TEST REPORT

of

FCC Part 15 Subpart C §15.247/RSS-210 Issue 8, RSS-Gen Issue 3

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

Equipment Under Test	:	SAMSUNG NOTE PC
Model Name	:	QCMD335 (Tested inside of Samsung Notebook PC NP455R4J)
Applicant	:	Qualcomm Atheros, Inc.
Manufacturer	:	SAMSUNG ELECTRONICS CO., LTD.
Date of Test(s)	:	2014. 03. 04 ~ 2014. 03. 21
Date of Issue	:	2014. 05. 30

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

Tested By: **Wonjun Sim** **Date:** **2014.05.30**

Approved By: **Hyunchae You** **Date:** **2014.05.30**

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 3FL, 4, LS-ro 182beon-gil, 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 Applicant

Applicant : Qualcomm Atheros, Inc.
Address : 1700 Technology Drive, San Jose, CA 95110
Contact Person : Stanley Lin
Phone No. : +1 408 773 5200
Fax No. +1 408 773 9940

1.3. Description of EUT

Kind of Product	SAMGSUNG NOTE PC
Model Name	QCMD335 (Tested inside of Samsung Notebook PC NP455R4J)
Power Supply	DC 11.4V
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(SISO)
Antenna Gain	0.84 ㏈i

1.4. Declaration by the manufacturer

- N/A

1.5. Information about the FHSS characteristics:

1.5.1. Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

1.5.2. Equal Hopping Frequency Use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

1.5.3. Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

1.5.4. System Receiver Input Bandwidth

Each channel bandwidth is 1 ㎒

1.5.5. Equipment Description

15.247(a)(1) that the rx input bandwidths shift frequencies in synchronization with the transmitted

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

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1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100272	Aug. 23, 2013	Annual	Aug. 23, 2014
Signal Generator	R&S	SMBV100A	3847M00534	Jul. 15, 2013	Annual	Jul. 15, 2014
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 08, 2013	Annual	Oct. 08, 2014
Bluetooth Tester	TESOM	TC-3000C	3000C000142	Dec. 12, 2013	Annual	Dec. 12, 2014
Directional Coupler	KRYTAR	152613	122660	Jun. 07, 2013	Annual	Jun. 07, 2014
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	11	Jun. 08, 2013	Annual	Jun. 08, 2014
Low Pass Filter	Mini circuits	NLP-1200+	V8979400903-1	Jun. 12, 2013	Annual	Jun. 12, 2014
Power Sensor	R&S	NRP-Z81	100669	Apr. 05. 2013	Annual	Apr. 05. 2014
DC Power Supply	Agilent	U8002A	MY53150029	Jul. 20, 2013	Annual	Jul. 20, 2014
Preamplifier	H.P.	8447F	2944A03909	Jun. 28, 2013	Annual	Jun. 28, 2014
Preamplifier	R&S	SCU 18	1391123	Sep. 30, 2013	Annual	Sep. 30, 2014
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Jun. 13, 2013	Annual	Jun. 13, 2014
Test Receiver	R&S	ESU26	100109	Mar. 04, 2014	Annual	Mar. 04, 2015
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jun. 07, 2013	Biennial	Jun. 07, 2015
Loop Antenna	R&S	HFH2-Z2	100118	Jul. 12, 2013	Biennial	Jul. 12, 2015
Horn Antenna	R&S	HF906	100326	Nov. 01, 2013	Biennial	Nov. 01, 2015
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170431	May 15, 2012	Biennial	May 15, 2014
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

1.7. 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
15.247(b)(3)	RSS-210 A8.4(4)	Maximum Conducted Output Power	Complied

1.8. Sample calculation

Where relevant, the following sample calculation is provided:

1.8.1. Conducted test

Offset value (dB) = Directional Coupler(dB) + Power Divider (dB) + Cable loss (dB)

1.8.2. Radiation test

Field strength level ($dB\mu V/m$) = Measured level ($dB\mu V$) + Antenna factor (dB) + Cable loss (dB) – amplifier gain (dB)

