	52.18	-2.66	49.52	74.00	-24.48	peak	
6	5794.000	42.80	-2.66	40.14	54.00	-13.86	AVG	
7	7568.250	50.22	2.75	52.97	74.00	-21.03	peak	
8	7568.250	40.81	2.75	43.56	54.00	-10.44	AVG	
9	9918.250	49.51	4.95	54.46	74.00	-19.54	peak	
10	9918.250	39.69	4.95	44.64	54.00	-9.36	AVG	
11	12526.750	49.76	6.95	56.71	74.00	-17.29	peak	
12	12526.750	38.22	6.95	45.17	54.00	-8.83	AVG	

802.11b: Middle Channel 2437MHz (Horizontal)



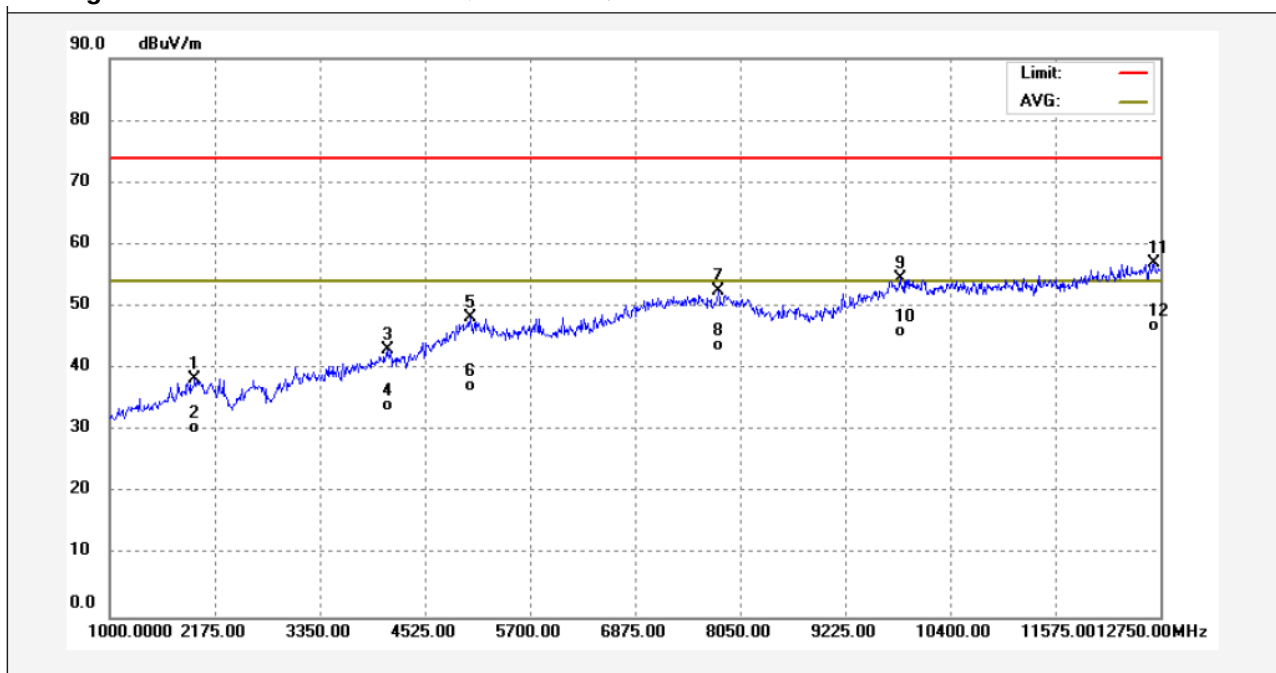
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2116.250	49.77	-10.79	38.98	74.00	-35.02	peak	
2	2116.250	41.26	-10.79	30.47	54.00	-23.53	AVG	
3	4031.500	48.19	-6.71	41.48	74.00	-32.52	peak	
4	4031.500	39.45	-6.71	32.74	54.00	-21.26	AVG	
5	5124.250	49.96	-1.79	48.17	74.00	-25.83	peak	
6	5124.250	41.50	-1.79	39.71	54.00	-14.29	AVG	
7	8026.500	50.01	2.22	52.23	74.00	-21.77	peak	
8	8026.500	41.10	2.22	43.32	54.00	-10.68	AVG	
9	9894.750	51.29	3.80	55.09	74.00	-18.91	peak	
10	9894.750	42.12	3.80	45.92	54.00	-8.08	AVG	
11	12291.750	49.02	6.75	55.77	74.00	-18.23	peak	
12	12291.750	39.32	6.75	46.07	54.00	-7.93	AVG	

802.11g: Middle Channel 2437MHz (Vertical)



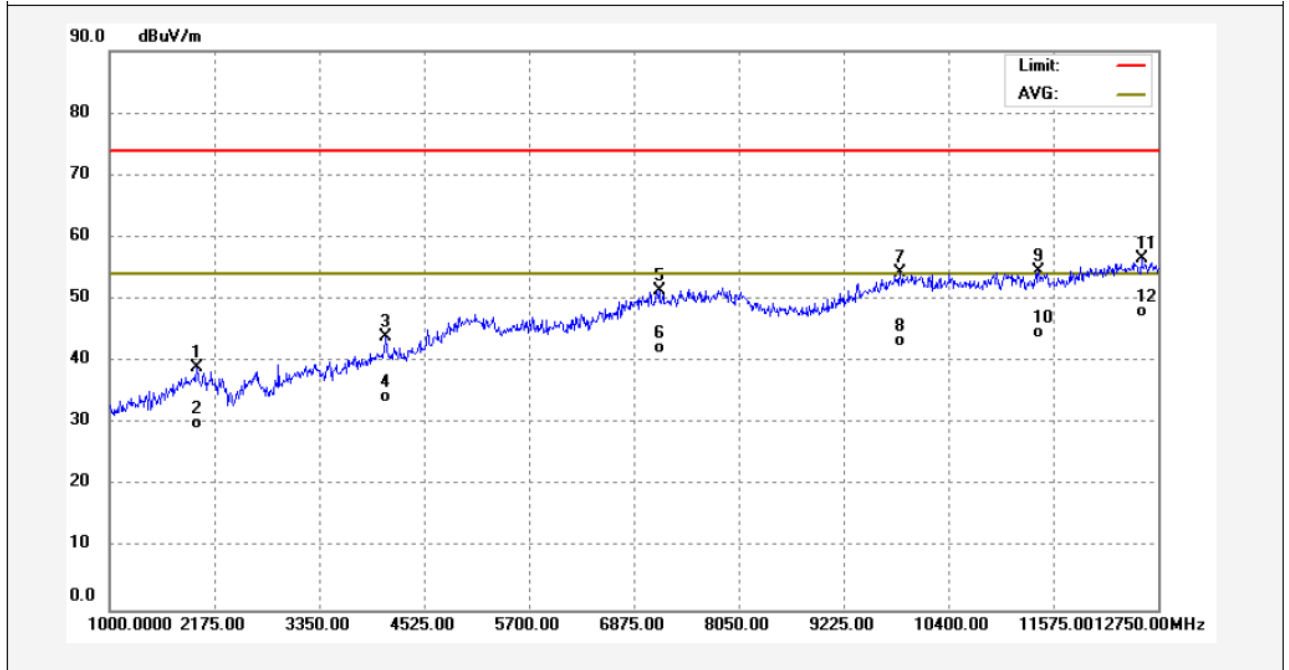
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1963.500	48.63	-10.62	38.01	74.00	-35.99	peak	
2	1963.500	40.19	-10.62	29.57	54.00	-24.43	AVG	
3	3702.500	50.09	-8.25	41.84	74.00	-32.16	peak	
4	3702.500	40.73	-8.25	32.48	54.00	-21.52	AVG	
5	5347.500	51.07	-2.60	48.47	74.00	-25.53	peak	
6	5347.500	42.11	-2.60	39.51	54.00	-14.49	AVG	
7	7615.250	50.45	2.01	52.46	74.00	-21.54	peak	
8	7615.250	41.57	2.01	43.58	54.00	-10.42	AVG	
9	10094.500	50.70	4.01	54.71	74.00	-19.29	peak	
10	10094.500	41.70	4.01	45.71	54.00	-8.29	AVG	
11	12444.500	50.67	6.99	57.66	74.00	-16.34	peak	
12	12444.500	41.70	6.99	48.69	54.00	-5.31	AVG	

802.11g: Middle Channel 2437MHz (Horizontal)

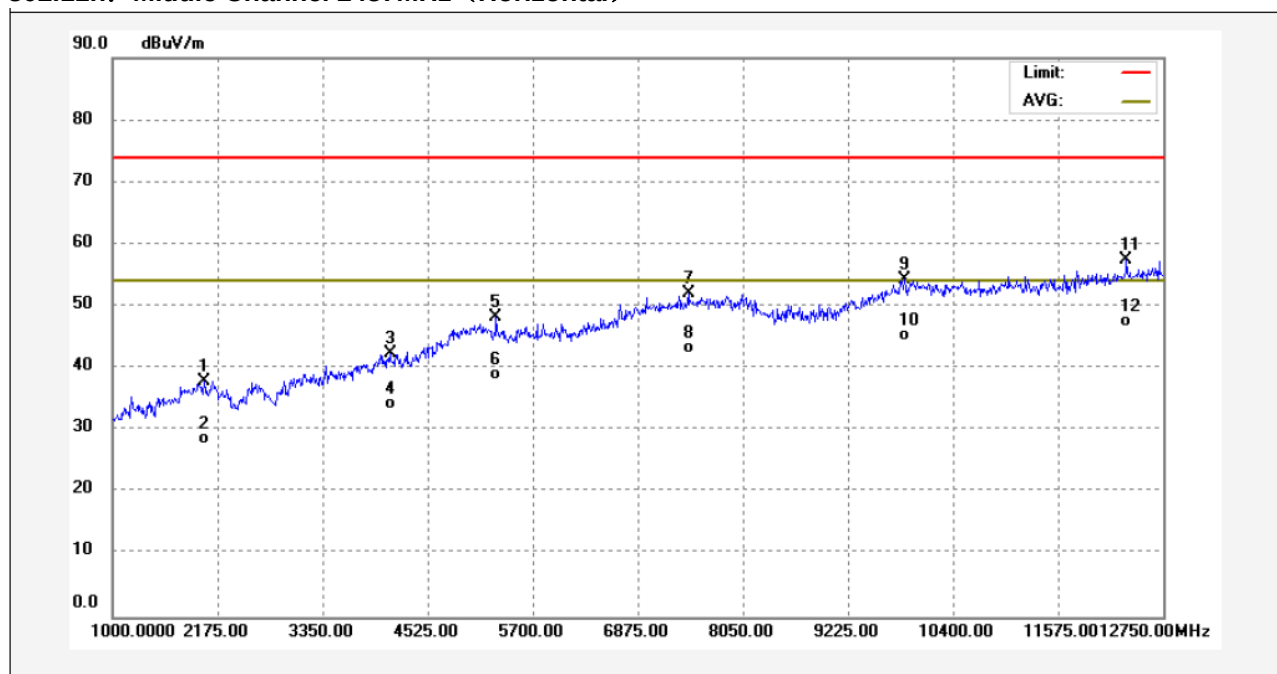


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1951.750	47.23	-8.86	38.37	74.00	-35.63	peak	
2	1951.750	39.38	-8.86	30.52	54.00	-23.48	AVG	
3	4102.000	49.37	-6.32	43.05	74.00	-30.95	peak	
4	4102.000	40.38	-6.32	34.06	54.00	-19.94	AVG	
5	5030.250	52.18	-3.99	48.19	74.00	-25.81	peak	
6	5030.250	41.28	-3.99	37.29	54.00	-16.71	AVG	
7	7803.250	49.66	2.81	52.47	74.00	-21.53	peak	
8	7803.250	40.93	2.81	43.74	54.00	-10.26	AVG	
9	9836.000	49.77	4.82	54.59	74.00	-19.41	peak	
10	9836.000	41.21	4.82	46.03	54.00	-7.97	AVG	
11	12679.500	49.65	7.37	57.02	74.00	-16.98	peak	
12	12679.500	39.63	7.37	47.00	54.00	-7.00	AVG	

802.11n: Middle Channel 2437MHz (Vertical)

