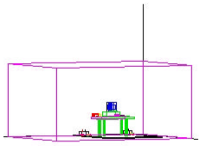
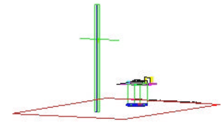


PCTEST Engineering Laboratory, Inc.

6660-B Dobbin Road · Columbia, MD 28145 · U.S.A.
TEL (481) 290-6652 · FAX (481) 290-6654
http://www.pctestlab.com



CERTIFICATE OF COMPLIANCE

LG ELECTRONICS INC.
459-9, Kasan-dong, Keumchun-Ku
Seoul, KOREA 153-023
Attention: Harris Ahn, Principal Engineer

Dates of Tests: Sept. 14-15, 2001
Report S/N: 15.210709578.BEJ
Test Site: PCTEST Lab, Columbia MD

FCC ID	**BEJTM910B**
APPLICANT	**LG ELECTRONICS INC.**

FCC Rule Part(s):	**§ 15.247; ANSI C-63.4 (1992)**
Classification:	**Spread Spectrum Transceiver (BLUETOOTH)**
Method/System:	**HYBRID System**
Equipment Type:	**BLUETOOTH & Tri-mode Dual-Band Analog/PCS Phone**
Max Output Power:	**0.0025 Watts**
Frequency Range:	**2412 – 2483.5 MHz**
Trade/Model No(s).:	***LGE - TM910B***

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C-63-4.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President & Chief Engineer

LAB CODE 100431-0

2 1 0 7 0 9 5 7 8 . B E J

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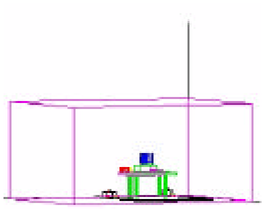

MEASUREMENT REPORT

Scope - Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

§2.983(a) General Information

Applicant Name:	**LG ELECTRONICS INC**
Address:	**459-9, Kasan-dong, Keumchun-Ku** **Seoul, KOREA 153-023**
Attention:	**Harris Ahn**

- FCC ID: **BEJTM910B**
- Class: Spread Spectrum Transceiver (Hybrid)
- Type: BLUETOOTH & Tri-mode Dual-Band Analog/PCS Phone
- Freq. Range: 2412 – 2483.5 MHz
- Method/System: Direct Sequence System (DSS)
- Model No(s): **LGE LG-TM910B**
- Max. RF Output Power: 0.0025 W
- Rule Part(s): § 15.247
- Dates of Tests: September 14-15, 2001
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 15. 210709578.BEJ

Lab Code 100431-0

INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) and FCC Public Notice dated July 12, 1995 entitled "Guidance on Measurement for Direct Sequence Spread Spectrum Systems" were used in the measurement of **LGE Spread Spectrum Wireless BLUETOOTH Transceiver.**

These measurement tests were conducted at ***PCTEST Engineering Laboratory, Inc.*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 28145. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

PCTEST Location

The map at right shows the location of the PCTEST Lab, its proximity to the FCC Lab, the Columbia vicinity area, the Baltimore-Washington International (BWI) airport, and the city of Baltimore, and the Washington, D.C. area. (see Figure1).

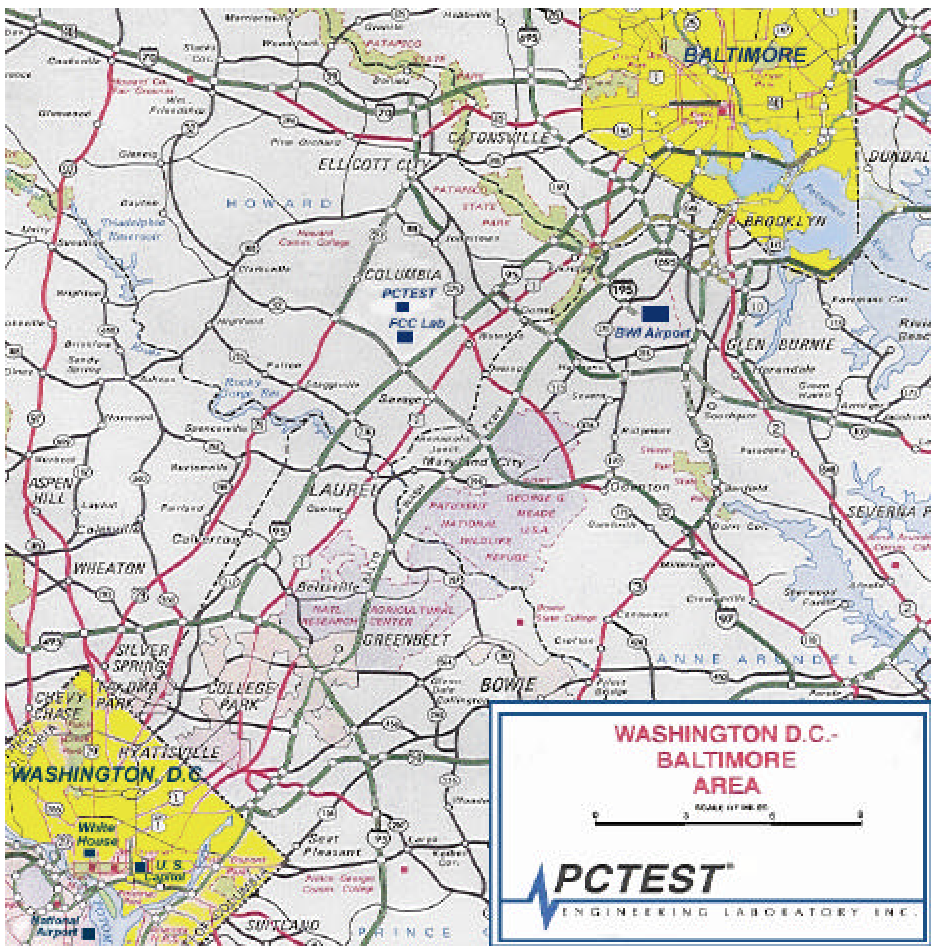

Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.

