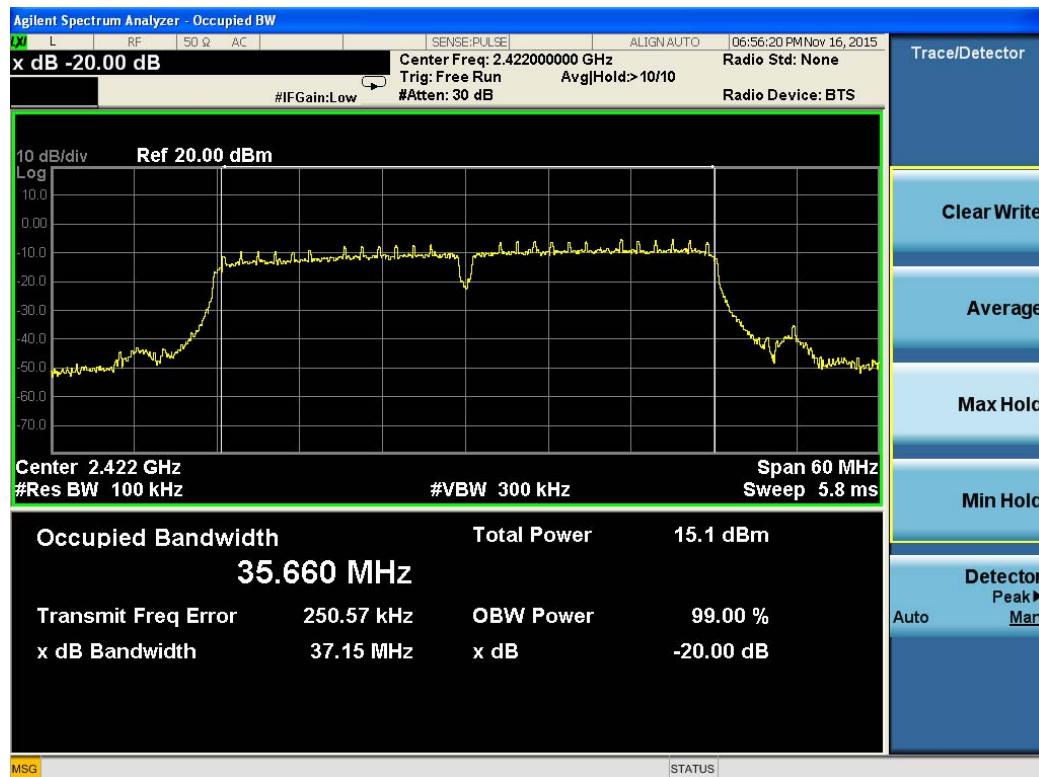


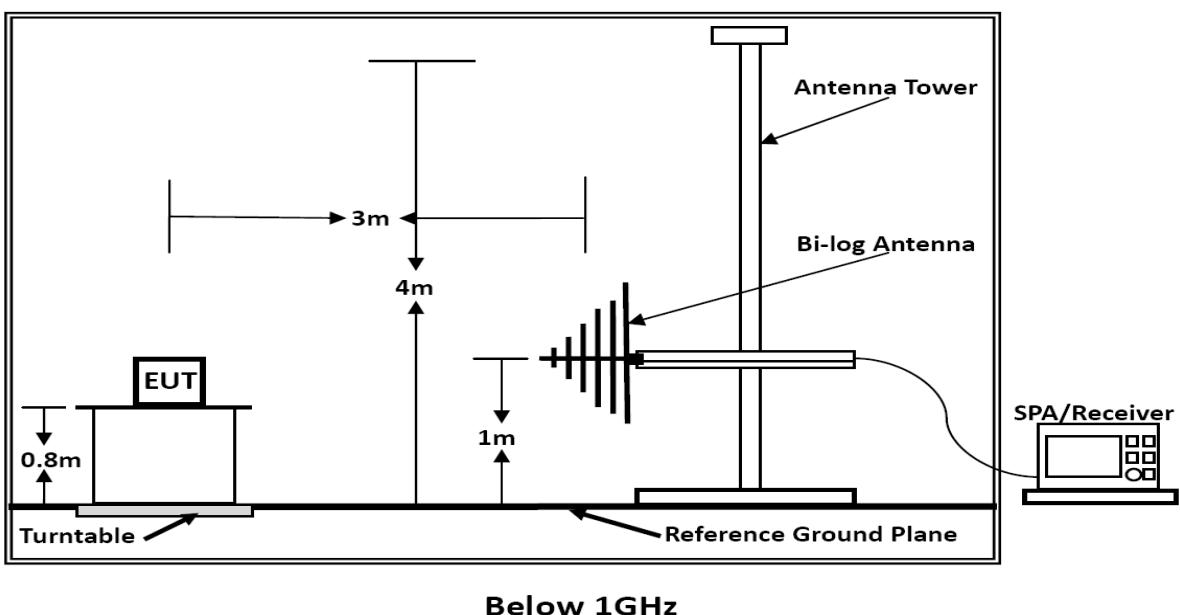
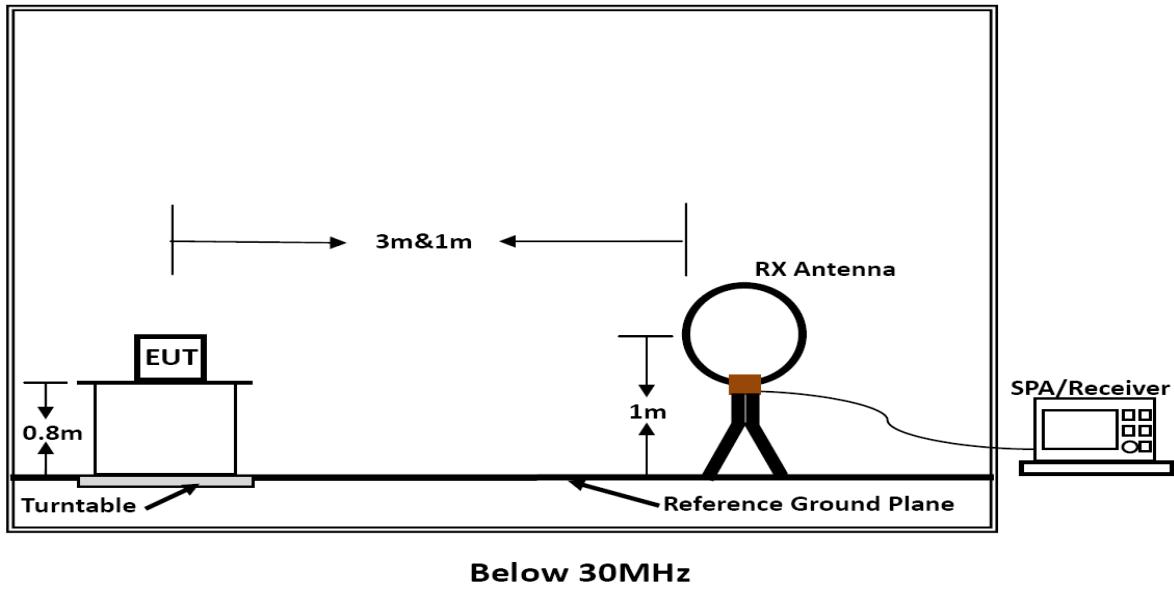
802.11n HT40 channel, 20dB bandwidth

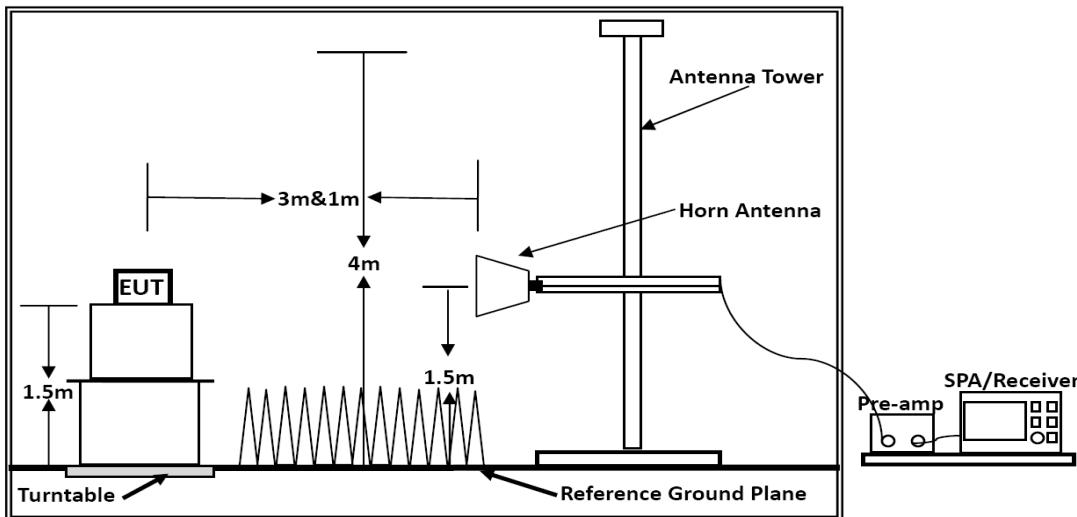




## 5.4. Radiated Emissions Measurement

### Block Diagram of Test Setup





Above 1GHz

### Radiated Emission Limit

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

\2\ Above 38.6

Part 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector.

Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be

demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Part 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/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

## Instruments Setting

The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz 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 100kHz for QP

## Test Procedures

### 1) Sequence of testing 9 kHz to 30 MHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 0.8 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

#### Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 2) Sequence of testing 30 MHz to 1 GHz

### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

## 3) Sequence of testing 1 GHz to 18 GHz

## Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

## Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

## Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

## 4) Sequence of testing above 18 GHz

## Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

## Premeasurement:

- The antenna is moved spherical over the EUT in different polarizations of the antenna.

## Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## Results for Radiated Emissions

**PASS.**

*Only record the worst test result in this report.*

*The radiated emissions from 9kHz to 30MHz are at least 20dB below the official limit and no need to report.*

*The test data please refer to following page:*

## Results of Radiated Emissions (9kHz~30MHz)

Temperature	25°C	Humidity	60%
Test Engineer	Dick	Configurations	BLE 4.0; 802.11b/g/n

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

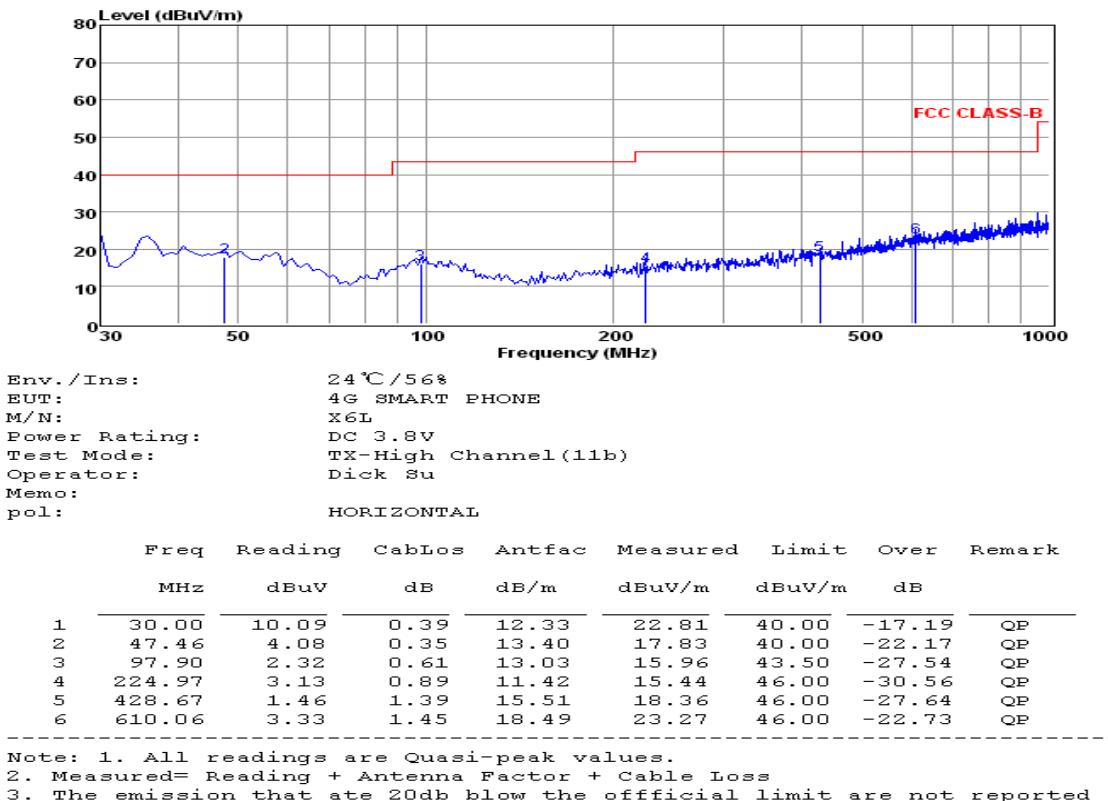
The radiated emissions from 9kHz to 30MHz are at least 20dB below the official limit and no need to report.

