



Federal Communications Commission  
Equipment Approval Services  
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**Re: FCC ID H9PLA2400 Ref # 13730**

Date: May 9, 2000

Dear Reviewer,

In response to the following Email:

To: Norman Nelson, Symbol Technologies, Inc.  
From: Joe Dichoso  
jdichoso@fcc.gov  
FCC Application Processing Branch

Re: FCC ID H9PLA2400  
Applicant: Symbol Technologies Inc  
Correspondence Reference Number: 13730  
731 Confirmation Number: EA96849  
Date of Original E-Mail: 05/01/2000

This is a permissive change, adding new antennas to a 2.4 GHz FHSS, at 500 mW.

Please address the following.

The radiated data indicates the 2nd harmonic, at the low channel, has an average level 1 dB over the limit. The footnote references a 6 dB duty cycle correction factor, which is unsubstantiated.

Also,

Re RF Exposure, please ask them the following:

1. The RF Exposure summary sheet lists an unsubstantiated figure of 9 dB for the duty cycle factor. Please clarify. For RF Exposure purposes, only a source-based duty factor may be applied- see Sections 2.1091(d)(2) and 2.1093(d)(5). If the duty factor is not acceptable, then SAR measurements will be required for the body-worn version of the EUT. Also, if the duty factor is not acceptable, then the statement in the user's manual must be preceded by the word "Caution" instead of "Important Note".

**Attached is a detailed analysis of the maximum possible duty cycle for both mobile and portable installations. Also included is a new Antenna summary table that incorporates these substantiated values. The 9 dB value was inadvertently used from  $\text{dBV} = 20 * \log(0.32)$  which is appropriate for radiated emissions offset of  $\text{dBuV/m}$  but not for EIRP.**

**Note that the SAR test included with the Class II permissive change for H9PLA3020 was for the same 2 dBi antenna and a 240 mW transmitter for a test EIRP of 380 mW. This new configuration uses a higher power lower data rate transmitter with a source based offset of -4.9 dB. This generates an EIRP of 240 mW which is well under the SAR test parameters. Note that the radios have the same form factor, the terminals and antennas are the same so that the SAR test covers this new configuration.**

2. Please provide the peak antenna gain for each antenna, and not the nominal gain (for RF Exposure purposes). We note that the summary sheet lists the gain for the Vocollect (body worn) antenna as 0 dBi, while the spec sheet for that antenna lists it as 2 dBi. Please address.

**I have updated the Antenna Summary table with maximum gain values.**

3. Please revise the language in the user's manual to reference other person's bodies, as well as the user's, with respect to maintaining the minimum separation distance of 20 cm, and submit the new language. Also, please indicate where, in the actual user's manual, this statement will be placed.

**I have replaced the words "20 cm or more between the antenna and the user's body" with "20 cm or more between the antenna and everyone's body."**

**When there are installation instructions for a particular antenna the RF safety information is located prominently within that section and flagged with an Icon in the margins. For those antennas that are already installed in a device (most portable devices) the RF safety information is listed in the "roman numeral pages" in the front of the manual along with other safety information such as laser safety guidelines.**

4. Please provide a list of all of the antennas, as well as all of the devices into which the EUT is placed, as documented in the filing for the original grant of authorization.

**Attached is a table that lists all antennas both approved and applied for this FCC ID.**

I hope these answers are satisfactory.

Respectfully,

Norman H. Nelson



## Duty Cycle Calculation

The LA2400 PC Card is used in mobile hand held computers which communicate with Spectrum 24 Access Points which also contain a LA2400 PC Card. The communication is half duplex, when one unit is in transmit the other is in receive. The Access Point acts like a base station in that it talks to one or more mobiles on a time shared basis and relays the messages. The mobiles and Access Point compete for transmit time with a listen before talk protocol.

### Mobile Duty Cycle

The communications from the mobile to the Access Point begins with the mobile listening (in receive mode, transmitter off) to determine if any other transmission is under way the listening takes place for at least .1 msec. The mobile then transmits a maximum packet of 548 bytes with addressing and other packet overhead the packet size is 609 bytes at 1 Mbit per second the packet time is therefore (609 bytes x 8 bits/byte / 1 Mbitsec = 4.872 msec). The Access Point replies with an acknowledgment in .02 msec the acknowledgment packet is .2 msec long and during the acknowledgment packet the mobile is in receive mode (transmitter is off). The mobile then prepares another packet, which takes 10 msec or more during which the mobile transmitter is off. The process then repeats itself. For the mobile the maximum transmit duty cycle is

Total transaction time  $\geq$  .1 msec (mobile receive) + 4.872 msec (mobile transmit) + .02 msec (turn from transmit to receive) + .2 msec (mobile receive) + 10 msec (mobile prepares next packet)

Total transaction time  $\geq$  15.19 msec

Total mobile transmit time  $\leq$  4.872 msec (mobile transmit)

