Operational Description of UP-DX100

The digital photo printer UP-DX100 is a printer used in the digital printing system UPX-C200. By incorporating the Bluetooth radio module in UP-DX100, it transmits with the digital video camera DKC-C200X on the air, receives image data from DKC-C200X and prints out the image on a proper paper.

The circuit blocks of UP-DX100 are as follow:

[Outline Description of Each Block]

-Main CPU Block

-MA-123 Circuit Board

>Load Digital Signal from Bluetooth/USB to main memory and after running with software, output to thermal head.

>Mechanical Block Controlling

>Controlling Bluetooth System/ USB Controlling

>Memory (FLASH ROM, SDRAM, EEPROM) Controlling

>Liquid crystal display/ Key input/ LED Controlling

>3.3V/ 1.8V regulator

[Mechanical Controlling Block]

-MD-128 Circuit Board

>Stepping Motor/ DC Motor Controlling

>Ribbon Insertion/ Type Detection

>Detect Head location

>Controlling Buzzer/ Fan

>5V Regulator

[Other Blocks]

-IF-908 Circuit Board

>USB Interface Connector

-JUM-5 Circuit Board

>Paper Edge detection/ Paper Presence

-PE-40 Circuit Board

>Paper Edge detection/ Paper Presence

-RM-194 Circuit Board

>Ribbon Start Mark Detection

-Thermal Head Block

>Receive image data from MA-123 Circuit Board and print out the image.

-Power Supply Block

>Switching Regulator

[Power Supply of Bluetooth Block]

Circuits in the Bluetooth block use +3.3 V and +1.8 V.

The regulated +3.3 V is generated by +5.0 V regulated power supply IC803 on the PCB board MD-128 . The 5.0 V is supplied from +22.0 V in the power supply block.

The 3.3 V is supplied to the Bluetooth module on the PCB board MA-123 after filtering by L501. The regulated +1.8 is generated in the Bluetooth HIC and supplied to the radio part of the Bluetooth module.

Functional Description 20/May/2002

MITSUMI Bluetooth Module

" WML-C09###" " WML-C10###"

Hardware: Version 1

Ultra-small and thin size achieved through use of high density mounting technology.

1. APPLICATIONS

Notebook PCs, mobile phones, digital cameras, PC peripherals, PDA.

2. DESCRIPTIONS

Wireless communication module conforming to Bluetooth Ver.1.1.

3. FEATURES

1) Ultra-small and thin size achieved through use of high density mounting technology.
2) SMD type can be surface mounted.
3) High sensitivity supports communications of up to 1 0 m.
4) UART, USB and PCMIF interfaces enable wide range of applications.
5) Conforms to FCC, CE and other countries' EMI standards.
6) Supports Bluetooth Class2.

Note) The BLUETOOTH trademarks are owned by Bluetooth SIG, INC.,U.S.A.

4. SPECIFICATIONS

I t e m	S p e c I f I c a t I o n s
F r e q u e n c y	2402 to 2480 MHz
M o d u l a t I o n	FHSS / GFSK
Channel intervals	1 MHz
Number of channels	7 9 CH
Power supply voltage	3.3 V (typ.), 2.8 ~ 3.4V
Transmission rate	7 2 1 kbps
Receive sensitivity	-80 dBm typ.
Output level (Class2)	4 dBm max.