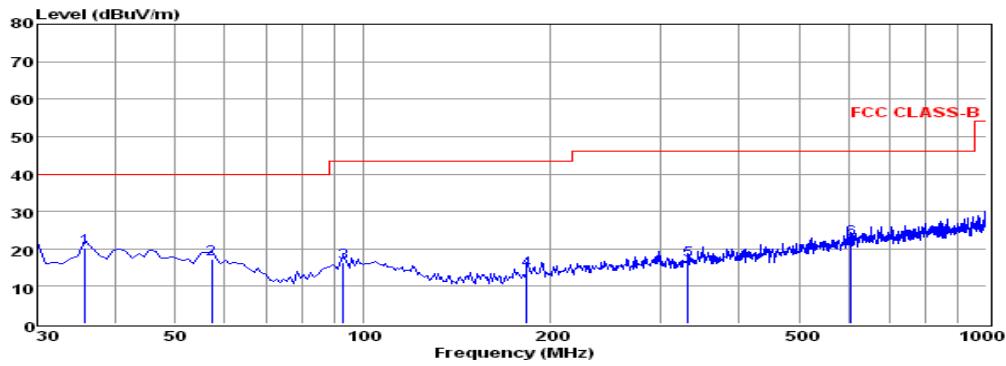
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

## Results of Radiated Emissions (30MHz~1GHz)

Temperature	25°C	Humidity	60%
Test Engineer	Dick	Configurations	802.11b (High Channel)



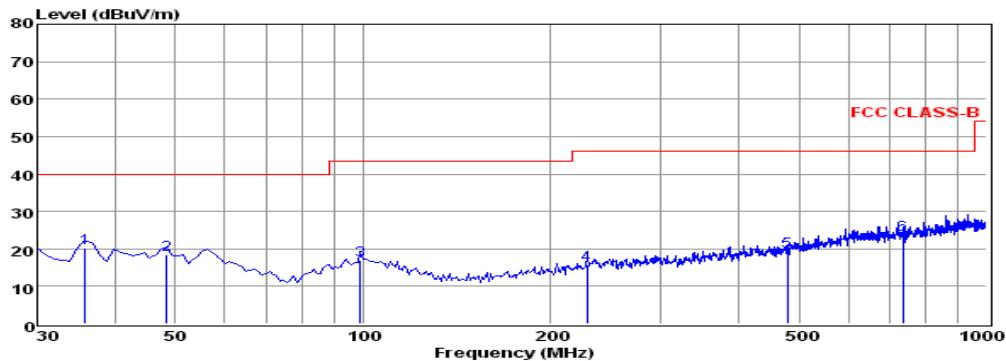


Env./Ins: 24 °C / 56%  
 BUT: 4G SMART PHONE  
 M/N: X6L  
 Power Rating: DC 3.8V  
 Test Mode: TX-High Channel (11b)  
 Operator: Dick Su  
 Memo:  
 pol: VERTICAL

Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1 35.82	7.44	0.41	12.51	20.36	40.00	-19.64	QP
2 57.16	3.92	0.47	12.88	17.27	40.00	-22.73	QP
3 93.05	3.30	0.56	12.47	16.33	43.50	-27.17	QP
4 183.26	3.68	0.70	9.97	14.35	43.50	-29.15	QP
5 331.67	1.97	1.11	13.79	16.87	46.00	-29.13	QP
6 606.18	2.45	1.57	18.47	22.49	46.00	-23.51	QP

Note: 1. All readings are Quasi-peak values.  
 2. Measured= Reading + Antenna Factor + Cable Loss  
 3. The emission that ate 20db blow the official limit are not reported

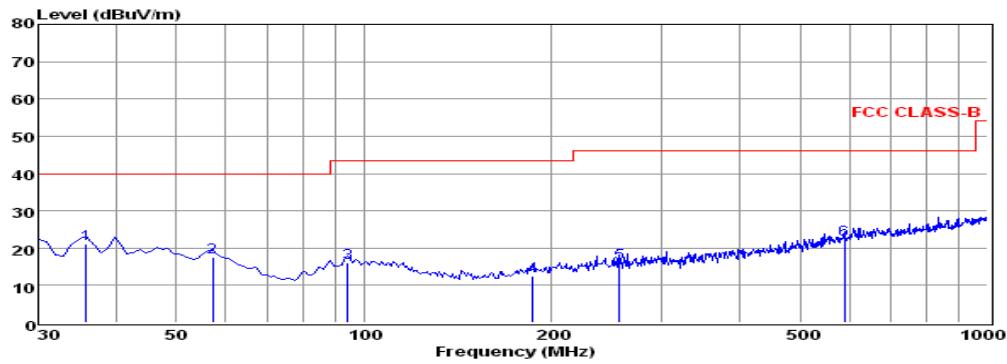
Temperature	25°C	Humidity	60%
Test Engineer	Dick	Configurations	BLE (High Channel)



Env./Ins: 24 °C / 56%  
 BUT: 4G SMART PHONE  
 M/N: X6L  
 Power Rating: DC 3.8V  
 Test Mode: TX-High Channel (BLE)  
 Operator: Dick Su  
 Memo:  
 pol: VERTICAL

Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1 35.82	7.27	0.41	12.51	20.19	40.00	-19.81	QP
2 48.43	4.71	0.35	13.34	18.40	40.00	-21.60	QP
3 98.87	3.30	0.61	13.09	17.00	43.50	-26.50	QP
4 228.85	3.27	0.93	11.59	15.79	46.00	-30.21	QP
5 479.11	1.82	1.39	16.05	19.26	46.00	-26.74	QP
6 735.19	2.92	1.74	19.25	23.91	46.00	-22.09	QP

Note: 1. All readings are Quasi-peak values.  
 2. Measured= Reading + Antenna Factor + Cable Loss  
 3. The emission that ate 20db blow the official limit are not reported



Env./Ins: 24 °C / 56%  
 EUT: 4G SMART PHONE  
 M/N: X6L  
 Power Rating: DC 3.8V  
 Test Mode: TX-High Channel (BLE)  
 Operator: Dick Su  
 Memo:  
 pol: HORIZONTAL

	Freq MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	35.82	8.33	0.41	12.51	21.25	40.00	-18.75	QP
2	57.16	4.16	0.47	12.88	17.51	40.00	-22.49	QP
3	94.02	2.68	0.58	12.66	15.92	43.50	-27.58	QP
4	186.17	1.39	0.98	10.22	12.59	43.50	-30.91	QP
5	256.98	3.08	1.02	12.06	16.16	46.00	-29.84	QP
6	588.72	2.68	1.40	18.24	22.32	46.00	-23.68	QP

Note: 1. All readings are Quasi-peak values.  
 2. Measured = Reading + Antenna Factor + Cable Loss  
 3. The emission that ate 20db blow the offical limit are not reported

### \*\*\*Note:

Pre-scan all mode and recorded the worst case results in this report (802.11b (High Channel) and BLE (High Channel)).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 5.4.8. Results for Radiated Emissions (Above 1GHz)

Note: Only recorded the worst test result.

BLE 4.0

Channel 0

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4804.17	42.74	33.06	35.04	3.94	44.70	74	-29.30	Peak	Horizontal
4804.20	34.19	33.06	35.04	3.94	36.15	54	-17.85	Average	Horizontal
4804.17	43.09	33.06	35.04	3.94	45.05	74	-28.95	Peak	Vertical
4804.20	36.05	33.06	35.04	3.94	38.01	54	-15.99	Average	Vertical

Channel 19

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4880.24	43.14	33.16	35.15	3.96	45.11	74	-28.89	Peak	Horizontal
4880.26	31.78	33.16	35.15	3.96	33.75	54	-20.25	Average	Horizontal
4880.24	43.52	33.16	35.15	3.96	45.49	74	-28.51	Peak	Vertical
4880.26	34.20	33.16	35.15	3.96	36.17	54	-17.83	Average	Vertical

Channel 39

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.33	41.73	33.26	35.14	3.98	43.83	74	-30.17	Peak	Horizontal
4960.36	33.39	33.26	35.14	3.98	35.49	54	-18.51	Average	Horizontal
4960.33	44.75	33.26	35.14	3.98	46.85	74	-27.15	Peak	Vertical
4960.36	32.94	33.26	35.14	3.98	35.04	54	-18.96	Average	Vertical

802.11b

Channel 1

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.17	54.13	33.06	35.04	3.94	56.09	74	-17.91	Peak	Horizontal
4824.19	42.01	33.06	35.04	3.94	43.97	54	-10.03	Average	Horizontal
4824.17	53.41	33.06	35.04	3.94	55.37	74	-18.63	Peak	Vertical
4824.19	46.41	33.06	35.04	3.94	48.37	54	-5.63	Average	Vertical

Channel 6

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4874.31	51.98	33.16	35.15	3.96	53.95	74	-20.05	Peak	Horizontal
4874.33	42.17	33.16	35.15	3.96	44.14	54	-9.86	Average	Horizontal
4874.31	52.74	33.16	35.15	3.96	54.71	74	-19.29	Peak	Vertical
4874.33	43.38	33.16	35.15	3.96	45.35	54	-8.65	Average	Vertical

Channel 11

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4924.34	52.27	33.26	35.14	3.98	54.37	74	-19.63	Peak	Horizontal
4924.37	41.32	33.26	35.14	3.98	43.42	54	-10.58	Average	Horizontal
4924.34	53.99	33.26	35.14	3.98	56.09	74	-17.91	Peak	Vertical
4924.37	44.97	33.26	35.14	3.98	47.07	54	-6.93	Average	Vertical

802.11g

Channel 1

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.23	52.18	33.06	35.04	3.94	54.14	74	-19.86	Peak	Horizontal
4824.25	42.47	33.06	35.04	3.94	44.43	54	-9.57	Average	Horizontal
4824.23	52.99	33.06	35.04	3.94	54.95	74	-19.05	Peak	Vertical
4824.25	44.64	33.06	35.04	3.94	46.60	54	-7.40	Average	Vertical

Channel 6

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4874.36	50.40	33.16	35.15	3.96	52.37	74	-21.63	Peak	Horizontal
4874.39	39.23	33.16	35.15	3.96	41.20	54	-12.80	Average	Horizontal
4874.36	53.21	33.16	35.15	3.96	55.18	74	-18.82	Peak	Vertical
4874.39	41.98	33.16	35.15	3.96	43.95	54	-10.05	Average	Vertical

Channel 11

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4924.41	49.89	33.26	35.14	3.98	51.99	74	-22.01	Peak	Horizontal
4924.44	40.70	33.26	35.14	3.98	42.80	54	-11.20	Average	Horizontal
4924.41	52.21	33.26	35.14	3.98	54.31	74	-19.69	Peak	Vertical
4924.44	43.13	33.26	35.14	3.98	45.23	54	-8.77	Average	Vertical

## 802.11n HT20

## Channel 1

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.18	50.06	33.06	35.04	3.94	52.02	74	-21.98	Peak	Horizontal
4824.20	40.42	33.06	35.04	3.94	42.38	54	-11.62	Average	Horizontal
4824.18	49.94	33.06	35.04	3.94	51.90	74	-22.10	Peak	Vertical
4824.20	41.24	33.06	35.04	3.94	43.20	54	-10.80	Average	Vertical

## Channel 6

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4874.33	47.10	33.16	35.15	3.96	49.07	74	-24.93	Peak	Horizontal
4874.36	39.71	33.16	35.15	3.96	41.68	54	-12.32	Average	Horizontal
4874.33	48.94	33.16	35.15	3.96	50.91	74	-23.09	Peak	Vertical
4874.36	40.65	33.16	35.15	3.96	42.62	54	-11.38	Average	Vertical

## Channel 11

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4924.43	46.06	33.26	35.14	3.98	48.16	74	-25.84	Peak	Horizontal
4924.45	35.58	33.26	35.14	3.98	37.68	54	-16.32	Average	Horizontal
4924.43	50.19	33.26	35.14	3.98	52.29	74	-21.71	Peak	Vertical
4924.45	41.66	33.26	35.14	3.98	43.76	54	-10.24	Average	Vertical

## 802.11n HT40

## Channel 3

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.18	49.62	33.06	35.04	3.94	51.58	74	-22.42	Peak	Horizontal
4824.20	40.77	33.06	35.04	3.94	42.73	54	-11.27	Average	Horizontal
4824.18	50.07	33.06	35.04	3.94	52.03	74	-21.97	Peak	Vertical
4824.20	39.90	33.06	35.04	3.94	41.86	54	-12.14	Average	Vertical

## Channel 6

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4874.33	46.83	33.16	35.15	3.96	48.80	74	-25.20	Peak	Horizontal
4874.36	39.88	33.16	35.15	3.96	41.85	54	-12.15	Average	Horizontal
4874.33	48.37	33.16	35.15	3.96	50.34	74	-23.66	Peak	Vertical
4874.36	40.21	33.16	35.15	3.96	42.18	54	-11.82	Average	Vertical

## Channel 9

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4924.43	45.34	33.26	35.14	3.98	47.44	74	-26.56	Peak	Horizontal
4924.45	36.08	33.26	35.14	3.98	38.18	54	-15.82	Average	Horizontal
4924.43	51.53	33.26	35.14	3.98	53.63	74	-20.37	Peak	Vertical
4924.45	40.09	33.26	35.14	3.98	42.19	54	-11.81	Average	Vertical

**Notes:**

1. Measuring frequencies from 9k~10th harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
2. Radiated emissions measured in frequency range from 30MHz~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
3. The radiated emissions from 18GHz to 25GHz are at least 20dB below the official limit and no need to report.