1.9. Test report revision

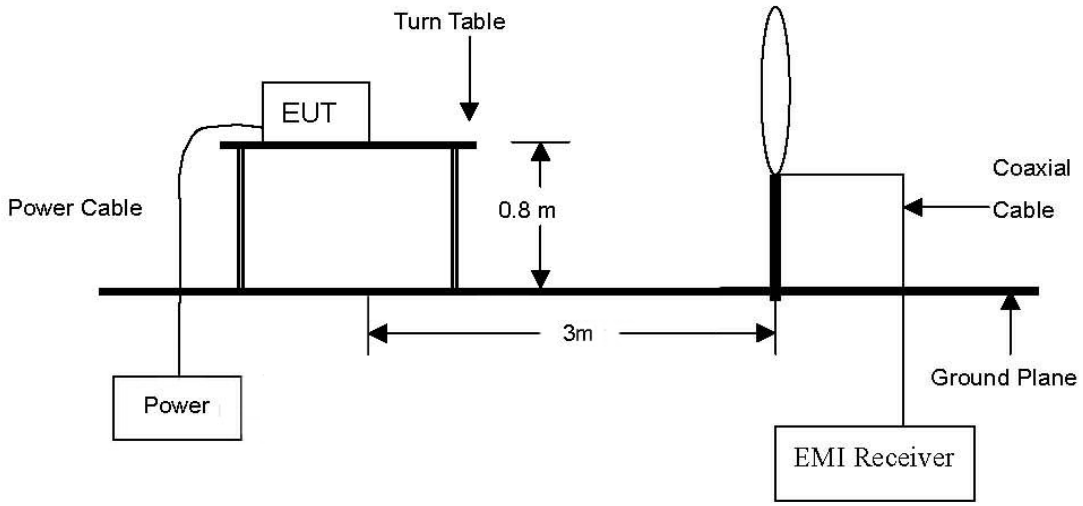
Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007500	2014.03.21	Initial
1	F690501/RF-RTL007500-1	2014.05.27	Modified Applicant information
2	F690501/RF-RTL007500-2	2014.05.30	Correct typo

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

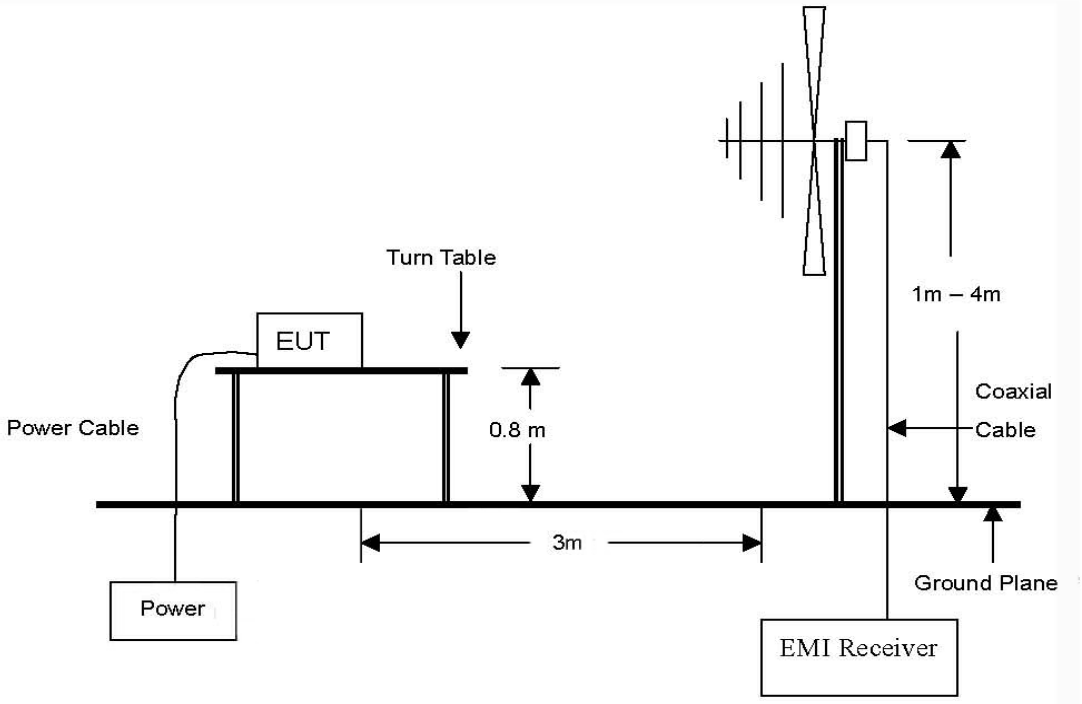
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

