

	SPECIFICATION	APPROVED BY	CHECKED BY	WRITTEN BY
	WML-C29A Series	Date: 11. Jun.2004		

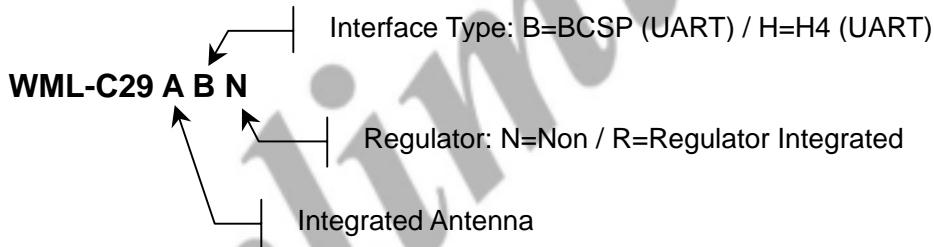
1. Scope

This specification covers the Bluetooth HCI module "WML-C29A" series, which complies with Bluetooth specification version 1.2 Class2 power level, built in 8Mbits Flash ROM, and integrates RF and base-band controller in ultra small package.

2. Definition for Type Of Module

WML-C29A series provides 2-type of module, which has 2 types of interface without regulator. The following means the definition of each letter.

Letter	Description	Definitions
Letter 1~7	Bluetooth Module	WML-C29: Class-2 Compliant
Letter 8	Antenna	A: Integrated Antenna.
Letter 9	Interface	B: BCSP (UART). H: H4 (UART).
Letter 10	1.8V Voltage Regulator	N: Not Integrated.

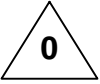


All Type

Type	Function	Interface		Regulator
		UART		
		BCSP	H4	
WML-C29A	BN	O		X
	HN		O	X

3. Dimensions

The dimension of each module shall be in accordance with appearance drawing No. 64 ****.

REVISION										

4. Specification

<Operating Rating>

No.	Items	Sym.	Specifications
4-1	Supply Voltage Range *Note1		BN HN
		VDD1	1.8V+/-0.1V
		VDD2	2.8 ~ 3.4V
		VDD3	1.7 ~ 3.4V
4-2	Temperature Range		233.15K to 358.15K (-40 to +85 degree)

Note1: The supply voltages VDD1, VDD2 & VDD3, which are described at 4-1, must be supplied the regulated voltage with noise level less than 10mVp-p.

<Absolute Maximum Rating>

No.	Items	Specifications
4-3-1	Supply Voltage	VDD1: 1.9V VDD2, VDD3: 3.6V
4-3-2	Input Voltage	AIO terminal: Port set = AIO: VDD1, Port set = PIO: VDD2 Other terminal: VDD3+0.3V
4-4	Storage Temperature	233.15K to 358.15K (-40 to +85 degree)

<General>

No.	Items	Specifications	
4-5	Deep-sleep Current Consumption	20uA typ. *Note2 (Except WML-C29AHN *Note3)	
4-6	Carrier Frequency	2402MHz to 2480MHz.	
4-7	Modulation Method	GFSK, 1Mbps, 0.5BT Gaussian	
4-8	Maximum Data Rate	Asynchronous: 723.2kbps/57.6kbps Synchronous: 433.9kbps/433.9kbps	
4-9	Output Power	0dBm typ. (Class 2)	
4-10	Hopping	1600hops/sec, 1MHz channel space	
4-11	Receiving Signal Range	-82 to 0dBm typ.	
4-12	Receiver IF Frequency	1.5MHz lower heterodyne	
4-13	RF input Impedance	50 ohms	
4-14	Base-band Crystal OSC	16MHz	
4-15	Host interface	Data	UART (BCSP or H4)
		Voice	Single PCM Interface UART *Note4
4-16	Compliant Bluetooth Specification	Bluetooth Specification Ver1.2 . *Note5	
4-17	Hopping Frequency	2402 to 2480MHz F=2402+k MHz, k=0...78	

Note2: Current consumption of 1.8V voltage for VDD1.

Note3: Don't support Deep-sleep mode.

Note4: Bluetooth Core Specification defines the SCO over UART specification.

Note5: Don't support e-SCO.



