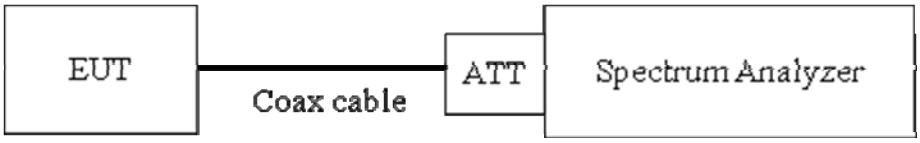
8.4 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d)

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)).

Limit : 20 dBc

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 7.7.10 in ANSI 63.10)

RBW = 100 kHz(Upon 1 GHz = 1 MHz)

VBW = 300 kHz(Upon 1 GHz = 1 MHz)

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep = auto couple

Measurements are made over the 30 MHz to 26 GHz range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. Actual value of loss for the attenuator and cable combination is below table.
   So, 10.1 dB is offset. And the offset gap in the 2.4 GHz range do not affect the band edge final result.

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	10.11
	2437	10.10
	2462	10.12

(Actual value of loss for the attenuator and cable combination)

5. In case of conducted spurious emissions test, please check factors blow table.

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	10.37
100	10.16
200	10.15
300	10.14
400	10.18
500	10.19
600	10.20
700	10.30
800	10.25
900	10.28
1000	10.29
2000	10.17
2412*	10.11
2437*	10.10
2462*	10.12
3000	10.26
4000	10.31
5000	9.85
6000	10.20
7000	10.60
8000	10.53
9000	10.23
10000	10.41
11000	10.65
12000	11.19
13000	10.97
14000	11.42
15000	12.01
16000	11.77
17000	10.78
18000	10.76
19000	11.15
20000	10.75
21000	10.82
22000	10.82
23000	11.26
24000	11.08
25000	11.18
26000	10.90

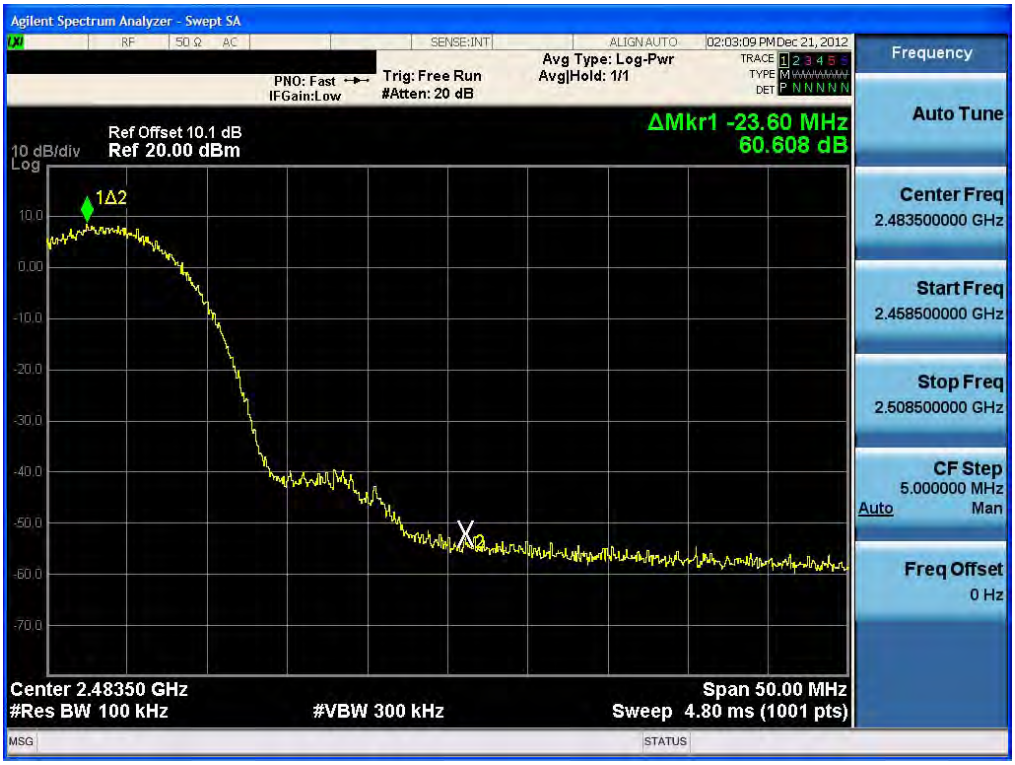
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

BandEdge (802.11b-CH1)

BandEdge (802.11b-CH11)



BandEdge (802.11g-CH1)

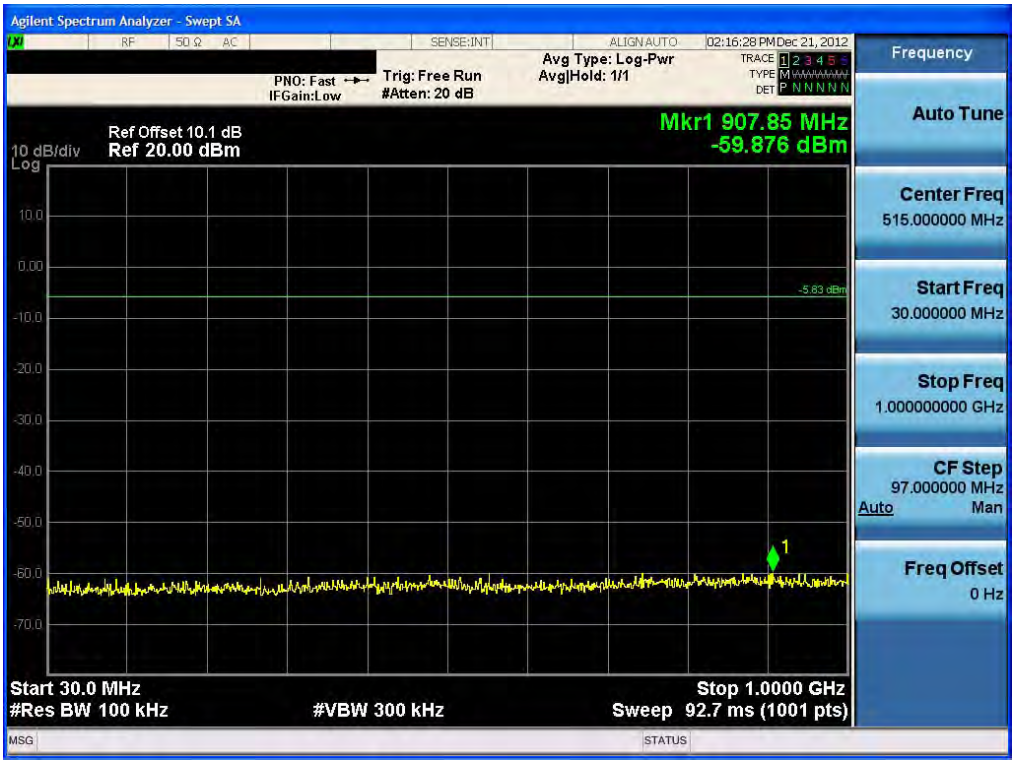
BandEdge (802.11g-CH11)