## 5.4.9. Results of Band Edges Test (Radiated)

Note: Only recorded the worst test result.

BLE 4.0

Tx-2402

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2374.61	42.25	32.89	35.16	3.51	43.49	74	-30.51	Peak	Horizontal
2374.63	33.30	32.90	35.16	3.51	34.55	54	-19.45	Average	Horizontal
2390.00	45.77	32.92	35.16	3.54	47.07	74	-26.93	Peak	Horizontal
2389.97	36.11	32.92	35.16	3.54	37.41	54	-16.59	Average	Horizontal
2400.00	55.58	32.92	35.16	3.54	56.88	74	-17.12	Peak	Horizontal
2399.99	47.04	32.92	35.16	3.54	48.34	54	-5.66	Average	Horizontal
2374.61	42.67	32.89	35.16	3.51	43.91	74	-30.09	Peak	Vertical
2374.63	31.96	32.90	35.16	3.51	33.21	54	-20.79	Average	Vertical
2390.00	46.30	32.92	35.16	3.54	47.60	74	-26.40	Peak	Vertical
2389.97	38.94	32.92	35.16	3.54	40.24	54	-13.76	Average	Vertical
2400.00	58.25	32.92	35.16	3.54	59.55	74	-14.45	Peak	Vertical
2399.99	47.90	32.92	35.16	3.54	49.20	54	-4.80	Average	Vertical

Tx-2480

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	45.07	33.06	35.18	3.60	46.55	74	-27.45	Peak	Horizontal
2483.51	36.89	33.08	35.18	3.60	38.39	54	-15.61	Average	Horizontal
2487.57	41.13	33.08	35.18	3.62	42.65	74	-31.35	Peak	Horizontal
2487.60	32.41	33.08	35.18	3.62	33.93	54	-20.07	Average	Horizontal
2483.50	45.64	33.06	35.18	3.60	47.12	74	-26.88	Peak	Vertical
2483.51	35.29	33.08	35.18	3.60	36.79	54	-17.21	Average	Vertical
2487.57	43.02	33.08	35.18	3.62	44.54	74	-29.46	Peak	Vertical
2487.60	32.64	33.08	35.18	3.62	34.16	54	-19.84	Average	Vertical

802.11b

Tx-2412

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2371.86	45.86	32.89	35.16	3.51	47.10	74	-26.90	Peak	Horizontal
2371.89	38.22	32.90	35.16	3.51	39.47	54	-14.53	Average	Horizontal
2390.00	49.30	32.92	35.16	3.54	50.60	74	-23.40	Peak	Horizontal
2389.97	39.41	32.92	35.16	3.54	40.71	54	-13.29	Average	Horizontal
2400.00	57.90	32.92	35.16	3.54	59.20	74	-14.80	Peak	Horizontal
2399.98	49.01	32.92	35.16	3.54	50.31	54	-3.69	Average	Horizontal
2371.86	49.96	32.89	35.16	3.51	51.20	74	-22.80	Peak	Vertical
2371.89	37.67	32.90	35.16	3.51	38.92	54	-15.08	Average	Vertical
2390.00	48.39	32.92	35.16	3.54	49.69	74	-24.31	Peak	Vertical
2389.97	38.25	32.92	35.16	3.54	39.55	54	-14.45	Average	Vertical
2400.00	61.51	32.92	35.16	3.54	62.81	74	-11.19	Peak	Vertical
2399.98	48.96	32.92	35.16	3.54	50.26	54	-3.74	Average	Vertical

Tx-2462

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2483.50	46.78	33.06	35.18	3.60	48.26	74	-25.74	Peak	Horizontal
2483.51	37.76	33.08	35.18	3.60	39.26	54	-14.74	Average	Horizontal
2489.15	52.37	33.08	35.18	3.62	53.89	74	-20.11	Peak	Horizontal
2489.17	39.91	33.08	35.18	3.62	41.43	54	-12.57	Average	Horizontal
2483.50	46.77	33.06	35.18	3.60	48.25	74	-25.75	Peak	Vertical
2483.53	36.99	33.08	35.18	3.60	38.49	54	-15.51	Average	Vertical
2489.15	52.31	33.08	35.18	3.62	53.83	74	-20.17	Peak	Vertical
2489.17	41.72	33.08	35.18	3.62	43.24	54	-10.76	Average	Vertical

802.11g

Tx-2412

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2375.54	45.27	32.89	35.16	3.51	46.51	74	-27.49	Peak	Horizontal
2375.57	37.68	32.90	35.16	3.51	38.93	54	-15.07	Average	Horizontal
2390.00	49.38	32.92	35.16	3.54	50.68	74	-23.32	Peak	Horizontal
2389.97	35.76	32.92	35.16	3.54	37.06	54	-16.94	Average	Horizontal
2400.00	58.87	32.92	35.16	3.54	60.17	74	-13.83	Peak	Horizontal
2399.97	48.37	32.92	35.16	3.54	49.67	54	-4.33	Average	Horizontal
2375.54	46.77	32.89	35.16	3.51	48.01	74	-25.99	Peak	Vertical
2375.57	34.91	32.90	35.16	3.51	36.16	54	-17.84	Average	Vertical
2390.00	48.06	32.92	35.16	3.54	49.36	74	-24.64	Peak	Vertical
2389.97	38.57	32.92	35.16	3.54	39.87	54	-14.13	Average	Vertical
2400.00	58.44	32.92	35.16	3.54	59.74	74	-14.26	Peak	Vertical
2399.97	51.14	32.92	35.16	3.54	52.44	54	-1.56	Average	Vertical

Tx-2462

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2483.50	44.24	33.06	35.18	3.60	45.72	74	-28.28	Peak	Horizontal
2483.51	33.14	33.08	35.18	3.60	34.64	54	-19.36	Average	Horizontal
2488.13	50.92	33.08	35.18	3.62	52.44	74	-21.56	Peak	Horizontal
2488.15	36.65	33.08	35.18	3.62	38.17	54	-15.83	Average	Horizontal
2483.50	44.59	33.06	35.18	3.60	46.07	74	-27.93	Peak	Vertical
2483.51	33.26	33.08	35.18	3.60	34.76	54	-19.24	Average	Vertical
2488.13	49.97	33.08	35.18	3.62	51.49	74	-22.51	Peak	Vertical
2488.15	39.96	33.08	35.18	3.62	41.48	54	-12.52	Average	Vertical

802.11n(HT20)

Tx-2412

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2373.26	46.86	32.89	35.16	3.51	48.10	74	-25.90	Peak	Horizontal
2373.29	37.33	32.90	35.16	3.51	38.58	54	-15.42	Average	Horizontal
2390.00	48.67	32.92	35.16	3.54	49.97	74	-24.03	Peak	Horizontal
2389.97	38.27	32.92	35.16	3.54	39.57	54	-14.43	Average	Horizontal
2400.00	56.83	32.92	35.16	3.54	58.13	74	-15.87	Peak	Horizontal
2399.97	48.05	32.92	35.16	3.54	49.35	54	-4.65	Average	Horizontal
2373.26	45.02	32.89	35.16	3.51	46.26	74	-27.74	Peak	Vertical
2373.29	36.16	32.90	35.16	3.51	37.41	54	-16.59	Average	Vertical
2390.00	49.10	32.92	35.16	3.54	50.40	74	-23.60	Peak	Vertical
2389.97	37.84	32.92	35.16	3.54	39.14	54	-14.86	Average	Vertical
2400.00	58.19	32.92	35.16	3.54	59.49	74	-14.51	Peak	Vertical
2399.97	48.56	32.92	35.16	3.54	49.86	54	-4.14	Average	Vertical

Tx-2462

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2483.50	44.11	33.06	35.18	3.60	45.59	74	-28.41	Peak	Horizontal
2483.51	31.72	33.08	35.18	3.60	33.22	54	-20.78	Average	Horizontal
2487.44	48.27	33.08	35.18	3.62	49.79	74	-24.21	Peak	Horizontal
2487.46	35.66	33.08	35.18	3.62	37.18	54	-16.82	Average	Horizontal
2483.50	44.36	33.06	35.18	3.60	45.84	74	-28.16	Peak	Vertical
2483.53	31.80	33.08	35.18	3.60	33.30	54	-20.70	Average	Vertical
2487.44	48.60	33.08	35.18	3.62	50.12	74	-23.88	Peak	Vertical
2487.46	38.71	33.08	35.18	3.62	40.23	54	-13.77	Average	Vertical

802.11n(HT40)

Tx-2422

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2373.26	45.06	32.89	35.16	3.51	46.30	74	-27.70	Peak	Horizontal
2373.29	37.86	32.90	35.16	3.51	39.11	54	-14.89	Average	Horizontal
2390.00	48.27	32.92	35.16	3.54	49.57	74	-24.43	Peak	Horizontal
2389.97	37.88	32.92	35.16	3.54	39.18	54	-14.82	Average	Horizontal
2400.00	55.03	32.92	35.16	3.54	56.33	74	-17.67	Peak	Horizontal
2399.97	47.39	32.92	35.16	3.54	48.69	54	-5.31	Average	Horizontal
2373.26	44.53	32.89	35.16	3.51	45.77	74	-28.23	Peak	Vertical
2373.29	36.78	32.90	35.16	3.51	38.03	54	-15.97	Average	Vertical
2390.00	48.02	32.92	35.16	3.54	49.32	74	-24.68	Peak	Vertical
2389.97	37.99	32.92	35.16	3.54	39.29	54	-14.71	Average	Vertical
2400.00	57.75	32.92	35.16	3.54	59.05	74	-14.95	Peak	Vertical
2399.97	47.25	32.92	35.16	3.54	48.55	54	-5.45	Average	Vertical

Tx-2452

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
2483.50	44.08	33.06	35.18	3.60	45.56	74	-28.44	Peak	Horizontal
2483.51	31.88	33.08	35.18	3.60	33.38	54	-20.62	Average	Horizontal
2487.44	49.05	33.08	35.18	3.62	50.57	74	-23.43	Peak	Horizontal
2487.46	36.72	33.08	35.18	3.62	38.24	54	-15.76	Average	Horizontal
2483.50	44.99	33.06	35.18	3.60	46.47	74	-27.53	Peak	Vertical
2483.53	31.43	33.08	35.18	3.60	32.93	54	-21.07	Average	Vertical
2487.44	49.30	33.08	35.18	3.62	50.82	74	-23.18	Peak	Vertical
2487.46	39.52	33.08	35.18	3.62	41.04	54	-12.96	Average	Vertical

## 5.5. Conducted Spurious Emissions and Band Edges Test

### 5.5.1. Standard Applicable

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)).

