5. 20dBc BW

5.1. Test Setup

Refer to the APPENDIX I.

5.2. Limit

Limit: Not Applicable

5.3. Test Procedure

1. The 20dBc bandwidth were measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW ≥ 1% of the 20 dB bandwidth, VBW ≥RBW, Span = 3㎒.

5.4. Test Results

Ambient temperature : 20 °C
Relative humidity : 35 %

Modulation	Tested Channel	20 dBc BW (MHz)
GFSK	**Lowest**	**0.939**
	Middle	**0.927**
	Highest	**0.924**
π/4DQPSK	**Lowest**	**1.299**
	Middle	**1.299**
	Highest	**1.296**
8DPSK	**Lowest**	**1.269**
	Middle	**1.275**
	Highest	**1.269**

Note 1: See next pages for actual measured spectrum plots.

20dBc Bandwidth ***Lowest Channel & Modulation: GFSK***

20dBc Bandwidth ***Middle Channel & Modulation: GFSK***

20dBc Bandwidth ***Highest Channel & Modulation: GFSK***

20dBc Bandwidth ***Lowest Channel & Modulation: π/4DQPSK***

20dBc Bandwidth ***Middle Channel & Modulation: π/4DQPSK***

20dBc Bandwidth ***Highest Channel & Modulation: π/4DQPSK***

20dBc Bandwidth ***Lowest Channel & Modulation: 8DPSK***

20dBc Bandwidth ***Middle Channel & Modulation: 8DPSK***

20dBc Bandwidth ***Highest Channel & Modulation: 8DPSK***

6. Time of Occupancy (Dwell Time)

6.1. Test Setup

Refer to the APPENDIX I.

6.2. Limit

Limit: Not Applicable

6.3. Test Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz
Span = zero
RBW = 1 MHz
VBW = ≥ RBW
Trace = max hold
Detector function = peak

6.4. Test Results

Ambient temperature : 22 °C
Relative humidity : 36 %

- FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	79	2.89	3.75	0.308
	2 DH 5	79	2.89	3.75	0.308
	3 DH 5	79	2.89	3.75	0.308

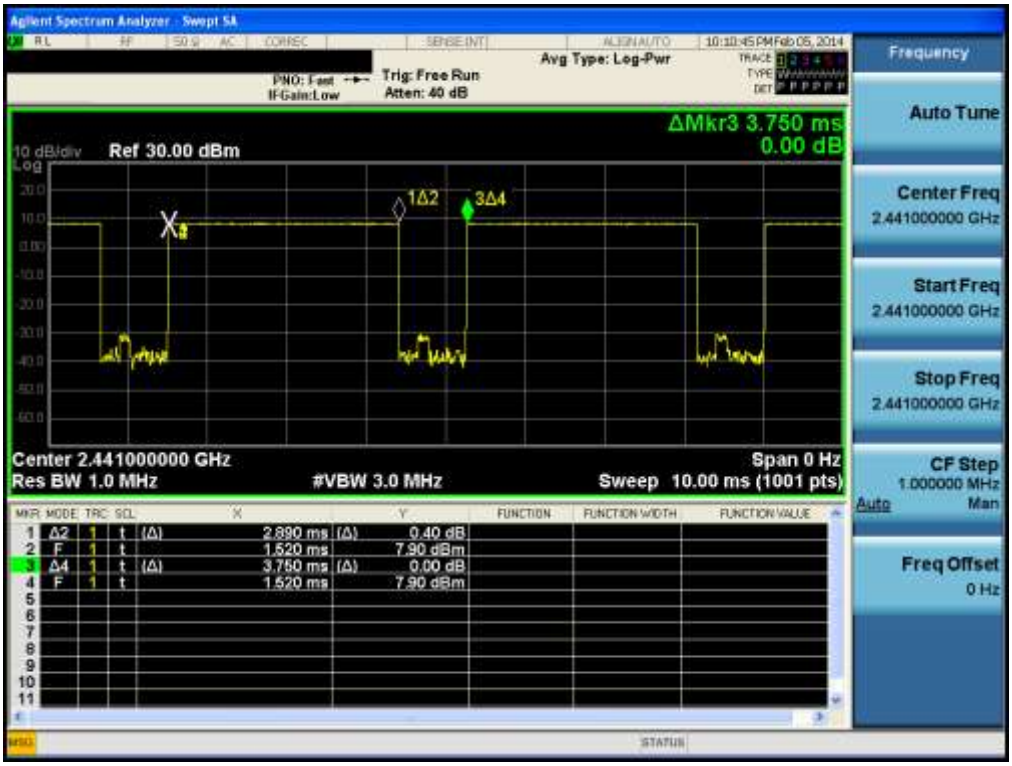
- AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	20	2.89	3.75	0.154
	2 DH 5	20	2.89	3.75	0.154
	3 DH 5	20	2.89	3.75	0.154