5. Terminal description

No.	Symbol	I/O	Description	
			BN	HN
1	GND		Ground	
2	VDD1		Operating supply voltage is 1.8V	
3	RESET	I	Reset if high. (1Kohm pull-down)	
4	AIO [1]	I/O	Programmable I/O line	
5	SPI_MISO	O	Synchronous Serial Interface data output (N.C.*)	
6	SPI_CSB	I	Chip select for Synchronous Serial Interface (N.C.*)	
7	SPI_CLK	I	Synchronous Serial Interface Clock (N.C.*)	
8	SPI_MOSI	I	Synchronous Serial Interface data input (N.C.*)	
9	VDD2 (VDD_MEM)		2.8~3.4V	
			Operating supply 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(VDD_ PIO, PADS)		1.7~3.4V	
			Operating supply for PIO & all other Input / Output	
20	GND		Ground	
21	AIO [0]	I/O	Programmable I/O line	
22	PIO [9]	I/O	Programmable I/O line	
23	PIO [2]	I/O	Programmable I/O line	
24	PIO [5]	I/O	Programmable I/O line	
25	PIO [6]	I/O	Programmable I/O line	
26	PIO [3]	I/O	Programmable I/O line	
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	N.C.		N.C. (for RF-test Input / Output)	
32	N.C.		N.C. (for RF-test Input / Output)	

* N.C.=OPEN



6. Electrical characteristics

6-1. Transmitter section

No.	Items	Min	Typ	Max	Unit	Condition
6-1-1	Output Power (ETC)	-6	0	+4	dBm	DH5 packet
6-1-2	Initial Frequency Accuracy (ETC)	-75	0	+75	kHz	Hopping OFF, Continuous TX
6-1-3	Tx Output Spectrum (ETC) 20dB Bandwidth M +/- 500 kHz Adjacent Channel Power M-N =2 M-N >=3 Exception			-20	dBc	*Note8
				-20	dBm	*Note9
				-40	dBm	
				-20	dBm	
6-1-4	Out-of-band Spurious Emissions (ETC) Operation mode 30MHz to 1GHz 1GHz to 12.75GHz 1.8GHz to 1.9GHz 5.15GHz to 5.3GHz Standby mode 30MHz to 1GHz 1GHz to 12.75GHz 1.8GHz to 1.9GHz 5.15GHz to 5.3GHz			-36	dBm	Max hold and 100kHz RBW
				-30	dBm	
				-47	dBm	
				-47	dBm	
				-57	dBm	
				-47	dBm	
6-1-5	Modulation Characteristics (ETC)	F1 _{AVG}	140	175	KHz	00001111, Hopping off, DH1 packet.
		F2 _{MIN}	115		KHz	01010101, Hopping off, DH1 packet.
		F2 _{AVG} /F1 _{AVG}	0.8			
6-1-6	Operation Current (NTC)		57	70	mA	DH5 packet

Note6: NTC: Normal test condition is defined as 298.15K (25 degree), 65%, VDD1=1.8+/-0.05V, VDD2=3.3+/-0.05V, VDD3=3.3+/-0.05V.

ETC: ETC test condition is defined as 233.15K to 358.15K(-40 degree to 85 degree), VDD1=1.8+/-0.1V, VDD2=3.3+/-0.1V, VDD3=3.3+/-0.1V.

Note7: Otherwise specified, the items are specified measuring payload of PRBS9 and packet type of DH1 on each frequencies of 2402MHz, 2441MHz and 2480MHz in test mode of module.

In each specification items, different test conditions from the standard are described in.

Note8: M is integer channel number of transmission channel and N is the integer channel number of adjacent channel.

Note9: Exceptions are allowed in up to three bands of 1 MHz width centered on a frequency which is an integer multiple of 1 MHz.

They must, however, comply with an absolute value of -20dBm.



6-2. Receiver Section

No.	Items	Min	Typ	Max	Unit	Condition
6-2-1	Sensitivity (ETC)					Hopping off, BER 10E-3, 1600K returned payload bits. Multi slot packets use DH5.
	Single slot packet		-82	-72	dBm	
	Multi slot packet		-82	-72	dBm	
6-2-2	Maximum Input Level (NTC)	-20	0		dBm	BER 10E-3, hopping off 1600K returned payload bits
6-2-3	Blocking Performance (NTC)					Hopping off, BER 10E-3 *Note10
	30MHz to 2000MHz	-10			dBm	
	2000MHz to 2399MHz	-27			dBm	
	2498MHz to 3000MHz	-27			dBm	
	3000MHz to 12.75GHz	-10			dBm	
6-2-4	Spurious emission (ETC)					Hopping off, 100kHz RBW
	30MHz to 1GHz			-57	dBm	
	1GHz to 12.75GHz			-47	dBm	
6-2-5	Operation Current (NTC)		54	70	mA	DH5 packet
6-2-6	Intermodulation Performance (NTC)	-39			dBm	Hopping off, BER 10E-3, *Note11
6-2-7	C/I Performance (NTC)					Hopping off, BER 10E-3 Interfering signal: BT modulated signal without hopping. *Note12
	Co-channel:			11	dB	
	+1MHz:			0	dB	
	+2MHz:			-30	dB	
	>+3MHz:			-40	dB	
	Image frequency: Adjacent (1MHz) to In-band image:			-9	dB	
			-20	dB		