BandEdge (802.11n-CH1)

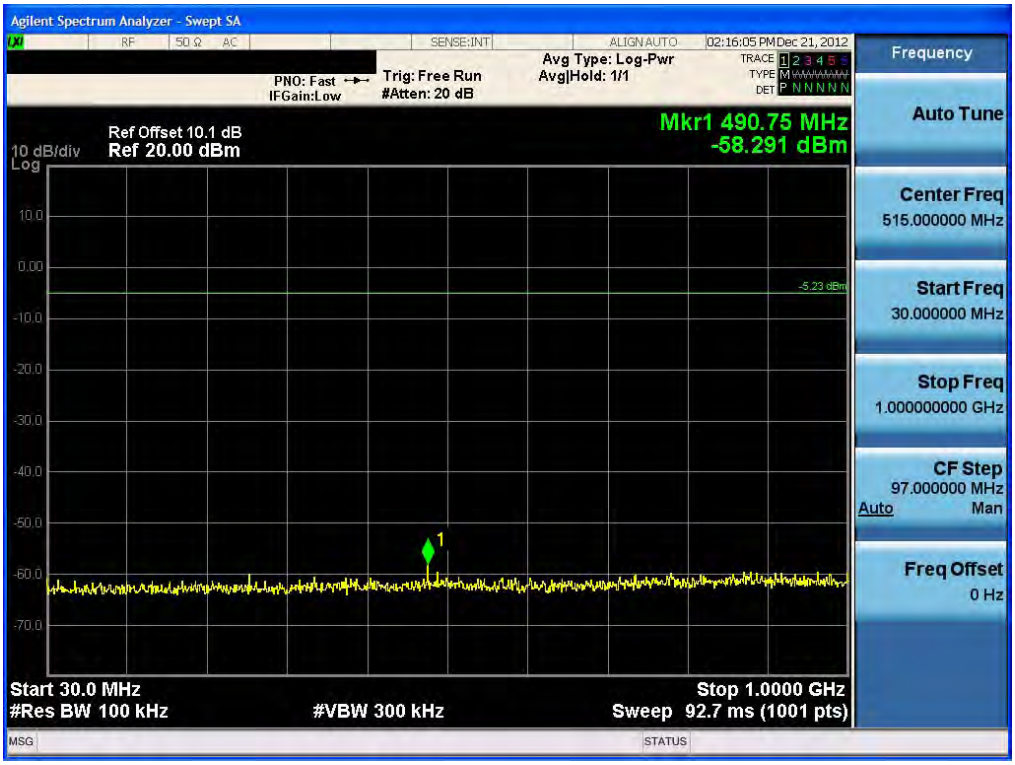
BandEdge (802.11n-CH11)

30 MHz ~ 1 GHz

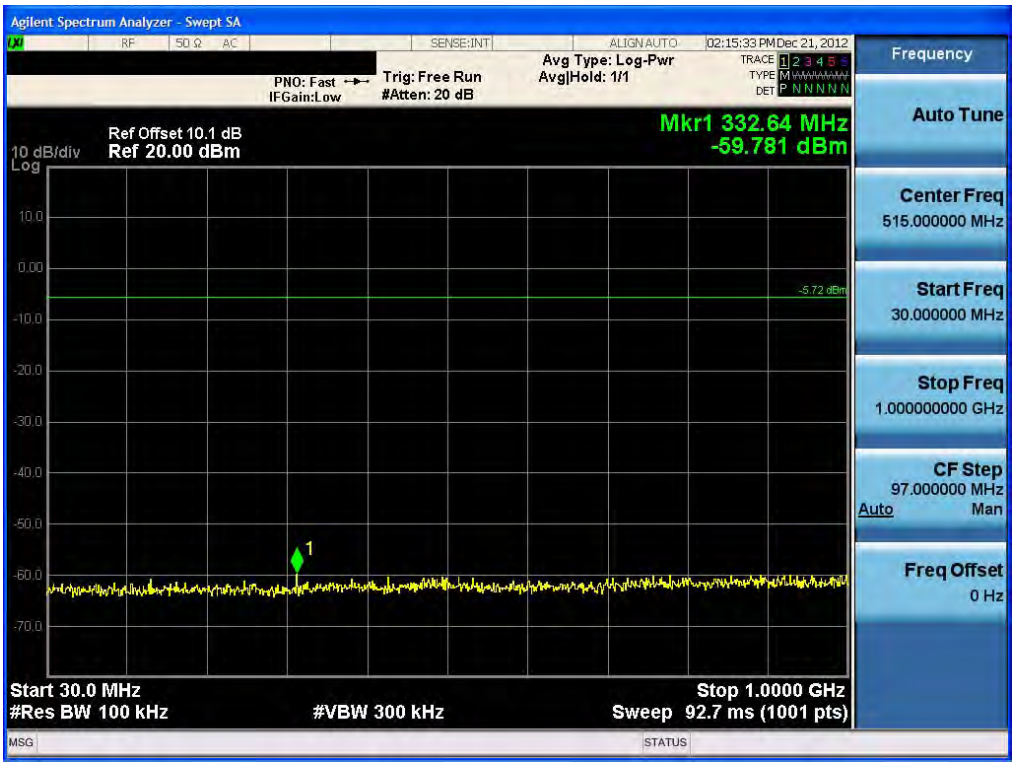
Conducted Spurious Emission (802.11b-CH1)