5. TERMINAL DESCRIPTION
5-1. WML-C09###

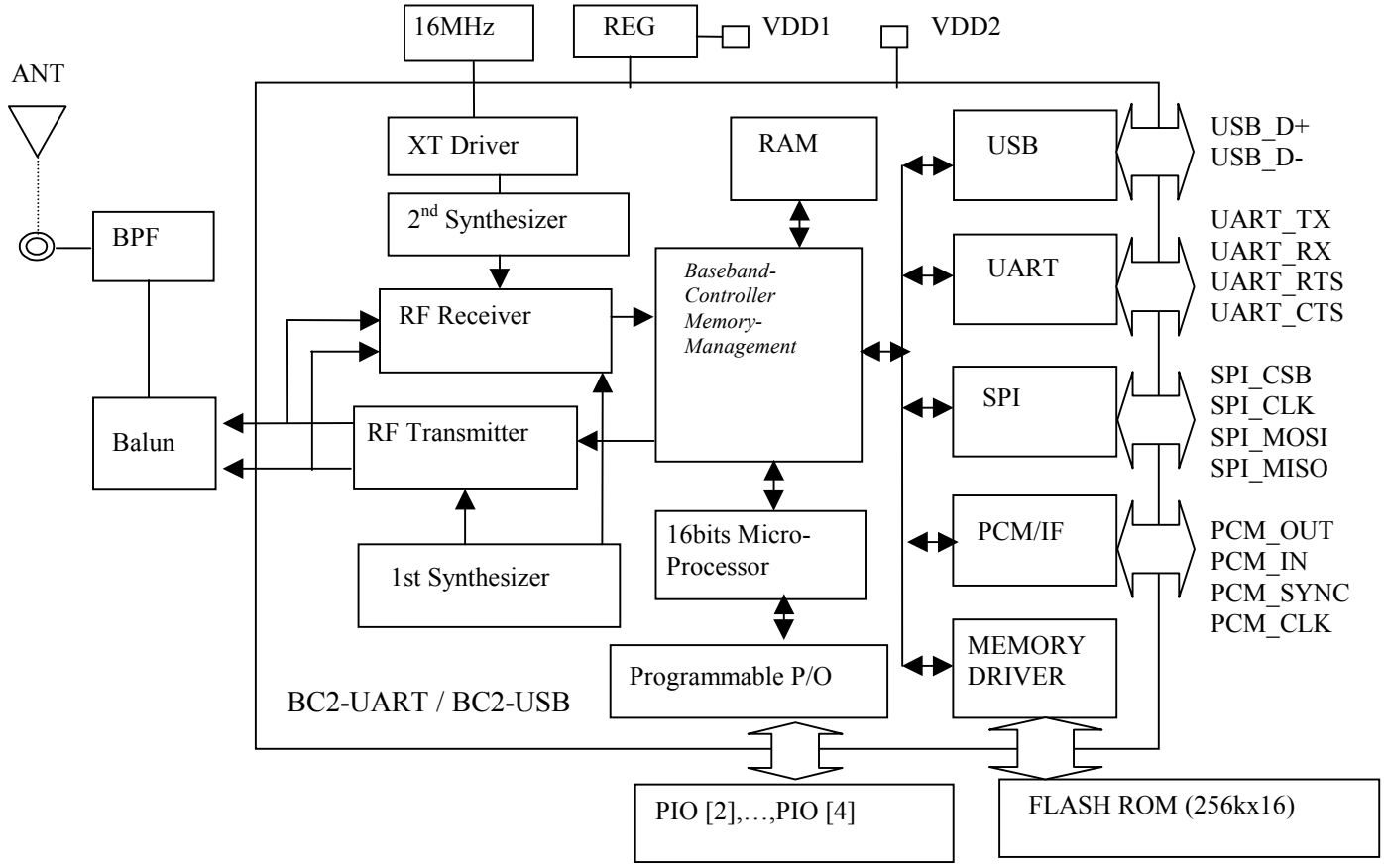
No.	Symbol	I/O	Description
1	GND		Ground
2	VDD1		Voltage monitor (+1.8V) when voltage regulator is integrated, or Supply voltage 1.8V
3	SPI_MISO	O	Synchronous Serial Interface data output
4	SPI_CSB	I	Chip select for Synchronous Serial Interface
5	SPI_CLK	I	Synchronous Serial Interface Clock
6	SPI_MOSI	I	Synchronous Serial Interface data input
7	VDD2		Supply voltage 3.3V
8	GND		Ground
9	UART_CTS	I	Asynchronous serial data CTS
10	UART_RTS	O	Asynchronous serial data RTS
11	UART_TX	O	Asynchronous serial data output
12	UART_RX	I	Asynchronous serial data input
13	PCM_CLK	I/O	Synchronous PCM data clock
14	PCM_IN	I	Synchronous PCM data input
15	PCM_SYNC	I/O	Synchronous data strobe
16	PCM_OUT	O	Synchronous PCM data out
17	GND		Ground
18	USB_D+	I/O	USB Data +
19	USB_D-	I/O	USB Data -
20	PIO [2] / USB_PULL_UP	I/O	Programmable I/O line / USB pull-up
21	PIO [3] / USB_RESUME	I/O	Programmable I/O line / USB resume
22	PIO [4]	I/O	Programmable I/O line
23	RST	I	Reset if high
24	GND		Ground
25	ANT	I/O	RF input/output
26	GND		Ground

