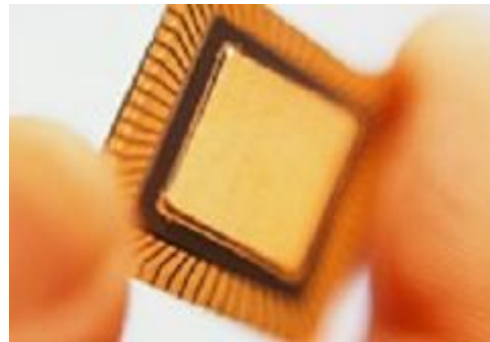


Bluetooth Solution for MTK Mobile Phones



WCP_SA
Kevin Shih
March, 2006



Agenda

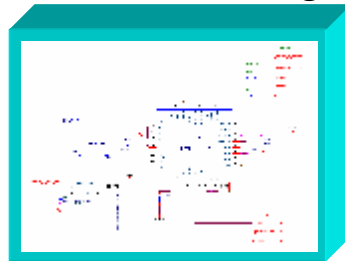
- What Bluetooth solution does MTK provide?
 - Easy to build in Bluetooth
 - 8 profiles supported for BT application
 - Low cost for stereo function
 - Good interoperability for Bluetooth
- MTK Bluetooth performance
 - RF performance
 - Function performance
- Summary
- Q&A