Note 1: $\text{Dwell Time} = 0.4 \times \text{Hopping channel} \times \text{Burst ON time} \times ((\text{Hopping rate} \div \text{Time slots}) \div \text{Hopping channel})$
- Time slots for DH5 = 6 slots(TX = 5 slot / RX = 1 slot)
- Hopping Rate = 1600 for FH mode & 800 for AFH mode

Note 2: See next pages for actual measured spectrum plots.

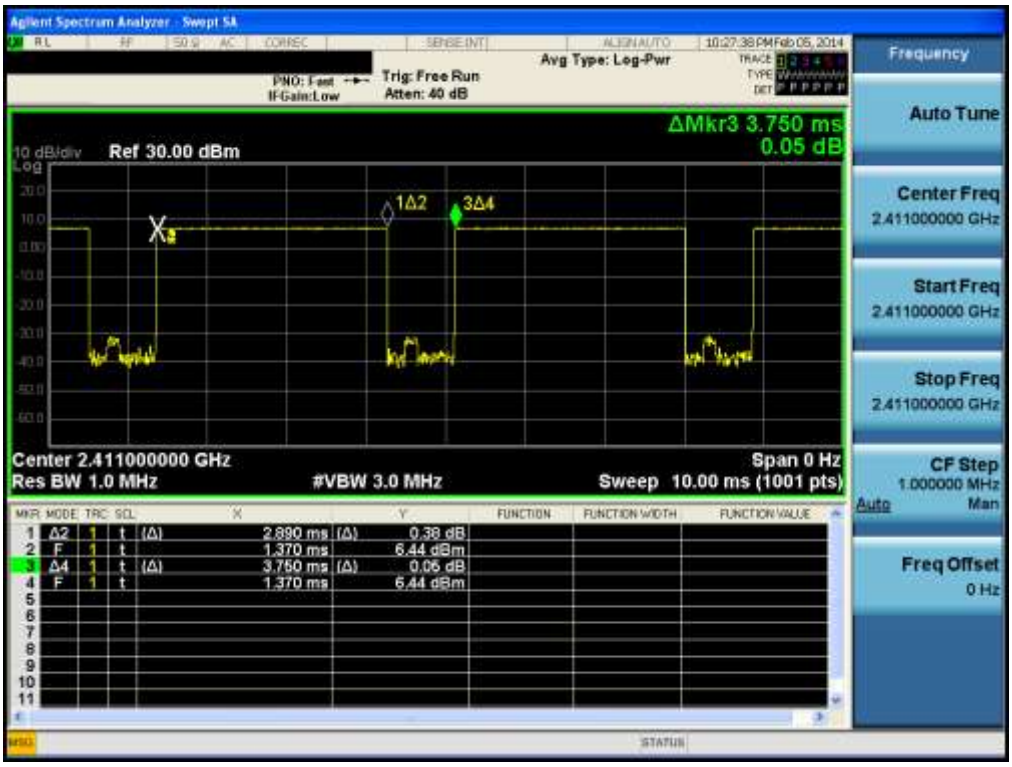
Time of Occupancy (FH) ***Hopping mode: Enable & GFSK***