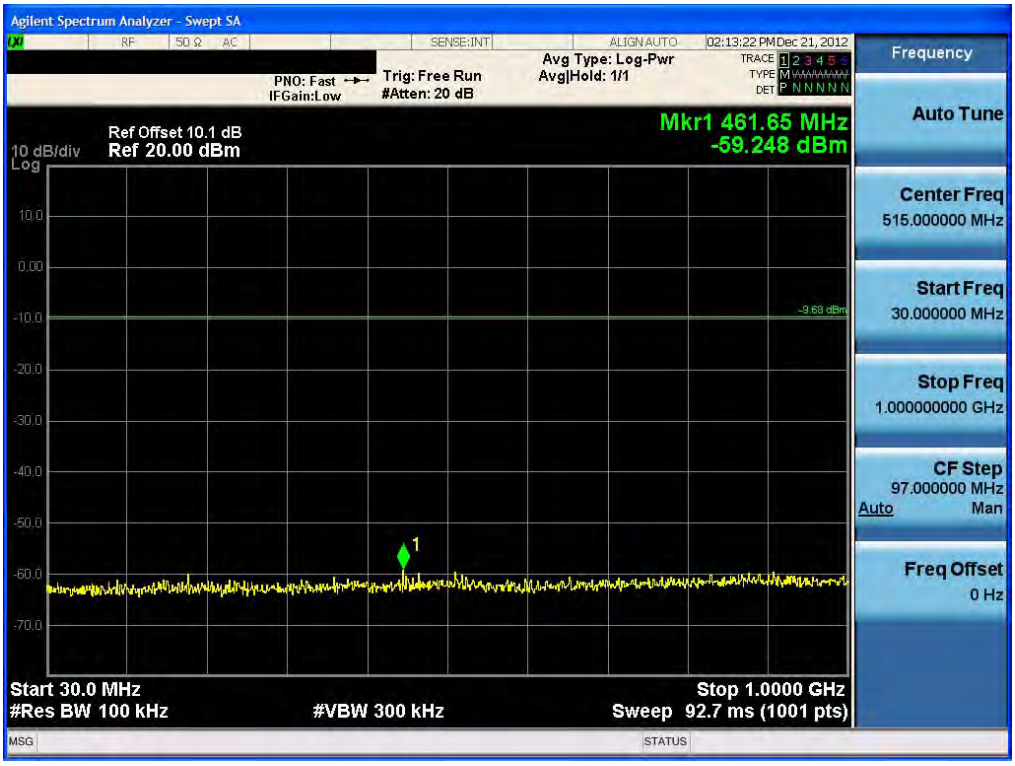
Conducted Spurious Emission (802.11b-CH6)



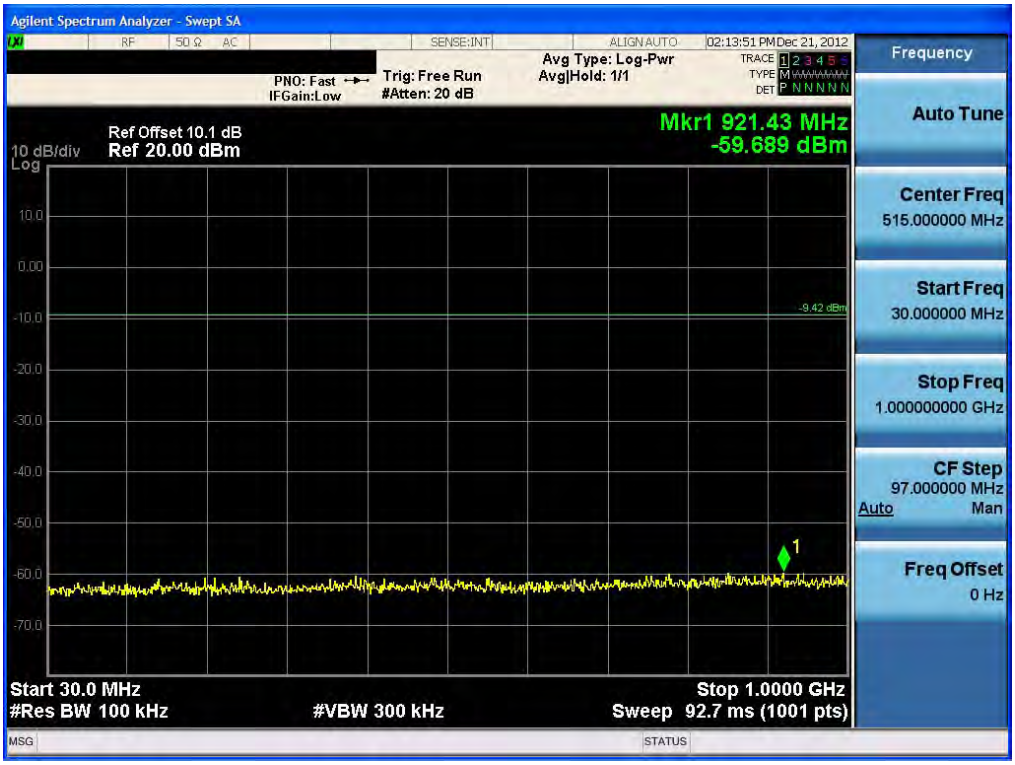
Conducted Spurious Emission (802.11b-CH11)