### 5.5.2. Instruments Setting

The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz
RB / VB (Emission in non-restricted band)	100KHz/300KHz

### 5.5.3. Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz

The spectrum from 9kHz to 26.5GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### 5.5.4. Test Setup Layout

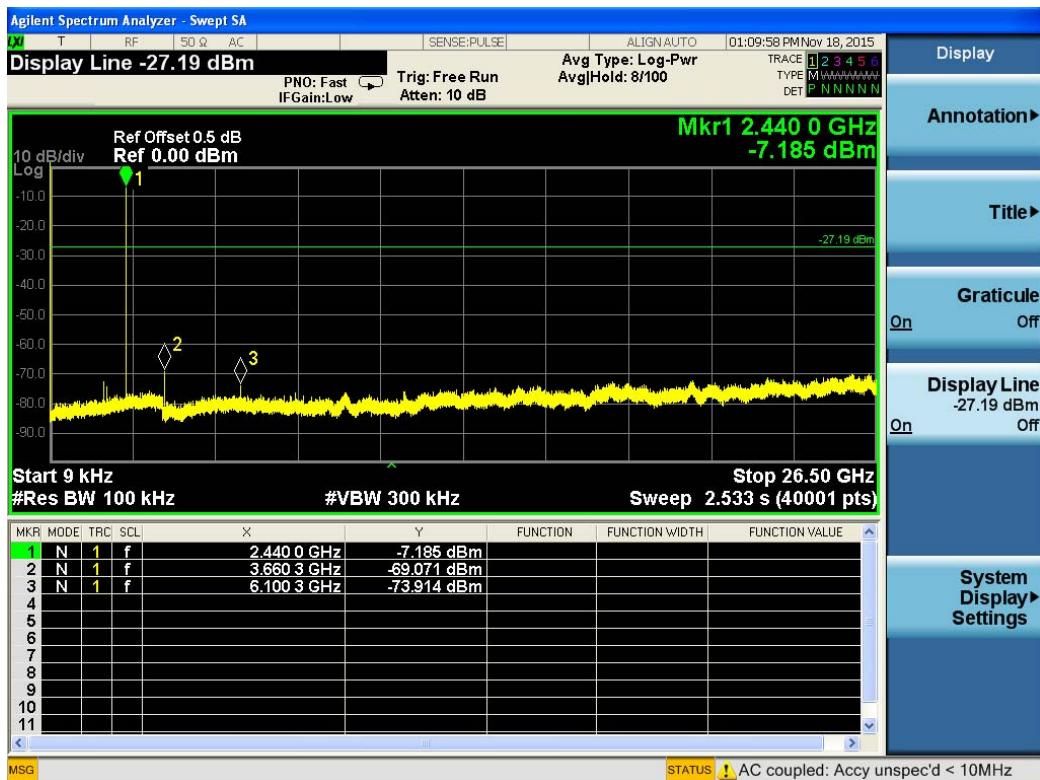
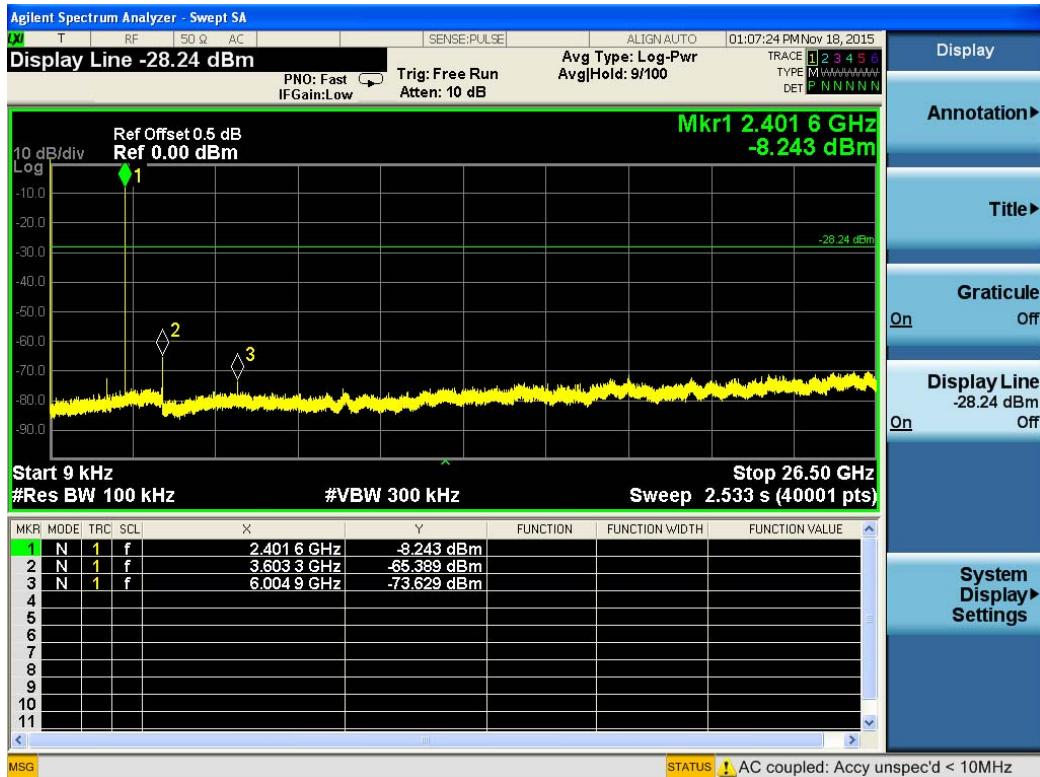
This test setup layout is the same as that shown in section 5.3.4.

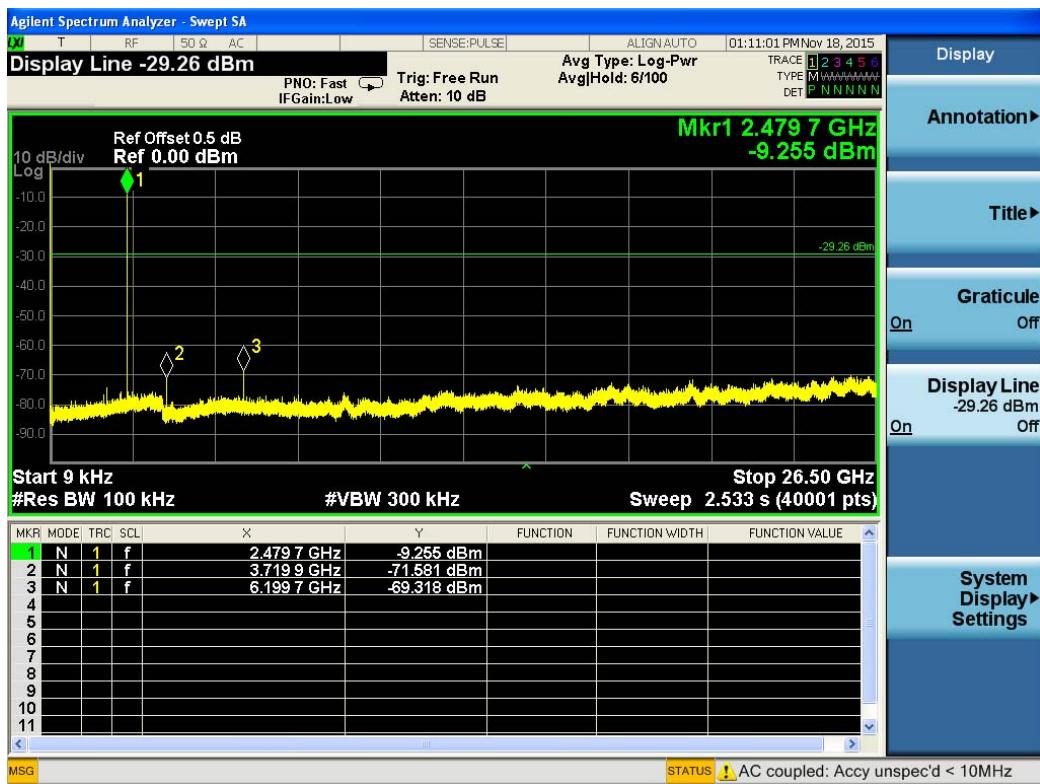
### 5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

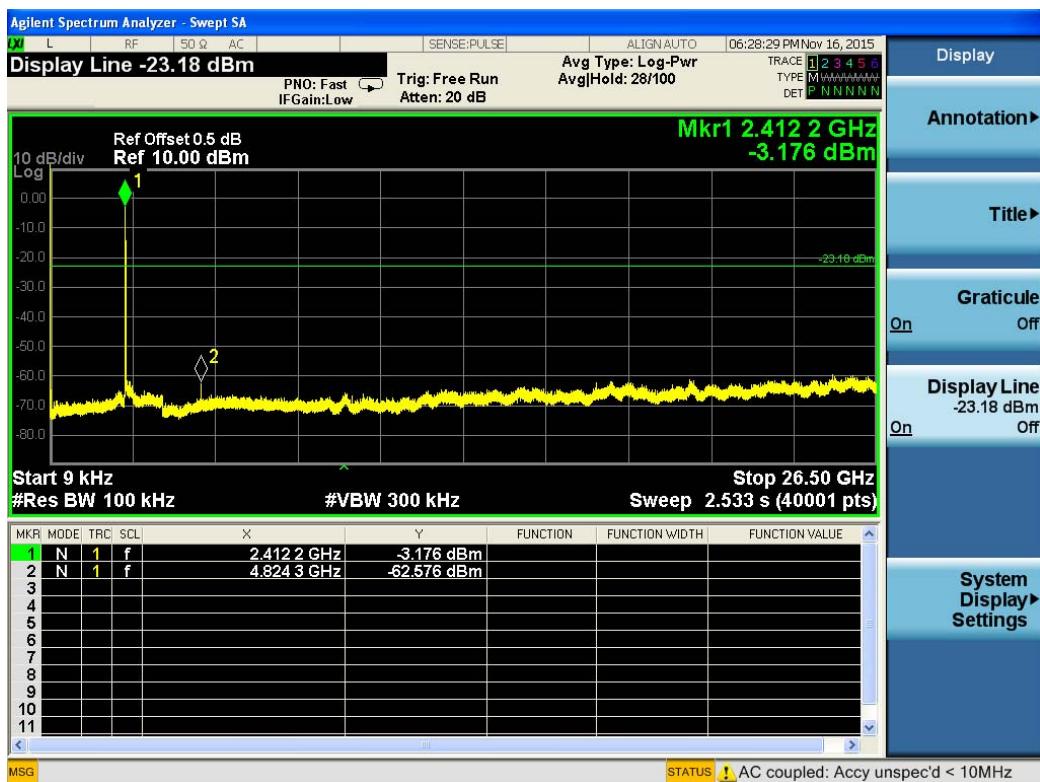
### 5.5.6. Test Results of Conducted Spurious Emissions

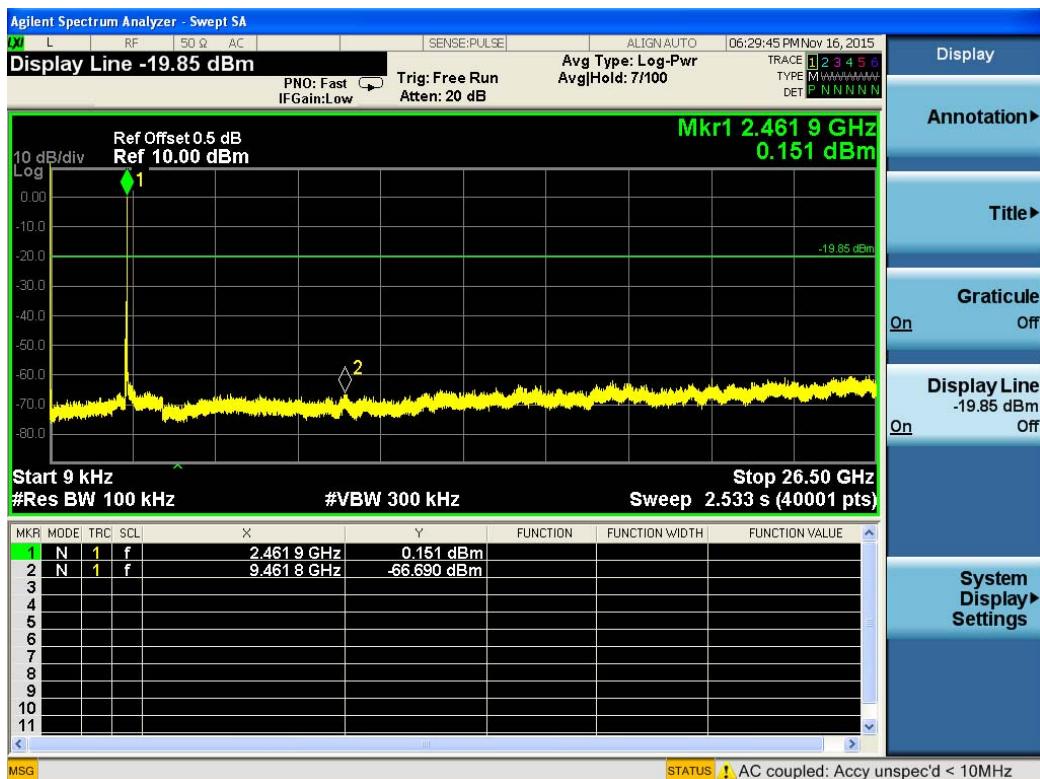
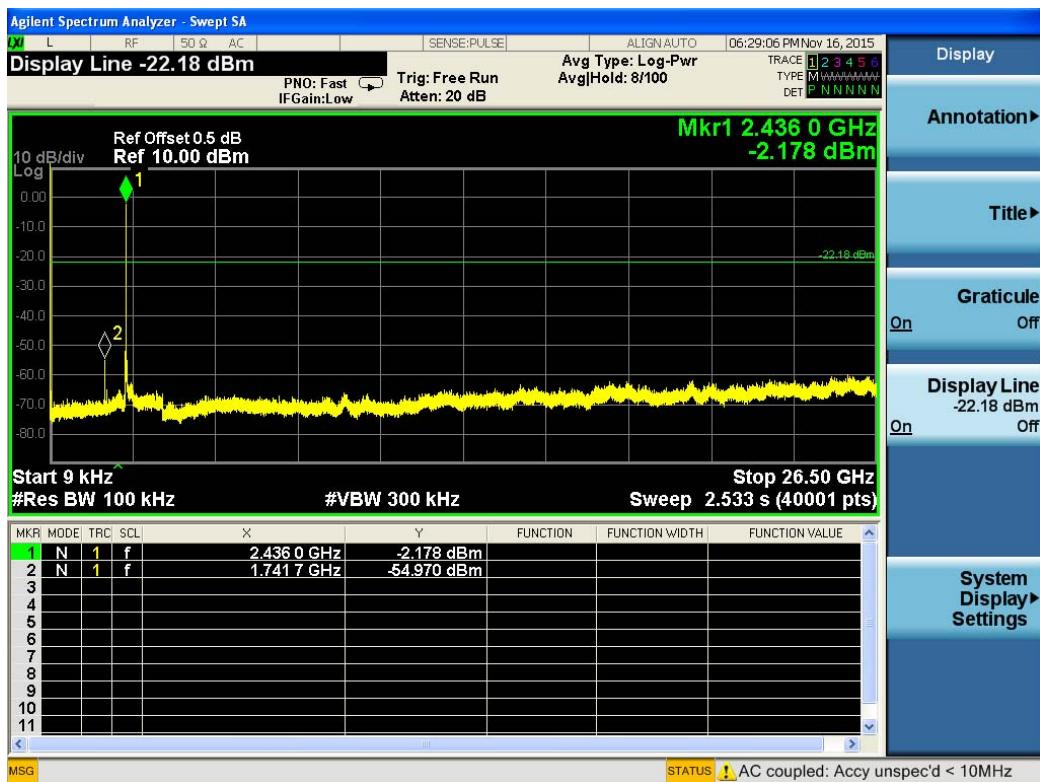
#### BLE 4.0