MTK's Bluetooth Solution

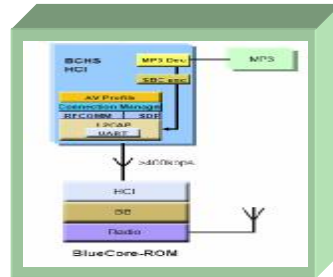


Easy to Integrate

MTK BT
Reference Design



CSR BCHS Build In



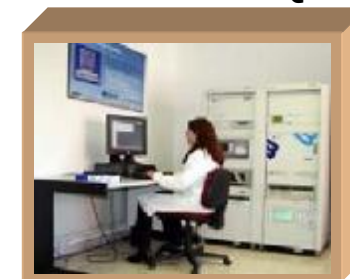
Factory Test Tool



Bluetooth MP

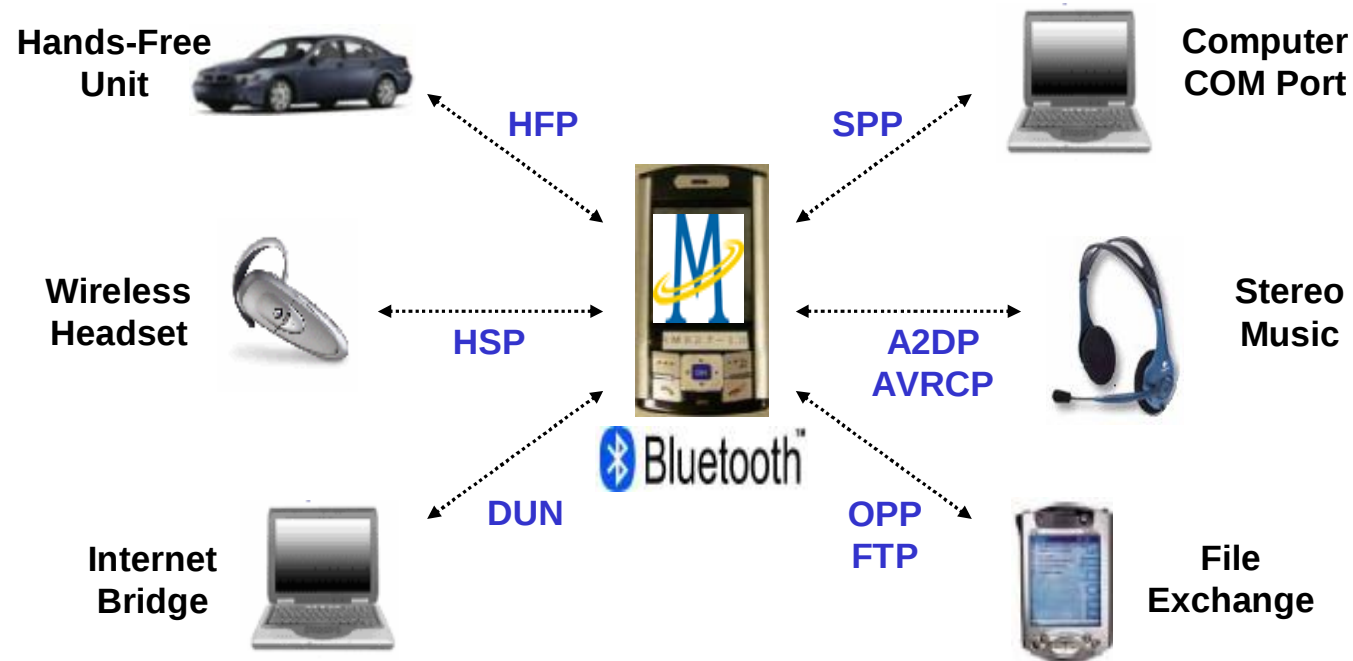


Bluetooth BQB



Supported Bluetooth Profiles

- MTK uses CSR BCHS software and supports the following profiles: SPP, DUN, HSP, HFP, OPP, FTP, A2DP, AVRCP



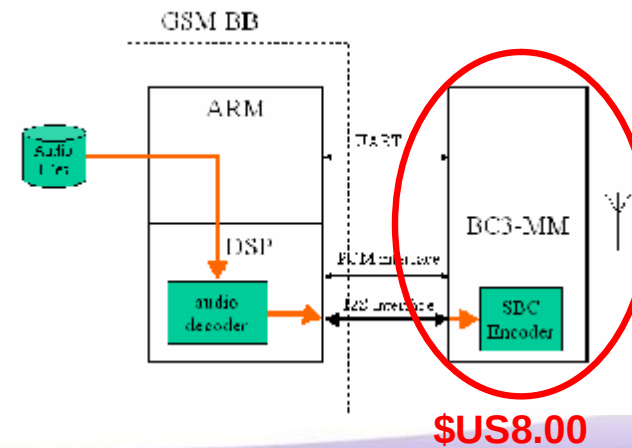
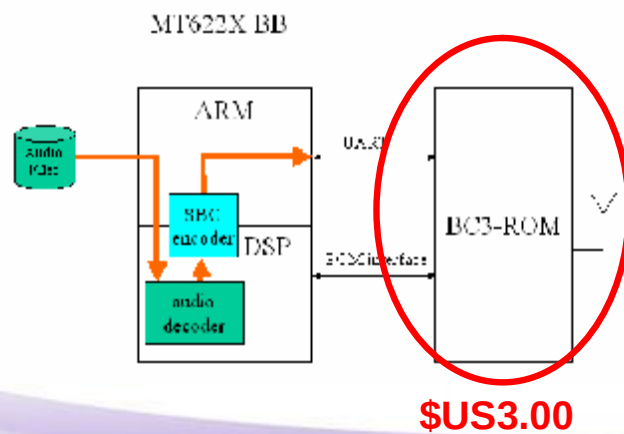
Low-Cost Stereo Function

- MTK MT622X has a built-in SBC (Sub-codec) that saves \$US5.00 for the stereo function.