Time of Occupancy (FH) ***Hopping mode: Enable & π/4-DQPSK***

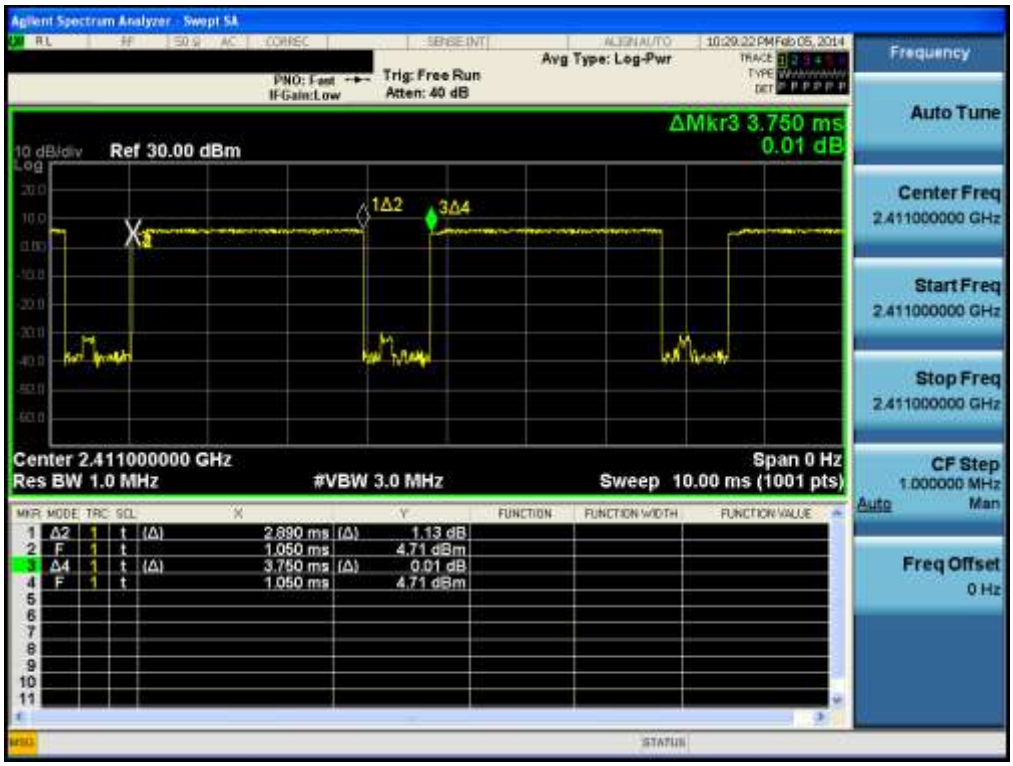
Time of Occupancy (FH) ***Hopping mode: Enable & 8DPSK***

Time of Occupancy (AFH) ***Hopping mode: Enable & GFSK***



Time of Occupancy (AFH) ***Hopping mode: Enable & π/4-DQPSK***

Time of Occupancy (AFH) ***Hopping mode: Enable & 8DPSK***



7. Maximum Peak Output Power Measurement

7.1. Test Setup

Refer to the APPENDIX I.

7.2. 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.

7.3. Test Procedure

1. The RF power output was measured with a Spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;
   Span = approximately 5 times of the 20 ㏈ bandwidth, centered on a hopping channel
   RBW ≥ 20 ㏈ BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

7.4. Test Results

Ambient temperature : 22 °C
Relative humidity : 36 %

Modulation	Tested Channel	Peak Output Power	
		dBm	mW
GFSK	**Lowest**	6.67	4.640
	Middle	8.37	6.866
	Highest	**9.18**	**8.283**
π/4DQPSK	**Lowest**	6.79	4.772
	Middle	8.32	6.790
	Highest	**9.13**	**8.183**
8DPSK	**Lowest**	6.83	4.818
	Middle	8.35	6.844
	Highest	**9.18**	**8.283**

Note 1: See next pages for actual measured spectrum plots.

Peak Output Power ***Lowest Channel & Modulation: GFSK***

Peak Output Power ***Middle Channel & Modulation: GFSK***

Peak Output Power ***Highest Channel & Modulation: GFSK***

Peak Output Power ***Lowest Channel & Modulation: π/4DQPSK***

Peak Output Power ***Middle Channel & Modulation: π/4DQPSK***

Peak Output Power ***Highest Channel & Modulation: π/4DQPSK***

Peak Output Power ***Lowest Channel & Modulation: 8DPSK***

Peak Output Power ***Middle Channel & Modulation: 8DPSK***

Peak Output Power ***Highest Channel & Modulation: 8DPSK***

8. Transmitter AC Power Line Conducted Emission

8.1. Test Setup

Refer to test setup photo.