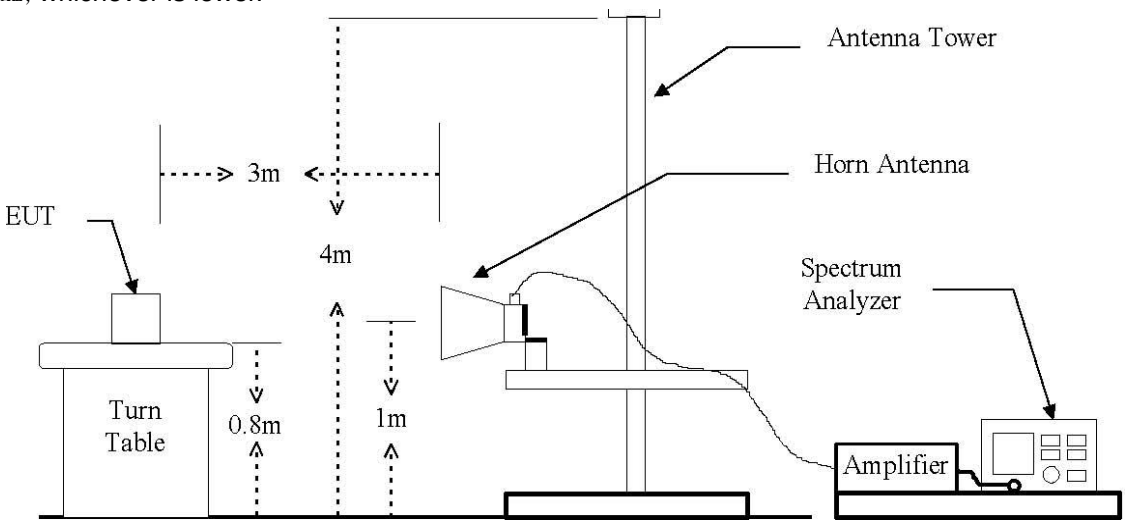
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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 (㏈μV/m)	Field Strength (μV/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 of DA000705

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. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1/T_{on} ㎐ (T_{on} = On-time of the Pulsed emission) for Average detection (AV) at frequency above 1 ㎓.
4. When Average result is different from peak result over 20 dB (over-averaging), According to 15.35 (c), as a “duty cycle correction factor”, pulse averaging with 20 log(duty cycle) has to be used.
5. 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. Spurious Radiated Emission (Worst case configuration_ GFSK mode, 1 Mbps, High channel)

The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP + CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
162.24	40.30	Peak	H	8.44	-25.64	23.10	43.50	20.40
202.74	38.40	Peak	H	11.81	-25.31	24.90	43.50	18.60
243.48	46.26	Peak	H	13.59	-25.05	34.80	46.00	11.20
283.90	36.86	Peak	H	14.76	-24.82	26.80	46.00	19.20
400.02	43.29	Peak	V	17.15	-25.14	35.30	46.00	10.70
Above 500.00	Not detected	-	-	-	-	-	-	-

Remark:

1. All spurious emissions at channels are almost the same below 1 ㎓, so that 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)

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*2 390.00	23.41	Peak	H	28.05	6.25	57.71	74.00	16.29
*2 390.00	14.34	Average	H	28.05	6.25	48.64	54.00	5.36

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*4 803.85	38.82	Peak	H	32.28	-34.58	36.52	74.00	37.48
*4 803.85	27.35	Average	H	32.28	-34.58	25.05	54.00	28.95
Above 4 900.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 882.57	37.38	Peak	H	32.86	-33.73	36.51	74.00	37.49
*4 882.57	26.76	Average	H	32.86	-33.73	25.89	54.00	28.11
Above 4 900.00	Not detected	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	22.84	Peak	H	28.31	6.27	57.42	74.00	16.58
*2 483.50	14.68	Average	H	28.31	6.27	49.26	54.00	4.74