MT622X for A2DP feature

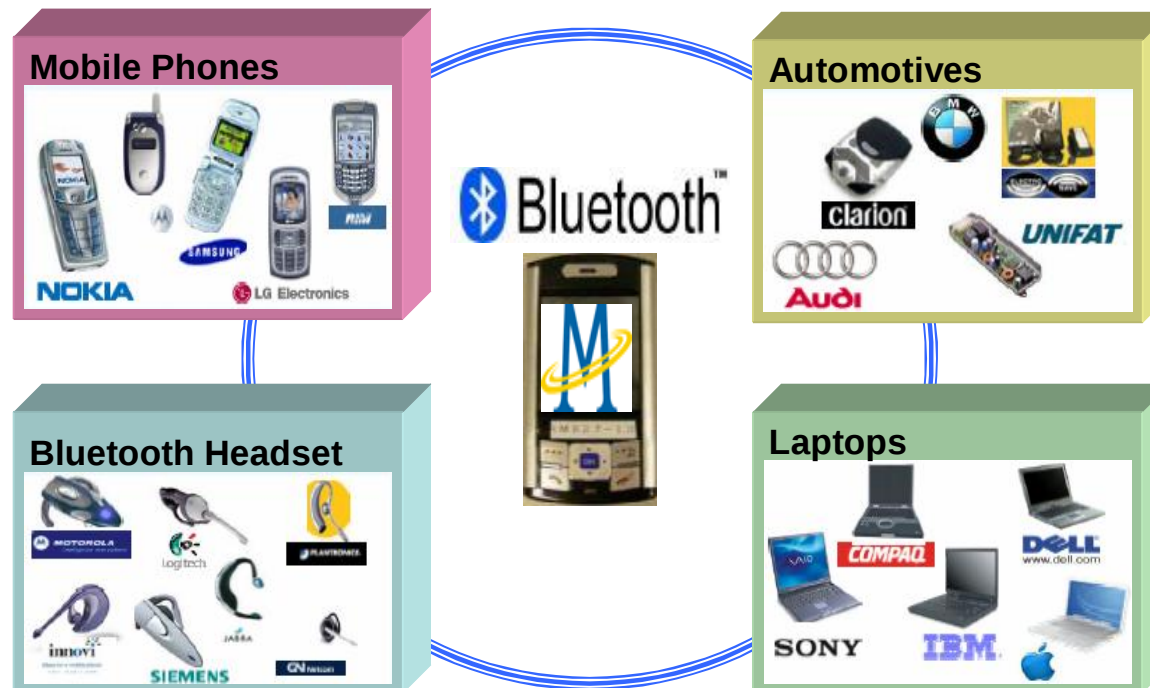


Other BB for A2DP feature



Good Interoperability for Bluetooth

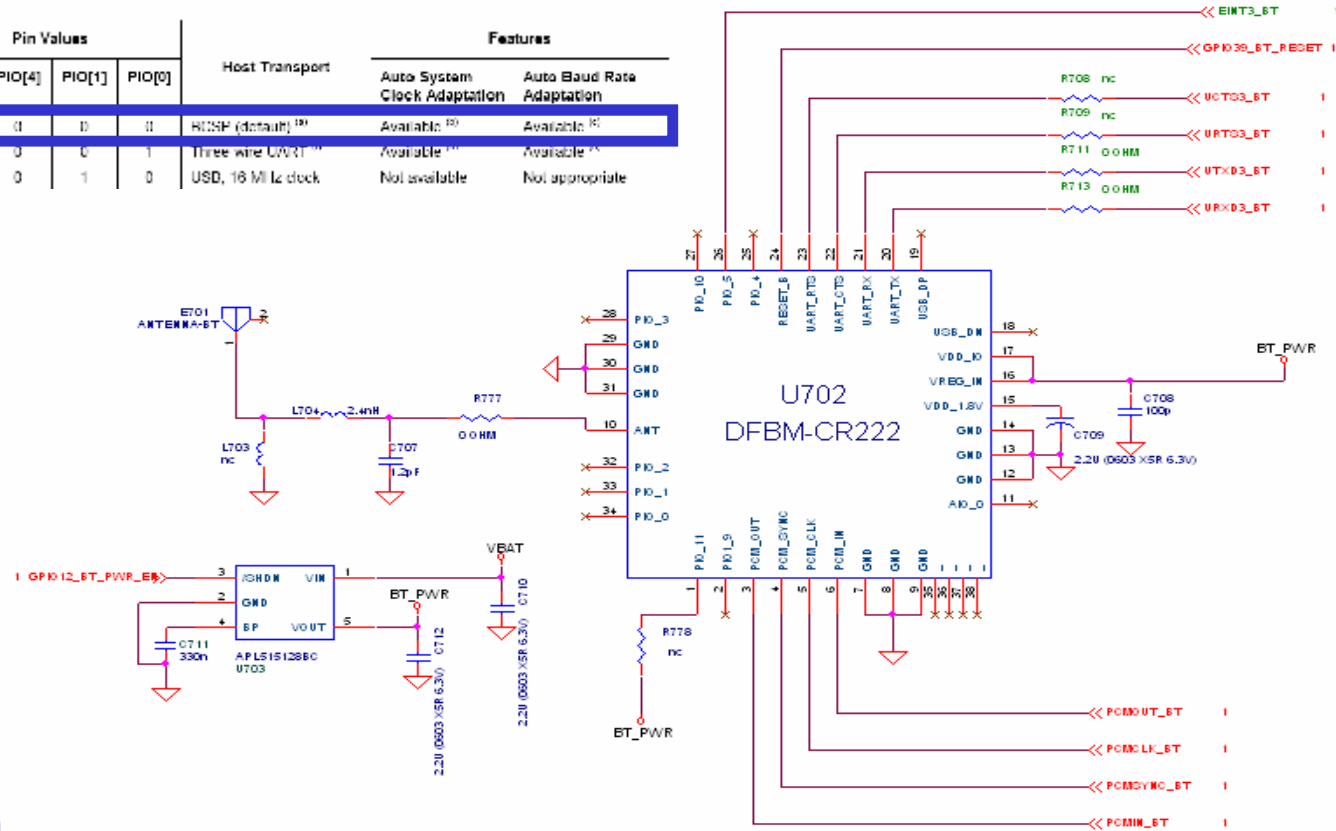
- MTK uses the CSR Bluetooth solution to obtain good interoperability for Bluetooth devices.