8.2. Limit

According to §15.207(a) for an intentional radiator that 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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

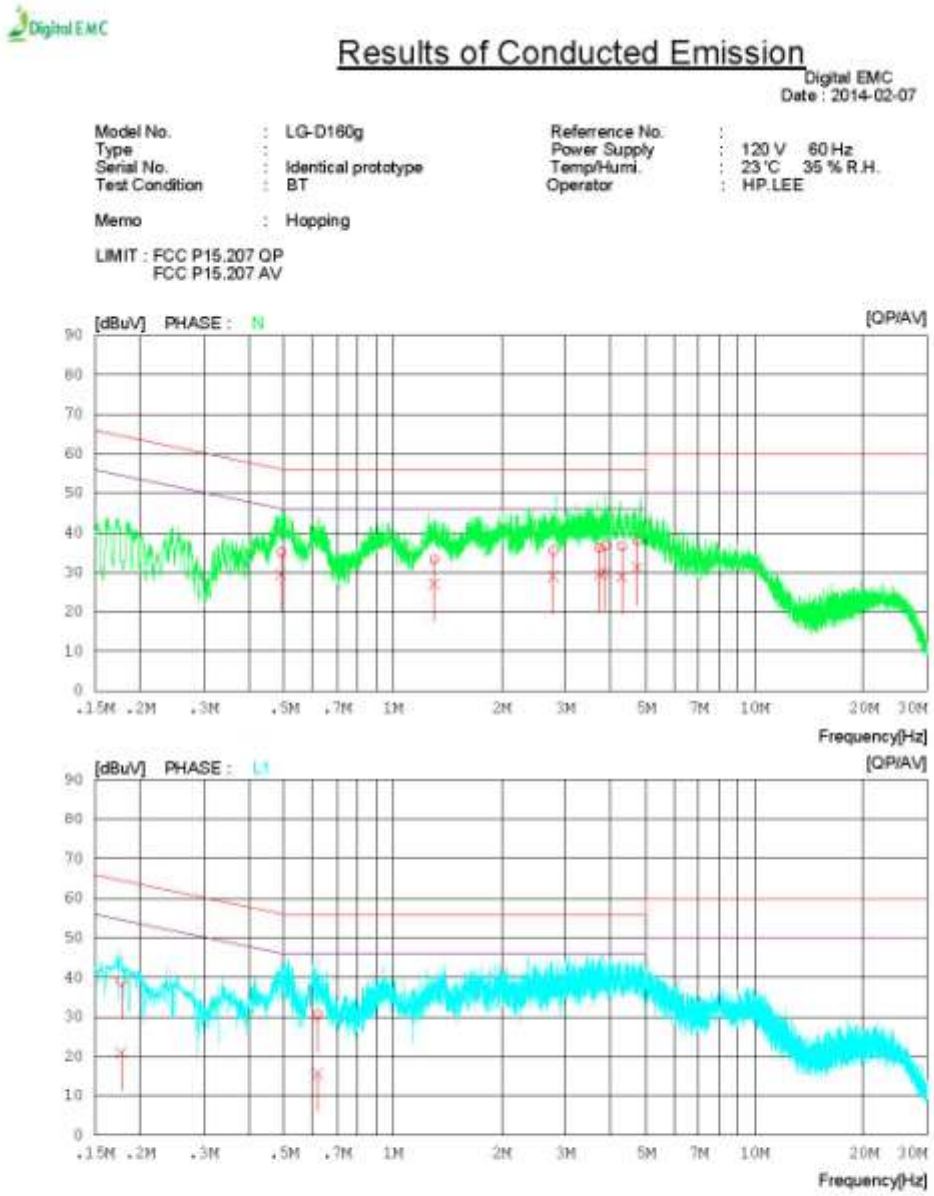
8.3. Test Procedures

Conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2009

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

8.4. Test Results

AC Line Conducted Emissions (Graph) & Modulation: ***GFSK***



AC Line Conducted Emissions (List) & Modulation: ***GFSK***

Results of Conducted Emission

Digital EMC
Date : 2014-02-07

Model No.	:	LG-D160g	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	23 'C 35 % R.H.
Test Condition	:	BT	Operator	:	HP LEE