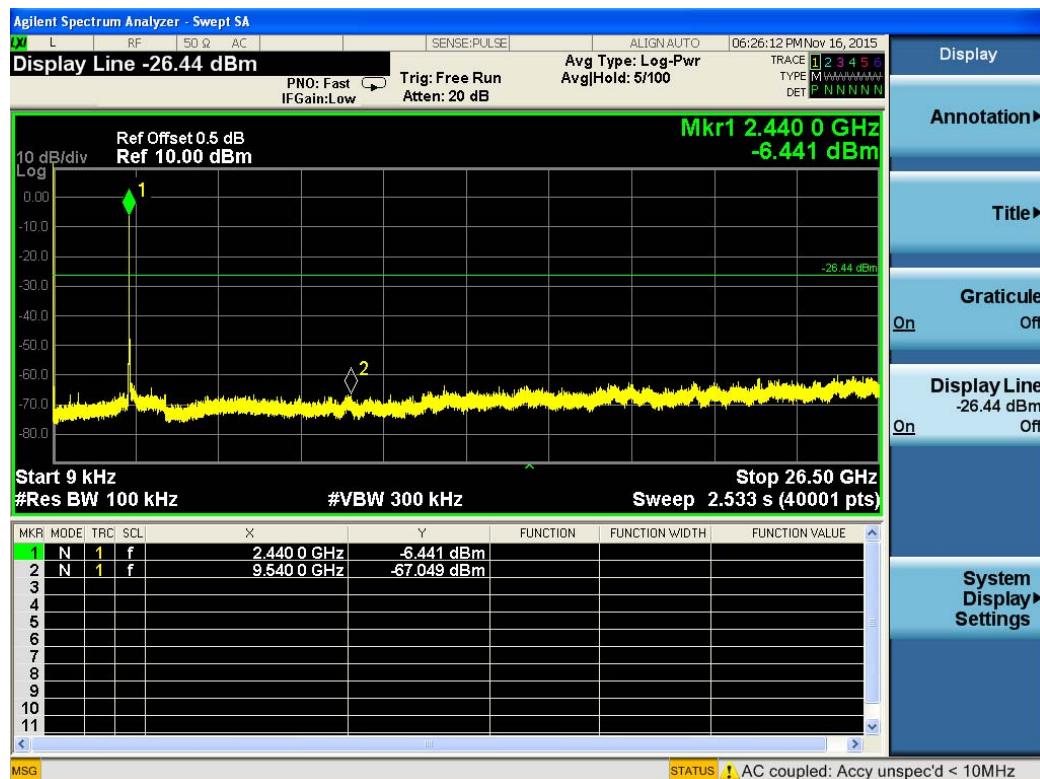
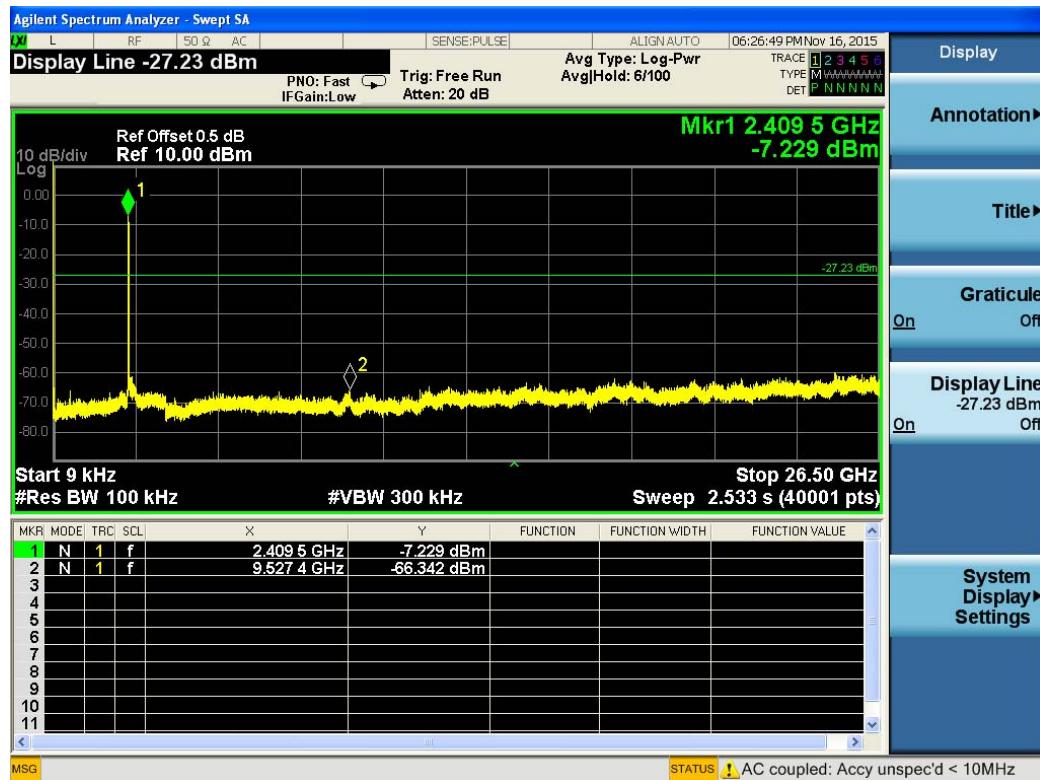