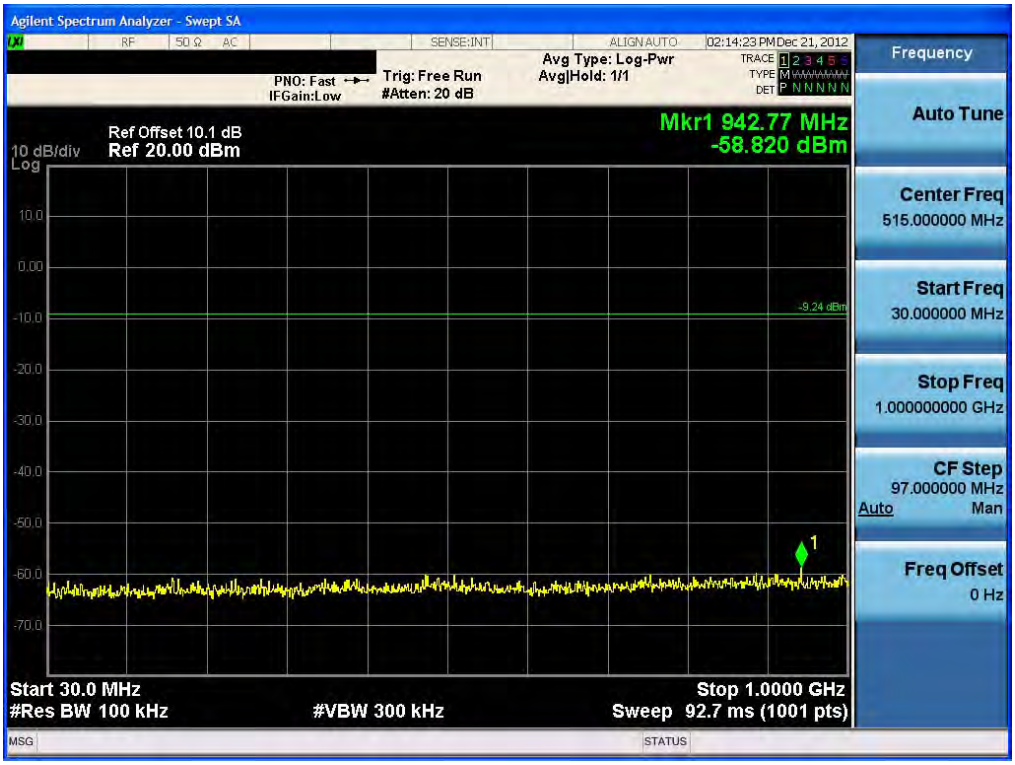
Conducted Spurious Emission (802.11g-CH1)



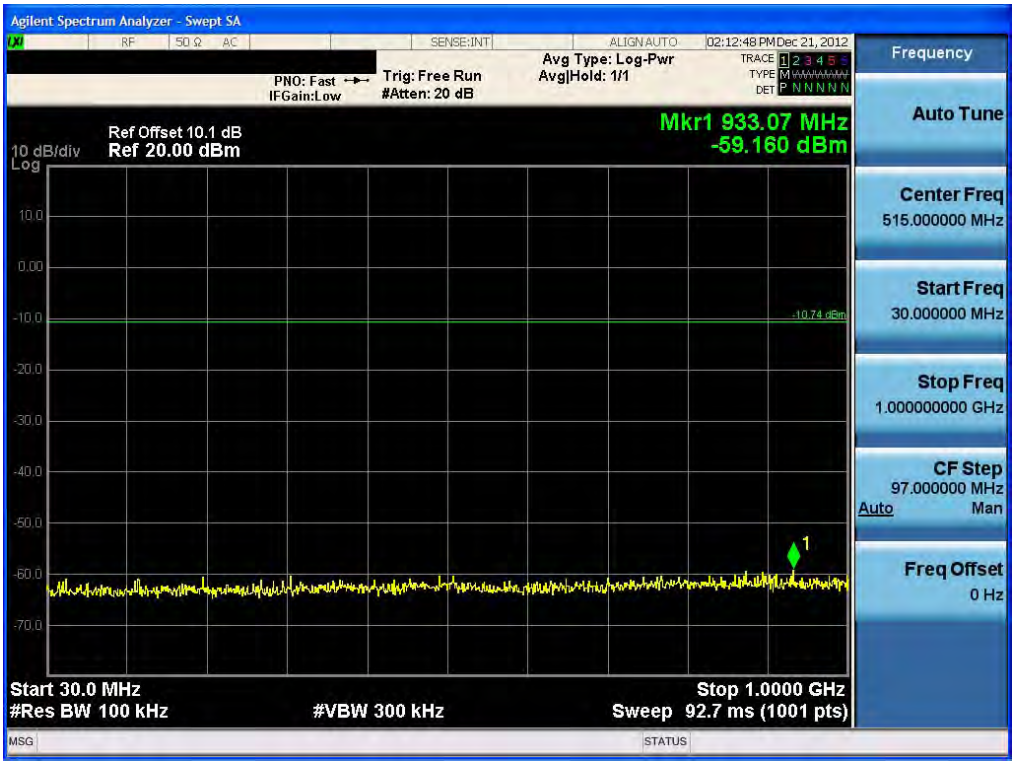
Conducted Spurious Emission (802.11g-CH6)



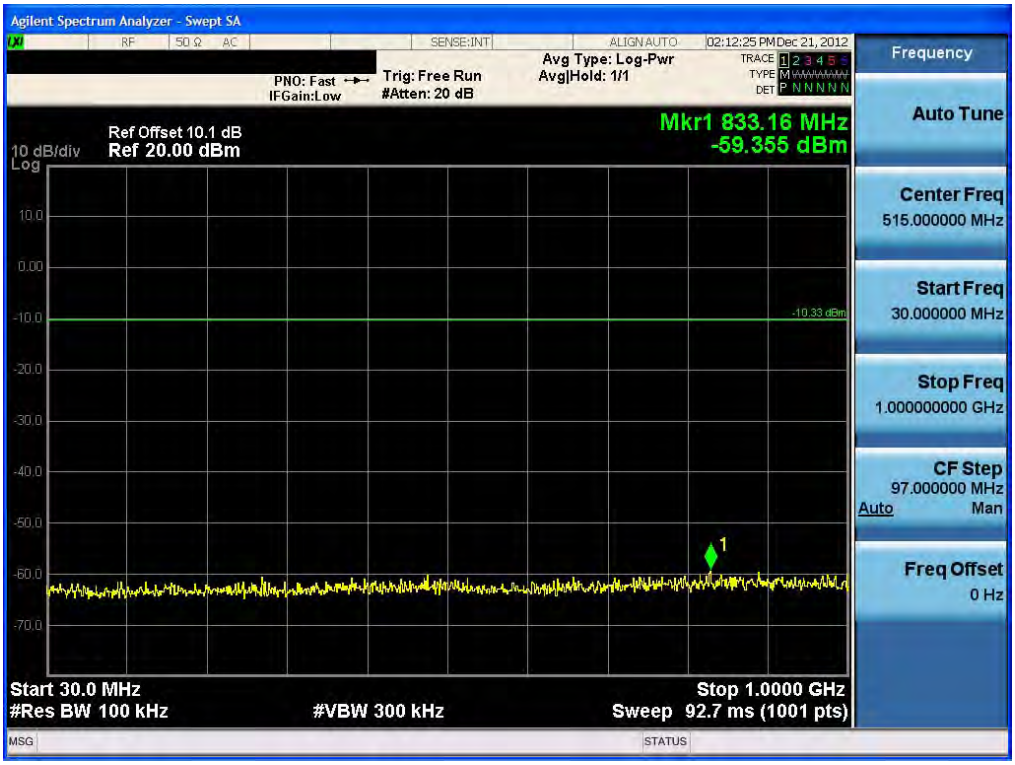
Conducted Spurious Emission (802.11g-CH11)