PRODUCT INFORMATION

Equipment Description:

The Equipment under test (EUT) is the **LG Electronics LG-TM910B** Bluetooth transceiver incorporated in Tri-Mode Dual-Band Analog/PCS phone FCC ID: BEJTM910B

Frequency Range:	2412 – 2483.5 MHz
Modulation:	Hybrid
Max RF Output Power:	0.0025 Watts
Antenna:	Omni-directional
Power Consumption:	700mA

Description of Tests

Conducted Emissions

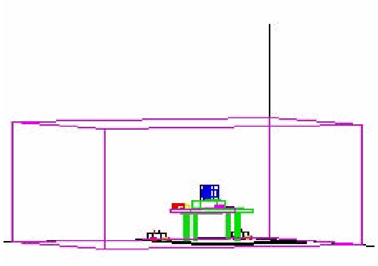

Figure 4. Shielded Enclosure Line-Conducted Test Facility

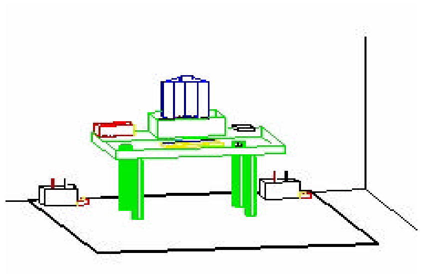

Figure 2. Line Conducted Emission Test Set-Up

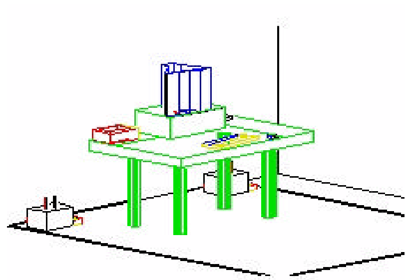

Figure 3. Wooden Table & Bonded LISNs

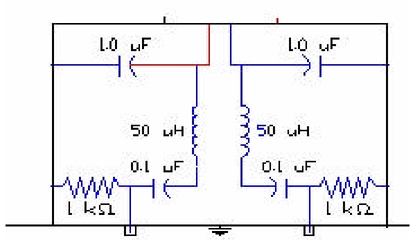

Figure 5. LISN Schematic Diagram

The line-conducted facility is located inside a 16'x20'x81' shielded enclosure. It is manufactured by Ray Proof Series 81 (see Figure 2). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1m. x 1.5m. wooden table 80cm. high is placed 40cm. away from the vertical wall and 1.5m away from the side wall of the shielded room (see Figure 3). Solar Electronics and EMCO Model 3725/2 (81kHz-30MHz) 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (see Figure 4). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (810dB 14kHz-81GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Solar LISN. LISN schematic diagram is shown in Figure 5. All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 450kHz to 30MHz with 20 msec. sweep time. The frequency producing the maximum level was reexamined using EMI/ Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode. The bandwidth of the receiver was set to 81 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the HP8640B signal generator.

Description of tests (Continued)

Radiated Emissions

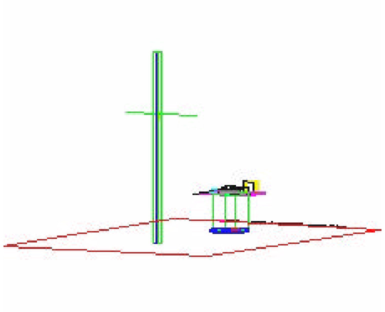

Figure 6. 3-Meter Test Site

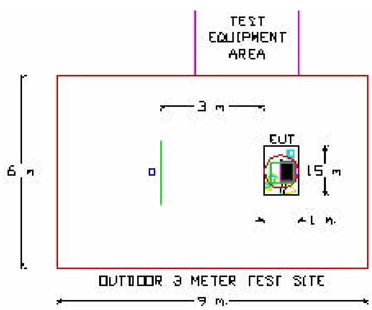

Figure 7. Dimensions of Outdoor Test Site

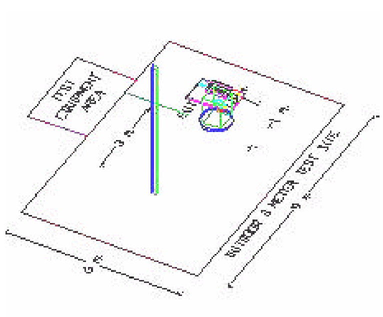

Figure 8. Turntable and System Setup

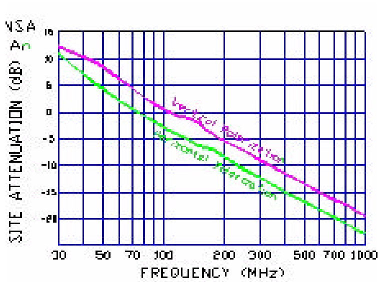

Figure 9. Normalized Site Attenuation Curves (H&V)

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and from 200 to 8100 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 6). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 7). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 810kHz or 1 MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 8). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in

Figure 9.

§ 15.205 Restricted Bands

Special attention is made for the EUT's harmonic and spurious radiated emission in the restricted bands of operation. The EUT was tested from 9kHz and up to the tenth harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average measurements was used using RBW 1 MHz – VBW 81Hz and linearly polarized horn antennas. In addition, peak measurements were taken to ensure that the peak levels are not more than 20dB above the average limit. All out of band emissions, other than those created by the spreading sequency, data sequence, and the carrier modulation must not exceed the limits show int Table 2 per 15.209.

Frequency (MHz)	F/S (UV/m)	Meas. Dist. (Meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.00	30	30
30.0-88.0	810	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

Tab. 2. Radiated Emission Limits Per 15.209

Test Equipment

HP 8566B	**Spectrum Analyzer 810Hz-22GHz**
HP83017A	**Microwave Analyzer 40dB Gain (0.5 – 26.5 GHz)**
HP 3784A	**Digital Transmission Analyzer**
Gigatronics	**POWER METER MODEL 8651A**
EMCO 3115	**Horn Antenna (1 – 18GHz)**
HP 8495A	**20dB Attenuator (DC-40GHz) 0-70dB**
HP 8493B	**81dB Attenuator**
MicroCoax Cables	**Low Loss Microwave Cables (1-26.5 GHz)**
CDI Dipoles	**Dipole Antennas (30 – 8100 MHz)**

§ 15.203 Antenna Requirement

An intentional radiator antenna shall be designed to ensure that no antenna other that that furnished by the applicant can 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 this requirement.

