RSE TEST REPORT

of

FCC Part 15 Subpart C §15.247 / RSS-210 Issue8, RSS-Gen Issue 3

FCC ID / IC Certification: PPD-QCMD335 / 4104A-QCMD335

Equipment Under Test	:	QCMD335 (Tested inside of Samsung Notebook PC NP450R5G)
Model Name	:	QCMD335
Serial No.	:	N/A
Applicant	:	Qualcomm Atheros, Inc.
Manufacturer	:	SAMSUNG ELECTRONICS CO., LTD.
Date of Test(s)	:	2013.07.04 ~ 2013.07.10
Date of Issue	:	2013.07.25

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Harim Lee** **Date:** **2013.07.25**

Approved By: **Feel Jeong** **Date:** **2013.07.25**

INDEX

Table of contents

1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

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1.2. Details of Manufacturer

Applicant : SAMSUNG ELECTRONICS CO., LTD.
Address : 129, Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, KR
Contact Person : Lee, Sang-cheong
Phone No. : +82 31 277 4784

1.3. Description of EUT

Kind of Product	QCMD335(Tested inside of Samsung Notebook PC NP450R5G)
Model Name	QCMD335
Serial Number	N/A
Power Supply	DC 11.1 V
Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (BT, BT LE), 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20), 2 422 ㎒ ~ 2 452 ㎒ (11n_HT40)
Modulation Technique	DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK
Number of Channels	11 channel (11b/g/n_HT20), 7 channel (11n_HT40), 79 channel (BT), 40 channel (BT LE)
Antenna Type	Internal type
Antenna Gain	2 402 ㎒ ~ 2 480 ㎒, 2 412 ㎒ ~ 2 462 ㎒, 2 422 ㎒ ~ 2 452 ㎒ : -4.23 ㏈i

1.4. Declaration by the manufacturer

- Duty Cycle ≥ 98 percent.

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Spectrum Analyzer	Agilent	N9030A	US51340132	Oct. 30, 2012	Annual	Oct. 30, 2013
Signal Generator	R&S	SMBV100A	255834	Jun, 26. 2013	Annual	Jun, 26. 2014
Signal Generator	R&S	SMR40	100272	Aug. 23, 2012	Annual	Aug. 23, 2013
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jun. 08, 2013	Annual	Jun. 08, 2014
High Pass Filter	Wainwright	WHK7.5//26.5G-6SS	N/A	Jun. 08, 2013	Annual	Jun. 08, 2014
Low Pass Filter	Mini-Circuits	NLP-1200+	V8979400903-1	Jul. 12, 2013	Annual	Jul. 12, 2014
Power Sensor	R&S	NRP-Z81	100669	Apr. 05, 2013	Annual	Apr. 05, 2014
DC power Supply	Agilent	U8002A	MY49030063	Dec. 20, 2012	Annual	Dec. 20, 2013
Preamplifier	H.P.	8447F	2944A03909	Jul. 28, 2013	Annual	Jul. 28, 2014
Preamplifier	R&S	SCU 18	10117	Jan. 14, 2013	Annual	Jan. 14, 2014
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Jul. 13, 2013	Annual	Jul, 13, 2014
Test Receiver	R&S	ESU26	100109	Feb. 28, 2013	Annual	Feb. 28, 2014
Loop Antenna	R&S	HFH2-Z2	100118	Aug. 24, 2011	Biennial	Aug. 24, 2013
Bilog Antenna	SCHWARZBECK	VULB9163	396	Apr. 19, 2012	Biennial	Apr. 19, 2014
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170431	May 15, 2012	Biennial	May 15, 2014
Horn Antenna	R&S	HF 906	100326	Nov. 23, 2011	Biennial	Nov. 23, 2013
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.

▶ **Support equipment**

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C § 15.247, RSS-210 Issue8, RSS-Gen Issue3			
Standard section		**Test Item(s)**	**Result**
15.205 15.209 15.247(d)	RSS-210 A8.5	Transmitter Radiated Spurious Emissions	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in KDB 558074 were used in the measurement of the DUT.

1.8. Sample calculation

Where relevant, the following sample calculation is provided:

1.8.1. Radiation test

Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) - amplifier gain(㏈)