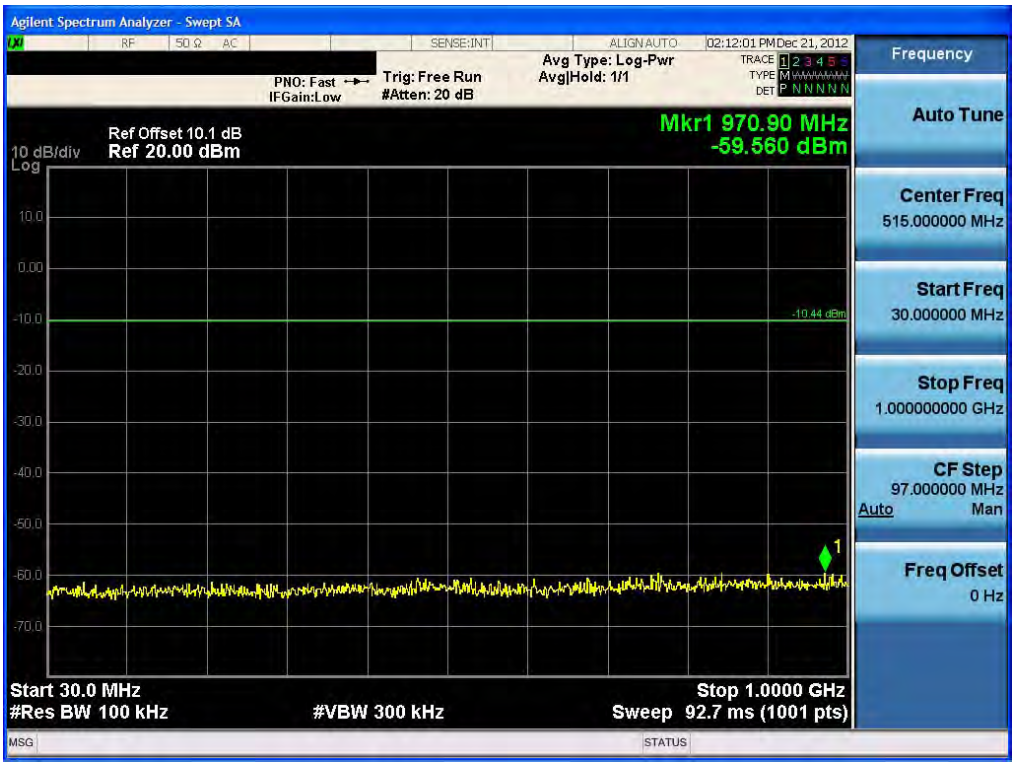
Conducted Spurious Emission (802.11n-CH1)



Conducted Spurious Emission (802.11n-CH6)



Conducted Spurious Emission (802.11n-CH11)



1 GHz ~ 26 GHz

Conducted Spurious Emission (802.11b-CH1)

Conducted Spurious Emission (802.11b-CH6)

Conducted Spurious Emission (802.11b-CH11)

Conducted Spurious Emission (802.11g-CH1)

Conducted Spurious Emission (802.11g-CH6)

Conducted Spurious Emission (802.11g-CH11)

Conducted Spurious Emission (802.11n-CH1)

Conducted Spurious Emission (802.11n-CH6)

Conducted Spurious Emission (802.11n-CH11)

8.5 RADIATED MEASUREMENT.

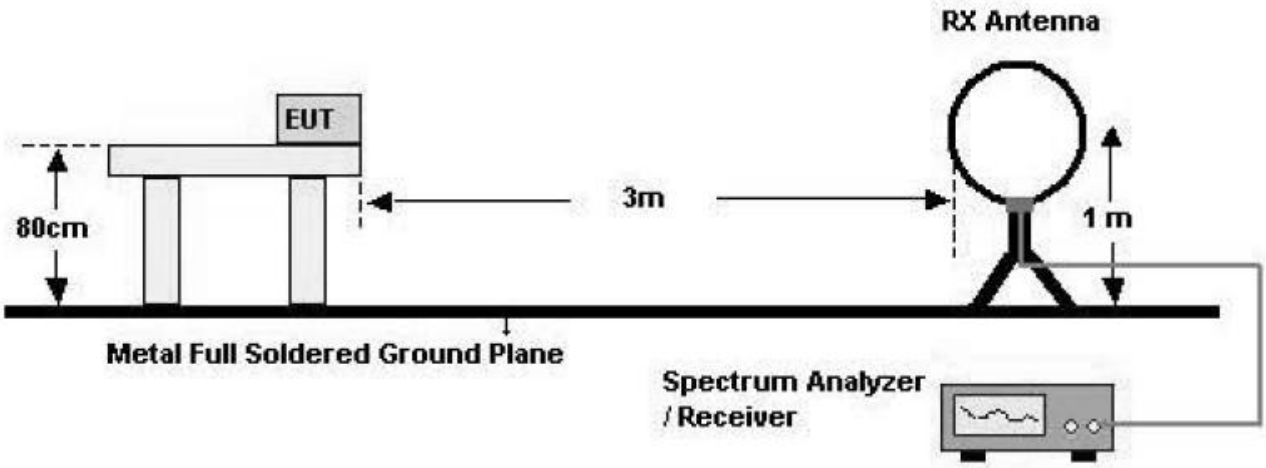
8.5.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