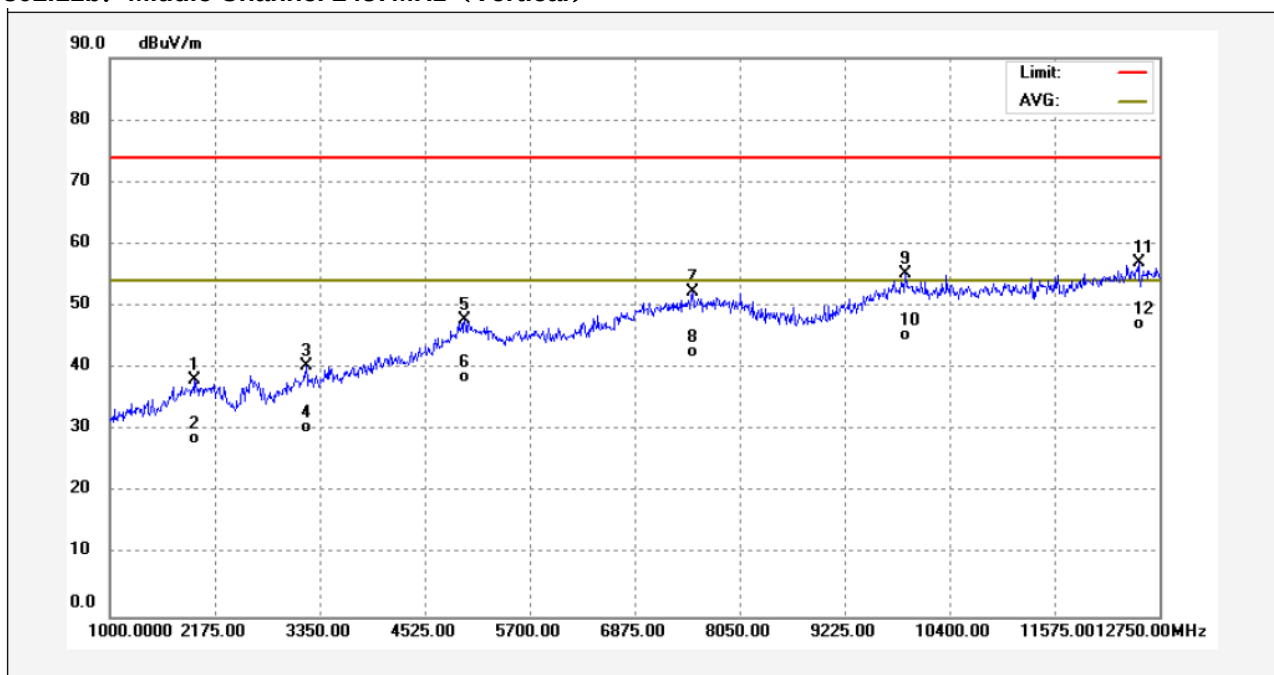


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1975.250	47.73	-8.72	39.01	74.00	-34.99	peak	
2	1975.250	38.84	-8.72	30.12	54.00	-23.88	AVG	
3	4090.250	50.27	-6.34	43.93	74.00	-30.07	peak	
4	4090.250	40.73	-6.34	34.39	54.00	-19.61	AVG	
5	7157.000	49.07	2.44	51.51	74.00	-22.49	peak	
6	7157.000	39.75	2.44	42.19	54.00	-11.81	AVG	
7	9859.500	49.38	4.86	54.24	74.00	-19.76	peak	
8	9859.500	38.56	4.86	43.42	54.00	-10.58	AVG	
9	11410.500	47.88	6.57	54.45	74.00	-19.55	peak	
10	11410.500	38.02	6.57	44.59	54.00	-9.41	AVG	
11	12562.000	49.44	7.05	56.49	74.00	-17.51	peak	
12	12562.000	40.90	7.05	47.95	54.00	-6.05	AVG	

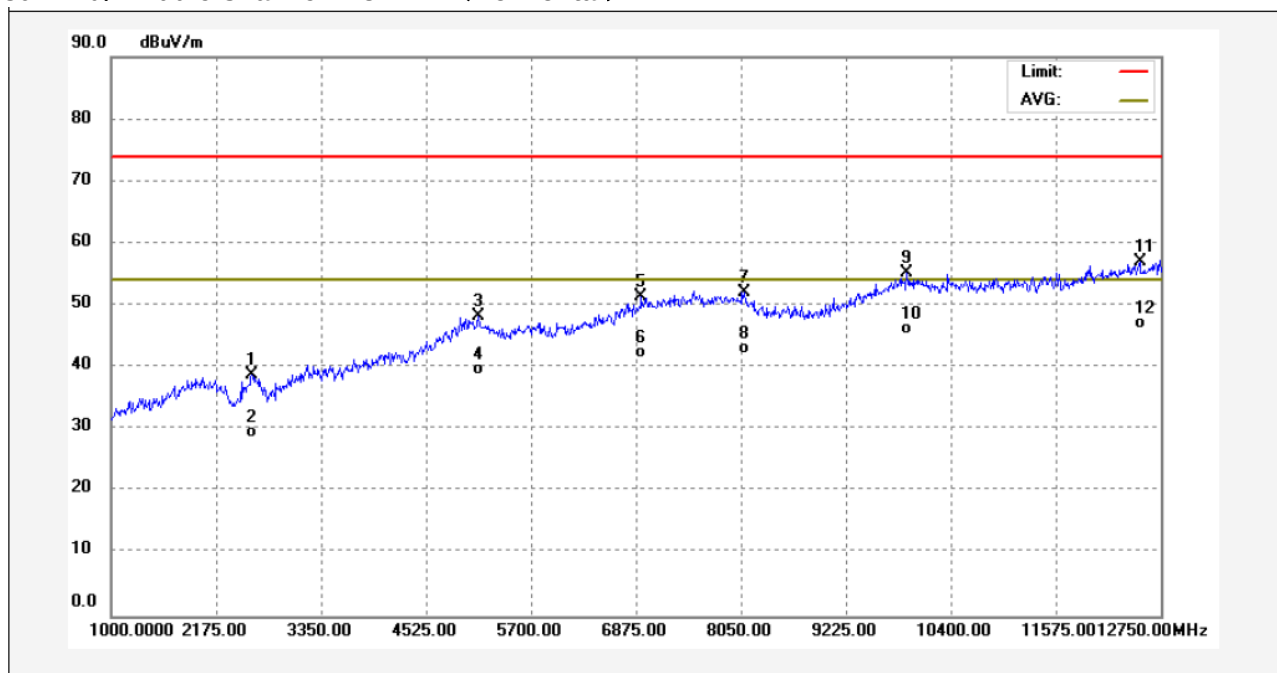
802.11n: Middle Channel 2437MHz (Horizontal)

WIFI: Stamped Metal Antenna

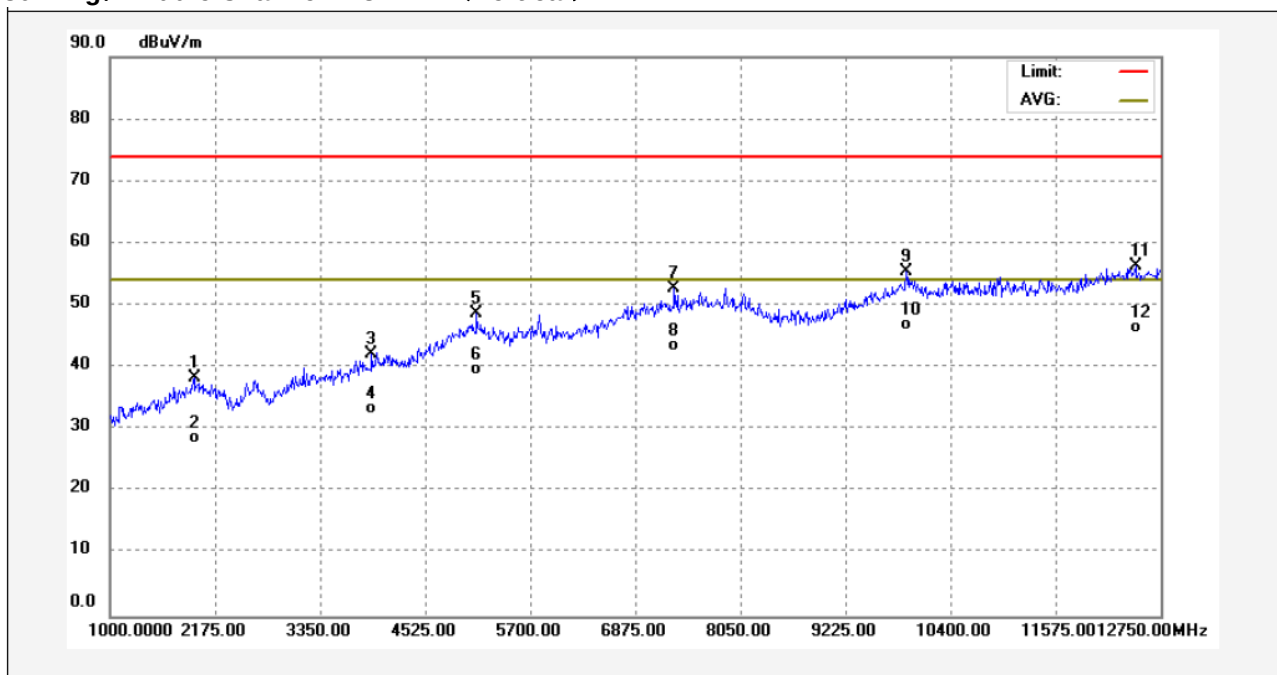
802.11b: Middle Channel 2437MHz (Vertical)

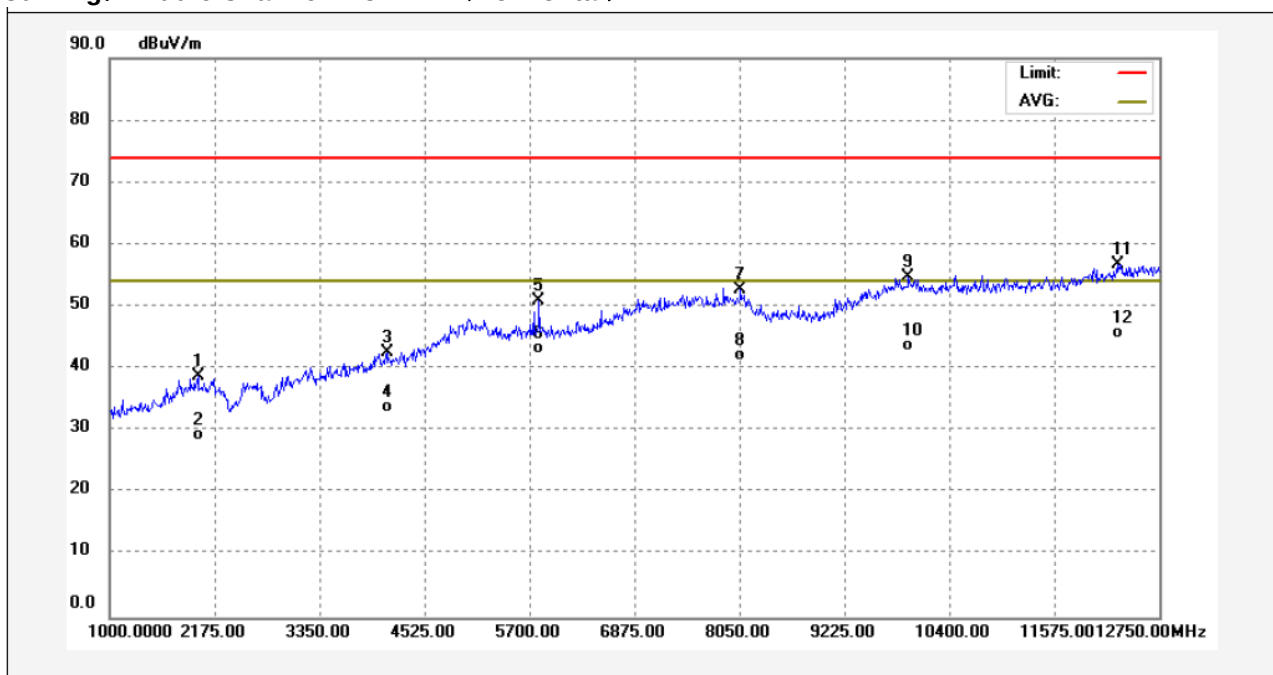


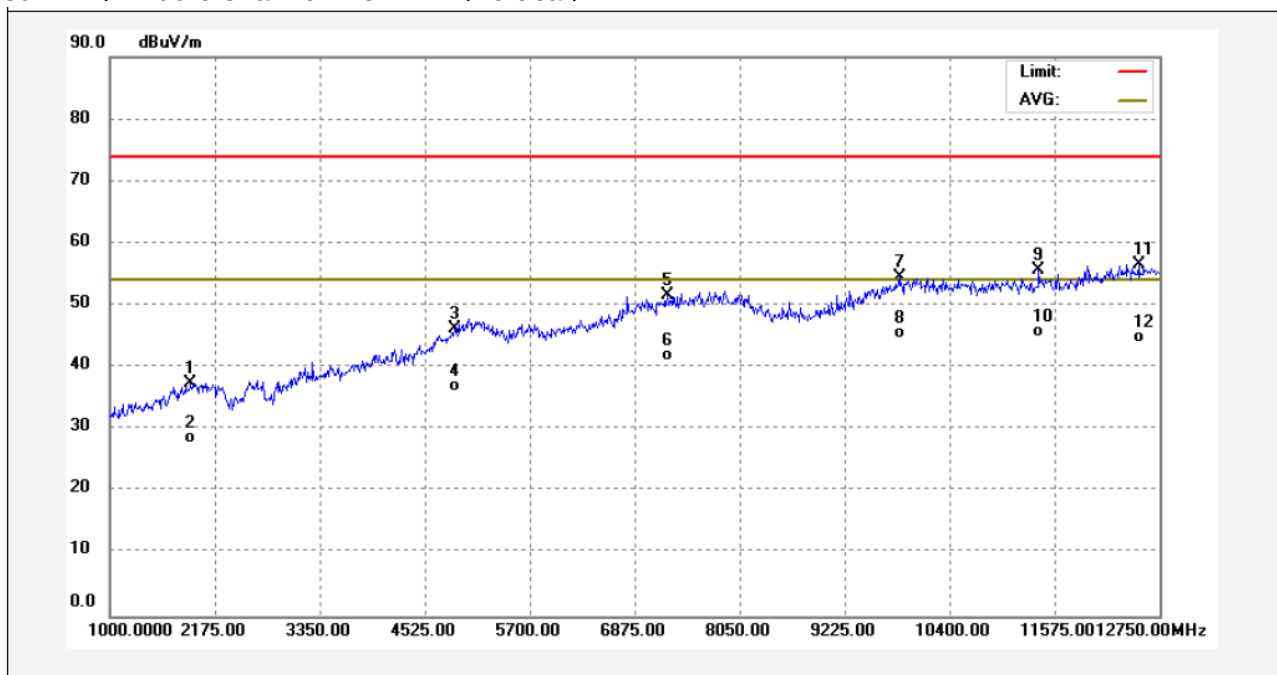
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1951.750	48.84	-10.69	38.15	74.00	-35.85	peak	
2	1951.750	39.36	-10.69	28.67	54.00	-25.33	AVG	
3	3197.250	50.38	-10.09	40.29	74.00	-33.71	peak	
4	3197.250	40.60	-10.09	30.51	54.00	-23.49	AVG	
5	4971.500	49.48	-1.58	47.90	74.00	-26.10	peak	
6	4971.500	40.22	-1.58	38.64	54.00	-15.36	AVG	
7	7521.250	50.45	1.96	52.41	74.00	-21.59	peak	
8	7521.250	40.72	1.96	42.68	54.00	-11.32	AVG	
9	9906.500	51.39	3.80	55.19	74.00	-18.81	peak	
10	9906.500	41.56	3.80	45.36	54.00	-8.64	AVG	
11	12515.000	49.83	7.12	56.95	74.00	-17.05	peak	
12	12515.000	39.93	7.12	47.05	54.00	-6.95	AVG	