5-2. WML-C10###

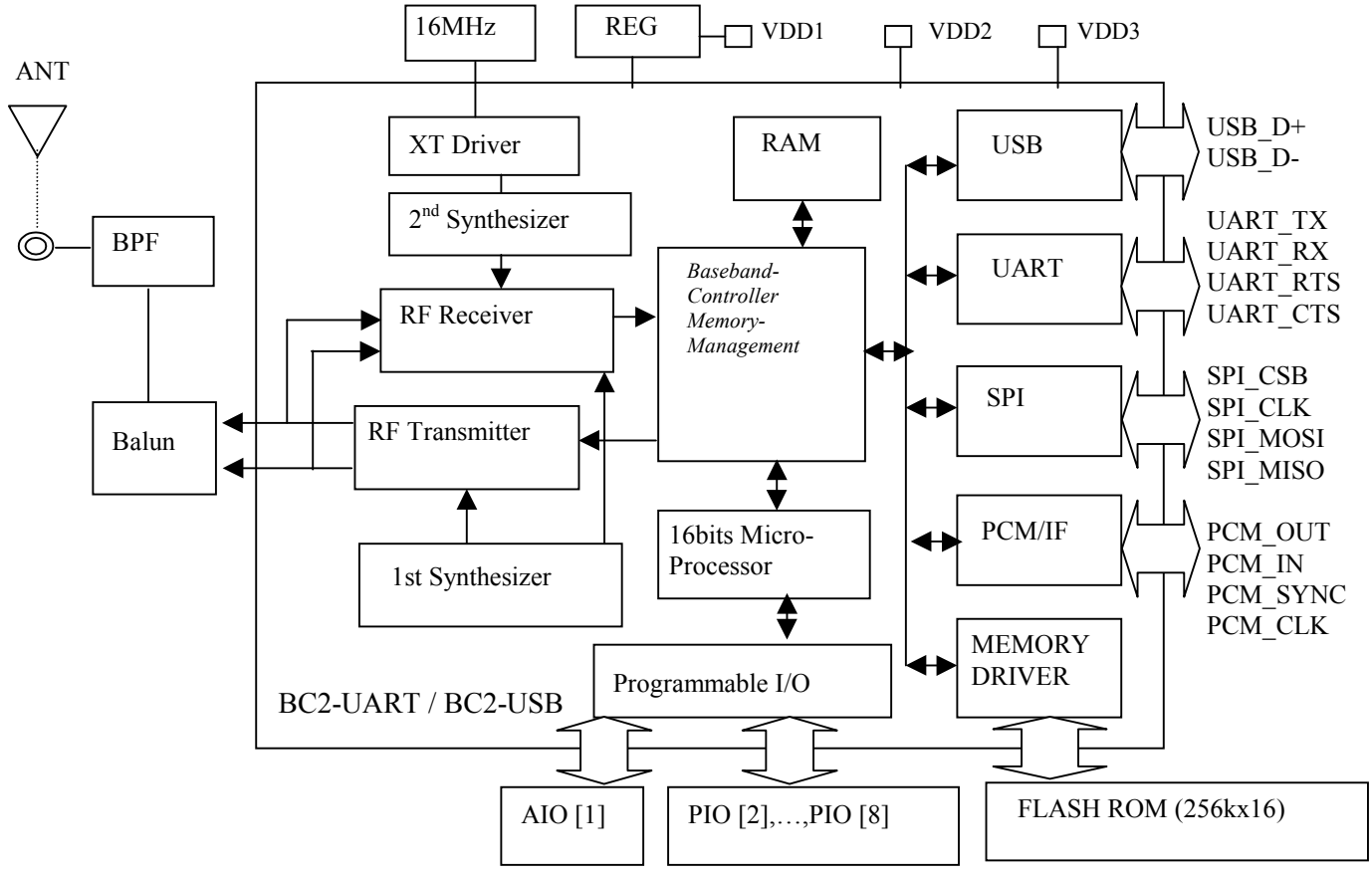
No.	Symbol	I/O	Description
1	GND		Ground
2	VDD1		Voltage monitor (+1.8V) when voltage regulator is integrated, or Supply voltage 1.8 V
3	RST	I	Reset if high
4	AIO [1]	I/O	Programmable I/O line
5	SPI_MISO	O	Synchronous Serial Interface data output
6	SPI_CSB	I	Chip select for Synchronous Serial Interface
7	SPI_CLK	I	Synchronous Serial Interface Clock
8	SPI_MOSI	I	Synchronous Serial Interface data input
9	VDD2		Supply voltage 3.3V (Operating voltage for memory & AIO)
10	GND		Ground
11	UART_CTS	I	Asynchronous serial data CTS
12	UART_RTS	O	Asynchronous serial data RTS
13	UART_TX	O	Asynchronous serial data output
14	UART_RX	I	Asynchronous serial data input
15	PCM_CLK	I/O	Synchronous PCM data clock
16	PCM_IN	I	Synchronous PCM data input
17	PCM_SYNC	I/O	Synchronous data strobe
18	PCM_OUT	O	Synchronous PCM data out
19	VDD3		Supply voltage 3.3V (Operating voltage for PIO & all other Input / Output)
20	GND		Ground
21	USB_D+	I/O	USB Data +
22	USB_D-	I/O	USB Data -
23	PIO [2] / USB_PULL_UP	I/O	Programmable I/O line / USB pull-up
24	PIO [5]	I/O	Programmable I/O line
25	PIO [6]	I/O	Programmable I/O line
26	PIO [3] / USB_RESUME	I/O	Programmable I/O line / USB resume
27	PIO [8]	I/O	Programmable I/O line
28	PIO [4]	I/O	Programmable I/O line
29	PIO [7]	I/O	Programmable I/O line
30	GND		Ground
31	ANT	I/O	RF input/output
32	GND		Ground