Memo : Hopping

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.49175	34.9	29.3	0.1	35.0	29.4	56.1	46.1	21.1	16.7	N
2	1.30040	33.1	26.9	0.2	33.3	27.1	56.0	46.0	22.7	18.9	N
3	2.77520	35.2	28.6	0.4	35.6	29.0	56.0	46.0	20.4	17.0	N
4	3.72680	35.9	29.1	0.4	36.3	29.5	56.0	46.0	19.7	16.5	N
5	3.85880	36.4	29.5	0.4	36.8	29.9	56.0	46.0	19.2	16.1	N
6	4.29900	36.2	28.5	0.4	36.6	28.9	56.0	46.0	19.4	17.1	N
7	4.73960	37.7	30.8	0.5	38.2	31.3	56.0	46.0	17.8	14.7	N
8	0.17752	38.9	20.9	0.1	39.0	21.0	64.6	54.6	25.6	33.6	L1
9	0.62078	30.5	15.6	0.1	30.6	15.7	56.0	46.0	25.4	30.3	L1

9. Antenna Requirement

▣ **Procedure:**

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

▣ **Conclusion: Comply**

The internal antenna is attached on the main PCB using the special spring tension. (Refer to Internal Photo file.)

▣ **Minimum Standard:**

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.

10. Occupied Bandwidth(99%)

- Procedure: (RSS-Gen Issue 3)
- The 99% power bandwidth was measured with a calibrated spectrum analyzer.
- Spectrum analyzer plots are included on the following pages.

- Measurement Data: NA

- **Minimum Standard:**

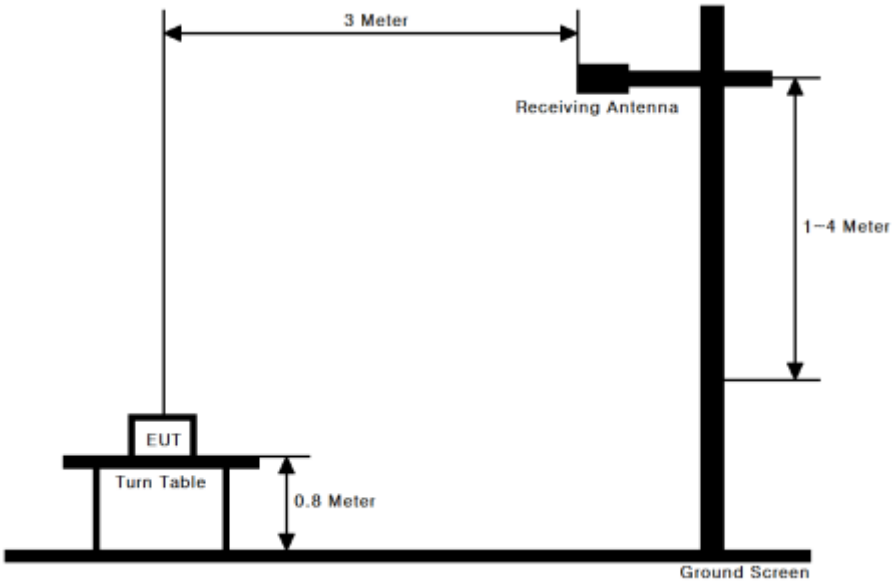
N/A

APPENDIX I

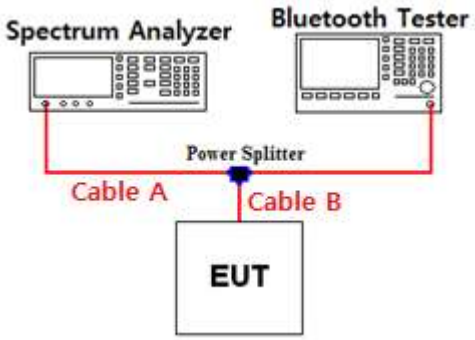
Test set up Diagrams & Path loss Information

▪Radiated Measurement

The diagram below shows the test setup that is utilized to make the measurements for emission from 9kHz to 25GHz Emissions.



▪Conducted Measurement



Offset value information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	5.73	15	7.6
1	6.53	20	7.45
2.402 & 2.441 & 2.480	7.16	25	9.23
5	7.72	-	-
10	7.39	-	-

Note. 1: The path loss from EUT to Spectrum analyzer were measured and used for test.
Path loss (= S/A's Offset value) = Cable A + Power splitter