802.11b: Middle Channel 2437MHz (Horizontal)

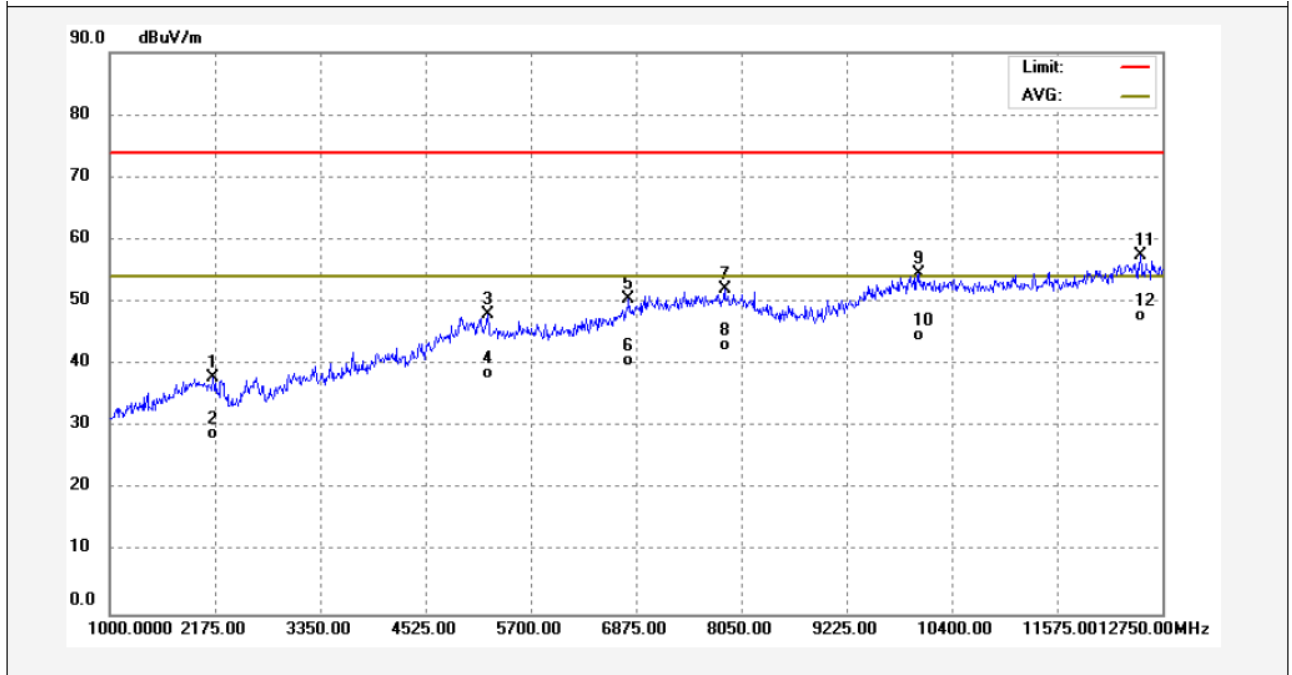
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2574.500	46.55	-7.83	38.72	74.00	-35.28	peak	
2	2574.500	37.40	-7.83	29.57	54.00	-24.43	AVG	
3	5112.500	52.14	-3.81	48.33	74.00	-25.67	peak	
4	5112.500	43.49	-3.81	39.68	54.00	-14.32	AVG	
5	6933.750	49.43	1.98	51.41	74.00	-22.59	peak	
6	6933.750	40.53	1.98	42.51	54.00	-11.49	AVG	
7	8085.250	49.15	2.91	52.06	74.00	-21.94	peak	
8	8085.250	40.23	2.91	43.14	54.00	-10.86	AVG	
9	9906.500	50.26	4.93	55.19	74.00	-18.81	peak	
10	9906.500	41.28	4.93	46.21	54.00	-7.79	AVG	
11	12515.000	50.04	6.91	56.95	74.00	-17.05	peak	
12	12515.000	40.15	6.91	47.06	54.00	-6.94	AVG	

802.11g: Middle Channel 2437MHz (Vertical)

802.11g: Middle Channel 2437MHz (Horizontal)

802.11n: Middle Channel 2437MHz (Vertical)

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1904.750	48.58	-11.01	37.57	74.00	-36.43	peak	
2	1904.750	39.70	-11.01	28.69	54.00	-25.31	AVG	
3	4854.000	48.65	-2.50	46.15	74.00	-27.85	peak	
4	4854.000	39.59	-2.50	37.09	54.00	-16.91	AVG	
5	7239.250	49.30	2.29	51.59	74.00	-22.41	peak	
6	7239.250	39.60	2.29	41.89	54.00	-12.11	AVG	
7	9836.000	50.91	3.75	54.66	74.00	-19.34	peak	
8	9836.000	41.91	3.75	45.66	54.00	-8.34	AVG	
9	11398.750	49.61	5.97	55.58	74.00	-18.42	peak	
10	11398.750	39.86	5.97	45.83	54.00	-8.17	AVG	
11	12515.000	49.55	7.12	56.67	74.00	-17.33	peak	
12	12515.000	37.84	7.12	44.96	54.00	-9.04	AVG	

802.11n: Middle Channel 2437MHz (Horizontal)

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2151.500	46.38	-8.37	38.01	74.00	-35.99	peak	
2	2151.500	37.31	-8.37	28.94	54.00	-25.06	AVG	
3	5218.250	51.65	-3.57	48.08	74.00	-25.92	peak	
4	5218.250	42.25	-3.57	38.68	54.00	-15.32	AVG	
5	6792.750	49.33	1.26	50.59	74.00	-23.41	peak	
6	6792.750	39.42	1.26	40.68	54.00	-13.32	AVG	
7	7862.000	49.21	2.83	52.04	74.00	-21.96	peak	
8	7862.000	40.32	2.83	43.15	54.00	-10.85	AVG	
9	10035.750	49.39	5.12	54.51	74.00	-19.49	peak	
10	10035.750	39.48	5.12	44.60	54.00	-9.40	AVG	
11	12503.250	50.59	6.89	57.48	74.00	-16.52	peak	
12	12503.250	40.95	6.89	47.84	54.00	-6.16	AVG	

Test Frequency : 12.75GHz ~ 25GHz

The measurements were more than 20 dB below the limit and not reported.

BT BLE:

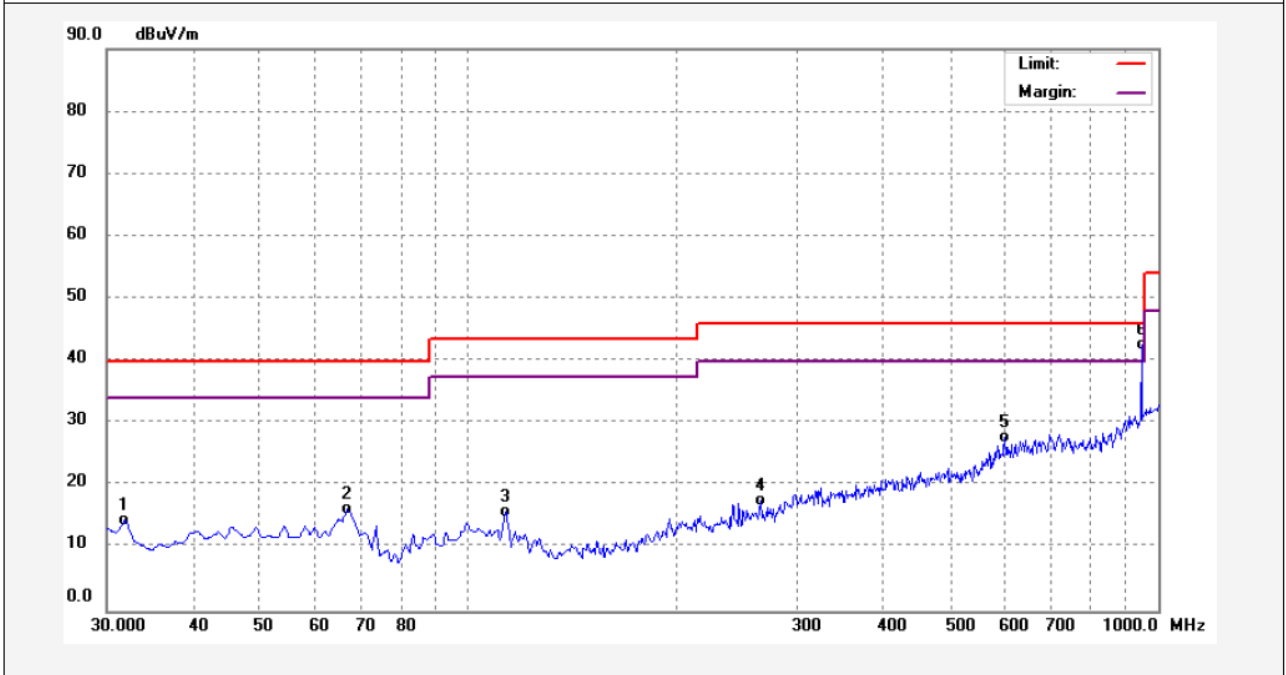
Test Frequency: 9KHz~30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 1GHz

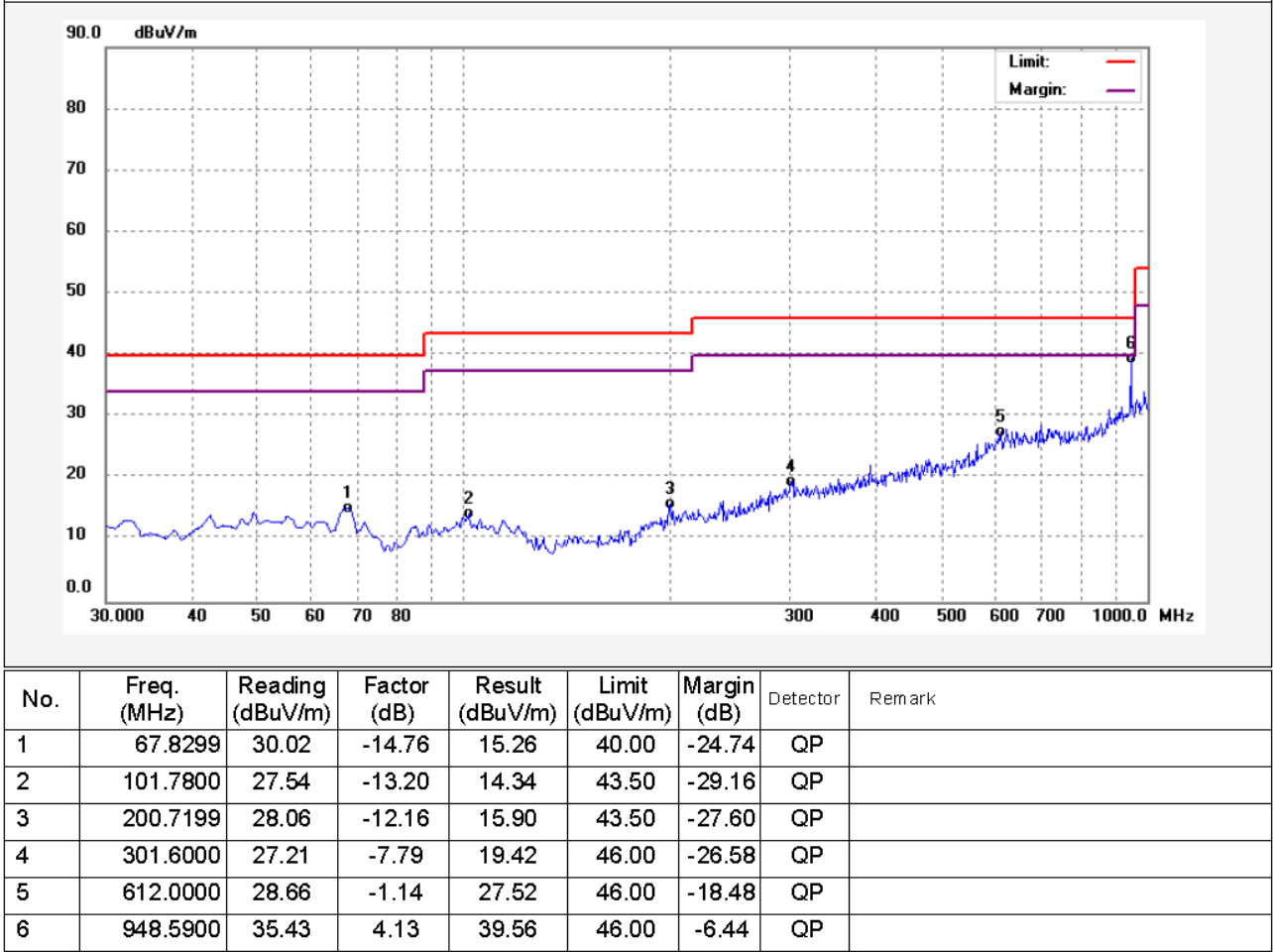
BLE: Stamped Metal Antenna

GFSK Low Channel 2402MHz(Vertical)