CONCLUSION

The **LGE TM910B** complies with the requirement of §15.203. The antenna is a **permanently attached omni-directional antenna.**

§15.247(a)(2) – Direct Sequence Bandwidth

Minimum Standard – 6dB bandwidth for direct sequence systems must be at least 500Hz (0.5 MHz).

Res. Bandwidth =	810 kHz (5dB/div)
Vid. BW =	810 kHz
Span =	30 MHz
Ref. Level	-37 dBm
Sweep	81.0ms
Attenuator	0 dB ext. pad
6dB Bandwidth – Mkr Delta	**(6dB down from peak)**
(see attached spectrum plots)	

FREQUENCY (MHz)	Channel	6dB Bandwidth (MHz)
2402	01	.507
2442	41	.512
2480	81	.516

Table 3. 6dB Bandwidth measurements

REMARKS:

PASS

§15.247(b) Maximum Peak Output Power

Minimum Standard – The maximum peak output power of the transmitter shall not exceed 1 watt.

Res. Bandwidth =	3 MHz (7dB/div)
Vid. BW=	3 MHz
Span=	30 MHz
Ref. Level	2.5 mW
Sweep	5 ms sec
Attenuator	0 dB ext. pad

Max. Power Peak + Atten = dBm ⇒ Watts

FREQUENCY (MHz)	Channel	Power Output Conducted (dBm)	Power Output Radiated (mW)
2402	01	3.97	2.5
2442	41	3.97	2.5
2480	81	3.96	2.4

Table 4. Output Power Measurements

Notes:

The Power Output measurements were taken with a Peak reading Power Meter.

REMARKS:

PASS

§15.247(c) Power Density

Minimum Standard – The transmitted power density averaged over any 1 second interval shall not be greater than 8dBm in any 3kHz bandwidth within these bands.

Res. Bandwidth =	3 kHz (81dB/div)
Vid. BW =	3 kHz
Span =	300 kHz
Ref. Level	-40 dBm
Sweep	8100 sec

Peak + Atten = dBm ⇒ (Limit < 8dBm)

FREQ (MHz)	Channel	Power Density (dBm)
2402	01	-12.38
2442	41	-14.13
2480	81	-13.62

Table 5. Output Power Density Data.

REMARKS:

PASS

RADIATED Measurements (Fundamental & Harmonics)

Operating Frequency: 2402 MHz

Distance of Measurements: 3 meters

Channel: 01

FREQ. (MHz)	**Level*** (dBm)	**AFCL** (dB)	**POL** (H/V)	**DET QP/AVG**	**F/S** (µV/m)	**F/S** (dBµV/m)	**Margin** (dB)
2402.0	- 40.5	32.7	V	Peak	91201.1	99.2	n/a
4804.0	- 105.9	40.4	V	Peak	118.7	41.5	12.5
7206.0	- 119.7	47.4	V	Peak	54.5	34.7	19.3
14412.0	< - 132						

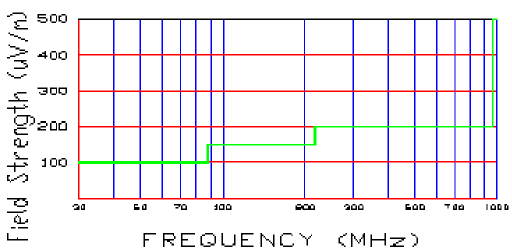

Figure 10. Restricted band harmonics and spurious limits.

Above 1 GHz limit is 500 uV/m (54dBu/m)

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in table 2. (note: * Restricted Band)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 810kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 81 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.

7. The spectrum is measured from 9kHz to the 81th harmonic and the worst-case emissions are reported.

8. < - 132 are below the analyzer floor level.

RADIATED Measurements (Fundamental & Harmonics) (Cont.)

Operating Frequency: 2442 MHz

Distance of Measurements: 3 meters

Channel: 41

FREQ. (MHz)	**Level*** (dBm)	**AFCL** (dB)	**POL** (H/V)	**DET QP/AVG**	**F/S** (µV/m)	**F/S** (dBµV/m)	**Margin** (dB)
2442.0	- 40.6	32.8	V	Peak	91201.1	99.2	n/a
4884.0	- 104.7	40.5	V	Peak	138.0	42.8	11.2
7326.0	- 118.9	48.0	V	Peak	63.8	36.1	17.9
14652.0	< - 132						

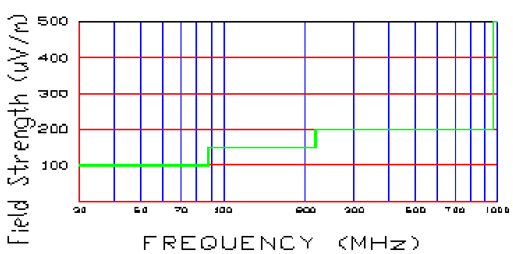

Figure 11. Restricted band harmonics and spurious limits.

Above 1 GHz limit is 500 uV/m (54dBu/m)

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in table 2. (note: * Restricted Band)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 810kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 81 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.

7. The spectrum is measured from 9kHz to the 81th harmonic and the worst-case emissions are reported.

8. < - 132 are below the analyzer floor level.

RADIATED Measurements (Fundamental & Harmonics) (Cont.)