6. BLOCK DIAGRAM

6-1.WML-C09###



6-2.WML-C10###



7. PCM IF

PCM_OUT, PCM_IN, PCM_CLK, PCM_SYNC carry one of bi-directional channel of voice data using 13bits PCM at 8ks/s.

PCM_SYNC operates at a fixed clock frequency of 8kHz.

PCM_CLK operates at a fixed clock frequency of 256kHz.

Bits 1 to 13 of the PCM_OUT data carry the current output sample value.
Bits 14 to 16 carry a three bit signal level value.

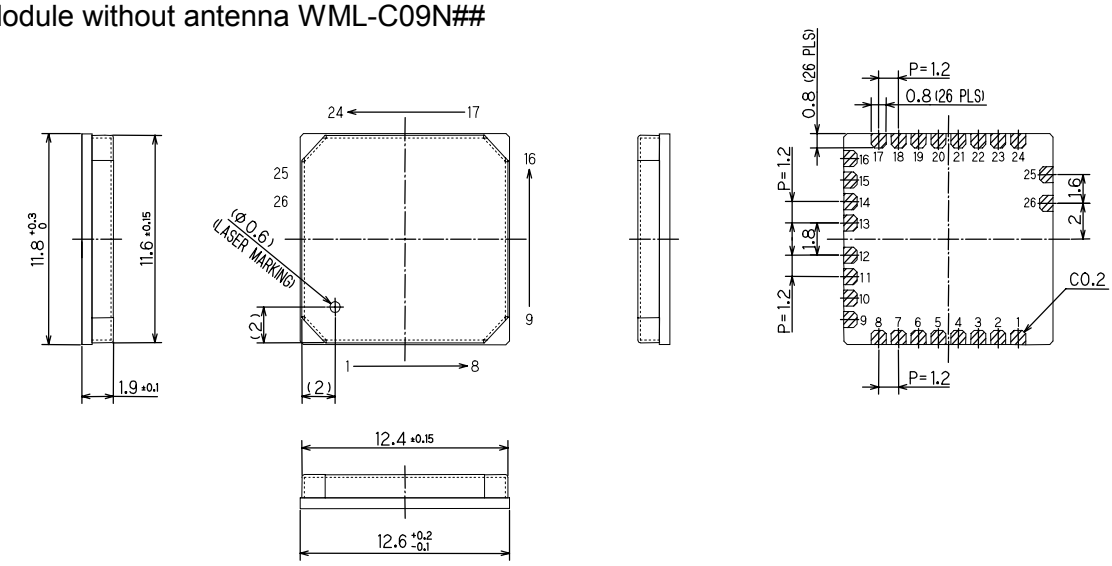
Reference PCM audio device is MC145483.

8. PIO PORT

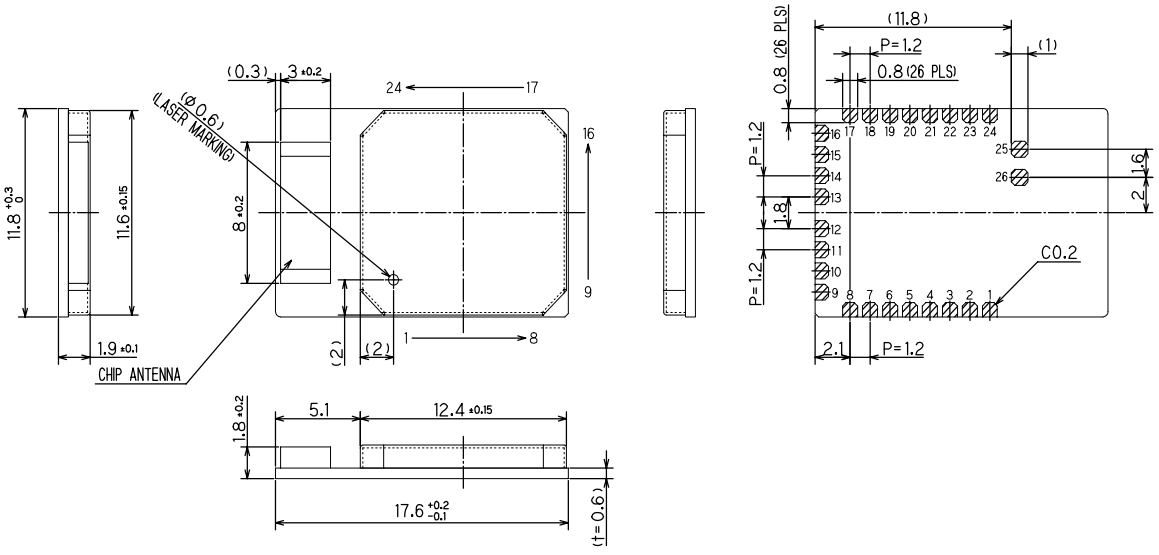
The PIO port is general purpose IO interface and the ports consists of 8 programmable, Bi-directional PIO [2:8] . The maximum current drive capability is 4mA.