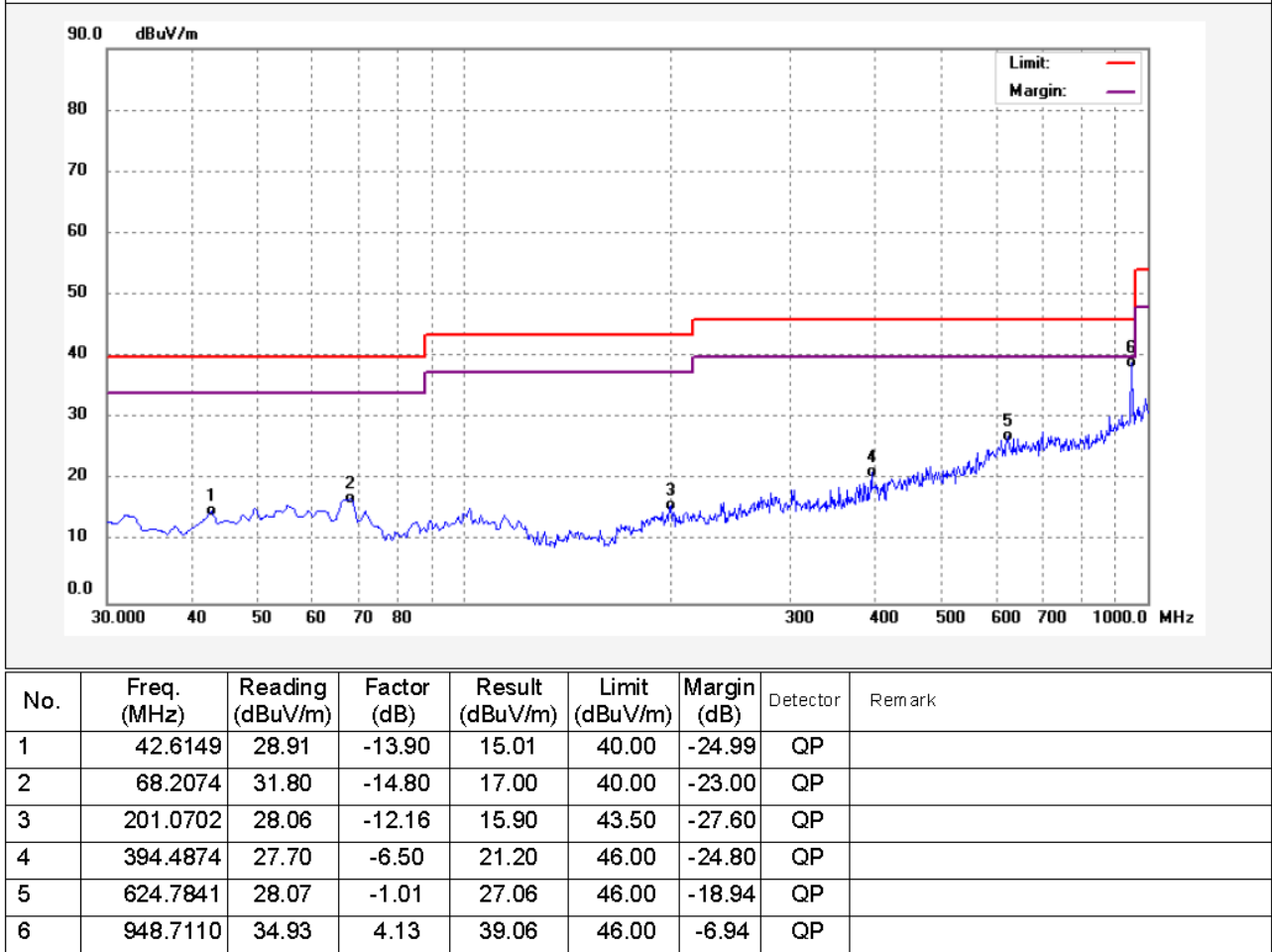
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	31.9400	30.80	-16.20	14.60	40.00	-25.40	QP	
2	66.8599	30.86	-14.65	16.21	40.00	-23.79	QP	
3	113.4200	29.79	-13.84	15.95	43.50	-27.55	QP	
4	265.7099	27.58	-9.96	17.62	46.00	-28.38	QP	
5	601.3300	29.09	-1.25	27.84	46.00	-18.16	QP	
6	948.5900	38.45	4.13	42.58	46.00	-3.42	QP	

GFSK Low Channel 2402MHz(Horizontal)

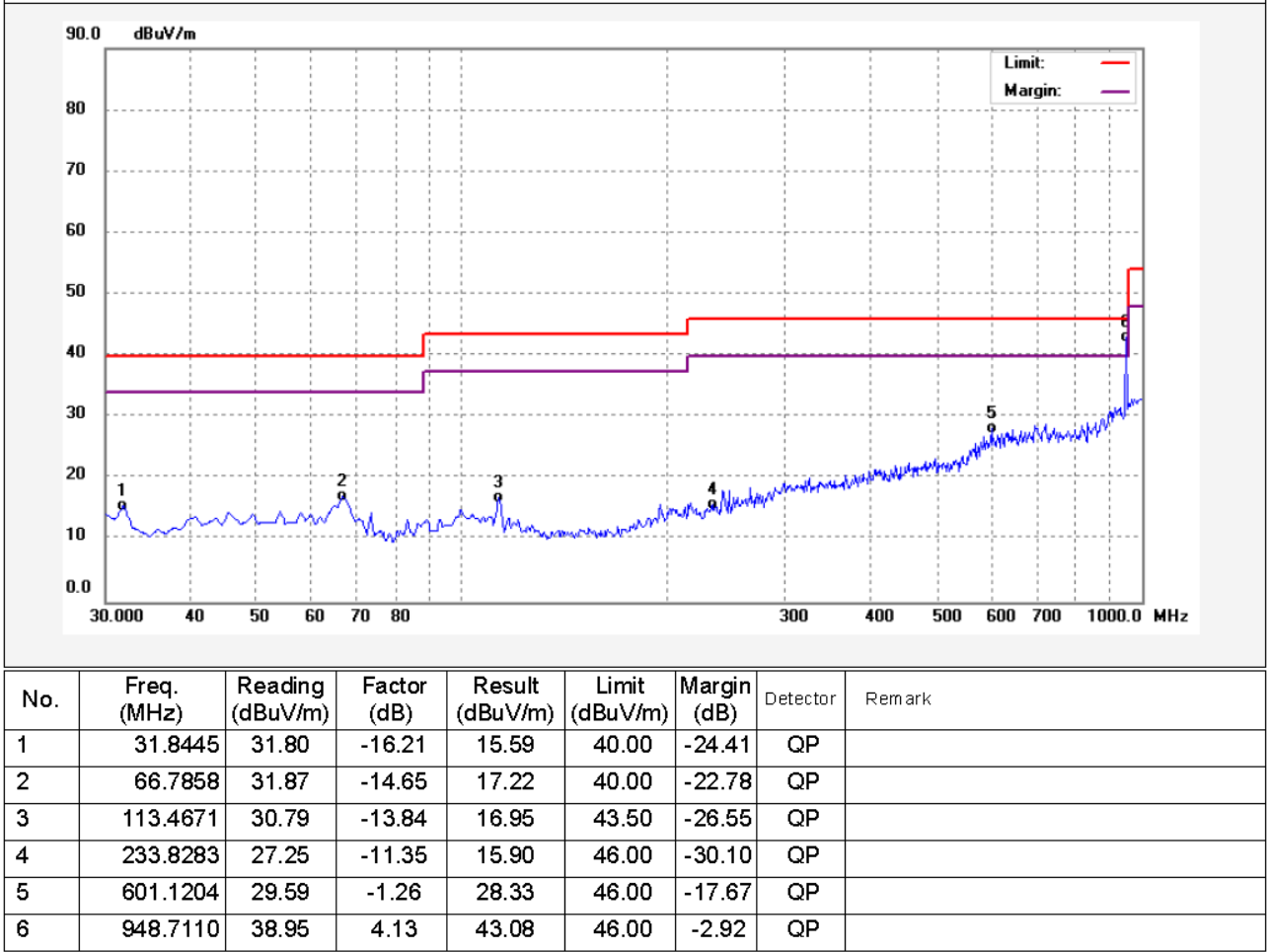


BLE:PCB printed antenna

GFSK Low Channel 2402MHz(Vertical)



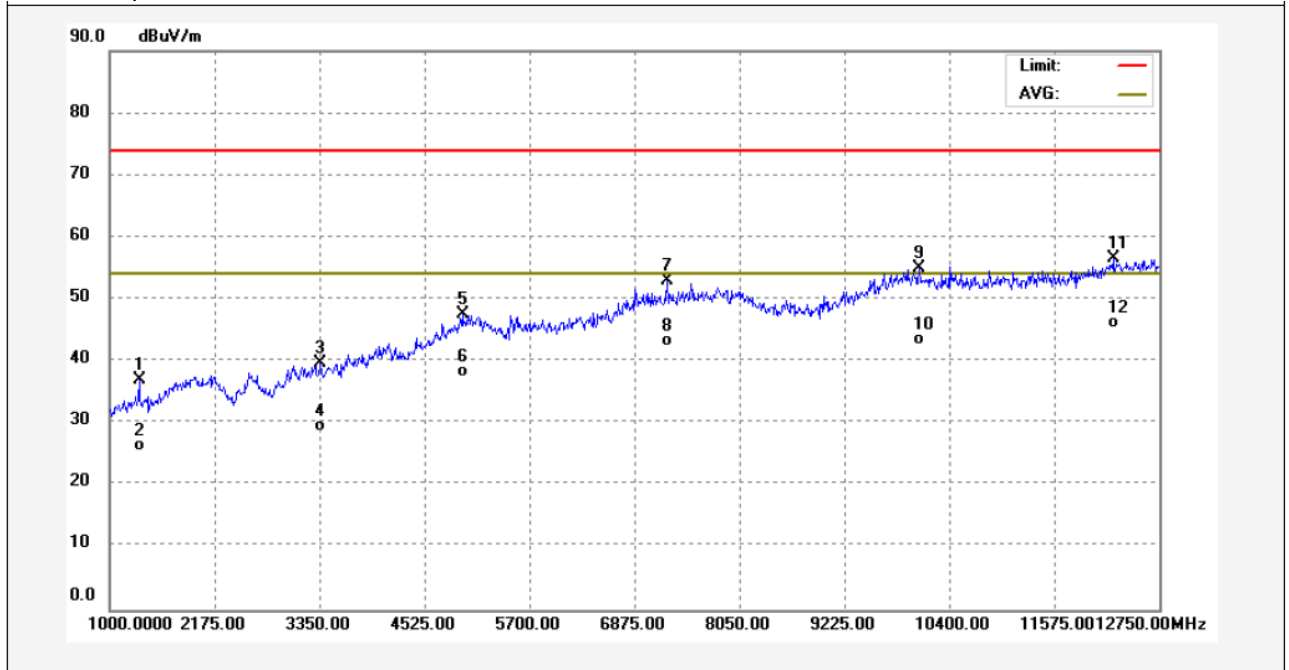
GFSK Low Channel 2402MHz(Horizontal)