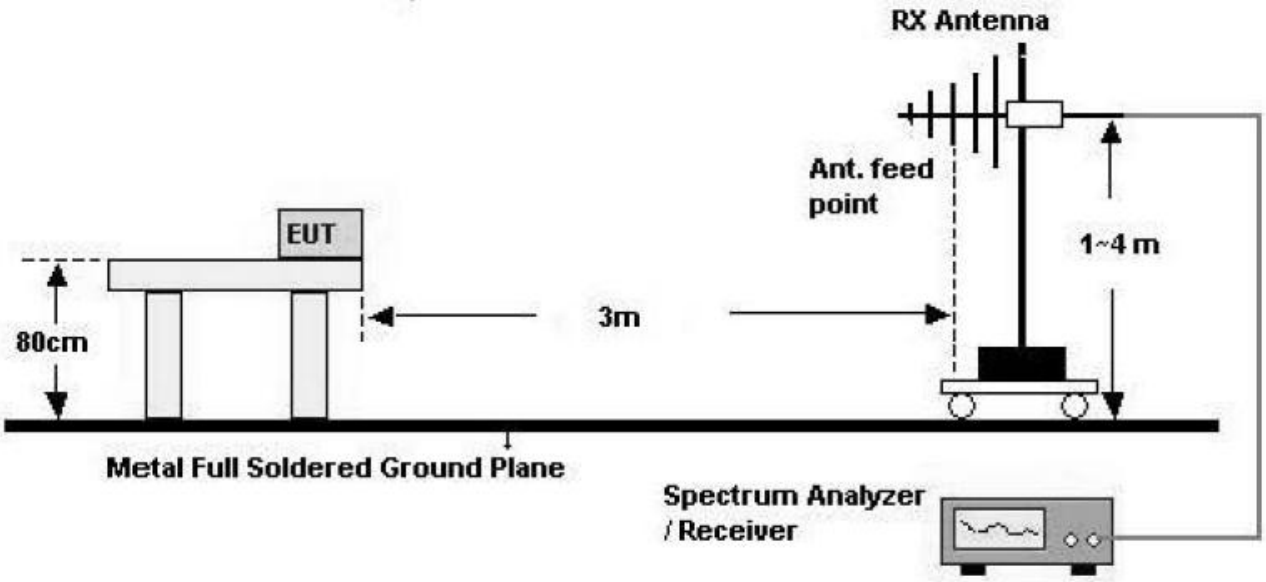
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

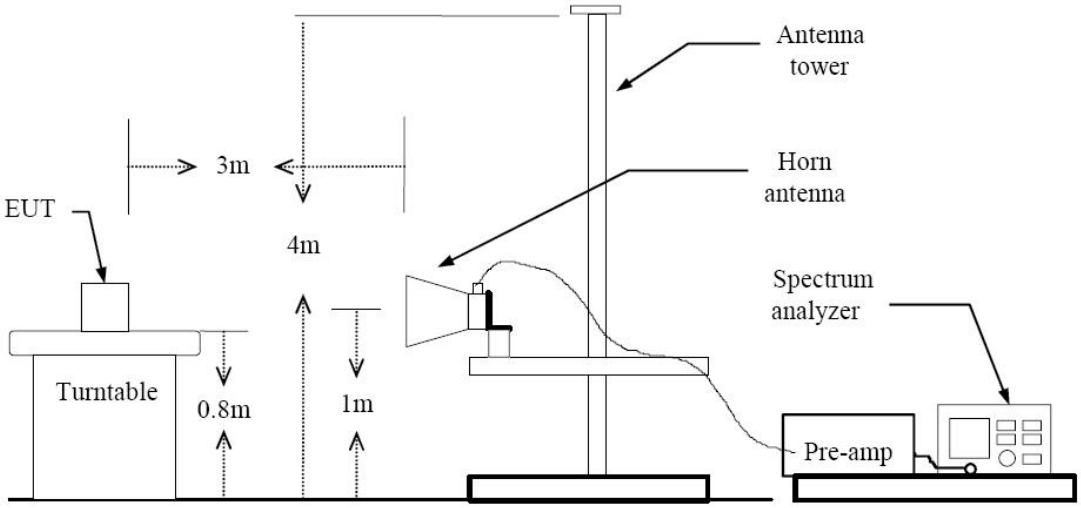
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest 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.

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
㎒	dB㎶	dB /m	dB	(H/V)	dB㎶/m	dB㎶/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
㎒	dB㎶	dB /m	dB	(H/V)	dB㎶/m	dB㎶/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Above 1 GHz

Operation Mode:	802.11 b
Transfer Rate:	1 Mbps
Operating Frequency	2412
Channel No.	01 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4824	53.46	-0.79	V	52.67	74	21.33	PK
4824	44.94	-0.79	V	44.15	54	9.85	AV
7236	49.14	9.08	V	58.22	74	15.78	PK
7236	36.14	9.08	V	45.22	54	8.78	AV
4824	53.25	-0.79	H	52.46	74	21.54	PK
4824	43.94	-0.79	H	43.15	54	10.85	AV
7236	50.12	9.08	H	59.2	74	14.80	PK
7236	36.16	9.08	H	45.24	54	8.76	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:

a. Peak (Procedure 4.2.3.2.2 in ANSI 63.10)

RBW = 1 MHz

VBW = 3 MHz

Detector = Peak

Trace = Max hold

Sweep = auto couple

b. Average (Procedure 4.2.3.2.3 in ANSI 63.10)

RBW = 1 MH

VBW = 10 Hz

Span = Zero

Detector Mode = Peak

Trace = Max hold

6. We have done 802.11b/g/n mode test. Worst case of EUT is 1 Mbps in 802.11b.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode:	802.11 b
Transfer Rate:	1 Mbps
Operating Frequency	2437
Channel No.	06 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4874	53.53	-0.37	V	53.16	74	20.84	PK
4874	45.51	-0.37	V	45.14	54	8.86	AV
7311	49.11	8.64	V	57.75	74	16.25	PK
7311	35.37	8.64	V	44.01	54	9.99	AV
4874	54.19	-0.37	H	53.82	74	20.18	PK
4874	46.83	-0.37	H	46.46	54	7.54	AV
7311	48.98	8.64	H	57.62	74	16.38	PK
7311	35.43	8.64	H	44.07	54	9.93	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:

a. Peak (Procedure 4.2.3.2.2 in ANSI 63.10)

RBW = 1 MHz

VBW = 3 MHz

Detector = Peak

Trace = Max hold

Sweep = auto couple

b. Average (Procedure 4.2.3.2.3 in ANSI 63.10)