Operating Frequency: 2480 MHz

Distance of Measurements: 3 meters

Channel: 81

FREQ. (MHz)	**Level*** (dBm)	**AFCL** (dB)	**POL** (H/V)	**DET QP/AVG**	**F/S** (µV/m)	**F/S** (dBµV/m)	**Margin** (dB)
2480.0	- 41.0	32.9	V	Peak	88104.9	98.9	n/a
4960.0	- 105.8	40.7	V	Peak	124.5	41.9	12.1
7440.0	- 120.0	48.2	V	Peak	57.5	35.2	18.8
14880.0	< - 132						

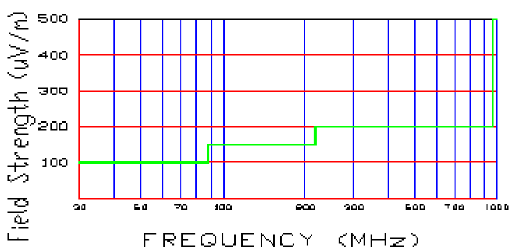

Figure 12. Restricted band harmonics and spurious limits.

Above 1 GHz limit is 500 uV/m (54dBu/m)

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in table 2. (note: * Restricted Band)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 810kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 81 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.

7. The spectrum is measured from 9kHz to the 81th harmonic and the worst-case emissions are reported.

8. < - 132 are below the analyzer floor level.

RADIATED Measurements (Spurious)

Operating Frequency: 2412 – 2483.5 MHz

Distance of Measurements: 3 meters

Channel: 01

FREQ. (MHz)	**Level*** (dBm)	**AFCL**** (dB)	**POL** (H/V)	**Height** (m)	**Azimuth** (° angle)	**F/S** (µV/m)	**Margin***** (dB)
120.0	-82.80	11.50	V	2.8	0	61.00	-7.8
233.0	-91.01	18.02	H	2.1	190	50.17	-12
200.0	-91.50	16.50	H	1.4	190	39.86	-11.5
233.0	-88.21	18.02	H	1.4	10	69.23	-9.2
819.8	-103.39	31.60	V	1.3	180	57.59	-10.8
920.0	-104.88	32.88	H	1.1	190	56.28	-11

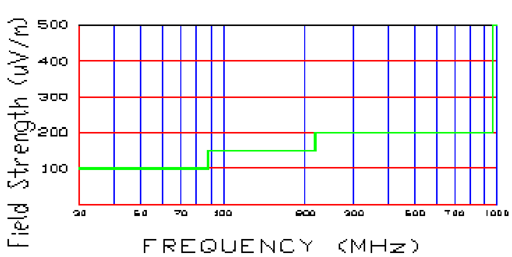

Figure 13. Restricted band harmonics and spurious limits.

Above 1 GHz limit is 500 uV/m (54dBu/m)

NOTES:

1.All emissions were investigated and the worst case emissions are reported

2. For hand-held devices, the EUT is rotated through three orthogonal axis to determine which configuration produces the maximum emissions.

3. The EUT is supplied with the minimal AC voltage or/and a new/fully recharged battery.

4. The EUT was tested up to the 81[th] harmonic (24 GHz) and no significant emission was found.

§15.247(e) PROCESSING GAIN (from LGE)

See attached Processing Gain data and test report from LG ELECTRONICS

Results:

PASS

The test results of Section 15.247(e) were confirmed by PCTEST Engineering Lab.

§15.247(e) PROCESSING GAIN (from LGE) Continued

BLUETOOTH APPROVALS

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

1) The occupied bandwidth in Section 15.247(a)(1)(ii).
2) Conducted output power specified in Section 15.247(b)(1).
3) EIRP limit in Section 15.247(b)(3).
4) RF safety requirement in Section 15.247(b)(4)
5) Spurious emission limits in Section 15.247(c).
6) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

NOTE :- In the case where a module's Bluetooth functionality is completely determined by the BC01 chip which features an integral transmitter, receiver and the processing gain filters. As discussed between Mr. J. Dichoso (FCC) and Mr. C. Neal (CSR), all BC01 based modules are deemed to have identical processing gains, and as such, the test report for product FCC ID O2Z-BT2 can be submitted as evidence for the Process Gain requirements.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

1 Output power and channel separation of a Bluetooth device in the different operating modes:
The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.
Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.
2 Frequency range of a Bluetooth device:
The maximum frequency of the device is: 2402 – 2480 MHz.
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification must not be supported by the device.
3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:
Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new

§15.247(e) PROCESSING GAIN (from LGE) Continued

piconets will always use different hop sequences.

4 Example of a hopping sequence in data mode:

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

5 Equally average use of frequencies in data mode and short transmissions:

The generation of the hopping sequence in connection mode depends essentially on tw input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312. µs. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) ar performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions, the Bluetooth system has the following behavior: The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

6 Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz.

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/R timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:
Dwell time = time slot length * hop rate / number of hopping channels *30s

§15.247(e) PROCESSING GAIN (from LGE) Continued

Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)
For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices comply with the FCC dwell time requirement in the data mode.
This was checked during the Bluetooth Qualification tests.
The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.
The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is fcenter = 75 kHz.
This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the Inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:
**For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
**For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.
So it is ensured that also in hybrid mode, the frequency is used equally on average.
Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54,41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23
Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

10 Receiver input bandwidth and synchronization in hybrid mode:

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

11 Spread rate / data rate of the direct sequence signal

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate

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/ Data rate will be 68/1.

12 Spurious emission in hybrid mode

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.

§15.247(e) PROCESSING GAIN (from LGE) Continued

FCC ID O2Z-BT2

MEMORANDUM – PROCESSING GAIN REPORT FOR INTEL(R) PERSONAL WIRELESS MODULE

Subject: Results of Processing Gain Tests for FCC Qualification

1 INTRODUCTION

This memo presents the results of the Processing Gain (PG) tests carried out for FCC qualification of the Intel(R) Personal Wireless Module chip. The FCC states that the PG from a hybrid Bluetooth receiver must be greater than 17 dB when measured in accordance with the Continuous Wave (CW) jamming margin method. Testing of the Intel(R) Personal Wireless Module "B" Bluetooth chip has found the PG due to the DS section to be approximately 5 dB and the PG due to the FH part to be approximately 15 dB. It is therefore concluded that the Intel(R) Personal Wireless Module Bluetooth Chip complies with the FCC PG requirements for radio communication systems.

The rest of this paper outlines the PG measurement technique and discusses the test results. Appendix A contains a list of test equipment and Appendix B contains a printout of the measurement results.