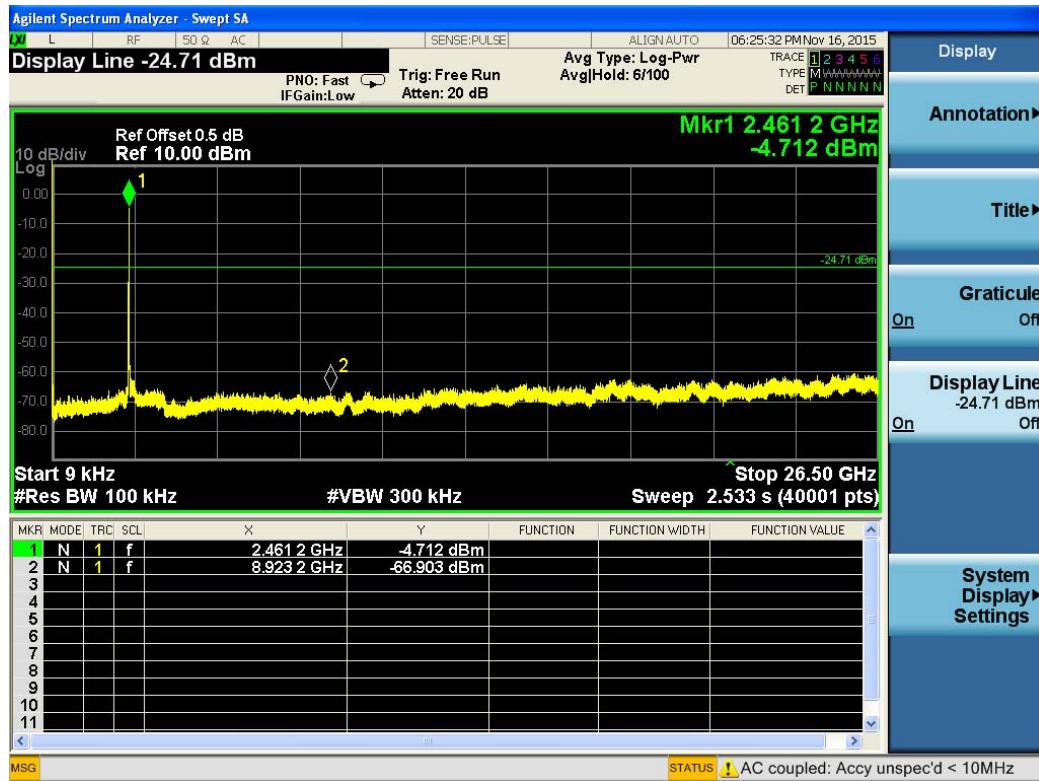
## 802.11b



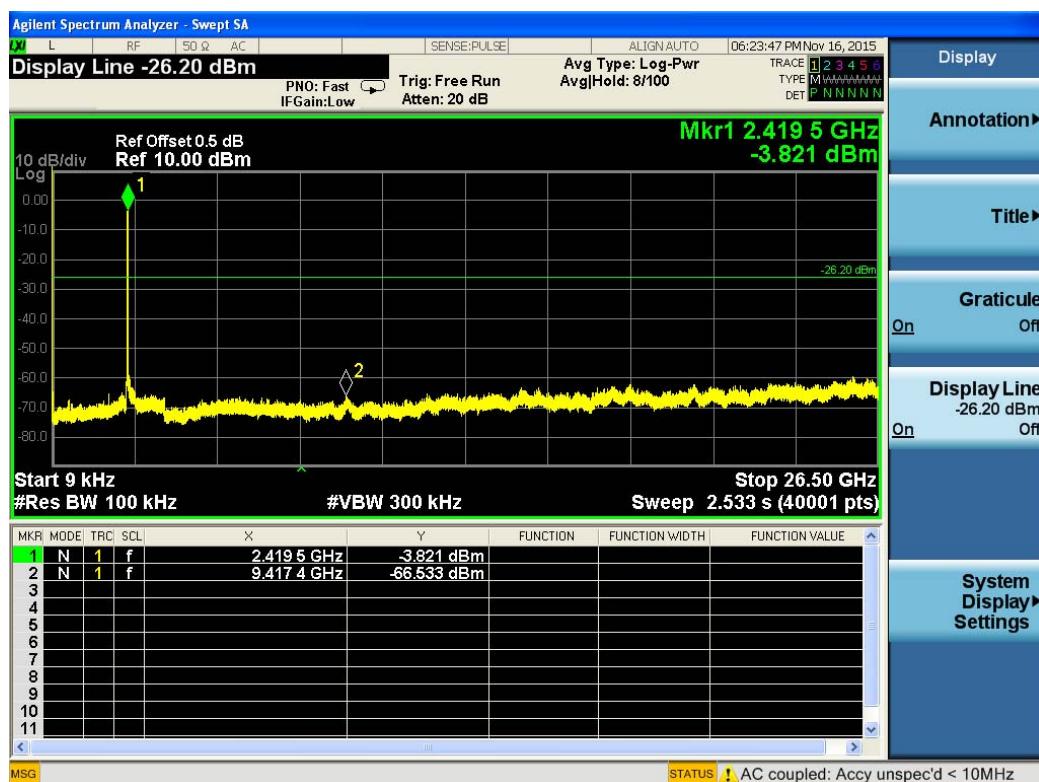


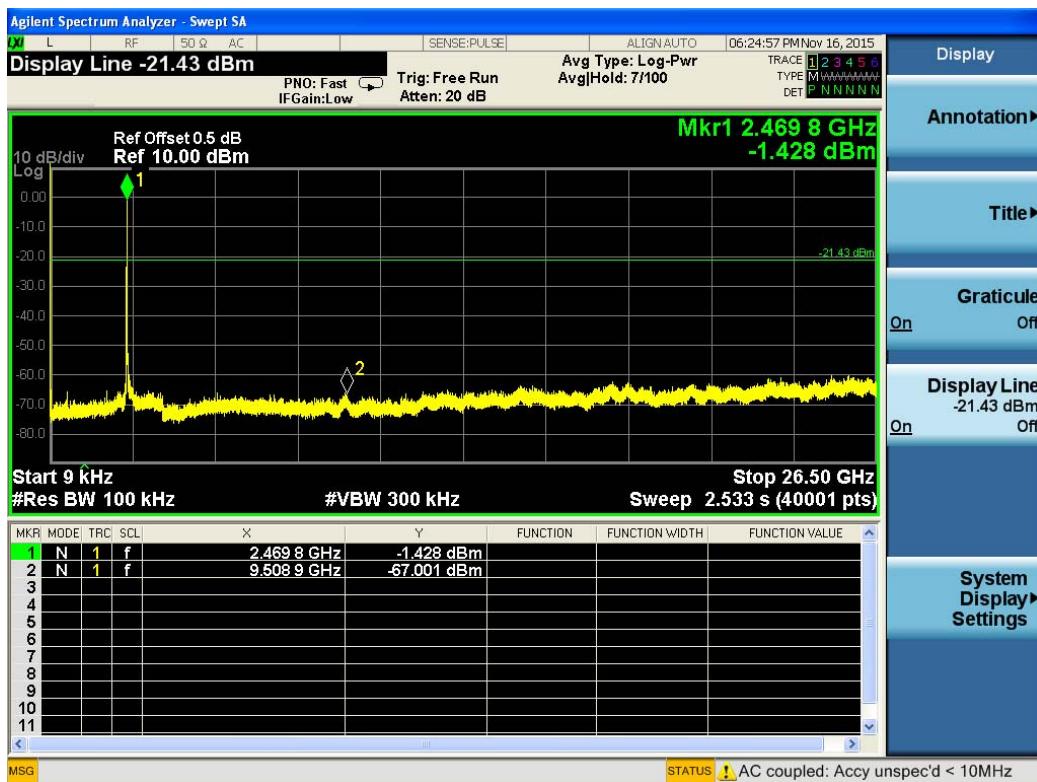
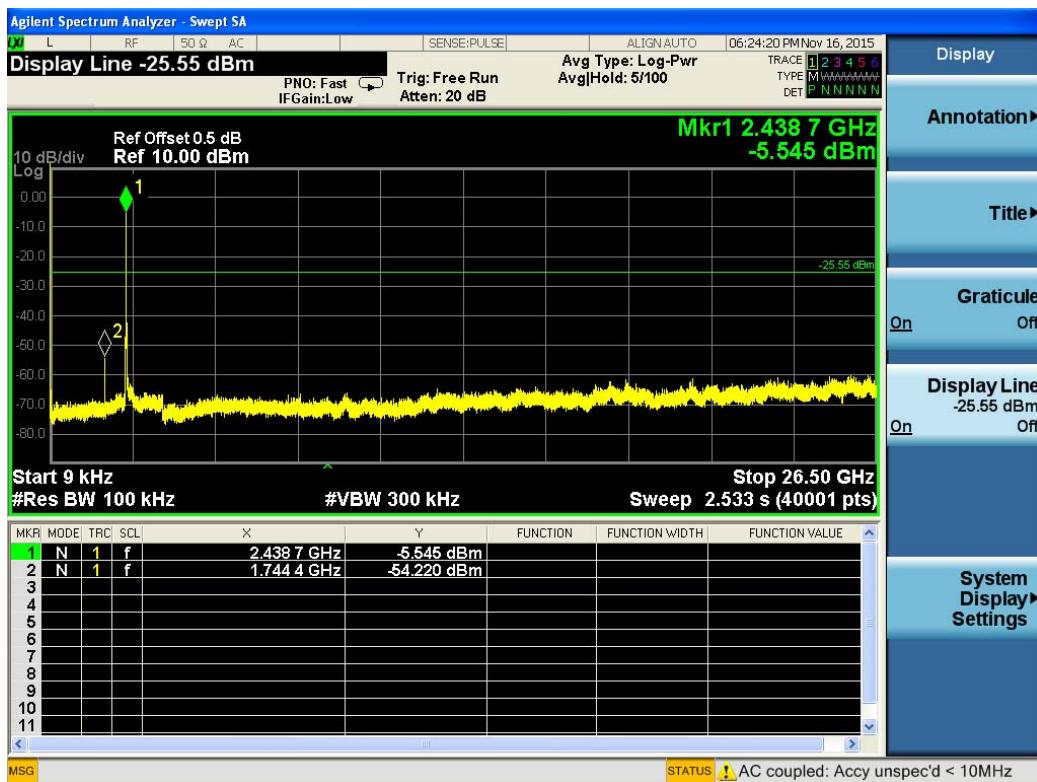
## 802.11g



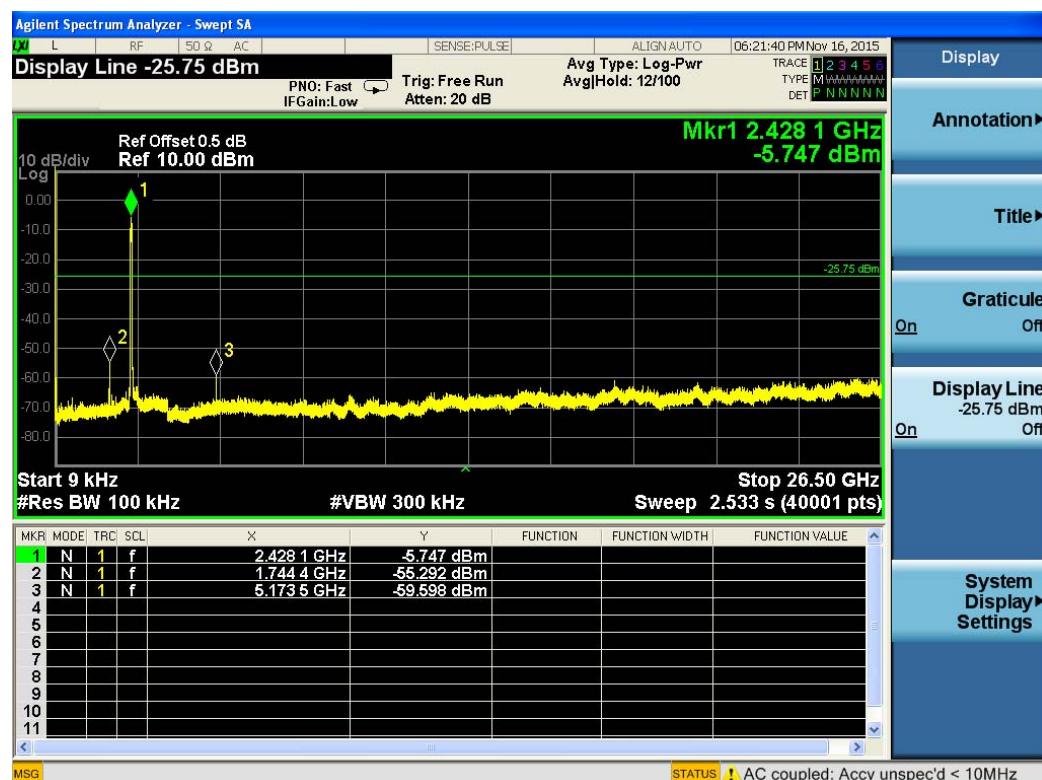
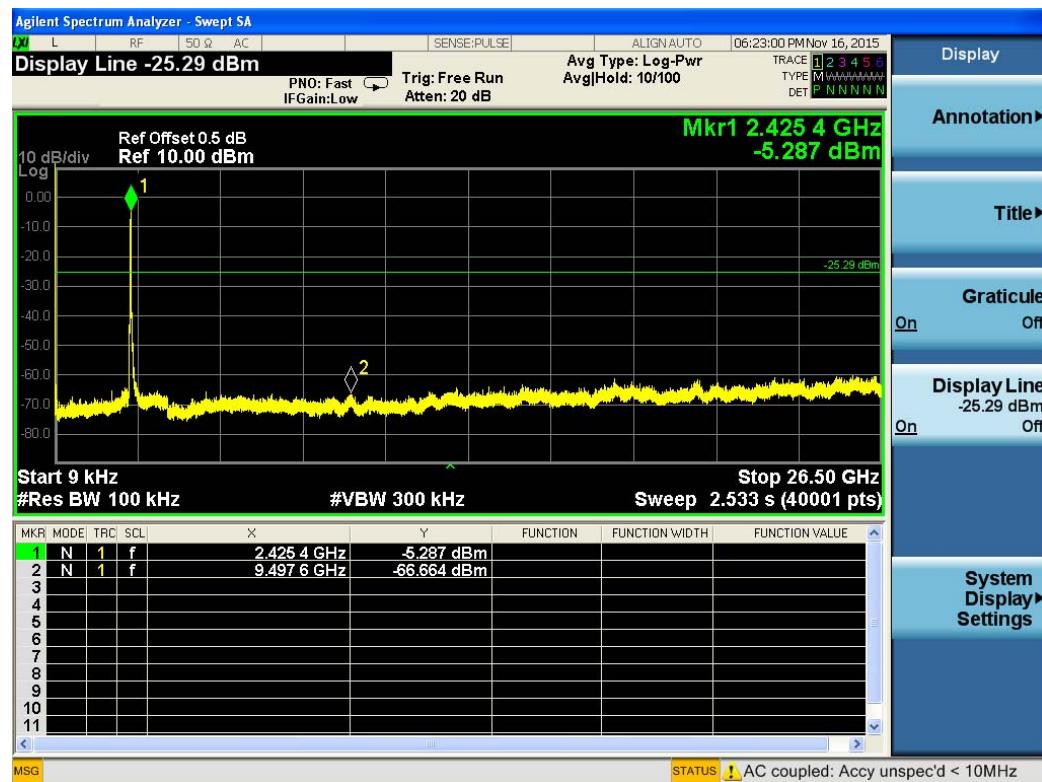