RBW = 1 MH

VBW = 10 Hz

Span = Zero

Detector Mode = Peak

Trace = Max hold

6. We have done 802.11b/g/n mode test. Worst case of EUT is 1 Mbps in 802.11b.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode:	802.11 b
Transfer Rate:	1 Mbps
Operating Frequency	2462
Channel No.	11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL-AMP G [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4924	53.64	-0.15	V	53.49	74	20.51	PK
4924	44.54	-0.15	V	44.39	54	9.61	AV
7386	49.14	9.06	V	58.2	74	15.8	PK
7386	35.89	9.06	V	44.95	54	9.05	AV
4924	52.76	-0.15	H	52.61	74	21.39	PK
4924	43.00	-0.15	H	42.85	54	11.15	AV
7386	49.99	9.06	H	59.05	74	14.95	PK
7386	35.88	9.06	H	44.94	54	9.06	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:

a. Peak (Procedure 4.2.3.2.2 in ANSI 63.10)

RBW = 1 MHz

VBW = 3 MHz

Detector = Peak

Trace = Max hold

Sweep = auto couple

b. Average (Procedure 4.2.3.2.3 in ANSI 63.10)

RBW = 1 MH

VBW = 10 Hz

Span = Zero

Detector Mode = Peak

Trace = Max hold.

6. We have done 802.11b/g/n mode test. Worst case of EUT is 1 Mbps in 802.11b.
7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

8.5.2 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d) §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. 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)).

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

Frequency [MHz]	Reading dBuV	AN.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	31.31	33.90	H	65.21	74	8.79	PK
2390.0	14.89	33.90	H	48.79	54	5.21	AV
2390.0	31.22	33.90	V	65.12	74	8.88	PK
2390.0	14.62	33.90	V	48.52	54	5.48	AV
2483.5	37.00	33.99	H	70.99	74	3.01	PK
2483.5	16.33	33.99	H	50.32	54	3.68	AV
2483.5	35.20	33.99	V	69.19	74	4.81	PK
2483.5	14.66	33.99	V	48.65	54	5.35	AV

Notes:

1. Total = Reading Value + Antenna Factor + Cable Loss
2. Spectrum setting:
   a. Peak (Procedure 4.2.3.2.2 in ANSI 63.10)
      RBW = 1 MHz
      VBW = 3 MHz
      Detector = Peak
      Trace = Max hold
      Sweep = auto couple
   b. Average (Procedure 4.2.3.2.3 in ANSI 63.10)
      RBW = 1 MH

VBW = 10 Hz

Span = Zero

Detector Mode = Peak

Trace = Max hold

3. We have done 802.11b/g/n mode test. . Worst case of EUT is 6 Mbps in 802.11g.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

8.6 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207

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 (dBμV)	
	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.
5. We are performed the AC Power Line Conducted Emission test for 11 Mbps, Ch.6 and 802.11b. Because 802.11b mode is worst case.

▣ RESULT PLOTS

Conducted Emissions (Line 1)

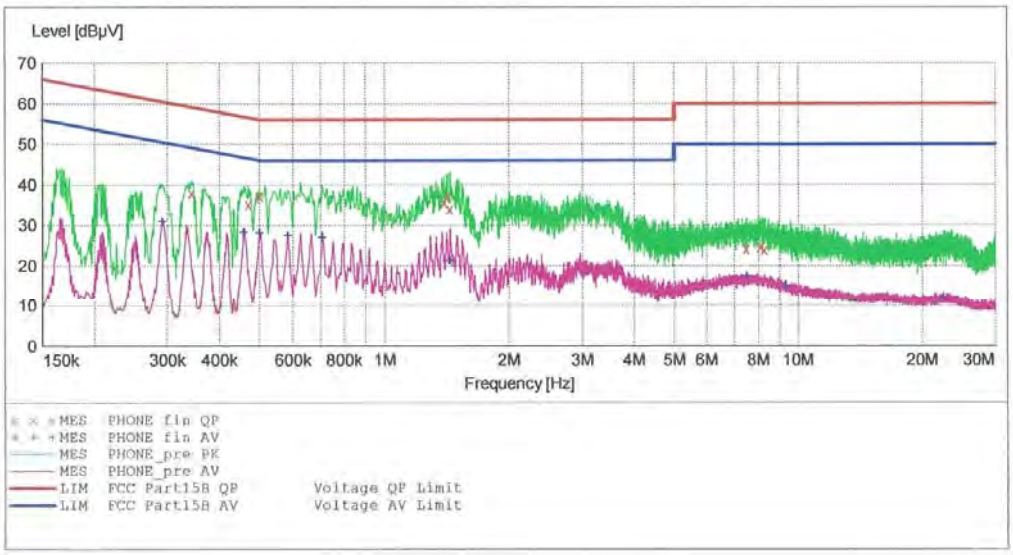
HCT

EMC

```
EUT:                    LG-P710
Manufacturer:           LGE
Operating Condition:    WLAN MODE
Test Site:              SHIELD ROOM
Operator:               JS LEE
Test Specification:     FCC PART 15 B
Comment:                H
```

SCAN TABLE: "FCC PART 15 B(H)"

```
Short Description:                  FCC PART 15 CLASS B
Start       Stop        Step        Detector   Meas.      IF       Transducer
Frequency   Frequency   Width                  Time       Bandw.
150.0 kHz   500.0 kHz   1.0 kHz     MaxPeak    10.0 ms    9 kHz    None
                                    Average
500.0 kHz   5.0 MHz     4.0 kHz     MaxPeak    10.0 ms    9 kHz    None
                                    Average
5.0 MHz     30.0 MHz    4.0 kHz     MaxPeak    10.0 ms    9 kHz    None
                                    Average
```



MEASUREMENT RESULT: "PHONE_fin QP"

12/17/2012 3:37PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.343010	38.00	9.7	59	21.1	---	---
0.469010	35.10	9.8	57	21.5	---	---
0.500000	37.30	9.8	56	18.7	---	---
1.396000	35.70	9.8	56	20.3	---	---
1.424000	37.20	9.9	56	18.8	---	---
1.444000	34.00	9.9	56	22.0	---	---
7.476000	24.20	10.3	60	35.8	---	---
8.092000	24.70	10.4	60	35.3	---	---
8.268000	24.00	10.4	60	36.0	---	---

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MEASUREMENT RESULT: "PHONE_fin AV"