Note10: Out-band blocking is measured with the wanted signal 3dB over the reference sensitivity level. Interfering signal shall be continuous wave signal.

Specification allows that measurement results are out of specification within 24 measure points (up to 12.75GHz from 30MHz increments by 1MHz). 19 points of 24 points as described above are permitted at reduced power level of -50dBm.

Note11: Wanted signal is modulated signal,

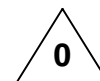
F1 is static sine wave with Power level of specified value (-39dBm max).

F2 is modulated signal level of specified value (-39dBm max).

$F_0 = 2F_1 - F_2$ and $|F_2 - F_1| = n * 1\text{MHz}$, $N = 5$.

Note12: Five spurious responses are allowed at frequencies with a distance of $\geq 2\text{MHz}$ from the wanted signal. On spurious response frequencies a relaxed interference requirement $C/I = -17\text{ dB}$ must be met.

Note13: All RF characteristics are measured with the terminal No.31.



6-3. Communication test

The Communication distance is not specified herein.

The Communication test is judged by the result whether audio test signal and alphabetic characters are properly transmitted and received or not by checking the alphabetic characters and the waveform, using application software and oscilloscope on PCs and fixture.

The Communication test is conducted by wired connection between Standard Test Unit (STU), which acts as Slave, and DUT that acts as Master. The attenuator is inserted in the RF cables between SUT and DUT. See the measurement block diagram 11-2.

6-4. Antenna characteristics

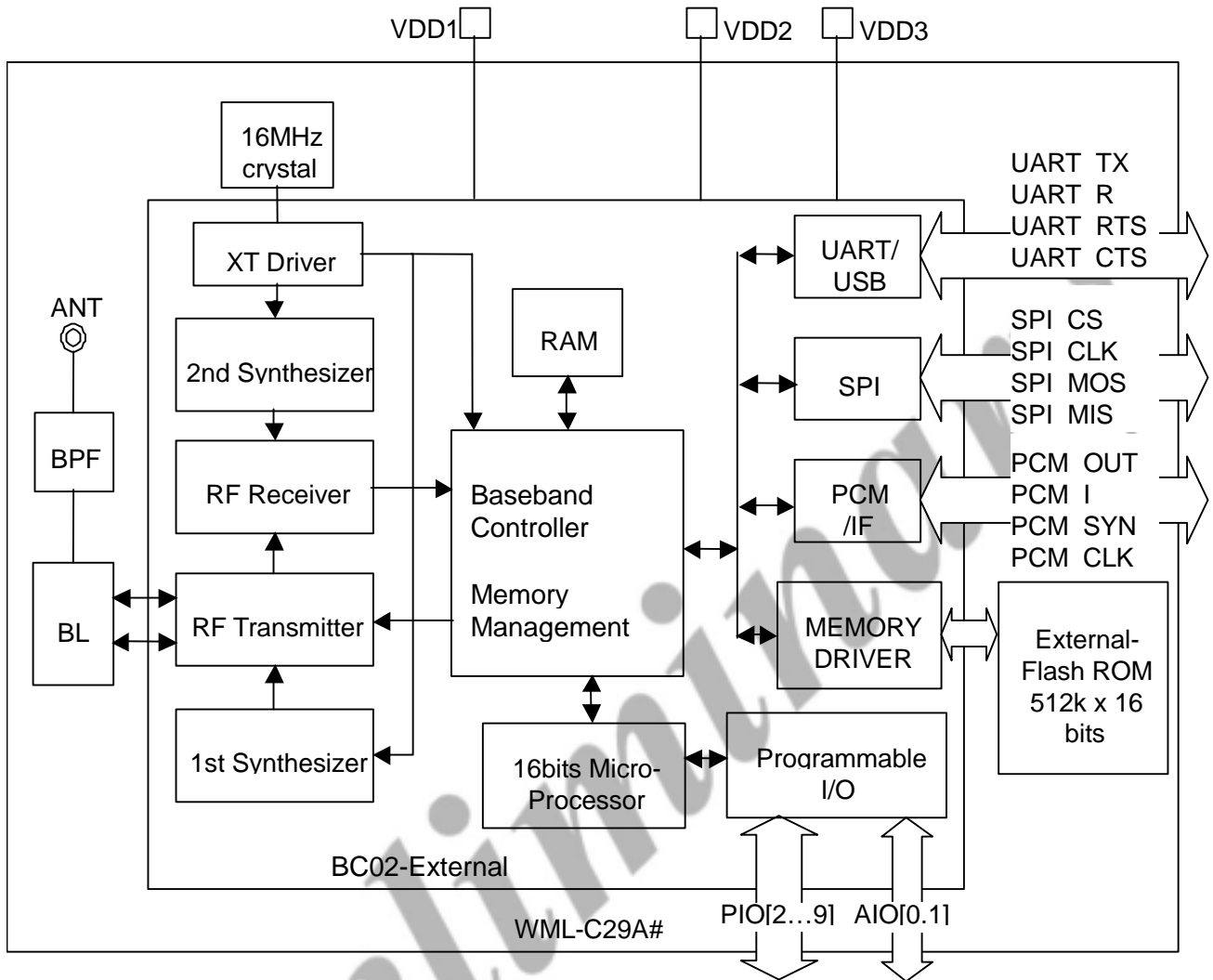
No.	Items	Min	Typ	Max	Unit	Condition
6-4-1	Antenna Peak Gain			2.14	dBi	298.15K(25 degree), Note14