9. OVERALL APPEARANCE
9-1.WML-C09###

Module without antenna WML-C09N##

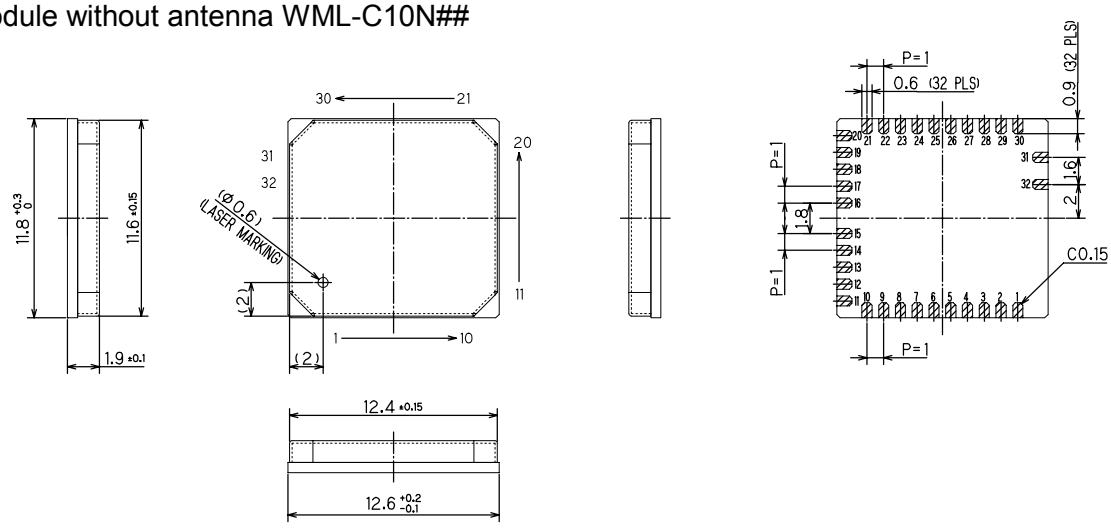


Module with antenna WML-C09A##

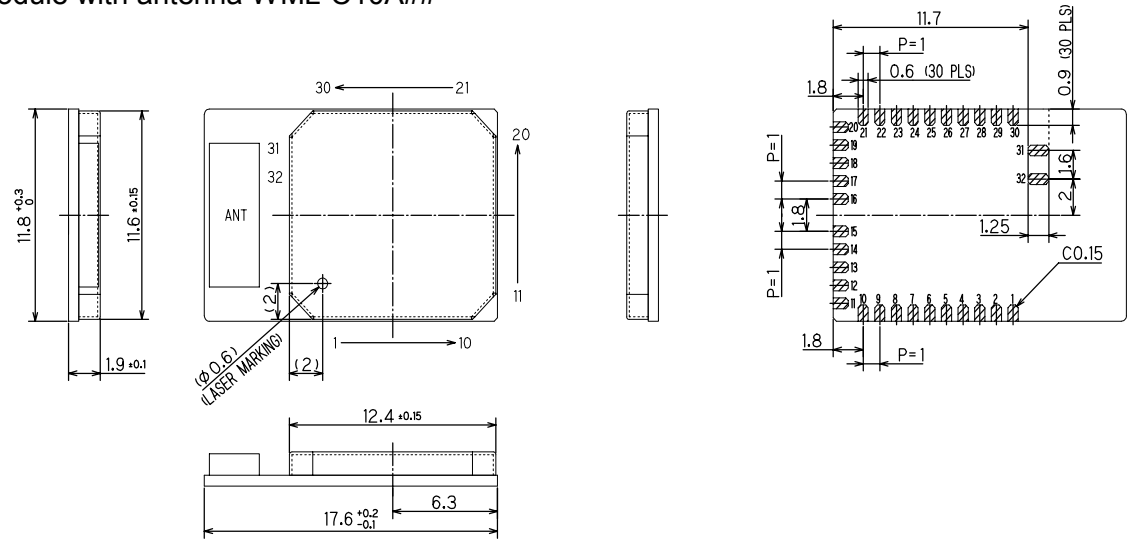


9-2.WML-C10###

Module without antenna WML-C10N##



Module with antenna WML-C10A##



FCC ID: AK8UPDX100

Additional information in accordance with requirements of FCC 15.247 and FCC Public Notice DA 00-705

1. Frequencies tested

Frequencies for the test are 2402 MHz, 2441 MHz and 2480 MHz as specified in 15.31(m).