MTK Reference Design

- MTK uses the BC03ROM (FW:18.4) as a reference design

Pin Values				Host Transport	Features	
PIO[9]	PIO[4]	PIO[1]	PIO[0]		Auto System Clock Adaptation	Auto Baud Rate Adaptation
0	0	0	0	RS485 (default) ⁽¹⁾	Available ⁽²⁾	Available ⁽³⁾
0	0	0	1	Three wire UART ⁽¹⁾	Available ⁽²⁾	Available ⁽³⁾
0	0	1	0	USB, 16 MHz clock	Not available	Not appropriate



BT Customer Configuration

- Customer can check the three customer for HW setting:
 - ~mcu\customer\drv\misc_drv\XXXXXX_BB\gpio_drv.c
 - ~mcu\customer\app\XXXXXX_BB\bt_user_config.c
 - ~mcu\customer\app\XXXXXX_BB\bt_user_config.h

For example

1.Change ANA_FREQ 26Mhz(In bt_user_config.c)

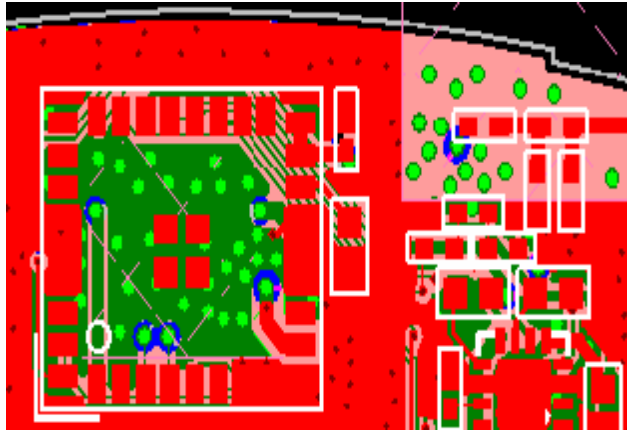
kal_unit16 bchs_mhz=26000

2.Change BT Pin PIO5 for Host wake up

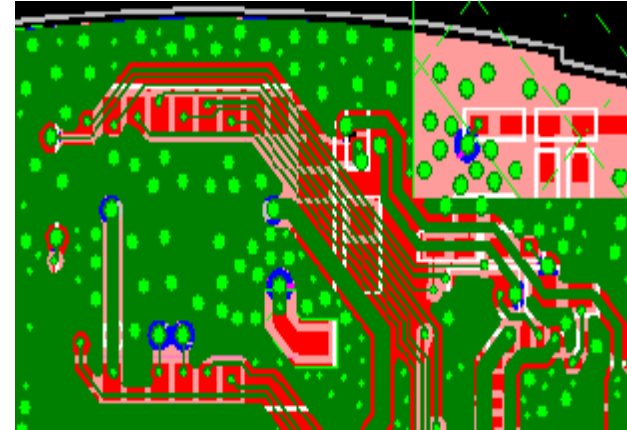
