

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

SEP 1 1994

IN REPLY REFER TO:

31030/EQU/4-2-4
1300B4

Mr. Valdis V. Liepa
University of Michigan
Radiation Laboratory
NASA/Center for Space Terahertz Technology
3228 EECS Building
Ann Arbor, MI 48109-2122

Dear Mr. Liepa:

This is in reply to your facsimile transmission of August 2, 1994, regarding the labelling of a low power communication device that will be marketed within the U.S. and Canada. You request approval to combine the labels for both countries, permitting a single label to be employed. As indicated, this combined label would read as follows:

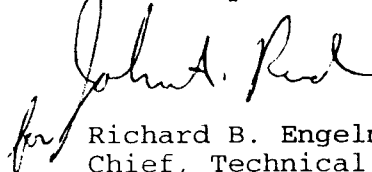
"This device complies with Part 15 of the FCC Rules and with RSS-210 of the Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

According to Section 15.19(a) of our rules, a low power communications device operating under Part 15 must be labelled with the specific statement contained in paragraph (a)(3). The only difference between the statement required under our rules and your proposed statement is the addition in the first sentence of the phrase "... and with RSS-210 of the Industry Canada."

I note that Kwai Lum of Industry Canada, in a facsimile to you on August 3, 1994, has already given permission to use this combined label. I also agree that the use of this combined label, as shown above, is acceptable under our regulations. This label conveys the desired information and is essentially identical to our requirement. As expressed by Mr. Lum, text denoting compliance with the standards for both countries was not stated in our rules as "it would be too presumptuous [to assume] that all products are for both markets."

I trust that the above responds to your inquiry. Additional questions should be directed to John Reed, 1300B4, at the address on the letterhead or at (202) 653-7313.

Sincerely,



Richard B. Engelman
Chief, Technical Standards Branch
Office of Engineering and Technology



TO/A: Name/Nom.....: Mr Valdis V. Liepa
Office/Bureau.: Radiation Lab, University of Michigan, USA
Tel. No./No. de tél.: Fax: 313-747-2106

FROM/DE: Name/Nom.....: Kwai Lum
Manager, Radio Equipment Standards,
300 Slater Street, 13th Floor,
Ottawa, Canada, K1A 0C8
Phone: 613-990-4699; Fax: 613-952-5108

Total pages : 1 Date & time sent: August 3, 94.
Pages totales: 1 Date & heure envoyé:

Our Ref : DGEP-5630-1 (RSS-210 Labelling)

This is to respond to your fax of August 1, 94 requesting that we permit a combined statement for FCC and Industry Canada on the equipment labels.

We wish to assure you that your suggested combined label that you submitted in your fax is acceptable to Canada since our standard (section 5.8 of RSS-210) allows (to quote) ".....equivalent statement.....".

We have made our labelling statement as close as we can to Part 15.19(3); the differences are : we left out the word "harmful" because of difficulties in defining what is harmful. We added the phrase "of the device" to remove any possible misunderstanding.

To re-capitulate, although your proposed statement uses FCC text except for the mention of "RSS-210 of Industry Canada", we consider it to be equivalent. Our preferred text is per RSS-210; the next best is to add the word "harmful" to meet FCC requirements.

Since FCC and Industry Canada are from different countries, we do not consider it necessary to state in our separate standards a combined text. In any case it would be too presumptuous that all products are for both markets.

Our equipment certification staff will be informed of the above. We will also copy this to Mr Reed of the FCC since you said that you sent a similar fax to him.

Regards,

Kwai Lum

cc Mr John Reed (FCC OET fax 202-653-8773).
cc R. Corey (Equipment Certification).



UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING
THE RADIATION LABORATORY
DEPARTMENT OF ELECTRICAL ENGINEERING
AND COMPUTER SCIENCE

3228 EECS BUILDING
1301 BEAL AVENUE
ANN ARBOR, MICHIGAN 48109-2122
734 764-0500 FAX 734 647-2106
<http://www.eecs.umich.edu/RADLAB/>

Re: Certification for JCI U-connect Transmitter
Model: U-connect
FCC ID: CB2UCONN
IC: 279B-UCONN

REQUEST FOR CONFIDENTIALITY

Pursuant to 47 CFR 0.459, JCI requests that a part of the subject application be held confidential. This comprises Exhibits

- (5) Schematics
- (10) Parts List (Part of Exhibit only)

JCI has spent substantial effort in developing this product and it is one of the first of its kind in industry. Having the subject information easily available to "competition" would negate the advantage they have achieved by developing this product. Not protecting the details of the design will result in financial hardship.

If there are any questions regarding this request, please contact me at the above address or call 734-483-4211, fax 734-647-2106 or e-mail liepa@umich.edu.

Sincerely,

A handwritten signature in cursive script that reads "Valdis V. Liepa".

Valdis V. Liepa
Research Scientist
University of Michigan



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October 4, 2002

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STATEMENT OF MODIFICATIONS

There were no modifications made to the DUT by this test laboratory. (Also see Section 3.1 of the attached Test Report).

A handwritten signature in black ink, reading "Valdis V. Liepa".

Valdis V. Liepa
Research Scientist



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GENERAL PRODUCT INFORMATION

The device, for which certification is pursued, has been designed by:

Johnson Controls Interiors L.L.C.
279B-UCONN
One Prince Center
Holland, MI 49423

Craig Harder
Tel: 616-394-6101
Fax: 616-394-3877

It will be manufactured by:

Jabil Circuits, Inc
1700 Atlantic Blvd.
Auburn Hills, MI 48326

Tel: 248-391-5300
Fax: 248-391-5317

Canadian Contact:

Jim Komar
Quality Manager
Lakeshore Plant
477 Jutras Drive South
Tecumseh, ON
N8N 5C4



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POWER OF ATTORNEY

A letter granting Valdis V. Liepa the Power of Attorney is on file and can be provided when so requested.

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 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 two 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 312.5 μ s. 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) are 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 μ s). 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/RX 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 as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 30\text{s} = 0.3797\text{s}$ (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 = $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/\text{s} / 79 * 30\text{s} = 0.3797\text{s}$ (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 $f_{\text{center}} = 75 \text{ kHz}$.

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 / 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.