2 METHOD

2.1 PG Definition

The Processing Gain from a frequency hopping communication system is derived from two parts, the FH section and the DS section. The PG due to FH is given by a simple equation and is constant. However measurement of the PG due to DS is a little more complex. One technique is to use the CW jamming margin method. This method measures PG due to DS using the following algorithm:

A CW signal generator is stepped in 50kHz increments across the passband of the system, recording at each point the generator level required to produce the 0.1% Packet Error Rate (PER). This is the jammer level. This level is then referenced to the output power of the intended Bluetooth signal and the Jammer to Signal Ratio JSR is thus calculated. The worst 4 JSR measurements are discarded and the worst remaining JSR is used to calculate the PG due to DS as follows:

$$_{sys\,p}\ L\ JSR\ SNR\ G + + = _{min}$$

where G_p = the processing gain of the system, SNR = the signal to noise ratio required for 0.1% BER, JSR_{min} = minimum J/S ratio and L_{sys} = system losses.

2.2 PG Measurement Technique

Figure 1 provides an overview of the PG measurement technique. The measurement is performed in two parts, measurement of the system SNR and measurement of JSR_{min}.

Figure 1: PG Measurement Technique

The system SNR is calculated using the following algorithm. Generate Bluetooth PRBS-9 packets using a Bluetooth chip emulator (1) and a Vector Signal Generator (2). Combine this signal with white noise of a constant level, which is generated using a noise source (4) and a CW Signal Generator (3). Then vary the level of the Bluetooth signal until the BER measured by the Bluetooth chip (7) is 0.1%. The resulting SNR is the signal level divided by the Noise level.

The JSR for a given jamming frequency is calculated using the following algorithm. Generate Bluetooth PRBS-9 packets using the Bluetooth chip emulator (1) and the Vector Signal Generator (2). Combine this signal with a constant CW tone at the jamming frequency using a CW Signal Generator (5) and a combiner (6). Then vary the level of the Bluetooth signal until the PER measured by the Casira Bluetooth Module (7) is 0.1%. The resulting JSR is the signal level divided by the jamming level.

3 RESULTS

3.1 Overview

The measurements found that the PG due to DS caused by the access code in page and

§15.247(e) PROCESSING GAIN (from LGE) Continued

inquiry mode is found to be approximately 5dB when the access code is a relatively random mixture of 1's and 0's. A random access code causes the most Inter Symbol Interference (ISI) and hence the worst PG for a hybr id system. Therefore only the results for this access code are used in the PG calculation.

The PG due to FH is given as

PG_{FH} = 10 $\log_{10}$ *(number of frequency hops)*

The number of hops in a Bluetooth system is 32, therefore the PG due to FH is approximately 15 dB. When this is added to the PG due to DS, the total PG for the Bluetooth chip is approximately 20 dB, above the minimum PG requirement for FCC qualification.

3.2 Detailed Results

Test Date: 17/11/00

Sample Time: 30 seconds

Access Code: c6967e

Signal Frequency: 2.432GHz

Receiver Sensitivity: -88.7 dBm

Jammer Signal Level: -85.7 dBm

Measured SNR: 18.8dB

System Losses: 2dB

To calculate processing gain, ignore the worst 20% of data points and then apply the following formula:

sys p L JSR SNR G + + = min

Where G_p = Processing Gain of the module

SNR = signal to noise ratio of the module

JS_{min} = minimum J/S ratio after the worst 20% of J/S samples have been discarded

L_{sys} = System losses

A total of 20 samples were taken by stepping the jamming signal frequency offsets in 50kHz increments over the bandwidth of the receiver. The worst 4 samples were found at –500kHz, -450kHz, -400kHz and 500kHz and were discarded. The remaining minimum J/S ratio was found to be -15.4dB at an offset of +350kHz

Thus, the processing gain due to direct sequence spreading in page and inquiry mode is

dB G_p 4 . 5 2 4 . 15 8 . 18 = + − =

-500 -400 -300 -200 -100 0 100 200 300 400 500
-30
-25
-20
-15
-10
-5
0
5
J a m m i n g F r e q u e n c y O f f s e t (k H z)
J/S (dBs)
J / S r a t i o p e r f o r m a n c e f o r P r o c e s s i n g G a i n F C C T e s t i n g