1.9. Test report revision

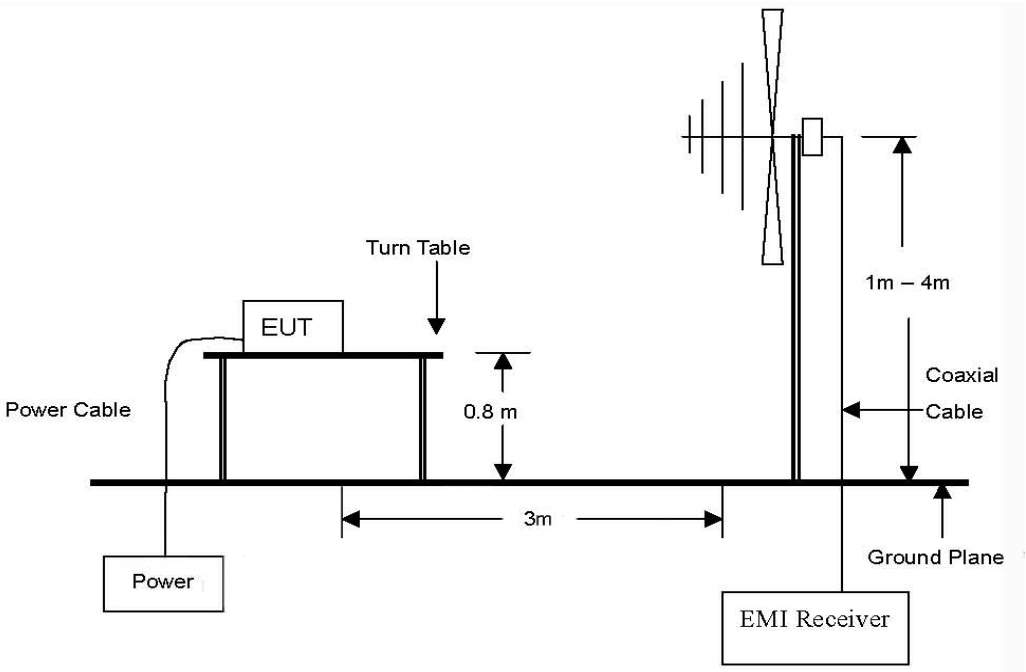
Revision	Report number	Description
0	F690501/RF-RTL006718	Initial
1	F690501/RF-RTL006718-1	Modify type error
2	F690501/RF-RTL006718-2	Modify applicant

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

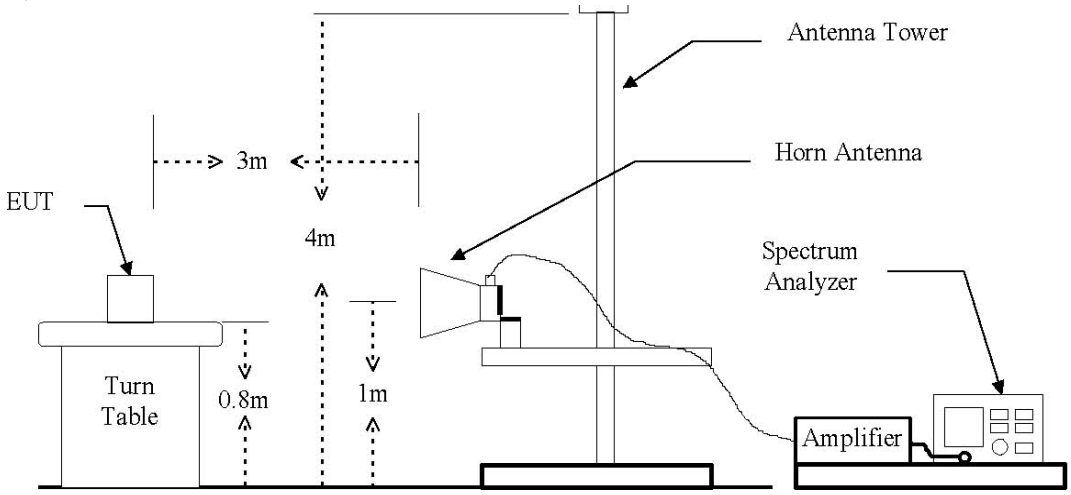
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.2. Limit

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 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 (㎒)	Distance (Meters)	Field Strength (㏈㎶/m)	Field Strength (㎶/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 11.0 & 12.0 of KDB 558074

2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

1. Unwanted Emissions into Non-Restricted Frequency Bands
 - The Reference Level Measurement refer to section 11.1
 Set analyzer center frequency to DTS channel center frequency, SPAN ≥ 1.5 times the DTS channel bandwidth, the RBW = 100 ㎑ and VBW ≥ 3 ㏓ RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

 - Unwanted Emissions Level Measurement refer to section 11.2
 Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 ㏓ RBW, Detector = Peak, Ensure that the number of measurement points ≥span/RBW, Sweep time = Auto couple, Trace = Max hold

2. Unwanted Emissions into Restricted Frequency Bands
 - Peak Power measurement procedure refer to section 12.2.3
 Set RBW = 1 ㎒, VBW ≥ 3 x RBW, SPAN ≥ RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