Note14: The Peak Gain is defined as the peak gain of antenna itself in one frequency that shows maximum gain with reference antenna board of antenna manufacture.

Antenna model name is TDK HAN8030B2R4GT-000.



7. Block Diagram



<Glossary>

ANT	Ceramic Chip Antenna
BL	Balun
BPF	Band Pass Filter
VDD1	RF & Core Operating
VDD2, VDD3	External Memory & PAD's Operating
PCM	Pulse Code Modulation
SPI	Serial Peripheral Interface
PIO	Programmable Input Output
AIO	Programmable Input Output



8. Interface Definition

8-1. UART Interface

WML-C29ABN/AHN supports Universal Asynchronous Receiver Transmitter (UART) interface which provides a simple mechanism for communicating with other devices.

8-1-1. Input/Output Terminal Characteristics

Item	Min	Typ	Max	Unit
V _{IL} : Input low voltage	-0.4	-	+0.8	V
V _{IH} : Input high voltage	0.7VDD2,3	-	VDD2,3+0.4	V
V _{OL} : Output low voltage	-	-	0.2	V
V _{OH} : Output high voltage	VDD2-0.2	-	-	V

VDD2, VDD3=3.0V

8-1-2. UART Configuration Parameters

Item	Definitions		Note
	BCSP I/F	H4 I/F	
Baud rate	4800bps, 9600bps, 19.2Kbps 38.4Kbps, 57.6Kbps, 115.2Kbps (default) 230.4Kbps, 460.8Kbps, 921.6Kbps		Selectable
Data bit	8 bits		
Stop bit	1 bit (default) or 2 bits		
Parity bit	On, Even	Non	
Flow control	Non	RTS/CTS	UART_RTS and UART_CTS are active low.

Configuration parameters are set using by internal register called PSKEY. (*Note15)

Note15: This specification defines the above default configurations as standard test condition, and the specification values shall be only effective by these defaulting configurations.



8-3. PCMIF

The module supports both 13-bits Linear and A-law/u-law CODEC Interface. The configuration is set using by PSKEY.

8-3-1. 13-bits Linear Interface. (Default)

- 1) The module is configured as master mode of PCM I/F.
- 2) PCM_OUT, PCM_IN, PCM_CLK, PCM_SYNC carry one of bi-directional channel of voice data is using 13bits PCM at 8ks/s.
- 3) PCM_SYNC is output and operates at a fixed clock frequency of 8kHz.
- 4) PCM_CLK is output and operates at a fixed clock frequency of 256kHz.
- 5) Reference PCM audio device is Motorola MC145483 13-bit linear CODEC.

8-3-2. A-law/u-law Interface

- 1) Reference PCM audio device is Motorola MC145481 8-bit CODEC.