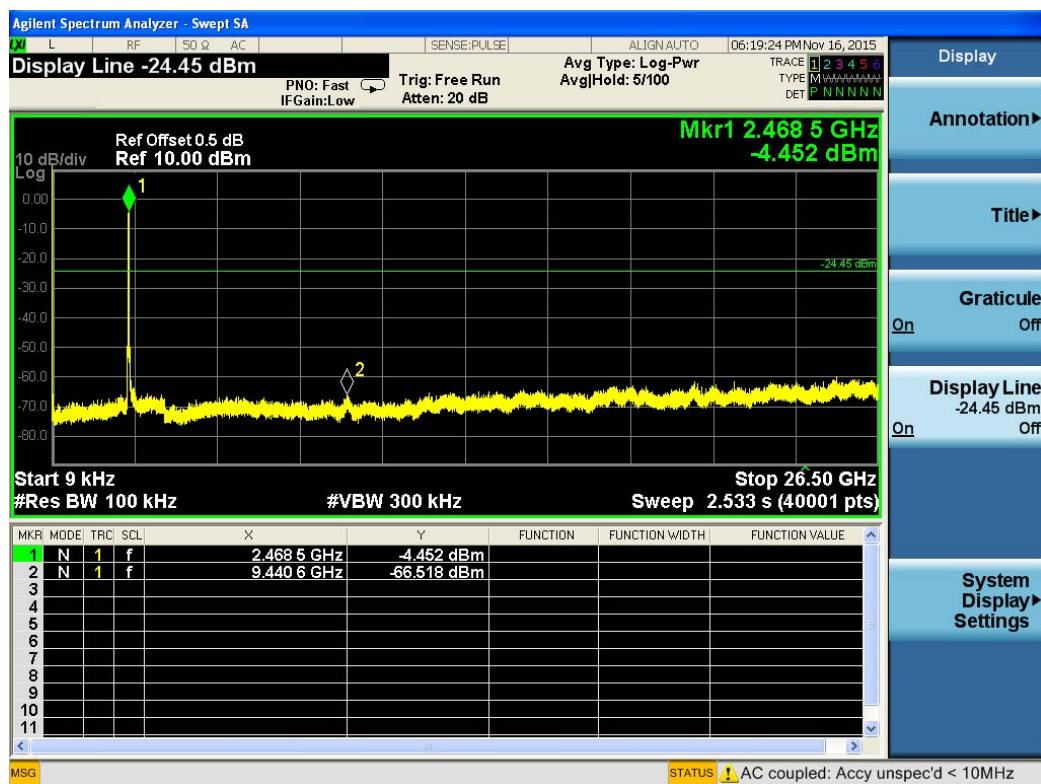
## 802.11n HT20





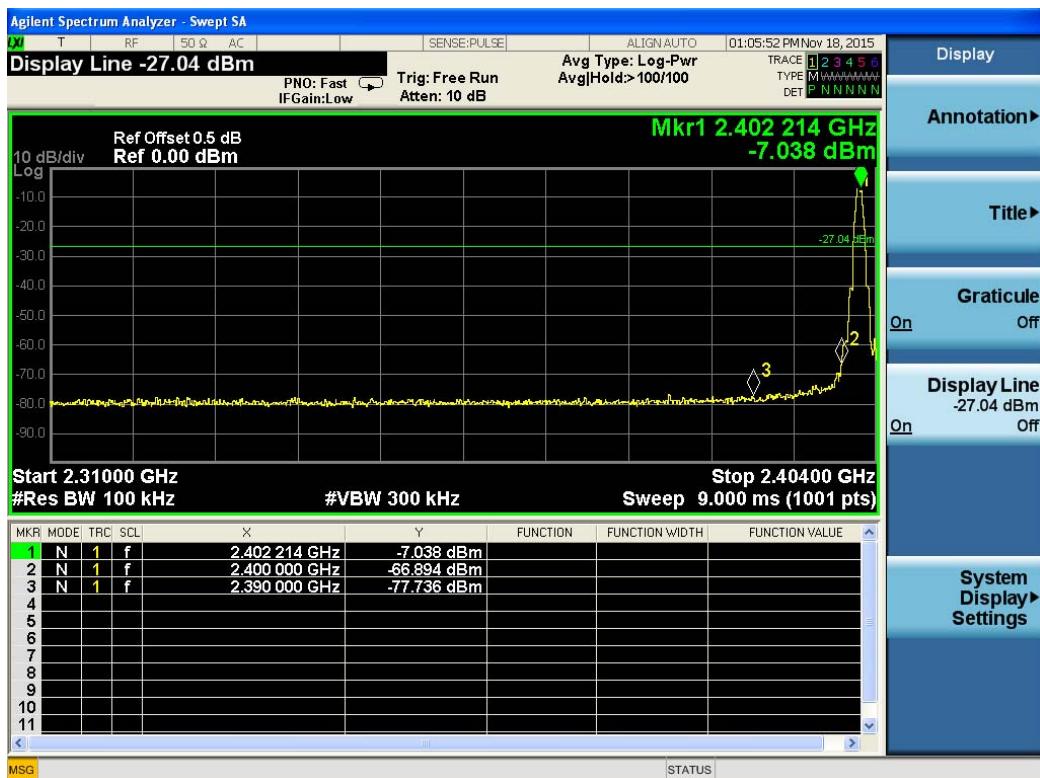
## 802.11n HT40



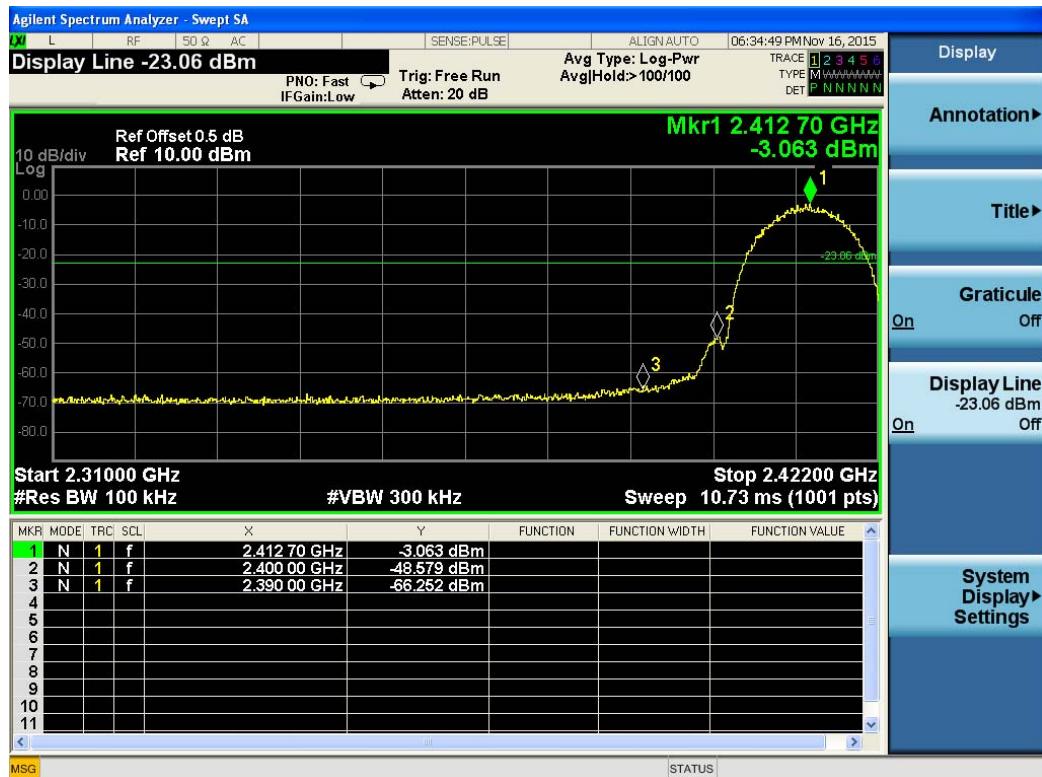


### 5.5.7. Test Results of Band Edges Test

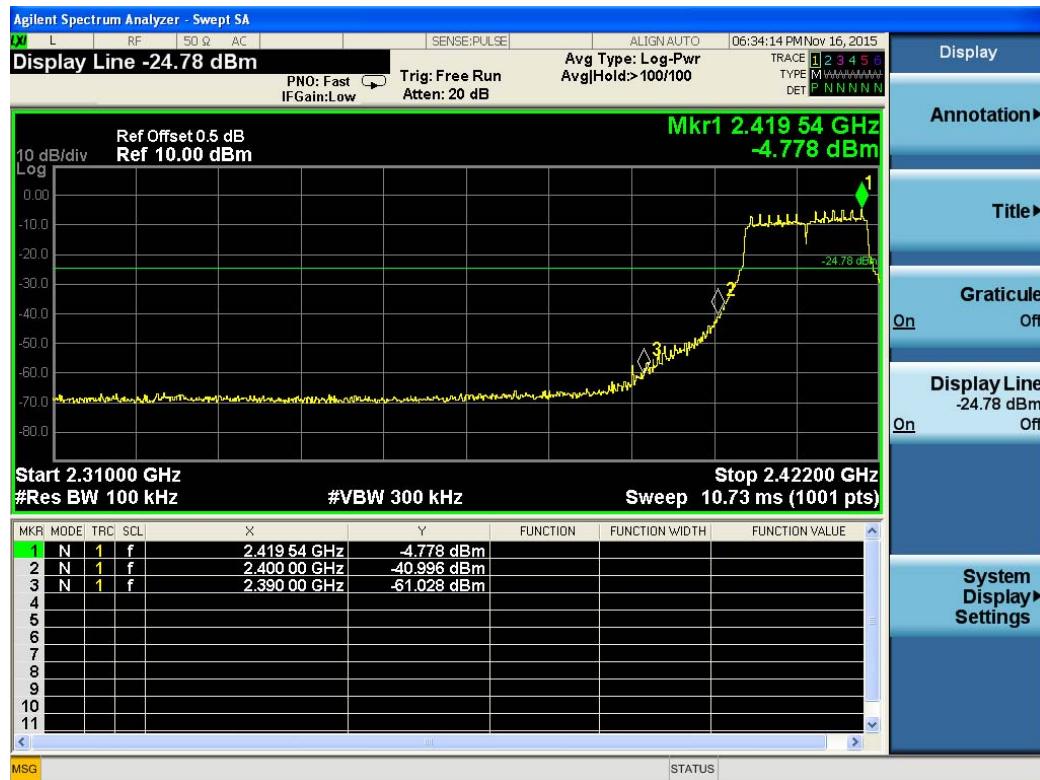
#### BLE 4.0



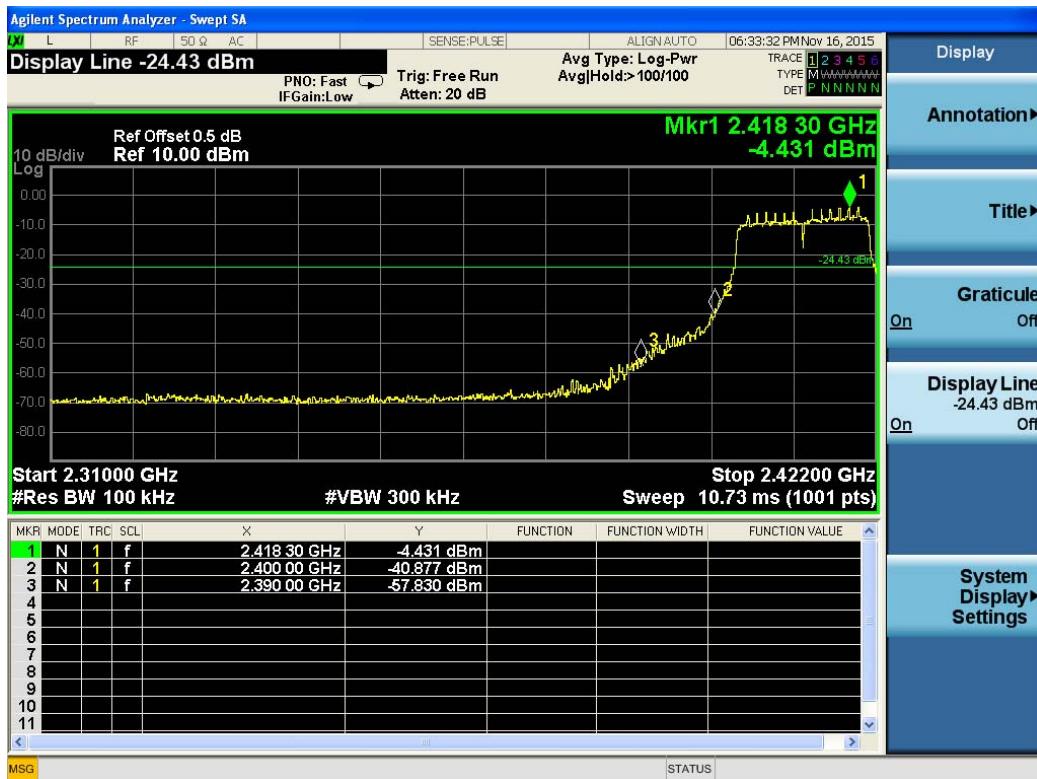
## 802.11b



## 802.11g



## 802.11n HT20



## 802.11n HT40



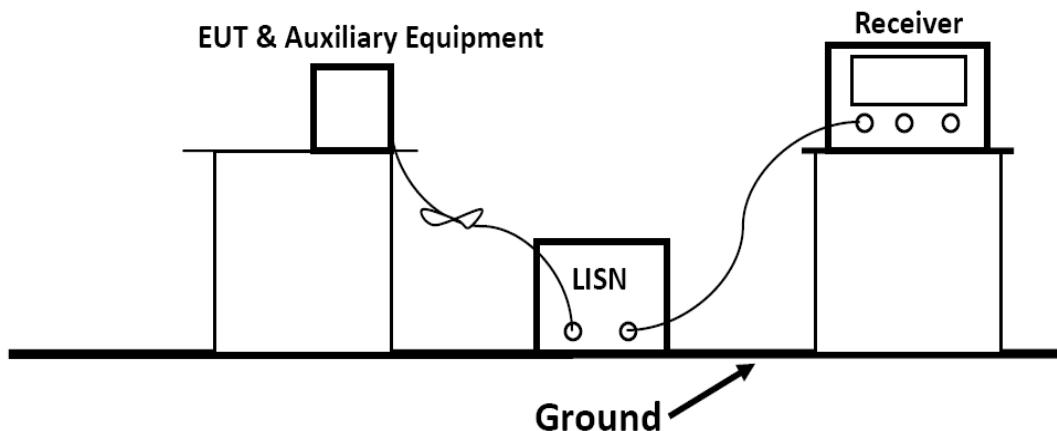
## 5.6. Power line conducted emissions

### 5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

### 5.6.2 Block Diagram of Test Setup

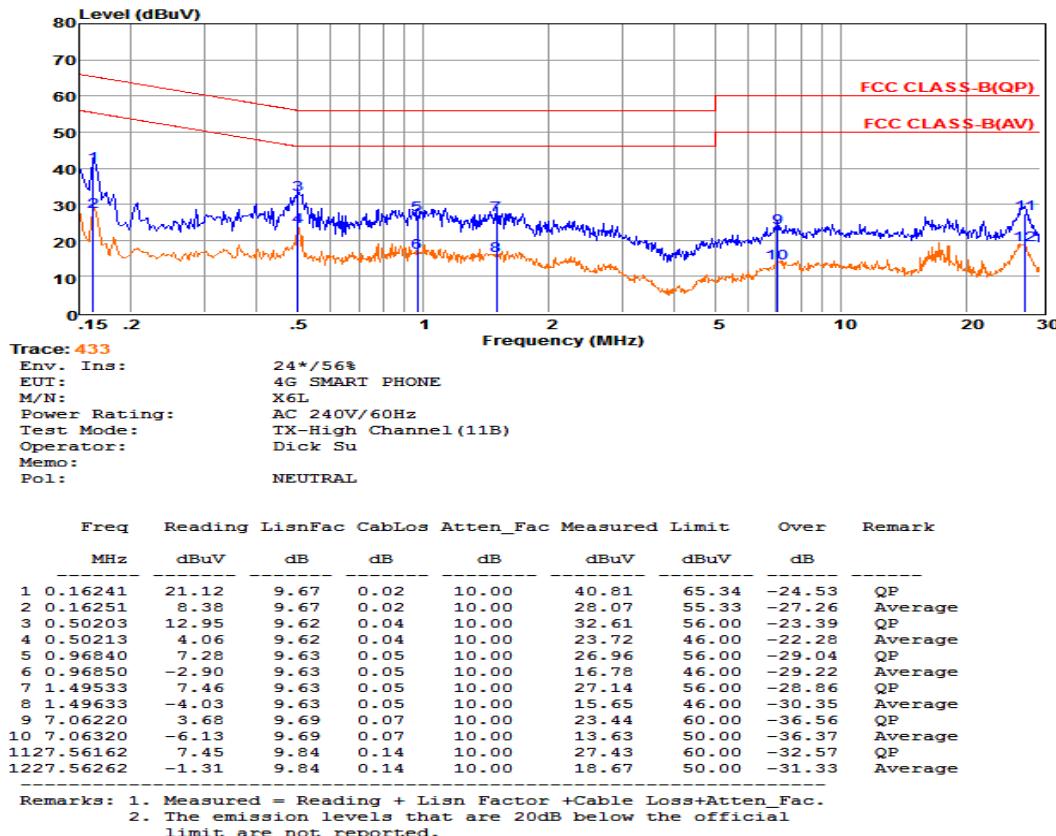
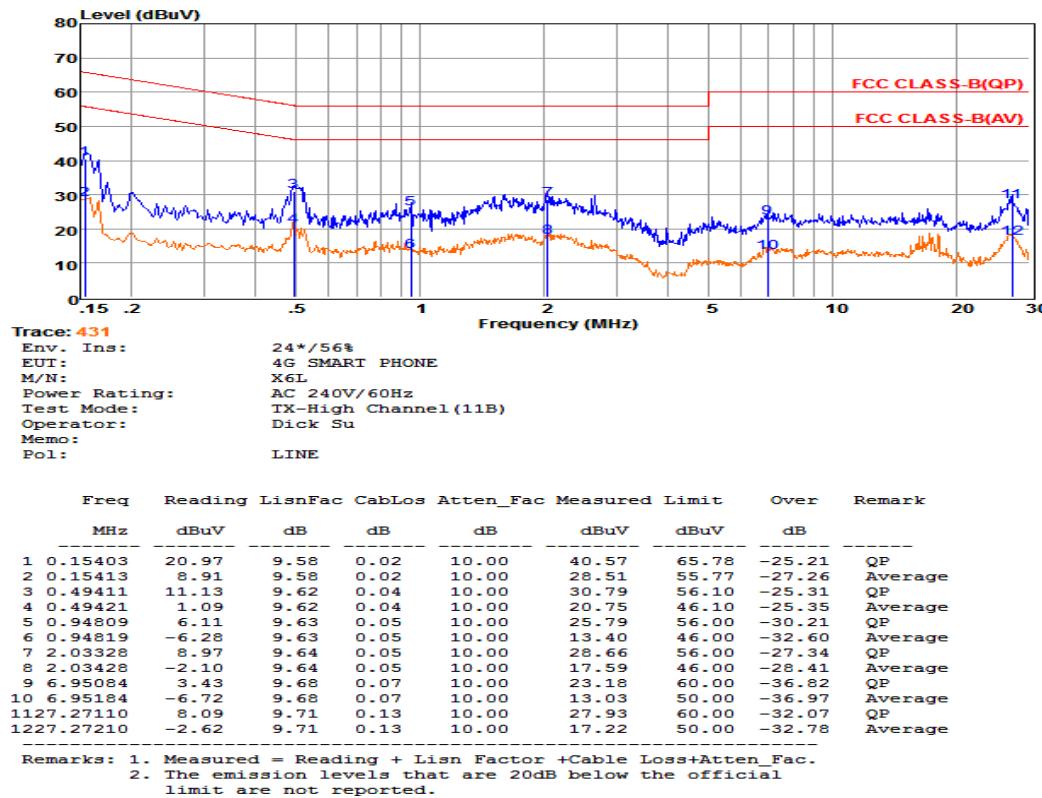


### 5.6.3 Test Results

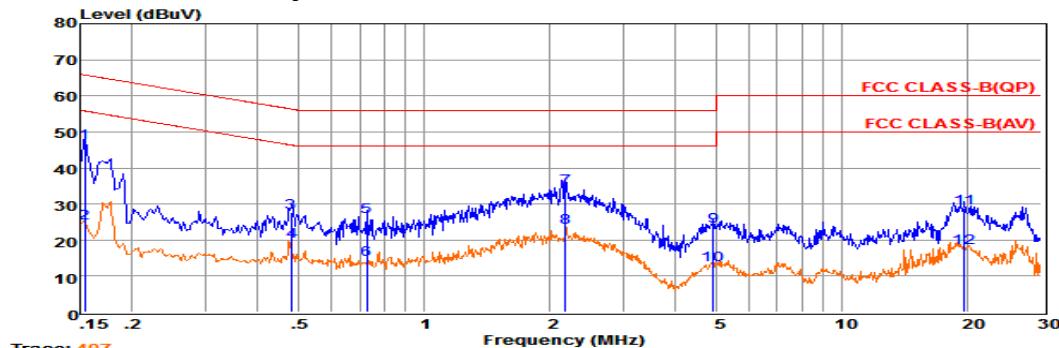
PASS.

The test data please refer to following page.

## Test Result For Line Power Input 240V/60Hz



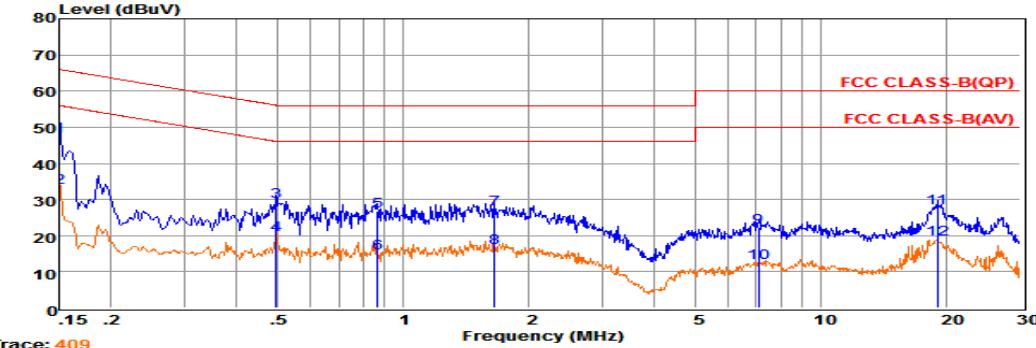
## Test Result For Line Power Input 120V/60Hz



Trace: 407  
 Env. Ins: 24\*/56%  
 EUT: 4G SMART PHONE  
 M/N: X6L  
 Power Rating: AC 120V/60Hz  
 Test Mode: TX-high Channel(11b)  
 Operator: Dick Su  
 Memo:  
 Pol: LINE

Freq	Reading	LisnFac	CabLos	Atten_Fac	Measured	Limit	Over	Remark
MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1.015403	27.31	9.58	0.02	10.00	46.91	65.78	-18.87	QP
2.015413	5.19	9.58	0.02	10.00	24.79	55.77	-30.98	Average
3.048119	8.03	9.62	0.04	10.00	27.69	56.32	-28.63	QP
4.048129	0.01	9.62	0.04	10.00	19.67	46.32	-26.65	Average
5.072744	6.69	9.64	0.04	10.00	26.37	56.00	-29.63	QP
6.072754	-5.25	9.64	0.04	10.00	14.43	46.00	-31.57	Average
7.2.17827	14.83	9.64	0.05	10.00	34.52	56.00	-21.48	QP
8.2.17927	3.79	9.64	0.05	10.00	23.48	46.00	-22.52	Average
9.4.92572	4.04	9.65	0.06	10.00	23.75	56.00	-32.25	QP
10.4.92672	-6.55	9.65	0.06	10.00	13.16	46.00	-32.84	Average
11.19.63536	8.83	9.76	0.12	10.00	28.71	60.00	-31.29	QP
12.19.63636	-2.13	9.76	0.12	10.00	17.75	50.00	-32.25	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
 2. The emission levels that are 20dB below the official limit are not reported.



Trace: 409  
 Env. Ins: 24\*/56%  
 EUT: 4G SMART PHONE  
 M/N: X6L  
 Power Rating: AC 120V/60Hz  
 Test Mode: TX-high Channel(11b)  
 Operator: Dick Su  
 Memo:  
 Pol: NEUTRAL

Freq	Reading	LisnFac	CabLos	Atten_Fac	Measured	Limit	Over	Remark
MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1.0.15000	27.77	9.70	0.02	10.00	47.49	66.00	-18.51	QP
2.0.15010	13.73	9.70	0.02	10.00	33.45	55.99	-22.54	Average
3.0.49673	9.66	9.62	0.04	10.00	29.32	56.05	-26.73	QP
4.0.49683	0.42	9.62	0.04	10.00	20.08	46.05	-25.97	Average
5.0.86643	7.16	9.63	0.04	10.00	26.83	56.00	-29.17	QP
6.0.86653	-4.42	9.63	0.04	10.00	15.25	46.00	-30.75	Average
7.1.65370	7.71	9.63	0.05	10.00	27.39	56.00	-28.61	QP
8.1.65470	-3.04	9.63	0.05	10.00	16.64	46.00	-29.36	Average
9.7.09972	2.66	9.69	0.07	10.00	22.42	60.00	-37.58	QP
10.7.10072	-7.20	9.69	0.07	10.00	12.56	50.00	-37.44	Average
11.19.02097	7.75	9.85	0.12	10.00	27.72	60.00	-32.28	QP
12.19.02197	-0.98	9.85	0.12	10.00	18.99	50.00	-31.01	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
 2. The emission levels that are 20dB below the official limit are not reported.