Test Frequency : 1GHz ~ 12.75GHz

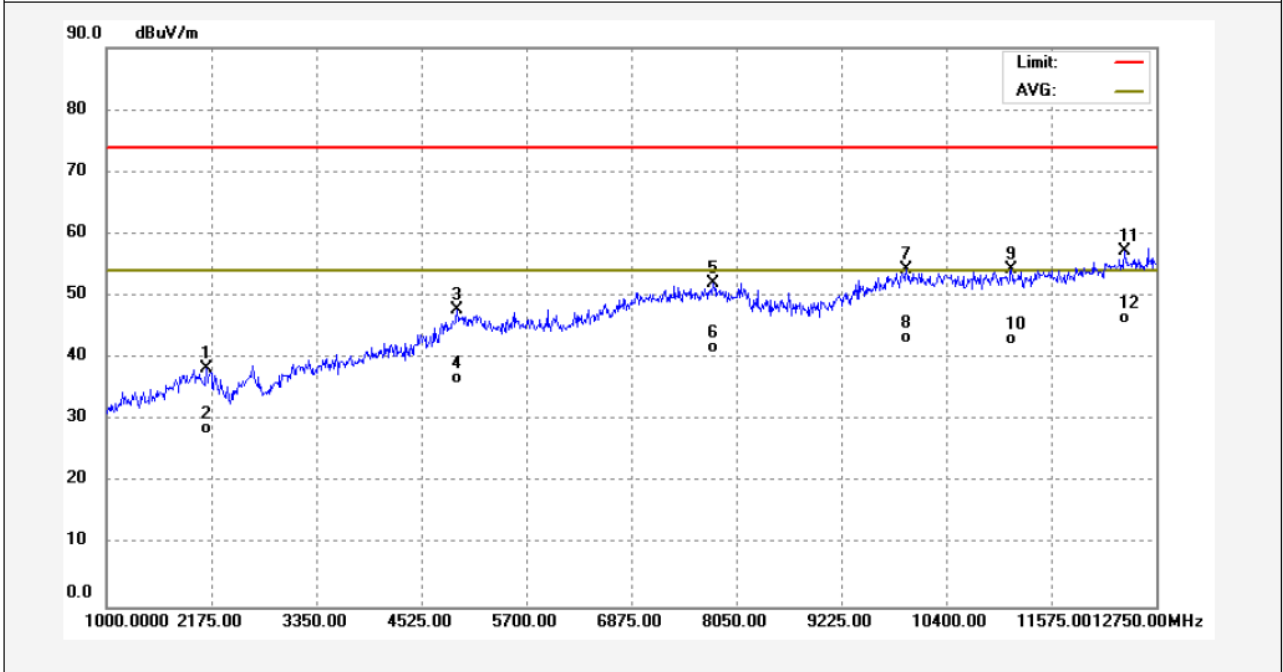
Remark: The current test plots doesn't have the fundamental signal, It's blocked by the filter
GFSK Low Channel 2402MHz(Vertical)

BLE: Stamped Metal Antenna



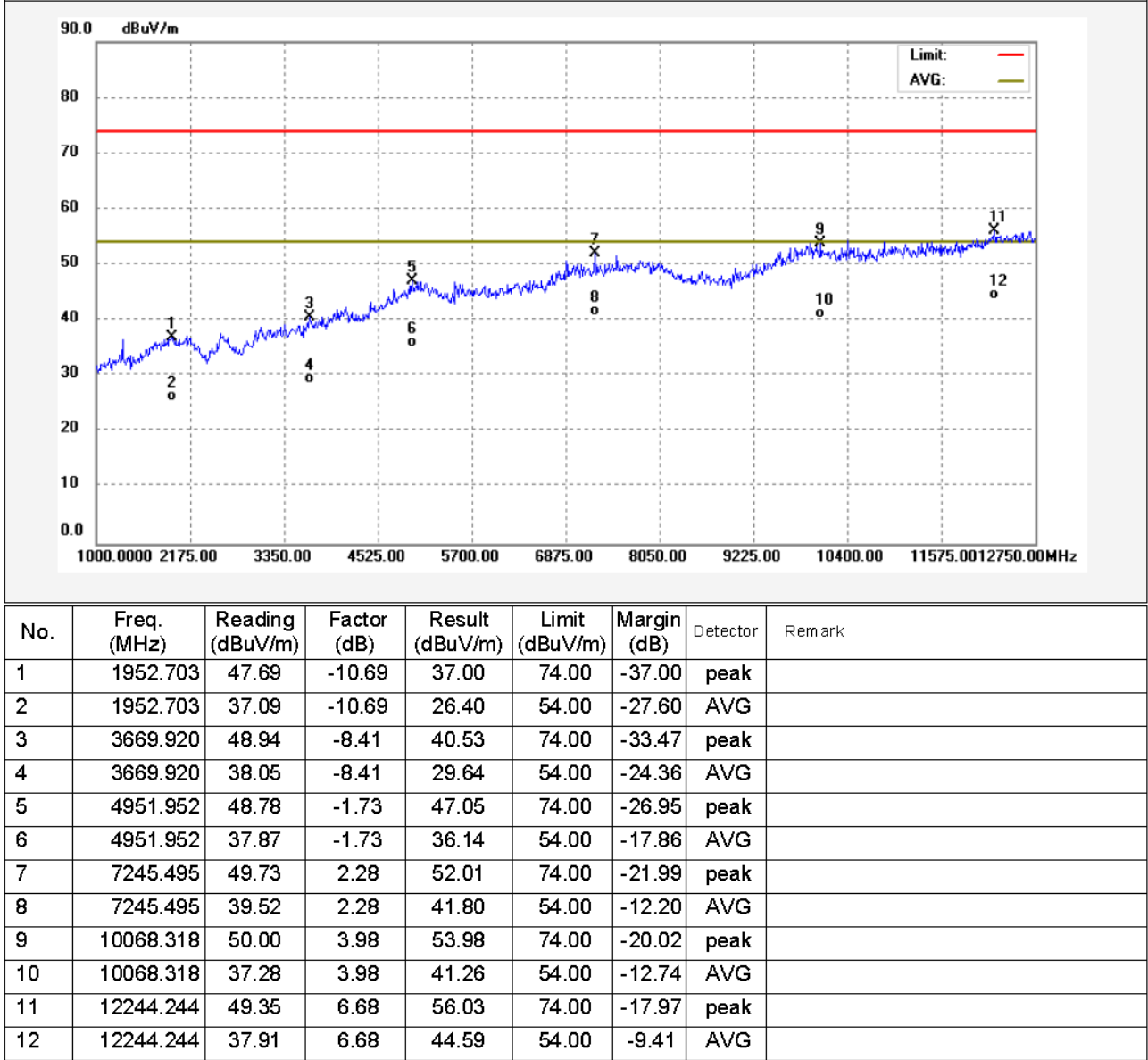
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1329.000	51.76	-14.67	37.09	74.00	-36.91	peak	
2	1329.000	41.01	-14.67	26.34	54.00	-27.66	AVG	
3	3361.750	49.39	-9.62	39.77	74.00	-34.23	peak	
4	3361.750	39.29	-9.62	29.67	54.00	-24.33	AVG	
5	4948.000	49.28	-1.76	47.52	74.00	-26.48	peak	
6	4948.000	40.17	-1.76	38.41	54.00	-15.59	AVG	
7	7239.250	50.73	2.29	53.02	74.00	-20.98	peak	
8	7239.250	40.95	2.29	43.24	54.00	-10.76	AVG	
9	10059.250	51.00	3.97	54.97	74.00	-19.03	peak	
10	10059.250	39.62	3.97	43.59	54.00	-10.41	AVG	
11	12233.000	49.85	6.65	56.50	74.00	-17.50	peak	
12	12233.000	39.54	6.65	46.19	54.00	-7.81	AVG	

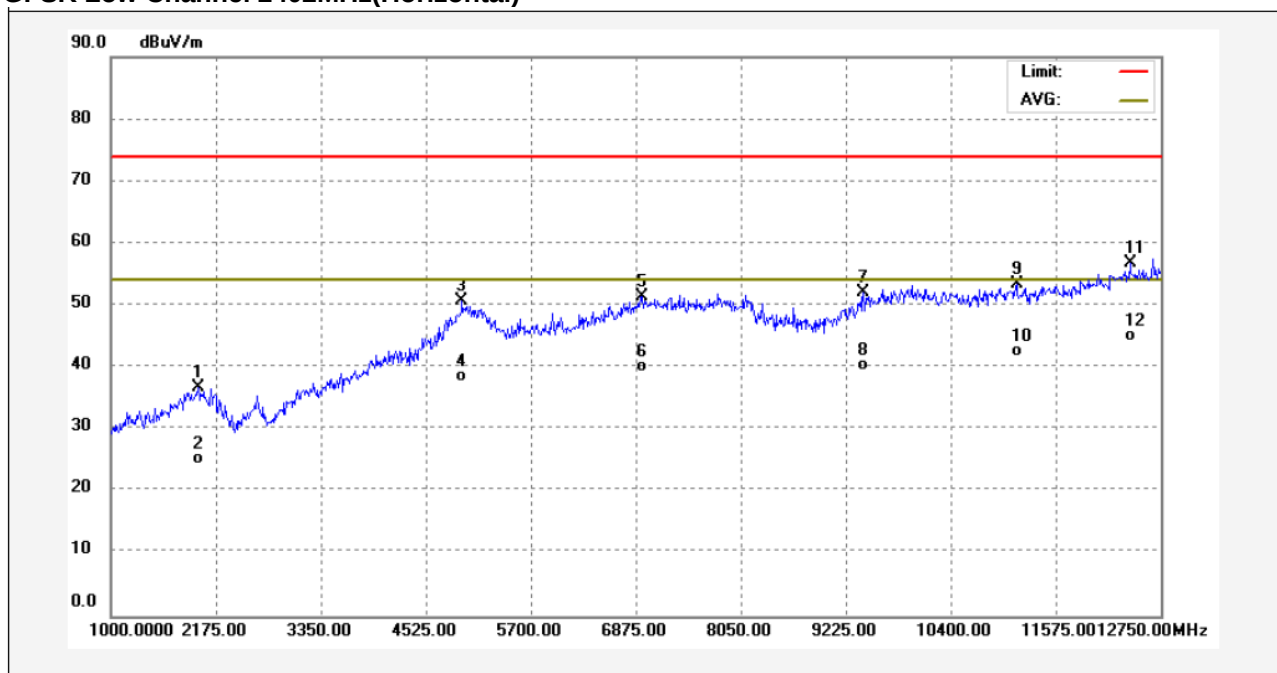
GFSK Low Channel 2402MHz(Horizontal)



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2116.250	46.88	-8.41	38.47	74.00	-35.53	peak	
2	2116.250	37.09	-8.41	28.68	54.00	-25.32	AVG	
3	4924.500	52.11	-4.29	47.82	74.00	-26.18	peak	
4	4924.500	41.08	-4.29	36.79	54.00	-17.21	AVG	
5	7791.500	49.29	2.80	52.09	74.00	-21.91	peak	
6	7791.500	39.02	2.80	41.82	54.00	-12.18	AVG	
7	9953.500	49.40	5.00	54.40	74.00	-19.60	peak	
8	9953.500	38.24	5.00	43.24	54.00	-10.76	AVG	
9	11128.500	48.20	6.22	54.42	74.00	-19.58	peak	
10	11128.500	36.92	6.22	43.14	54.00	-10.86	AVG	
11	12397.500	50.41	6.75	57.16	74.00	-16.84	peak	
12	12397.500	39.63	6.75	46.38	54.00	-7.62	AVG	

BLE: PCB printed antenna



GFSK Low Channel 2402MHz(Horizontal)

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1976.226	47.43	-10.54	36.89	74.00	-37.11	peak	
2	1976.226	35.82	-10.54	25.28	54.00	-28.72	AVG	
3	4928.428	52.61	-1.91	50.70	74.00	-23.30	peak	
4	4928.428	40.56	-1.91	38.65	54.00	-15.35	AVG	
5	6951.451	48.95	2.40	51.35	74.00	-22.65	peak	
6	6951.451	37.74	2.40	40.14	54.00	-13.86	AVG	
7	9421.421	48.80	3.27	52.07	74.00	-21.93	peak	
8	9421.421	37.08	3.27	40.35	54.00	-13.65	AVG	
9	11138.639	47.70	5.70	53.40	74.00	-20.60	peak	
10	11138.639	36.87	5.70	42.57	54.00	-11.43	AVG	
11	12408.909	49.91	6.93	56.84	74.00	-17.16	peak	
12	12408.909	38.23	6.93	45.16	54.00	-8.84	AVG	

Test Frequency: 12.75GHz~25GHz

The measurements were more than 20 dB below the limit and not reported.