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 961.24	37.21	Peak	H	33.32	-34.31	36.22	74.00	37.78
*4 961.24	26.55	Average	H	33.32	-34.31	25.56	54.00	28.44
Above 5 000.00	Not detected	-	-	-	-	-	-	-

Operating Mode: 8DPSK(3 Mbps)

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 390.00	24.90	Peak	H	28.05	6.25	59.20	74.00	14.80
*2 390.00	14.33	Average	H	28.05	6.25	48.63	54.00	5.37

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 804.24	37.49	Peak	H	32.28	-34.57	35.20	74.00	38.80
*4 804.24	27.32	Average	H	32.28	-34.57	25.03	54.00	28.97
Above 4 900.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 881.53	37.30	Peak	H	32.85	-33.73	36.42	74.00	37.58
*4 881.53	26.77	Average	H	32.85	-33.73	25.89	54.00	28.11
Above 4 900.00	Not detected	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	23.20	Peak	H	28.31	6.27	57.78	74.00	16.22
*2 483.50	14.73	Average	H	28.31	6.27	49.31	54.00	4.69

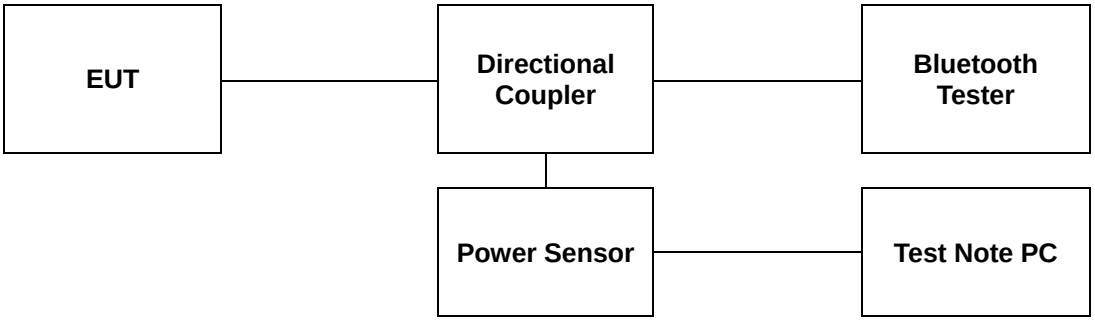
Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 960.46	36.77	Peak	H	33.31	-34.30	35.78	74.00	38.22
*4 960.46	26.61	Average	H	33.31	-34.30	25.62	54.00	28.38
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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
6. T = 2.88ms, 1/T = 347 ㎐ So, set the VBW = 360 ㎐

3. Maximum Peak Output Power Measurement

3.1. Test Setup



3.2. Limit

The maximum peak output power of the intentional radiator shall not exceed the following :

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.
2. §15.247(b)(1), For frequency hopping systems operating in the 2 400 – 2 483.5 ㎒ employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 – 5 805 ㎒ band: 1 Watt.

3.3. Test Procedure

All data rates and modes were investigated for this test. The test follows DA000705. Using the power sensor instead of a spectrum analyzer.

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 Power sensor.
3. Test program : (S/W name : R&S Power Viewer, Version : 3.2.0)
4. Measure peak & average power each channel.

3.4. Test Results

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

Operation Mode	Data Rate	Channel	Channel Frequency (㎒)	Attenuator + Cable offset (dB)	Average Power Result (dB m)	Peak Power Result (dB m)	Peak Power Limit (dB m)
GFSK	1 Mbps	Low	2 402	15.24	3.68	3.84	30.00
		Middle	2 441	15.24	3.82	4.12	30.00
		High	2 480	15.23	4.16	4.42	30.00
π/4DQPSK	2 Mbps	Low	2 402	15.21	3.72	6.74	20.97
		Middle	2 441	15.22	3.98	7.01	20.97
		High	2 480	15.23	4.24	7.21	20.97
8DPSK	3 Mbps	Low	2 402	15.23	3.89	6.86	20.97
		Middle	2 441	15.22	4.11	7.07	20.97
		High	2 480	15.24	4.32	7.39	20.97

Remark:
In the case of AFH, the limit for peak power is 0.125 W

4. Antenna Requirement

4.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

4.2. Antenna Connected Construction

Antenna used in this product is Integral type with gain of 0.84 dBi.