\*\*\*Note: Pre-scan all mode and recorded the worst case results in this report (802.11b (High Channel)).

## 5.7. Antenna Requirements

### 5.7.1. Standard Applicable

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### 5.7.2. Antenna Connector Construction

The antenna used for transmitting is permanently attached and no consideration of replacement and the maximum antenna gain is 0dBi. Please see EUT photo for details.

### 5.7.3. Results: Compliance.

#### Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

Conducted power refer ANSI C63.10:2013 Section 11.9 Output power test procedure for DTS devices  
Radiated power refers to ANSI C63.10:2013 Section 6.6.4 Radiated emissions tests.

#### Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

#### Limits

FCC	IC
Antenna Gain	
6 dBi	

#### Results

T <sub>nom</sub>	V <sub>nom</sub>	Lowest Channel 2412 MHz	Middle Channel 2437 MHz	Highest Channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		10.21	10.33	10.24
Conducted power [dBm] Measured with DSSS modulation		8.55	9.03	8.87
Gain [dBi] Calculated		-1.66	-1.30	-1.37
Measurement uncertainty		± 0.6 dB (cond.) / ± 4.32 dB (rad.)		

## 6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	June 18,2015	June 17,2016
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	July 16,2015	July 15,2016
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	June 18,2015	June 17,2016
LISN (Support Unit)	EMCO	3819/2NM	9703-1839	9KHz-30MHz	June 18,2015	June 17,2016
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	June 18,2015	June 17,2016
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	June 18,2015	June 17,2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-1GHz 3m	June 18,2015	June 17,2016
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHz	June 18,2015	June 17,2016
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	July 16,2015	July 15,2016
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	July 16,2015	July 15,2016
Spectrum Analyzer	Agilent	E4407B	MY41440292	9k-26.5GHz	July 16,2015	July 15,2016
MAX Signal Analyzer	Agilent	N9020A	MY50510140	20Hz~26.5GHz	Oct. 27, 2015	Oct. 26, 2016
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	June 18,2015	June 17,2016
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	June 10,2015	June 09,2016
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	June 10,2015	June 09,2016
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz-40GHz	June 10,2015	June 09,2016
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	June 18,2015	June 17,2016
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	June 18,2015	June 17,2016
Spectrum Meter	R&S	FSP 30	100023	9kHz-30GHz	July 16,2015	July 15,2016
Power Meter	R&S	NRVS	100444	DC-40GHz	June 18,2015	June 17,2016
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	June 18,2015	June 17,2016
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	June 18,2015	June 17,2016
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	June 18,2015	June 17,2016
RF CABLE-2m	JYE Bao	RG142	CB035-2m	20MHz-1GHz	June 18,2015	June 17,2016

*Note: All equipment through GRGT EST calibration*

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