8 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

Test Result: PASS

Limit:

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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
 - a) Set instrument center frequency to DTS channel center frequency.
 - b) Set the span to _ 1.5 times the DTS bandwidth.
 - c) Set the RBW = 100 kHz.
 - d) Set the VBW _ $[3 \times \text{RBW}]$.
 - e) Detector = peak.
 - f) Sweep time = auto couple.
 - g) Trace mode = max hold.
 - h) Allow trace to fully stabilize.
 - i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

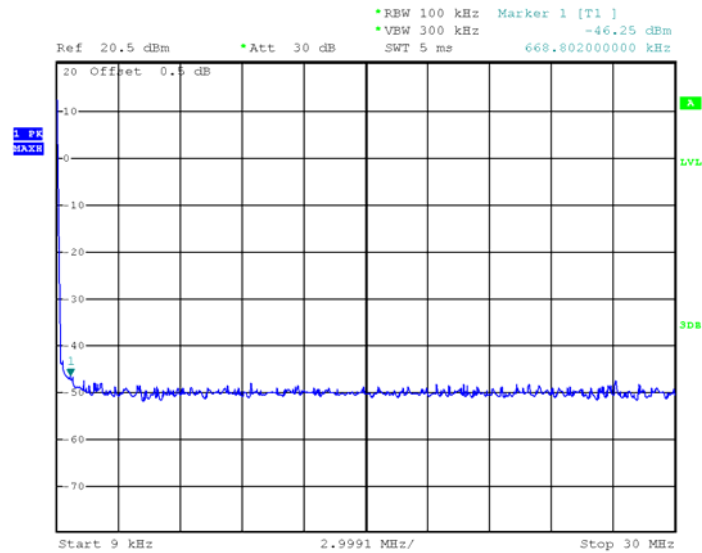
8.2 Test Result

Remark: For the WIFI, Both antenna 0 and antenna 1 are tested, and only the worst data antenna 0 is put in the report