2. Antenna requirement

The Bluetooth transceivers are used for picture data transmission between camera and printer. The antenna is a chip antenna and is permanently mounted on a printed electronic circuit board in the camera and printer. It is impossible for end user to replace it. This antenna configuration complies with the requirement of FCC 15.203.

The antenna information is submitted in a separate document in Exhibits.

3. AC conducted noise

The AC line conducted interference measurement is carried out in accordance with ANSI C63.4-2001 and the compliance are reported in the test report.

4. Carrier frequency separation

The measurement is carried out in accordance with FCC Public Notice DA 00-705 and the compliance is reported in the test report.

5. Hopping frequency requirements

The number of hopping frequencies is measured in accordance with FCC Public Notice DA 00-705 and reported the compliance in the test report.

On pseudorandom frequency hopping sequence the following is an example of a 79 hopping sequence in **data transmission mode**:

23, 21, 44, 40, 53, 42, 55, 46, 33, 48, 52, 35, 50, 20, 54, 67, 37, 56, 60, 39, 03, 69, 62, 71, 64, 25, 68, 66, 27, 57, 70, 59, 72, 28, 76, 22, 74, 61, 78, 63, 01, 41, 05, 43, 58, 73, 07, 75, 18, 45, 13, 47, 30, 77, 10, 00, 16, 49, 29, 31, 34, 02, 19, 06, 17, 51, 32, 36, 14, 04, 12, 26, 09, 24, 38, 08, 11, 65, 15

Example of a hopping sequence in **inquiry mode**:

71, 33, 47, 63, 57, 14, 61, 49, 55, 59, 73, 10, 69, 65, 43, 27, 04, 77, 00, 67, 37, 29, 31, 75, 08, 39, 51, 06, 40, 02, 35, 45

Example of a hopping sequence in **paging mode**:

53, 57, 68, 70, 55, 02, 42, 40, 14, 66, 44, 46, 63, 04, 48, 50, 16, 67, 54, 52, 65, 18, 56, 58, 60, 08, 20, 62, 51, 06, 61, 64

The requirement of **equal hopping frequency use** is met by a unique generation of the hopping sequence specified in the Bluetooth Standard as follows;

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 offset 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 us. The clock has a cycle of about one day (23 hours and half). In most case it is implemented as 28 bits 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 and 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 was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection is 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 than the minimum resolution of the clock (312.5 us). The hopping sequence always differs from the first one.

For the generation of the inquiry and page hop sequences the same procedures as described above, but this time with different input vectors.

For the inquiry hop sequence, a predefined fixed address is always used. This results on 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 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.

6. Dwell time

Dwell times are measured in accordance with FCC Public Notice DA 00-705 and reported the compliance in the test report.

7. 20 dB bandwidth

The 20 dB bandwidth is measured in accordance with FCC Public Notice DA 00-705 and reported the compliance in the test report.

8. Receiver input bandwidth and hopping capability

The input bandwidth of the receiver is limited to 1 MHz by a bandpass filter at the IF stage. It complies with the transmitter bandwidth at each hopping frequency.

In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. 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 is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing 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 is followed in any case. That means, a repeated packet is not sent on the same frequency, it is sent on the next frequency of the hopping sequence.

9. Peak output power

The peak output power is measured in accordance with FCC Public Notice DA 00-705 and reported the compliance in the test report.

10. Defact EIRP limit

The maximum gain of antenna used in UP-DX100 is 3.56 dBi (less than 6 dBi). There is no necessity to consider the defact EIRP limit.

11. RF exposure compliance

The transmitting power of UP-DX100 is low. Since UP-DX100 is normally used on a desk, it falls under a category of mobile equipment. The RF exposure statement is submitted as separate Exhibit.

12. Band-edge, RF conducted and radiated spurious emissions compliance

These compliance measurements are carried out in accordance with FCC Public Notice DA 00-705 and reported the compliance in the test report.

13. Requirements of 15.247 (g) and (h)

The compliance with 15.247 (g) and (h) was described in above section 5.