Duty Cycle  $\leq$  Total mobile transmit time / Total transaction time = 4.872 / 15.19

Duty Cycle < 0.32, 32%, -9.9 dB

### Access Point Duty Cycle

The Access Point can communicate with many mobiles, but only one at a time. The Access Point sends out periodic beacons at a rate of 1 every 100 msec. The maximum length of a beacon is 100 usec. The mobiles and the Access Point compete for transmit time between beacons using a listen before talk protocol. Each mobile when clear to talk will go through the exchange as described above. The Access Point can also initiate a transmission just as the mobiles do. The worst case transmit duty cycle for the Access

Point is when the Access Point is the only unit needing to transmit, so it is not competing with mobile units for transmit time. In this case the Access Point will be going through the same cycle as the remote did above. However the wait time for preparing a new packet can be as low as 3 msec.

Total transaction time  $\geq$  .1 msec (access point receive) + 4.872 msec (access point transmit) + .02 msec (turn from transmit to receive) + .2 msec (access point receive) + 3 msec (mobile prepares next packet)

Total transaction time  $\geq$  8.19 msec

Total access point transmit time  $\leq$  4.872 msec (access point transmit)

Duty Cycle  $\leq$  Total access point transmit time / Total transaction time = 4.872 / 8.19

Duty Cycle < 0.60, 60%, -4.4 dB

### **Summary:**

Unit	Max Duty Cycle	Duty Cycle Offset
Mobile	32%	-9.9 dB
Access Point	60%	-4.4 dB



# RF Exposure Antenna Summary

Network Systems Organization

Source Based

FCC ID: **H9PLA2400**

WLAN PC Card, 1 Mbps, CR-1, Hi Power

Mobile DC Factor: 0.600

Output Power: 500 mW

Class II Permissive Change

Portable DC Factor: 0.320

## Portable Antennas

Ant No	Model	Symbol P/N	Type	Gain (dBi)	Cabel Loss (dB)	Pout (dBm)	EIRP (mW)	TR Status	Device Type
01.	7540	10-38649-01	F-Element	0.0	0.32	26.67	148.5	Tested	Hand Held
02.	2740	703624-1	F-Element	0.0	0.07	26.92	157.3	Tested	Hand Held
04.	7240	10-35475-01	F-Element	0.0	0.13	26.86	155.3	Tested	Hand Held
05.	Toko	50-21900-022	Puck	0.0	0.00	26.99	160.0	Tested	Hand Held
07.	1740	703549-1	F-Element	0.0	0.07	26.92	157.3	See # 2	Hand Held
08.	XP	50-21900-024	Slot	0.0	0.58	26.41	140.1	Withdrawn	Hand Held
09.	3140F	10-38653-01	F-Element	0.0	0.14	26.84	154.8	See # 2	Hand Held

## Body Worn Antennas

Ant No	Model	Symbol P/N	Type	Gain (dBi)	Cabel Loss (dB)	Pout (dBm)	EIRP (mW)	TR Status	Device Type
03.	Vocollect BFA	50-21900-026	Dipole	2.0	0.25	26.74	239.5	Tested + SAR	Body Worn
06.	Oniel BFA	50-21900-023	Slot	0.0	0.39	26.60	146.4	Withdrawn	Body Worn

Antenna Gain listed without cable  
 TR Status refers to whether the antenna was tested. If not refer to the directed antenna test data

Duty Cycle Factors are applied to MPE and EIRP



# Antenna List by FCC ID

Network Systems Organization

FCC ID: **H9PLA2400**

WLAN PC Card, 1 Mbps, CR-1, Hi Power

Output Power: 500 mW

Grant Date	Ant #:	Model	Symbol P/N	Mfg	Mfg P/N
10/22/96					
	1	Plane	50-21900-008	Tecom	505042C(48IN)
	2	Pipe Bomb 11"x4'	50-11901-048P	Cushcraft	S2403BHPS48RBN
	2.1	Pipe Bomb 11"x15'	50-11901-180P	Cushcraft	S2403BHPS180RB
	3	Rubber Duck	50-21900-007	Cushcraft	RBN2400SXR
	4	End Cap, 6 Pin	50-21900-009	Tecom	505068E
	5	IBM		IBM	25H3851
	6	IBM Port Computer		IBM	25H3851
Applied For					
	1	7540	10-38649-01	Tecom	
	2	2740	703624-1	Tecom	703624-1
	3	Vocollect BFA	50-21900-026	Austin Antenna	200215
	4	7240	10-35475-01	Tecom	
	5	Toko	50-21900-022	Toko	DAC2450CT1
	6	Oniel BFA	50-21900-023	Tecom	703620
	7	1740	703549-1	Tecom	703549-1
	8	XP	50-21900-024	Tecom	703611
	9	3140F	10-38653-01	Tecom	703134