12/17/2012 3:38PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.291010	30.90	9.8	51	19.6	---	---
0.458010	28.30	9.8	47	18.4	---	---
0.500000	28.10	9.8	46	17.9	---	---
0.584000	27.50	9.8	46	18.5	---	---
0.708000	27.00	9.8	46	19.0	---	---
1.444000	21.30	9.9	46	24.7	---	---
7.492000	17.30	10.3	50	32.7	---	---
9.328000	15.10	10.4	50	34.9	---	---
22.400000	11.70	11.9	50	38.3	---	---

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Conducted Emissions (Line 2)

HCT

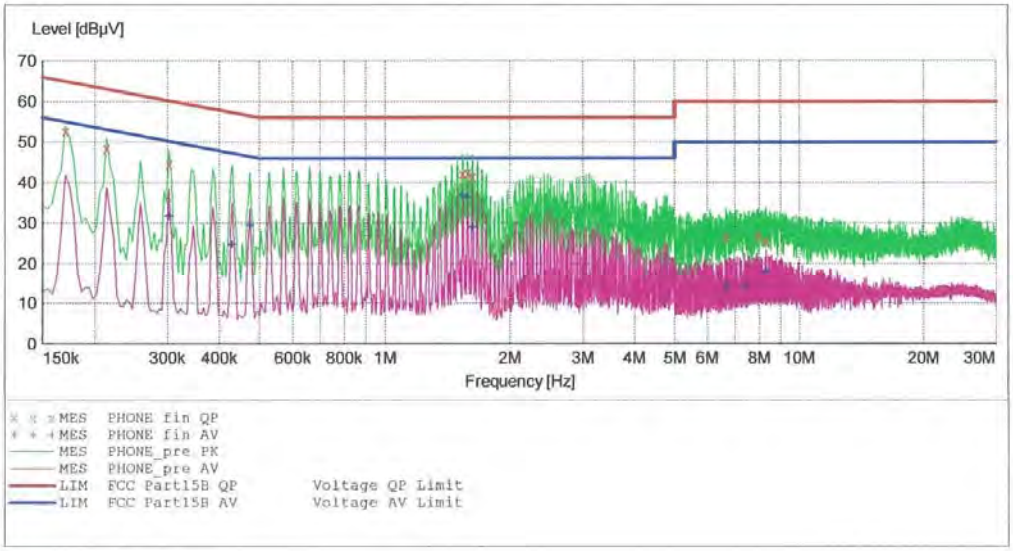
EMC

EUT: LG-P710
Manufacturer: LGE
Operating Condition: WLAN MODE
Test Site: SHIELD ROOM
Operator: JS LEE
Test Specification: FCC PART 15 CLASS B
Comment: N

SCAN TABLE: "FCC PART 15 B(N)"

Short Description: FCC PART 15 CLASS B

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	500.0 kHz	4.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
500.0 kHz	5.0 MHz	4.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
5.0 MHz	30.0 MHz	4.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None



MEASUREMENT RESULT: "PHONE_fin QP"

12/17/2012 3:07PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.170010	52.70	9.9	65	12.3	---	---
0.214010	48.50	9.9	63	14.6	---	---
0.302010	44.50	9.9	60	15.7	---	---
1.540000	42.20	10.1	56	13.8	---	---
1.584000	42.50	10.1	56	13.5	---	---
1.628000	41.50	10.1	56	14.5	---	---
6.668000	26.60	10.5	60	33.4	---	---
7.956000	26.90	10.6	60	33.1	---	---
8.316000	25.50	10.6	60	34.5	---	---

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MEASUREMENT RESULT: "PHONE_fin AV"

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Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.302010	31.70	9.9	50	18.5	---	---
0.430010	24.70	10.0	47	22.6	---	---
0.474010	29.50	10.0	46	16.9	---	---
1.540000	36.80	10.1	46	9.2	---	---
1.584000	36.40	10.1	46	9.6	---	---
1.628000	29.00	10.1	46	17.0	---	---
6.668000	14.50	10.5	50	35.5	---	---
7.376000	14.10	10.5	50	35.9	---	---
8.312000	18.10	10.6	50	31.9	---	---

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9. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Interval	Calibration Due	Serial No.
Rohde & Schwarz	ENV216/ LISN	Annual	02/09/2013	100073
Schwarzbeck	VULB 9168/ TRILOG Antenna	Biennial	02/09/2013	200
Rohde & Schwarz	ESI 40 / EMI TEST RECEIVER	Annual	05/03/2013	831564103
Agilent	E4440A/ Spectrum Analyzer	Annual	05/02/2013	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	Annual	07/31/2013	MY51110020
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
Rohde & Schwarz	SCU-18/ Signal Conditioning Unit	Annual	09/11/2013	10094
MITEQ	AMF-6B-180265-35-10P / POWER AMP	Annual	04/16/2013	667624
CERNEX	CBL26405040 / POWER AMP	Annual	04/16/2013	19660
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	10/17/2013	937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	Biennial	10/30/2014	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	Annual	02/09/2013	839117/011
Agilent	E4416A /Power Meter	Annual	11/07/2013	GB41291412
Agilent	E9327A /POWER SENSOR	Annual	05/02/2013	MY4442009
Wainwright Instrument	WHF3.3/18G-10EF / High Pass Filter	Annual	05/02/2013	1
Wainwright Instrument	WHNX6.0/26.5G-6SS / High Pass Filter	Annual	05/02/2013	1
Wainwright Instrument	WHNX7.0/18G-8SS / High Pass Filter	Annual	05/02/2013	29
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	Annual	05/02/2013	1
Hewlett Packard	11636B/Power Divider	Annual	11/07/2013	11377
Hewlett Packard	11667B / Power Splitter	Annual	06/05/2013	05001
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	11/07/2013	3110117
ITECH	IT6720 / DC POWER SUPPLY	Annual	11/07/2013	010002156287001199
TESCOM	TC-3000C / BLUETOOTH TESTER	Annual	11/07/2013	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	Annual	05/02/2013	100422
EMCO	6502.LOOP ANTENNA	Biennial	01/11/2014	9009-2536
MITEQ	AMF-6D-001180-35-20P/ POWER AMP	Annual	07/30/2013	990893
Agilent	8493C / Attenuator(10 dB)	Annual	07/30/2013	76649
WEINSCHEL	2-3 / Attenuator(3 dB)	Annual	11/07/2013	BR0617
CERNEX	CBLU1183540 / POWER AMP	Annual	07/27/2013	21691