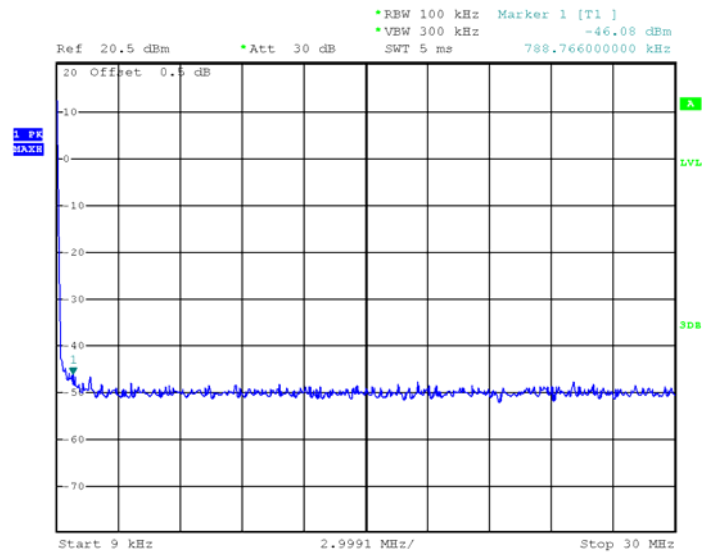
9KHz – 30MHz

802.11b

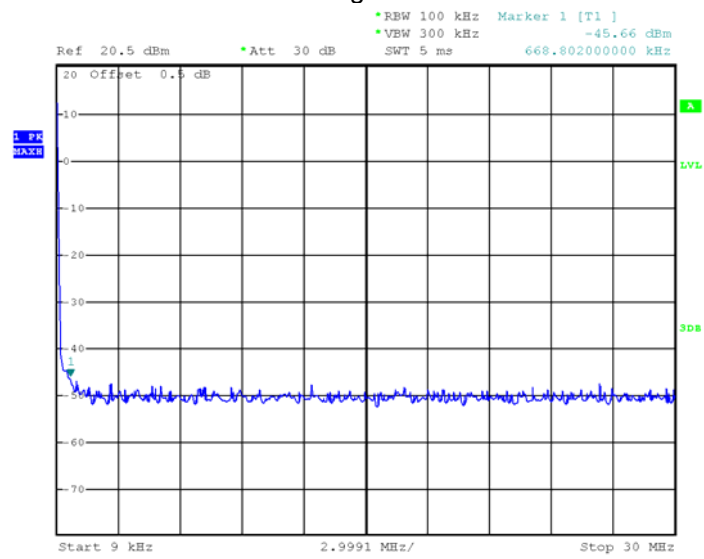
Low Channel



Middle Channel

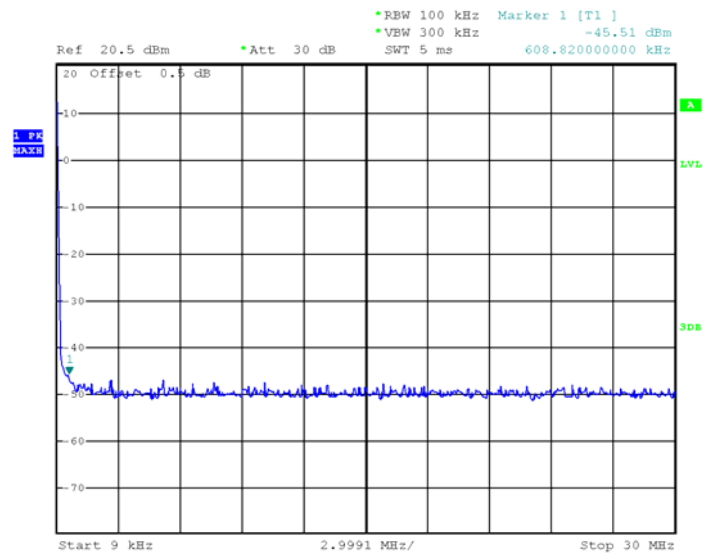


High Channel

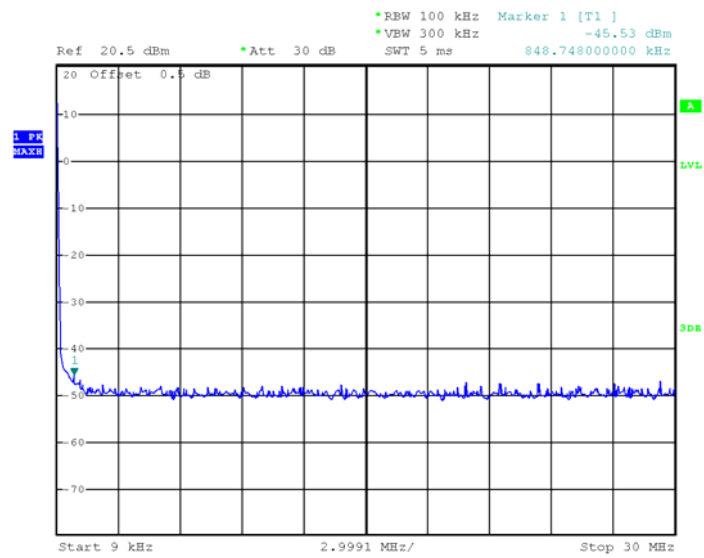


802.11g

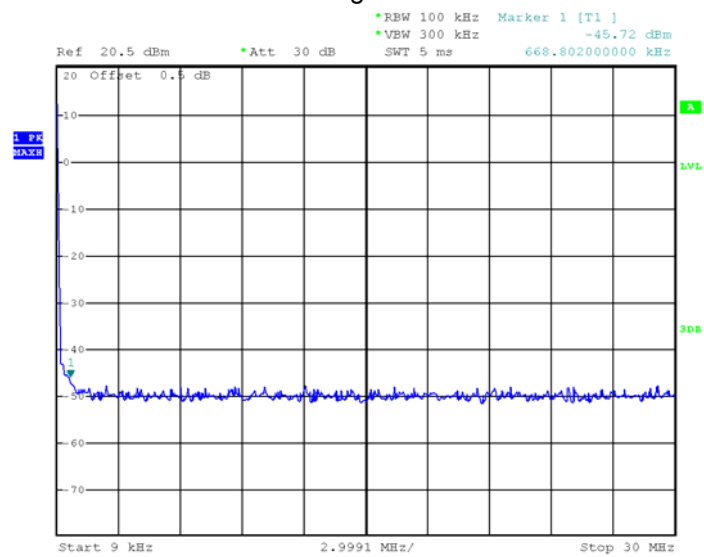
Low Channel



Middle Channel

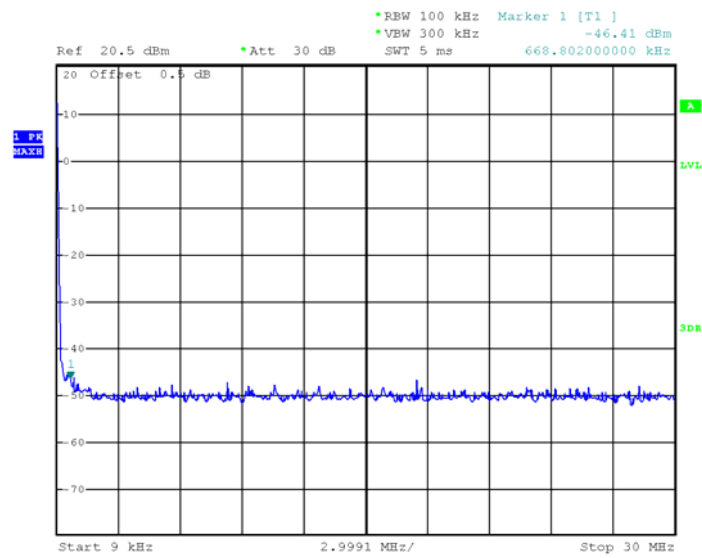


High Channel

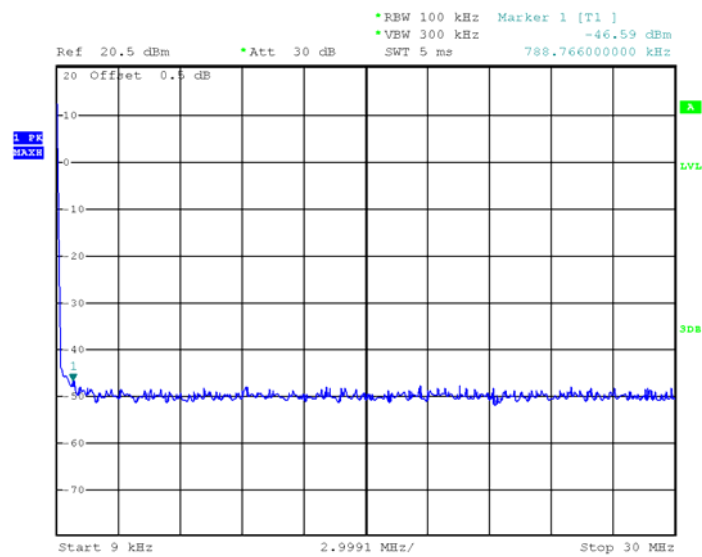


802.11n HT20

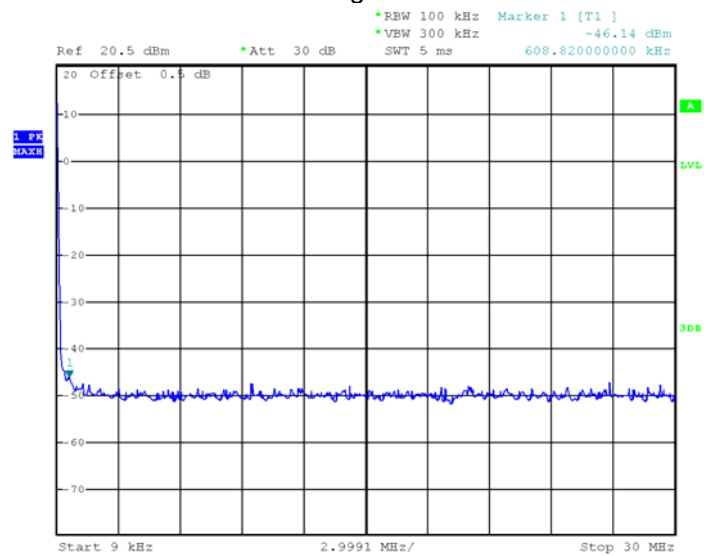
Low Channel



Middle Channel

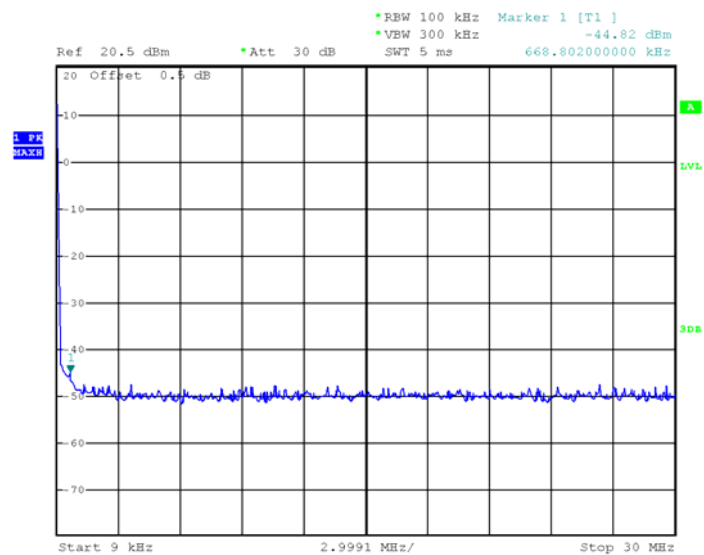


High Channel

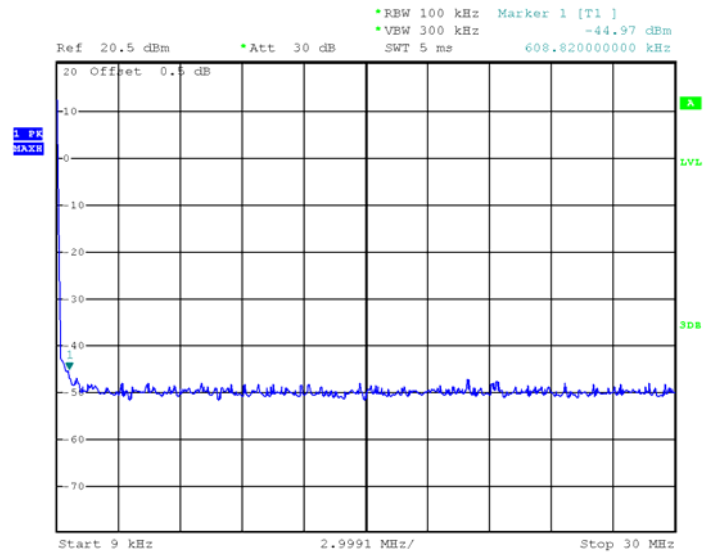


802.11n HT40

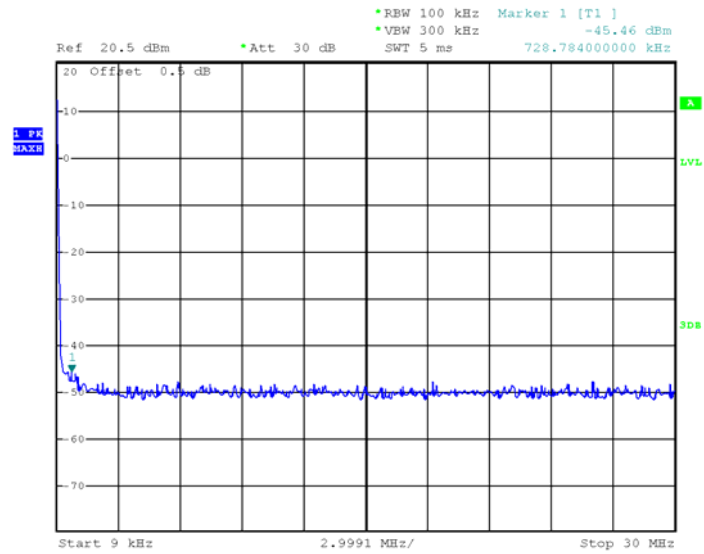
Low Channel



Middle Channel

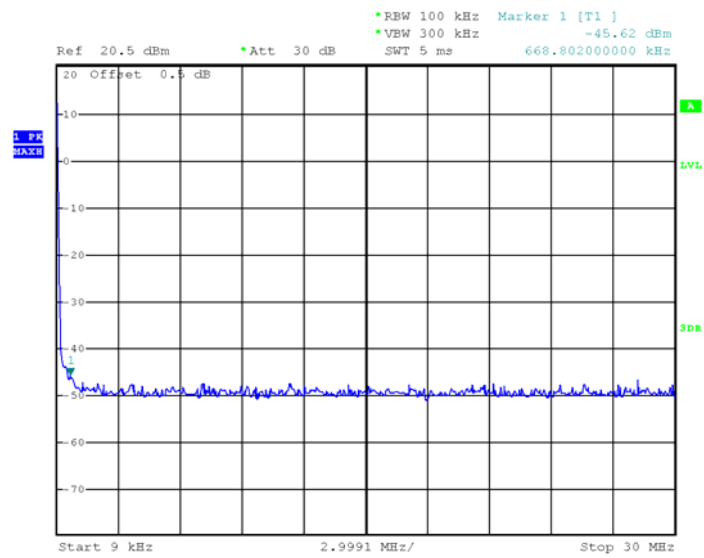


High Channel

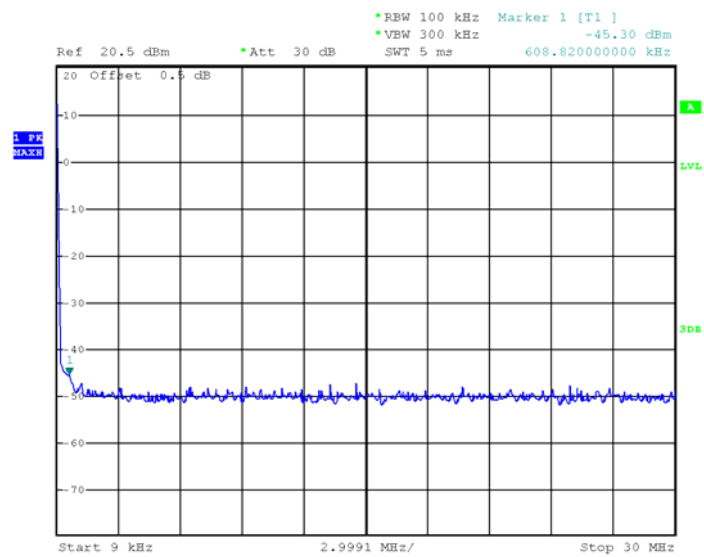


BLE

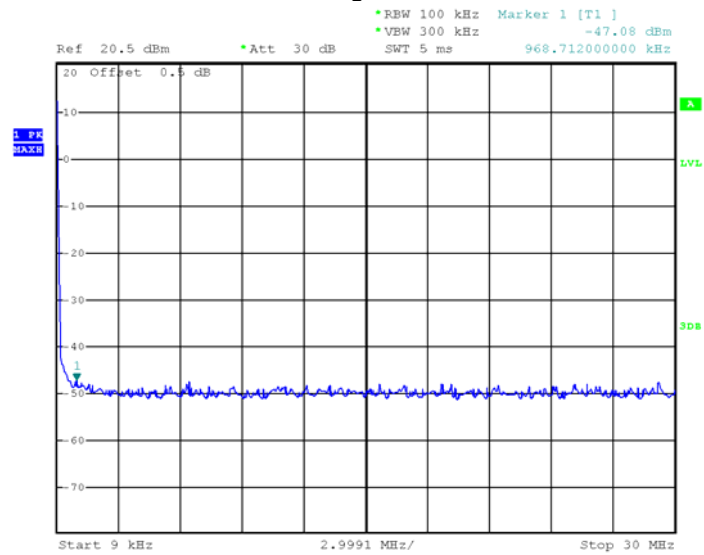
Low Channel



Middle Channel



High Channel

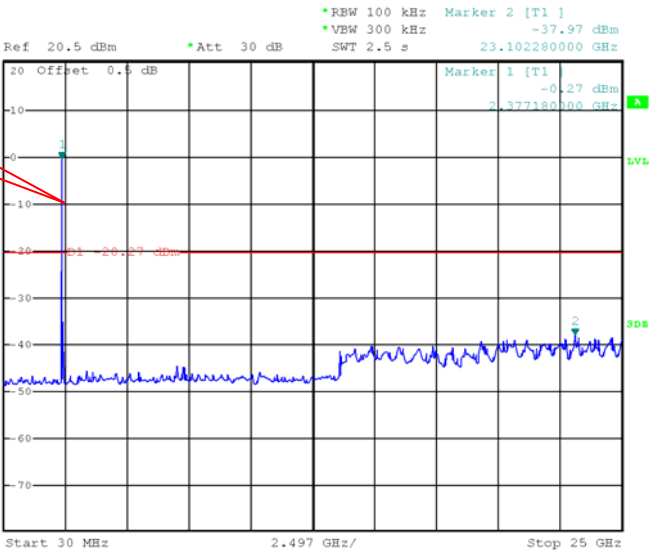


Above 30MHz

802.11b

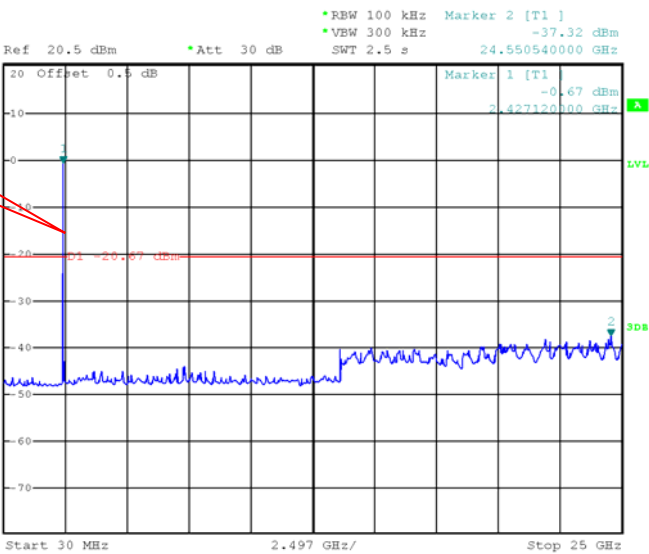
Low Channel

Fundamental



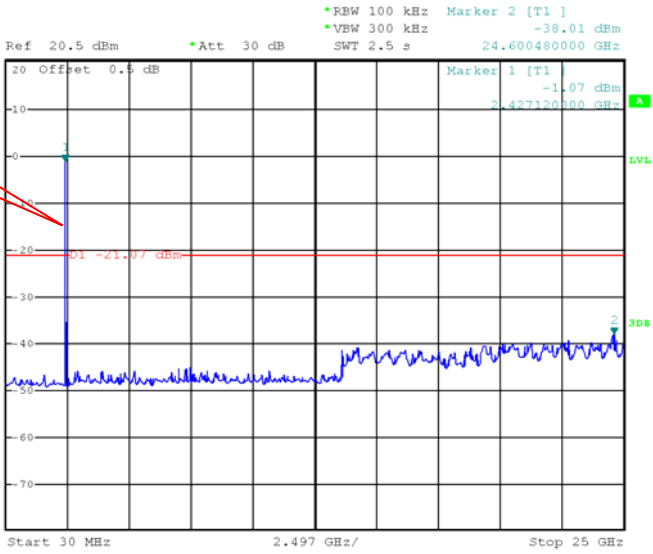
Middle Channel

Fundamental



High Channel

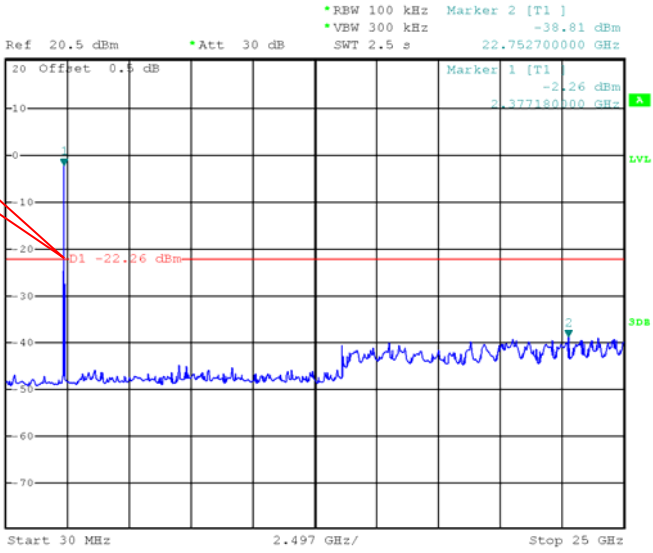
Fundamental



802.11g

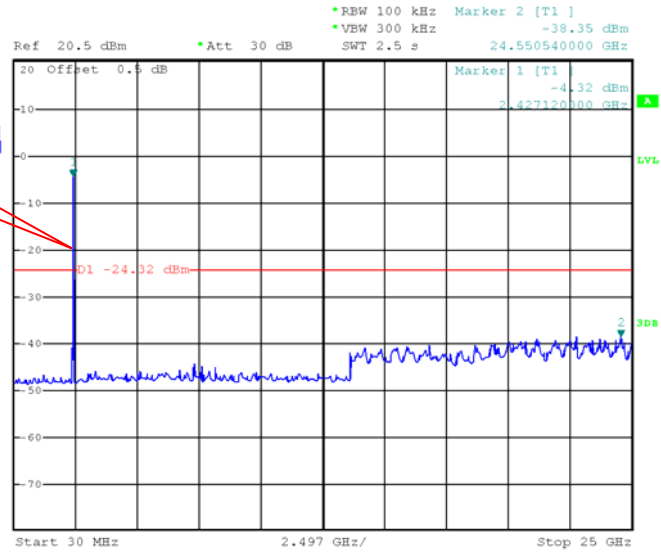
Low Channel

Fundamental



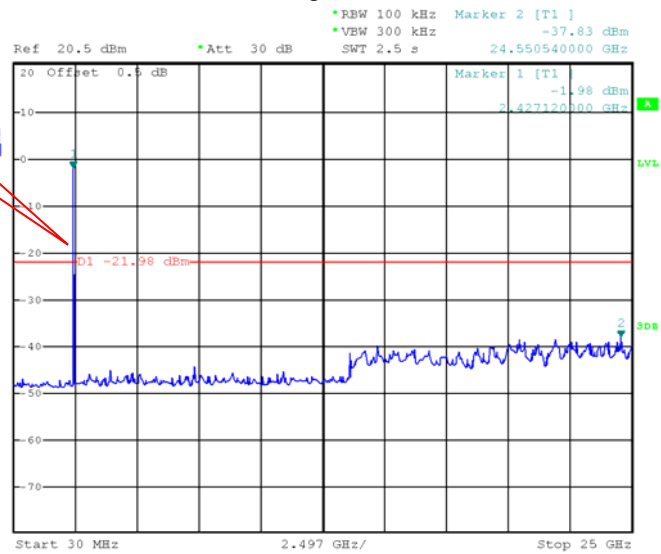