APPENDIX A - TEST EQUIPMENT LIST

Reference: Instrument Type Name

1 Bluetooth IC Emulator

Board

N/A

2 Vector Signal Generator IFR2052

3 CW Signal Generator IFR2025

4 White Noise Generator HP33120A

5 RF Mixer M8HC-7

§15.247(e) PROCESSING GAIN (from LGE) Continued

6 RF Combiner 6 dB loss combiner

7 Bluetooth Motherboard and

Bluetooth chip Module

Bluetooth Development Kit

8 5V, 4A DC Power Supply N/A

9 Spectrum Analyser HP E4405B

Timestamp: 14:42.43, 16/11/2000
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -500 kHz
Level = -68.7 dBm BER = 0.03% PER = 0.01% SER1 = 0.01% SER2 = 0.01%
Level = -70.7 dBm BER = 0.32% PER = 0.79% SER1 = 0.79% SER2 = 0.79%
Level = -69.7 dBm BER = 0.11% PER = 0.18% SER1 = 0.18% SER2 = 0.18%
Level = -68.7 dBm BER = 0.04% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -69.2 dBm BER = 0.06% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -69.7 dBm BER = 0.11% PER = 0.16% SER1 = 0.16% SER2 = 0.16%
Level = -69.5 dBm BER = 0.09% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -69.3 dBm BER = 0.07% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
J/S = -16.50 dB (SER = 0.05%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -450 kHz
Level = -69.2 dBm BER = 0.06% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -71.2 dBm BER = 0.84% PER = 1.72% SER1 = 1.69% SER2 = 1.69%
Level = -70.2 dBm BER = 0.26% PER = 0.40% SER1 = 0.40% SER2 = 0.40%
Level = -69.2 dBm BER = 0.07% PER = 0.06% SER1 = 0.06% SER2 = 0.06%
Level = -69.7 dBm BER = 0.12% PER = 0.18% SER1 = 0.18% SER2 = 0.18%
Level = -69.5 dBm BER = 0.09% PER = 0.14% SER1 = 0.14% SER2 = 0.14%
Level = -69.3 dBm BER = 0.07% PER = 0.08% SER1 = 0.08% SER2 = 0.08%
J/S = -16.40 dB (SER = 0.08%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -400 kHz
Level = -69.3 dBm BER = 0.04% PER = 0.02% SER1 = 0.02% SER2 = 0.02%
Level = -71.3 dBm BER = 0.44% PER = 0.72% SER1 = 0.71% SER2 = 0.71%
Level = -70.3 dBm BER = 0.13% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -69.3 dBm BER = 0.04% PER = 0.01% SER1 = 0.01% SER2 = 0.01%
Level = -69.8 dBm BER = 0.08% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -70.3 dBm BER = 0.13% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
J/S = -15.40 dB (SER = 0.10%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -350 kHz
Level = -70.3 dBm BER = 0.05% PER = 0.01% SER1 = 0.01% SER2 = 0.01%
Level = -72.3 dBm BER = 0.88% PER = 1.67% SER1 = 1.64% SER2 = 1.64%
Level = -71.3 dBm BER = 0.19% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
Level = -70.3 dBm BER = 0.06% PER = 0.01% SER1 = 0.01% SER2 = 0.01%
Level = -70.8 dBm BER = 0.09% PER = 0.04% SER1 = 0.04% SER2 = 0.04%
Level = -71.3 dBm BER = 0.17% PER = 0.12% SER1 = 0.12% SER2 = 0.12%
Level = -71.1 dBm BER = 0.13% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
J/S = -14.60 dB (SER = 0.05%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -300 kHz
Level = -71.1 dBm BER = 0.03% PER = 0.15% SER1 = 0.15% SER2 = 0.15%
Level = -69.1 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -70.1 dBm BER = 0.01% PER = 0.00% SER1 = 0.00% SER2 = 0.00%

Level = -71.1 dBm BER = 0.03% PER = 0.19% SER1 = 0.19% SER2 = 0.19%
Level = -70.6 dBm BER = 0.02% PER = 0.04% SER1 = 0.04% SER2 = 0.04%
Level = -70.8 dBm BER = 0.02% PER = 0.09% SER1 = 0.09% SER2 = 0.09%
J/S = -14.90 dB (SER = 0.09%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -250 kHz
Level = -70.8 dBm BER = 0.00% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -72.8 dBm BER = 0.05% PER = 2.34% SER1 = 2.29% SER2 = 2.29%
Level = -71.8 dBm BER = 0.01% PER = 0.33% SER1 = 0.33% SER2 = 0.33%
Level = -70.8 dBm BER = 0.00% PER = 0.03% SER1 = 0.03% SER2 = 0.03%

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Level = -71.3 dBm BER = 0.01% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -71.1 dBm BER = 0.00% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -70.9 dBm BER = 0.00% PER = 0.03% SER1 = 0.03% SER2 = 0.03%
J/S = -14.80 dB (SER = 0.03%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -200 kHz
Level = -70.9 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -72.9 dBm BER = 0.00% PER = 0.34% SER1 = 0.34% SER2 = 0.34%
Level = -71.9 dBm BER = 0.00% PER = 0.07% SER1 = 0.07% SER2 = 0.07%
Level = -72.4 dBm BER = 0.00% PER = 0.15% SER1 = 0.15% SER2 = 0.15%
Level = -72.2 dBm BER = 0.00% PER = 0.12% SER1 = 0.12% SER2 = 0.12%
Level = -72.0 dBm BER = 0.00% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
J/S = -13.80 dB (SER = 0.07%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -150 kHz
Level = -71.9 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -73.9 dBm BER = 0.00% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -75.9 dBm BER = 0.01% PER = 0.83% SER1 = 0.82% SER2 = 0.82%
Level = -74.9 dBm BER = 0.00% PER = 0.16% SER1 = 0.16% SER2 = 0.16%
Level = -73.9 dBm BER = 0.00% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -74.4 dBm BER = 0.00% PER = 0.08% SER1 = 0.07% SER2 = 0.07%
Level = -74.9 dBm BER = 0.00% PER = 0.18% SER1 = 0.18% SER2 = 0.18%
Level = -74.7 dBm BER = 0.00% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
J/S = -11.00 dB (SER = 0.10%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -100 kHz
Level = -74.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -76.7 dBm BER = 0.00% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -78.7 dBm BER = 0.01% PER = 2.05% SER1 = 2.01% SER2 = 2.01%
Level = -77.7 dBm BER = 0.00% PER = 0.30% SER1 = 0.30% SER2 = 0.30%
Level = -76.7 dBm BER = 0.00% PER = 0.06% SER1 = 0.06% SER2 = 0.06%
Level = -77.2 dBm BER = 0.00% PER = 0.13% SER1 = 0.12% SER2 = 0.12%
Level = -77.0 dBm BER = 0.00% PER = 0.08% SER1 = 0.07% SER2 = 0.07%
J/S = -8.70 dB (SER = 0.07%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = -50 kHz
Level = -77.0 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -79.0 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -81.0 dBm BER = 0.01% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -83.0 dBm BER = 0.16% PER = 0.73% SER1 = 0.72% SER2 = 0.72%
Level = -82.0 dBm BER = 0.03% PER = 0.26% SER1 = 0.26% SER2 = 0.26%
Level = -81.0 dBm BER = 0.01% PER = 0.06% SER1 = 0.06% SER2 = 0.06%
Level = -81.5 dBm BER = 0.02% PER = 0.13% SER1 = 0.13% SER2 = 0.13%
Level = -81.3 dBm BER = 0.02% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -81.1 dBm BER = 0.04% PER = 0.06% SER1 = 0.06% SER2 = 0.06%