 -Average Power measurements procedure refer to section 12.2.4.2
a) The EUT shall be configured to operate at the maximum achievable duty cycle.
b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.
c) RBW = 1 MHz (unless otherwise specified).
d) VBW ≥ 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
f) Averaging type = power (i.e., RMS).
1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
g) Sweep time = auto.
h) Perform a trace average of at least 100 traces.
i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows

1) If power averaging(RMS) mode was used in step f), then the applicable correction factor is 10log(1/x), where x is the duty cycle.
2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20log(1/x), where x is the duty cycle.
3) If a specific emission is demonstrated to be continuous (≥98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

2.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission (Worst case configuration_GFSK, Middle channel)

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	AMP (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
140.87	47.60	Peak	H	8.21	2.01	25.38	32.44	43.50	11.06
141.36	47.39	Peak	V	8.22	2.01	25.38	32.24	43.50	11.26
211.39	51.36	Peak	H	10.85	2.45	25.18	39.48	43.50	4.02
318.09	45.52	Peak	V	13.42	2.99	25.16	36.77	46.00	9.23
360.58	47.33	Peak	H	14.27	3.20	25.55	39.25	46.00	6.75
Above 400.00	Not detected	-	-	-	-		-	-	-

Remark:
1. All spurious emission at channels are almost the same below 1 ㎓, so that the middle channel was chosen at representative in final test.
2. Actual = Reading + AF - AMP + CL

2.4.2. Spurious Radiated Emission

The frequency spectrum above 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈.

Operating Mode: GFSK(1 Mbps)

Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*2 390.00	25.91	Peak	V	28.05	7.56	-	61.52	74.00	12.48
*2 390.00	15.11	Average	V	28.05	7.56	1.49	52.21	54.00	1.79

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP +CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*4 803.87	35.78	Peak	H	32.28	-32.66	-	35.40	74.00	38.60
*4 803.87	24.59	Average	H	32.28	-32.66	1.49	25.70	54.00	28.30
Above 4 900.00	Not detected	-	-	-	-		-	-	-

Middle Channel (2 440 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP +CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*4 879.91	35.96	Peak	H	32.84	-32.44	-	36.36	74.00	37.64
*4 879.91	24.38	Average	H	32.84	-32.44	1.49	26.27	54.00	27.73
Above 4 900.00	Not detected	-	-	-	-		-	-	-

High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	26.11	Peak	V	28.31	7.67	-	62.09	74.00	11.91
*2 483.50	14.89	Average	V	28.31	7.67	1.49	52.36	54.00	1.64

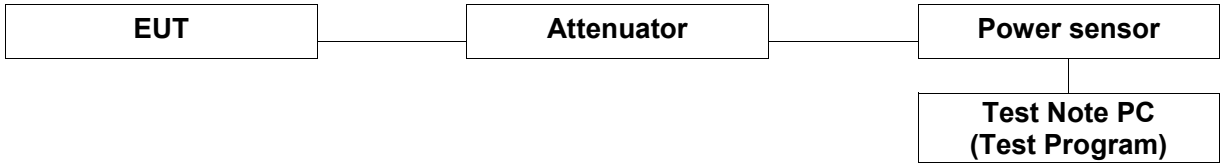
Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP +CL (dB)	Duty factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 959.01	34.41	Peak	H	33.31	-32.26	-	35.46	74.00	38.54
*4 959.01	24.14	Average	H	33.31	-32.26	1.49	26.68	54.00	27.32
Above 5 000.00	Not detected	-	-	-	-		-	-	-

Remarks;

1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit.
5. Actual = Reading + AF + AMP + CL + Duty factor
6. Duty factor = 10*Log(1/X), X = Duty cycle

3. Maximum Conducted Output Power

3.1. Test Setup



3.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
According to §15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antenna with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph(c) of this section, if transmitting antenna of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6㏈i.

3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 9.1.3 & 9.2.3 of FCC KDB Publication 558074

- Peak power meter method

-The maximum peak conducted output power can be measured using a broad band peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type detector.

- Average power meter method

- Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, of to transmit with a constant duty factor.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0 of KDB 558074.

Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Adjust the measurement in dB m by adding 10 log(1/x), where x is the duty cycle to the measurement result.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the broadband power meter and power sensor. The power sensor employs a VBW = 30 ㎒ which is greater than the DTS bandwidth
3. Measure peak & average power each channel.

3.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Mode	Channel	Channel Frequency (㎒)	Data Rate (Mbps)	Attenuator + Cable offset (dB)	Average power Result (dB m)			Peak Power Result (dB m)
					Reading	Duty factor	Result	
GFSK	Low	2 402	1	22.370	-1.30	1.49	0.19	0.31
	Middle	2 440	1		-1.29		0.20	0.24
	High	2 480	1		-1.17		0.32	0.26

Note;
Average power result = Reading + Duty factor
Duty factor = 10log(1/x), x = Duty cycle