Middle Channel

Fundamental



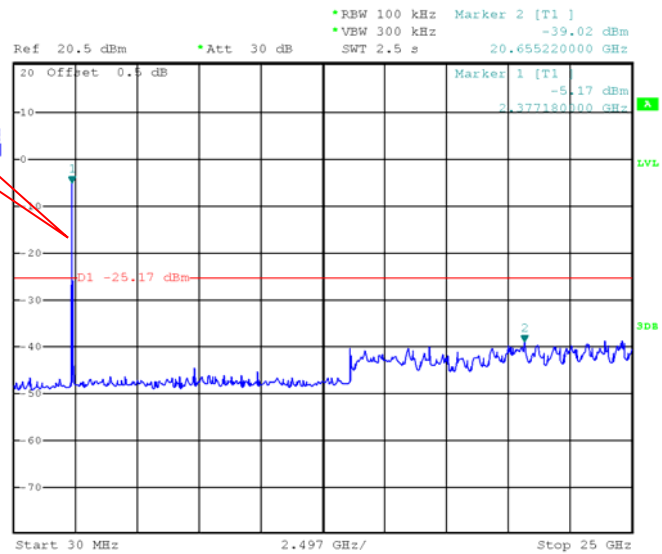
High Channel

Fundamental



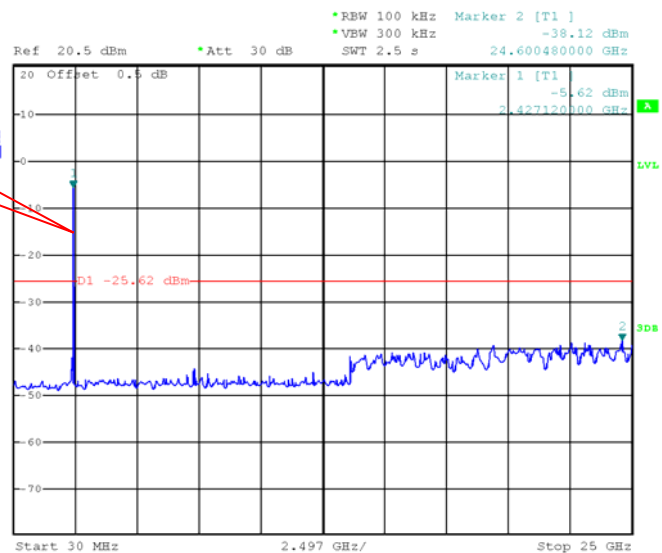
802.11n HT20
Low Channel

Fundamental



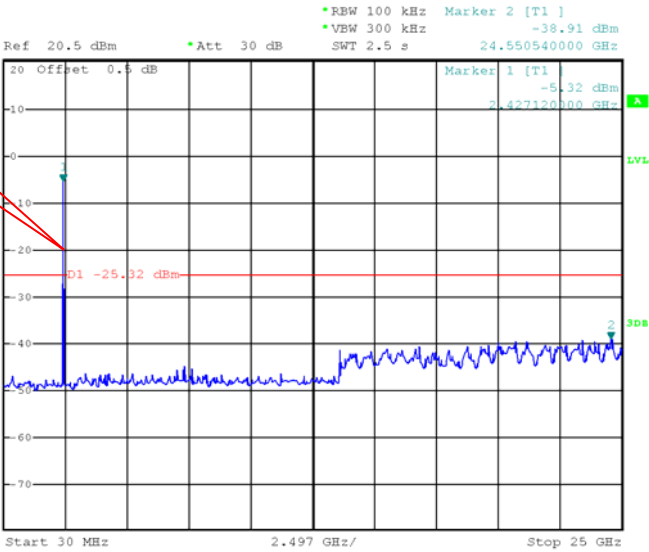
Middle Channel

Fundamental



High Channel

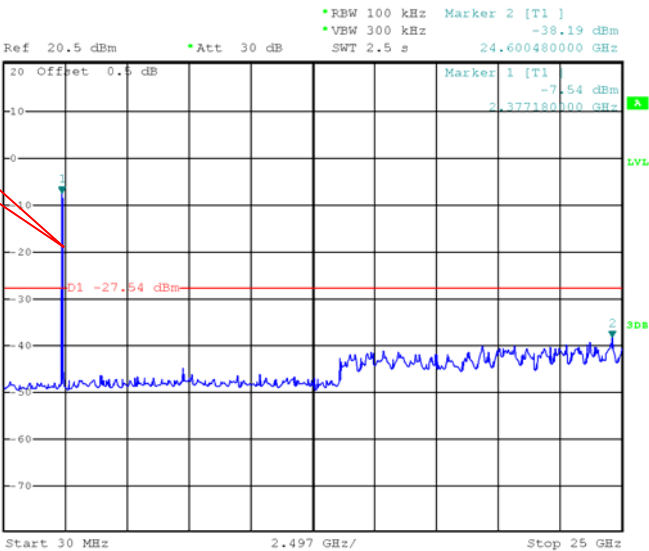
Fundamental



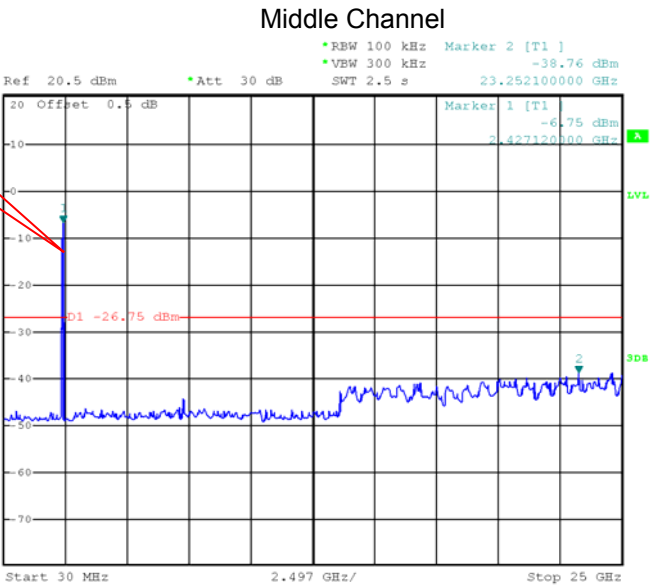
802.11n HT40

Low Channel

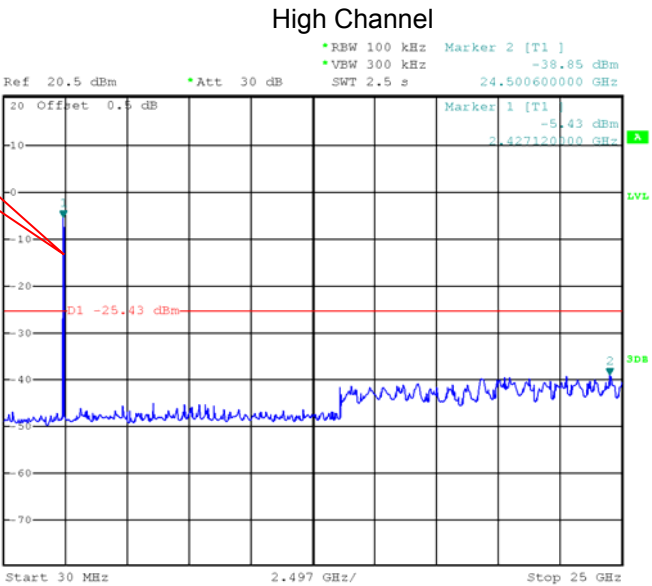
Fundamental



Fundamental



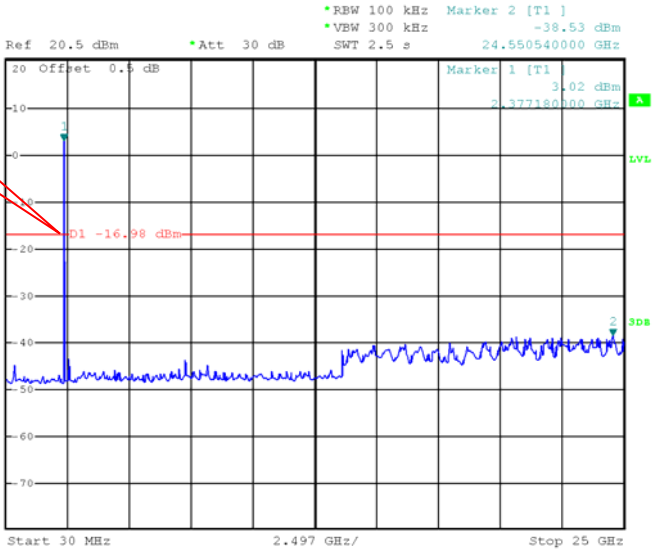
Fundamental



BLE

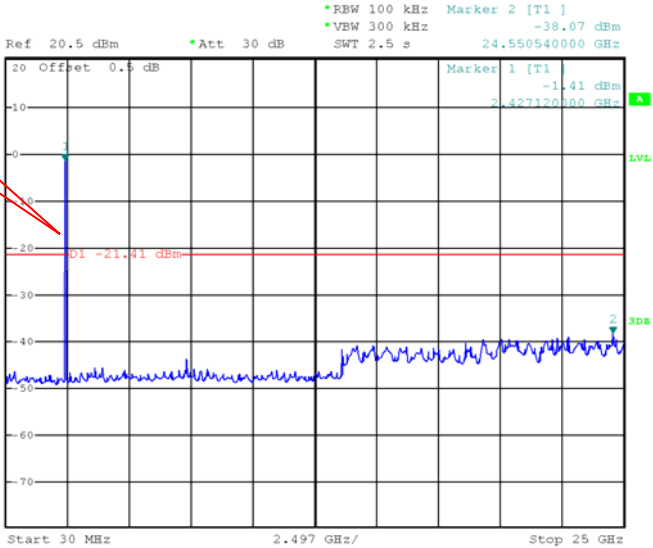
Low Channel

Fundamental

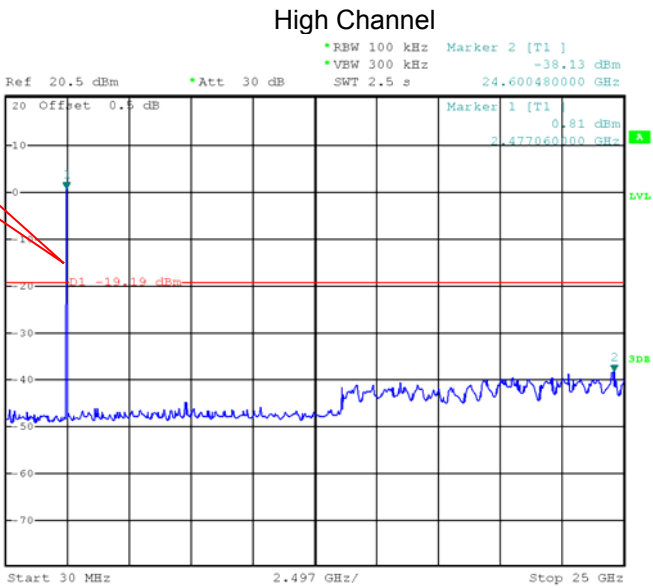


Middle Channel

Fundamental



Fundamental



9 Band Edge Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

Test Limit: Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band 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)).

Test Mode: Transmitting

9.1 Test Produce

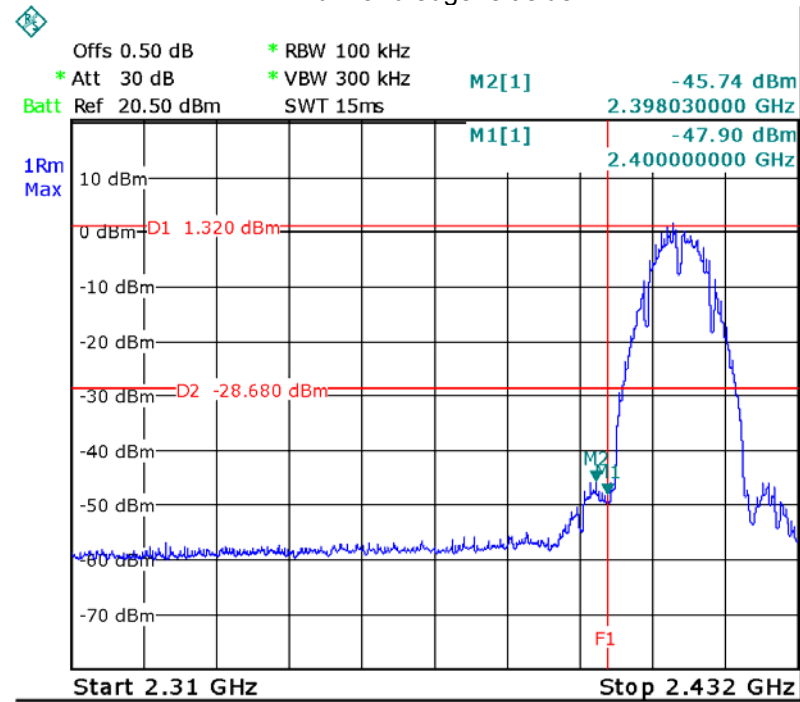
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. 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.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.

9.2 Test Result

Test result plots shown as follows:

Antenna 0

TX 11b: Band edge-left side



TX 11b: Band edge-right side