8-4. SPI

The SPI terminal is utilized as slave. SPI_MOSI, SPI_MISO, SPI_CLK, SPI_CSB are used for programming in the Flash ROM of this unit.

Maximum baud rate of SPI is 4M baud. The SPI_CSB consists of 4 CMOS signals and it is consistent with the specification of Motorola SPI standard. SPI_CSB is active low. These SPI terminals are not used in application circuit and stay open.

8-5. PIO Port

The PIO port is general-purpose IO interface and the port consists of 10 (8 digital and 2 analogue) programmable, Bi-directional PIO [2:9] and AIO [0:1].

8-6. Reset

The module must be reset with the terminal 3 "RESET" after turn on the power supply VDD1, VDD2 and VDD3. RESET terminal should be high for >5msec to cause a reset.



9. HCI Transport Layer

The module uses HCI Transport layer as Host Controller Transport Layer, which may exist to access between the stack in the module and the HCI driver on the host.

9-1. BCSP I/F (WML-C29ABN)

The module provides the UART HCI Transport layer called "BCSP (Blue Core Serial Protocol)", which itself is not specific to Bluetooth.

9-2. H4 I/F (WML-C29AHN)

The module provides the UART HCI Transport layer called "H4". Which is specified by Bluetooth Specification ver1.1, Part H: 4.

10. Reliability Test

The judgment of reliability test is conducted by Sensitivity, Output Power and Frequencies at normal test condition (NTC refer Note6). After each test, each item meets following spec.

1) Sensitivity: -70dBm min. (See6-2-1)

2) Output power: -10dBm min.

10-1. Thermal shock Cycling (TC)

The module can withstand 750 cycles of immediate environmental temperature changes from 233.15K to 358.15K (-40 to 85 degree) at 72 cycles/Day, and measurement shall be conducted after that.

10-2. High Temperature Storage Test (HTS)

This stress exposes the module to unbiased storage at an elevated temperature to 358.15K (85 degree) during 500 hours, and measurement shall be conducted after that.

10-3. Thermal Humidity Bias stressing (THB)

This accelerated temperature and humidity bias stress is performed at 358.15K (85 degree) and 85% relative humidity for 500 hours, and measurement shall be conducted after that.

10-4. Pressure Pot Test (PPOT)

This stress exposes the module to saturated steam at an elevated temperature to 383.15K (110 degree) and pressure to 85% for 400 hours, and measurement shall be conducted after that.

10-5. Low Temperature Storage test (LTS)

This stress exposes the module to unbiased storage at a demoted temperature to 233.15K (-40 degree) for 24 hours, and measurement shall be conducted after that.

10-6. Dropping Test

Dropping from the height 1m shall be performed to a wood floorboard once for each of 6 faces in a regular packaged condition, and measurement shall be conducted after that.

10-7. Vibration Test

The test shall be performed under the following conditions, and measurement shall be conducted after that:

(1) Vibration frequency range: 10 to 55Hz

(2) Test time: 1 min./1cycle

(3) Amplitude: 1.5mm

(4) Direction of vibration: 3 vertical directions

(5) Test time: 30min each



10-8. ESD susceptibility

This module meets the below ESD test specifications.

1) Human Body Model (HBM)

+/-2.0k Volts as C=100pF and R=1.5kohms

Number of test: Three times

Measurement shall be conducted after that.

2) Machine Model (MM)

+/-200 Volts as C=200pF / R=0 ohm

Number of test: One time

Measurement shall be conducted after that.

10-9. Module Reflow Condition

1) Lead Solder Reflow Condition

Reflow Temperature: 493.15K (220 degree), Time 20 to 30 sec,
Peak 503.15K (230 degree) Max

Preheat Temperature: 433.15K +/- 10K (160 degree +/- 10 degree),
Time 90 sec +/- 30 sec

2) Lead-free Solder Reflow Condition

Reflow Temperature: 503.15K (230 degree), Time 30 to 40 sec,
Peak 523.15K (250 degree) Max

Preheat Temperature: 438.15K +/- 15K (165 degree +/- 15 degree),
Time 90 to 120 sec

Reflow Time: One time

The module should end the mount processing within 48 hours after opening the package.