kal_unit16 bchs_wakeup_signal=0X0052

MTK Reference Layouts

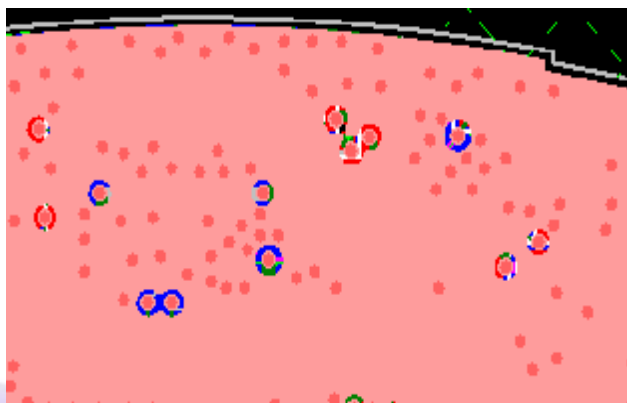
Layer 1



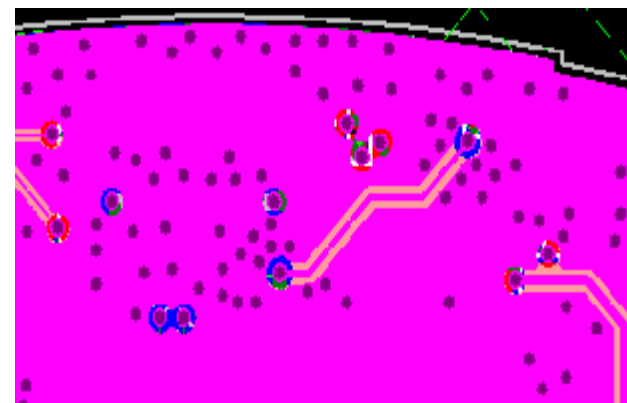
Layer 2



Layer 3

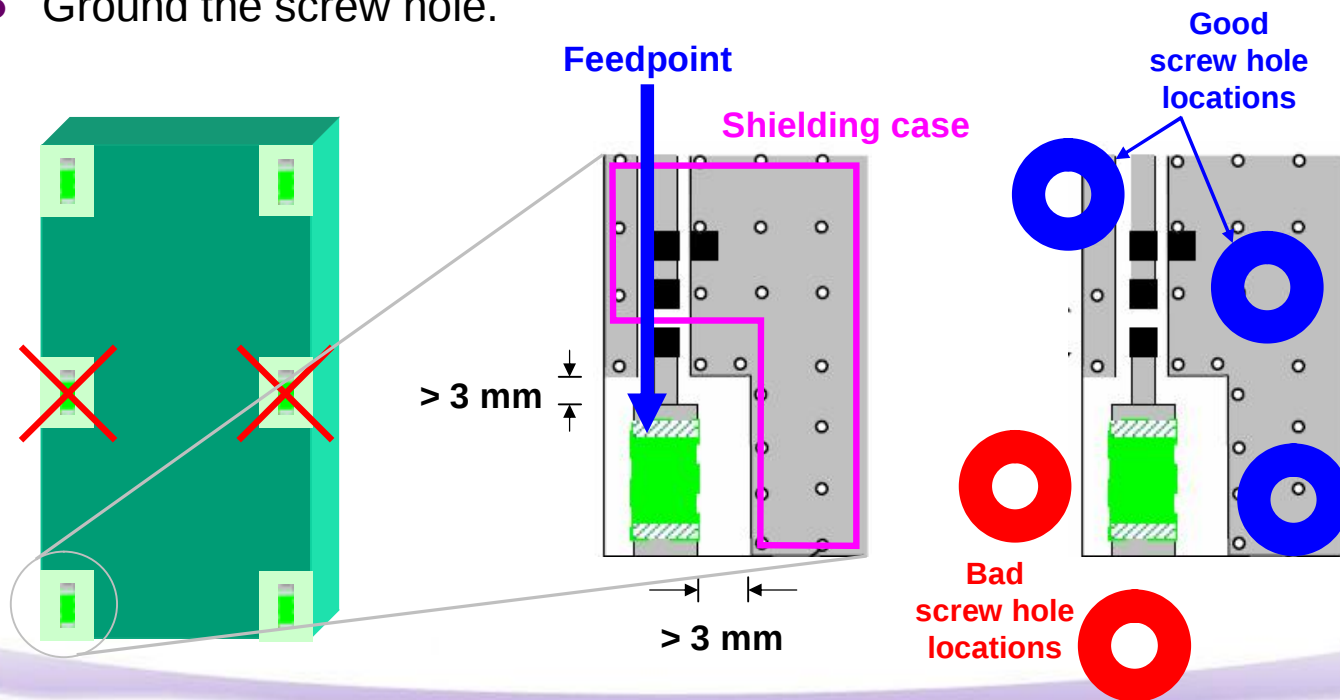


Layer 4

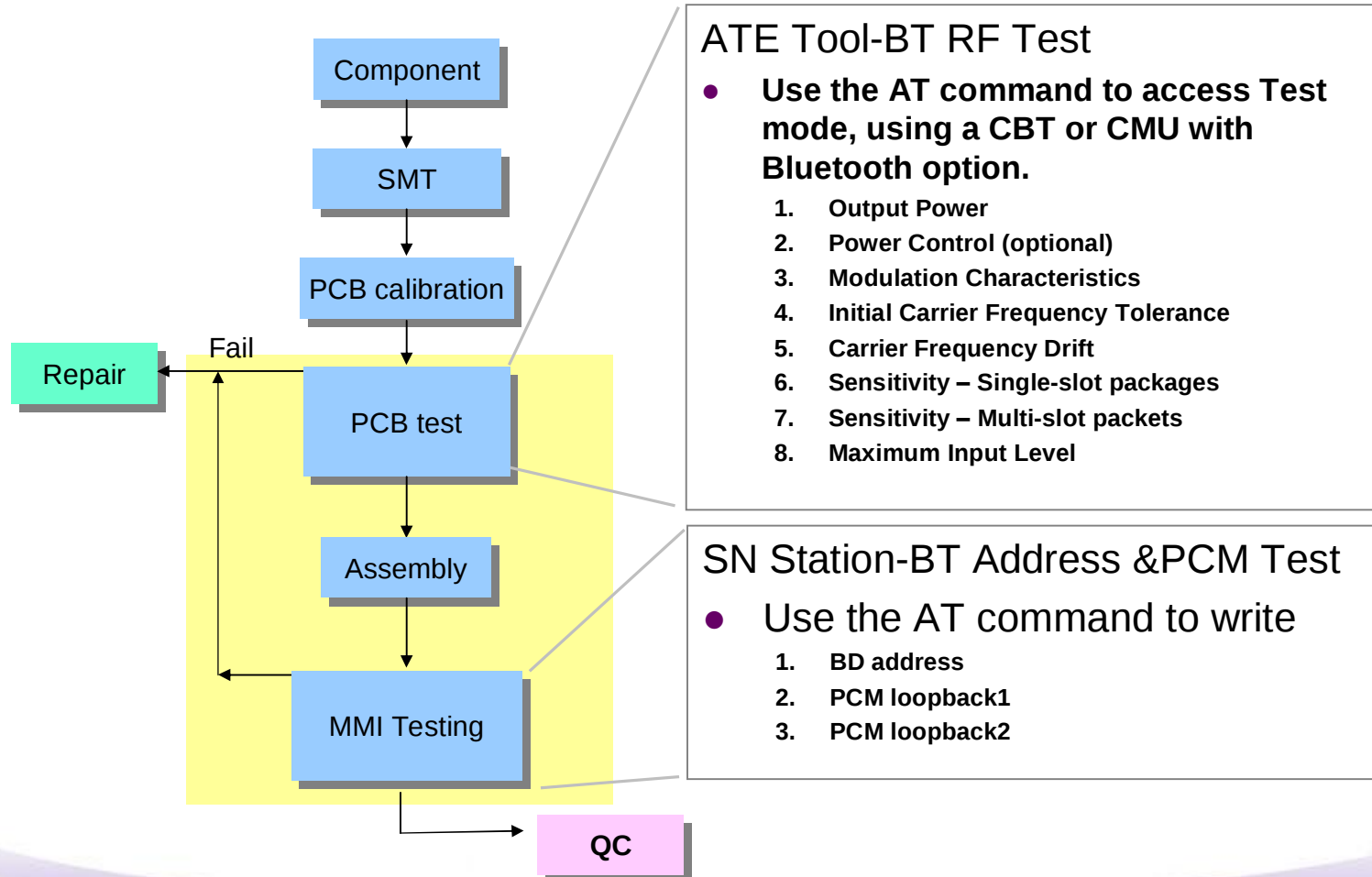


BT Antenna Design and Placement

- Place the BT antenna in the corner of the PCB.
- The feedpoint is directly connected to the antenna.