J/S = -4.60 dB (SER = 0.06%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +0 kHz
Level = -68.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -70.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -72.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -74.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -76.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -78.7 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -80.7 dBm BER = 0.01% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -82.7 dBm BER = 0.04% PER = 0.04% SER1 = 0.03% SER2 = 0.03%
Level = -84.7 dBm BER = 7.51% PER = 48.26% SER1 = 27.11% SER2 = 28.05%
Level = -83.7 dBm BER = 0.31% PER = 1.01% SER1 = 0.86% SER2 = 0.86%
Level = -82.7 dBm BER = 0.05% PER = 0.24% SER1 = 0.18% SER2 = 0.18%
Level = -81.7 dBm BER = 0.01% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -82.2 dBm BER = 0.02% PER = 0.13% SER1 = 0.10% SER2 = 0.10%
Level = -82.0 dBm BER = 0.02% PER = 2.31% SER1 = 2.24% SER2 = 2.24%
Level = -81.8 dBm BER = 0.02% PER = 0.06% SER1 = 0.05% SER2 = 0.05%
J/S = -3.90 dB (SER = 0.05%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +50 kHz
Level = -81.8 dBm BER = 0.11% PER = 0.02% SER1 = 0.02% SER2 = 0.02%
Level = -83.8 dBm BER = 0.68% PER = 2.16% SER1 = 1.82% SER2 = 1.82%
Level = -82.8 dBm BER = 0.28% PER = 0.35% SER1 = 0.29% SER2 = 0.29%
Level = -81.8 dBm BER = 0.09% PER = 0.02% SER1 = 0.02% SER2 = 0.02%
Level = -82.3 dBm BER = 0.15% PER = 0.25% SER1 = 0.22% SER2 = 0.22%
Level = -82.1 dBm BER = 0.12% PER = 0.09% SER1 = 0.07% SER2 = 0.07%
J/S = -3.60 dB (SER = 0.07%)
Signal Freq = 2.432 GHz

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Jammer Level = -85.7 dBm
Jammer Offset = +100 kHz
Level = -82.1 dBm BER = 1.55% PER = 15.88% SER1 = 13.44% SER2 = 13.51%
Level = -80.1 dBm BER = 0.28% PER = 5.78% SER1 = 5.47% SER2 = 5.47%
Level = -78.1 dBm BER = 0.03% PER = 0.09% SER1 = 0.09% SER2 = 0.09%
J/S = -7.60 dB (SER = 0.09%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +150 kHz
Level = -78.1 dBm BER = 0.41% PER = 13.58% SER1 = 11.96% SER2 = 12.16%
Level = -76.1 dBm BER = 0.09% PER = 0.42% SER1 = 0.42% SER2 = 0.42%
Level = -74.1 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -75.1 dBm BER = 0.01% PER = 0.02% SER1 = 0.02% SER2 = 0.02%
Level = -76.1 dBm BER = 0.04% PER = 0.41% SER1 = 0.41% SER2 = 0.41%
Level = -75.6 dBm BER = 0.03% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
J/S = -10.10 dB (SER = 0.10%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +200 kHz
Level = -75.6 dBm BER = 0.26% PER = 7.53% SER1 = 7.00% SER2 = 7.00%
Level = -73.6 dBm BER = 0.02% PER = 0.17% SER1 = 0.17% SER2 = 0.17%
Level = -71.6 dBm BER = 0.00% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -72.6 dBm BER = 0.00% PER = 0.03% SER1 = 0.03% SER2 = 0.03%
Level = -73.6 dBm BER = 0.02% PER = 0.14% SER1 = 0.14% SER2 = 0.14%
Level = -73.1 dBm BER = 0.01% PER = 0.04% SER1 = 0.04% SER2 = 0.04%
Level = -73.3 dBm BER = 0.01% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -73.5 dBm BER = 0.03% PER = 0.09% SER1 = 0.09% SER2 = 0.09%
J/S = -12.20 dB (SER = 0.09%)
Signal Freq = 2.432 GHz

Jammer Level = -85.7 dBm
Jammer Offset = +250 kHz
Level = -73.5 dBm BER = 0.25% PER = 3.58% SER1 = 3.46% SER2 = 3.46%
Level = -71.5 dBm BER = 0.01% PER = 0.03% SER1 = 0.03% SER2 = 0.03%
Level = -72.5 dBm BER = 0.06% PER = 0.57% SER1 = 0.57% SER2 = 0.57%
Level = -72.0 dBm BER = 0.02% PER = 0.12% SER1 = 0.12% SER2 = 0.12%
Level = -71.5 dBm BER = 0.01% PER = 0.04% SER1 = 0.04% SER2 = 0.04%
Level = -71.7 dBm BER = 0.01% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -71.9 dBm BER = 0.02% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
J/S = -14.00 dB (SER = 0.05%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +300 kHz
Level = -71.7 dBm BER = 0.08% PER = 0.10% SER1 = 0.10% SER2 = 0.10%
J/S = -14.00 dB (SER = 0.10%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +350 kHz
Level = -71.7 dBm BER = 0.25% PER = 1.43% SER1 = 1.41% SER2 = 1.41%
Level = -69.7 dBm BER = 0.02% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -70.7 dBm BER = 0.08% PER = 0.14% SER1 = 0.14% SER2 = 0.14%
Level = -70.2 dBm BER = 0.03% PER = 0.74% SER1 = 0.74% SER2 = 0.74%
Level = -69.7 dBm BER = 0.02% PER = 0.02% SER1 = 0.02% SER2 = 0.02%
Level = -69.9 dBm BER = 0.02% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -70.1 dBm BER = 0.03% PER = 0.03% SER1 = 0.03% SER2 = 0.03%
Level = -70.3 dBm BER = 0.03% PER = 0.06% SER1 = 0.06% SER2 = 0.06%
Level = -70.5 dBm BER = 0.06% PER = 0.13% SER1 = 0.13% SER2 = 0.13%
J/S = -15.40 dB (SER = 0.06%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +400 kHz
Level = -70.3 dBm BER = 0.07% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -72.3 dBm BER = 1.28% PER = 4.62% SER1 = 4.42% SER2 = 4.42%
Level = -71.3 dBm BER = 0.24% PER = 0.48% SER1 = 0.47% SER2 = 0.47%
Level = -70.3 dBm BER = 0.06% PER = 0.06% SER1 = 0.06% SER2 = 0 .06%
Level = -70.8 dBm BER = 0.12% PER = 0.15% SER1 = 0.15% SER2 = 0.15%
Level = -70.6 dBm BER = 0.11% PER = 0.08% SER1 = 0.08% SER2 = 0.08%
J/S = -15.10 dB (SER = 0.08%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +450 kHz
Level = -70.6 dBm BER = 0.17% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -68.6 dBm BER = 0.01% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -69.6 dBm BER = 0.04% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -70.6 dBm BER = 0.17% PER = 0.08% SER1 = 0.07% SER2 = 0.07%
Level = -71.6 dBm BER = 0.60% PER = 0.70% SER1 = 0.69% SER2 = 0.69%
Level = -71.1 dBm BER = 0.31% PER = 0.30% SER1 = 0.29% SER2 = 0.29%
Level = -70.6 dBm BER = 0.19% PER = 0.11% SER1 = 0.11% SER2 = 0.11%
Level = -70.1 dBm BER = 0.09% PER = 0.03% SER1 = 0.02% SER2 = 0.02%
Level = -70.3 dBm BER = 0.10% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -70.5 dBm BER = 0.16% PER = 0.06% SER1 = 0.06% SER2 = 0.06%