10-10. Precautions for use

1) Storage condition in Dry-pack

Shelf life: 90 days

Storage temperature: 303.15K (30 degree)

Storage humidity: 60 %RH and below

2) Use condition after unsealing Dry-pack

Temperature: 303.15K (30 degree) and below

Humidity: 60%RH and below

Expiration hours for use: Within 48 hours

3) Storage condition for the rest of parts after unsealing Dry-pack

Shelf life: 60 days

Storage temperature: 293.15K to 303.15K (20 degree to 30 degree)

Storage humidity: 10 %RH and below

4) Baking condition for use of the rest of the parts

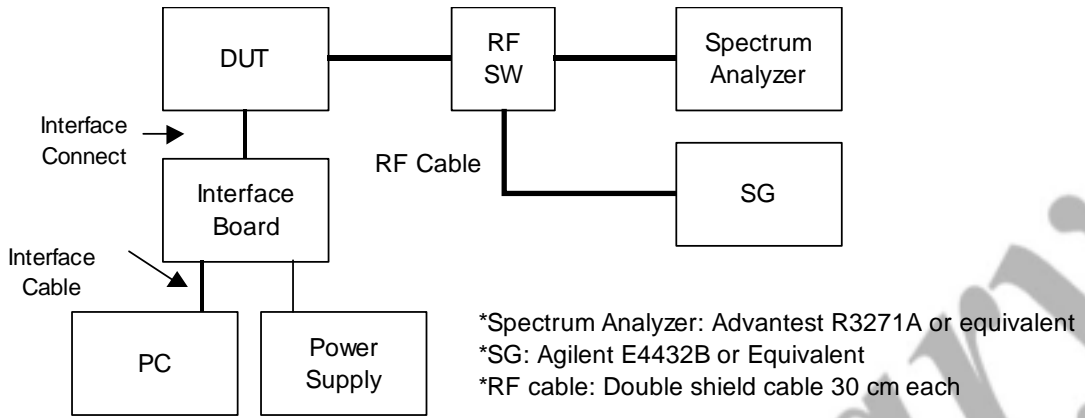
Condition: 398.15K (125 degree) / 8 hours on tray in Chamber.

The number of Baking shall be only one time.

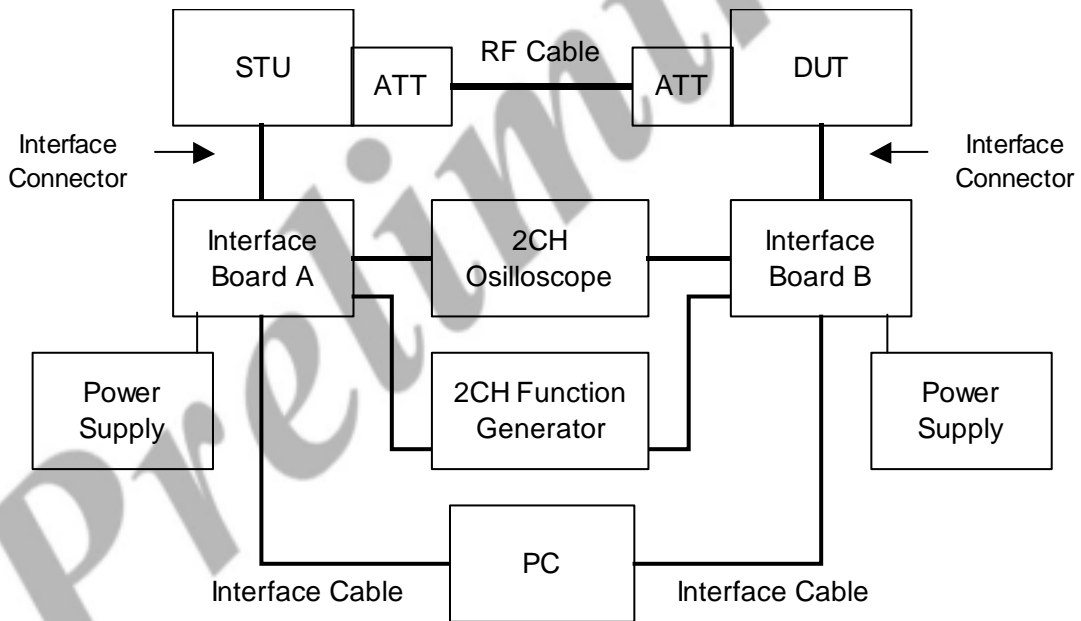


11. Data Measurement Block Diagram

11-1. Measurement A (Item No. 6-1-1, 6-1-2, 6-1-3, 6-1-4 and 6-2-1)



11-2. Measurement B (Item No. 6-3. Communication Test)



Revision Record

Rev No.	Date	Page	Contents	Person In Charge
00	11. Jun. '04		Original	R.Waki

Preliminary