§15.247(e) PROCESSING GAIN (from LGE) Continued

Level = -70.7 dBm BER = 0.20% PER = 0.05% SER1 = 0.05% SER2 = 0.05%
Level = -70.9 dBm BER = 0.26% PER = 0.15% SER1 = 0.15% SER2 = 0.15%
J/S = -15.10 dB (SER = 0.07%)
Signal Freq = 2.432 GHz
Jammer Level = -85.7 dBm
Jammer Offset = +500 kHz
Level = -68.7 dBm BER = 0.01% PER = 0.00% SER1 = 0.00% SER2 = 0.00%
Level = -70.7 dBm BER = 0.12% PER = 0.19% SER1 = 0.19% SER2 = 0.19%
Level = -69.7 dBm BER = 0.03% PER = 0.01% SER1 = 0.01% SER2 = 0.01%

Level = -70.2 dBm BER = 0.07% PER = 0.12% SER1 = 0.12% SER2 = 0.12%
Level = -70.0 dBm BER = 0.04% PER = 0.06% SER1 = 0.06% SER2 = 0.06%
J/S = -15.70 dB (SER = 0.06%)

TEST EQUIPMENT

Type	Model	Cal. Due Date	S/N
Microwave Spectrum Analyzer	HP 8566B (810Hz-22GHz)	12/05/01	3638A08713
Microwave Spectrum Analyzer	HP 8566B (810Hz-22GHz)	04/17/02	2542A11898
Spectrum Analyzer/Tracking Gen.	HP 8591A (9kHz-1.8GHz)	41/02/02	3144A02480
Spectrum Analyzer	HP 8591A (9kHz-1.8GHz)	81/15/02	3818A02053
Spectrum Analyzer	HP 8594A (9kHz-2.9GHz)	11/02/01	3051A00187
Signal Generator*	HP 8640B (500Hz-1GHz)	41/02/02	2232A19558
Signal Generator*	HP 8640B (500Hz-1GHz)	41/02/02	1851A09816
Signal Generator*	Rohde & Schwarz (0.1-8100MHz)	09/11/02	894215/012
Ailtech/Eaton Receiver	NM 37/57A-SL (30-8100MHz)	04/12/02	0792-03271
Ailtech/Eaton Receiver	NM 37/57A (30-8100MHz)	03/11/02	0805-03334
Ailtech/Eaton Receiver	NM 17/27A (0.1-32MHz)	09/17/02	4818-03241
Quasi-Peak Adapter	HP 85650A	08/09/02	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/02	0194-04082
RG58 Coax Test Cable	No. 167		n/a
Harmonic/Flicker Test System	HP 6841A (IEC 555-2/3)		3531A00115
Broadband Amplifier (2)	HP 8447D		1145A00470, 1937A03348
Broadband Amplifier	HP 8447F		2443A03784
Transient Limiter	HP 11947A (9kHz-200MHz)		2820A00300
Horn Antenna	EMCO Model 3115 (1-18GHz)		9704-5182
Horn Antenna	EMCO Model 3115 (1-18GHz)		9205-3874
Horn Antenna	EMCO Model 3116 (18-40GHz)		9203-2178
Biconical Antenna (4)	Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design		1295, 1332, 0355
Log-Spiral Antenna (3)	Ailtech/Eaton 93490-1		4818, 1813, 1814
Roberts Dipoles	Compliance Design (1 set) A810		5118
Ailtech Dipoles	DM-815A (1 set)		33448-111
EMCO LISN (2)	3816/2		8177, 8179
EMCO LISN	3725/2		2009
Microwave Preamplifier 40dB Gain	HP 83017A (0.5-26.5GHz)		3123A00181
Microwave Cables	MicroCoax (1.0-26.5GHz)		
Ailtech/Eaton Receiver	NM37/57A-SL		0792-03271
Spectrum Analyzer	HP 8591A		3034A01395
Modulation Analyzer	HP 8901A		2432A03467
NTSC Pattern Generator	Leader 408		0377433
Noise Figure Meter	HP 8970B		3141A02189
Noise Figure Meter	Ailtech 7581		TE31700
Noise Generator	Ailtech 7081		1473
Microwave Survey Meter	Holaday Model 1501 (2.450GHz)		80931
Digital Thermometer	Extech Instruments 421305		426966
Attenuator	HP 8495A (0-70dB) DC-4GHz		
Bi-Directional Coax Coupler	Narda 3020A (50-8100MHz)		
Shielded Screen Room	RF Lindgren Model 26-2/2-0		6781 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81		R2437 (PCT278)
Environmental Chamber	Associated Systems Model 8125 (Temperature/Humidity)		PCT285

* Calibration traceable to the National Institute of Standards and Technology (NIST).

CONCLUSION

The data collected shows that the **LGE FCC ID: BEJTM910B spread spectrum Bluetooth transceiver & Tri-mode Dual-Band Analog/PCS Phone** complies with Part 15.247 of the FCC Rules.