- Leave enough distance between the antenna, ground and the shielding case.
- Ground the screw hole.

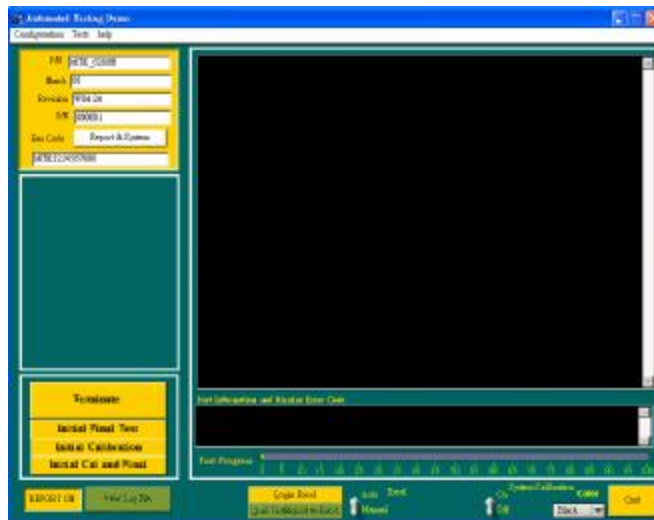


BT Factory and Calibration Flow



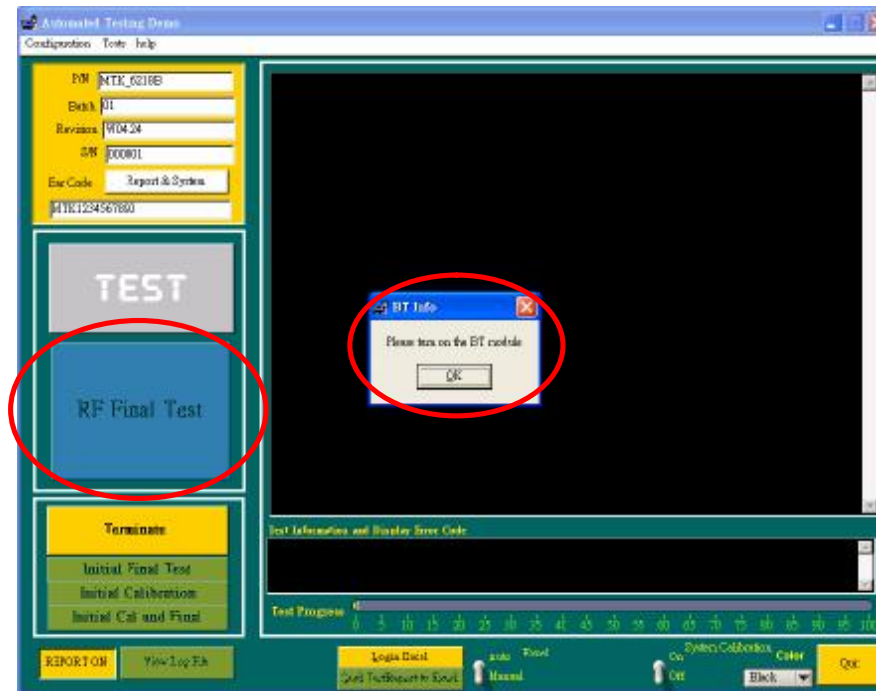
BT Factory Testing Flow

- Use AT commands:
 - AT+EMBT=1 à To enter Test mode
 - AT+EMBT=2 à To exit Test mode



CBT BT Tester, or
CMU200 with BT Option

BT Factory Testing Flow (cont'd)

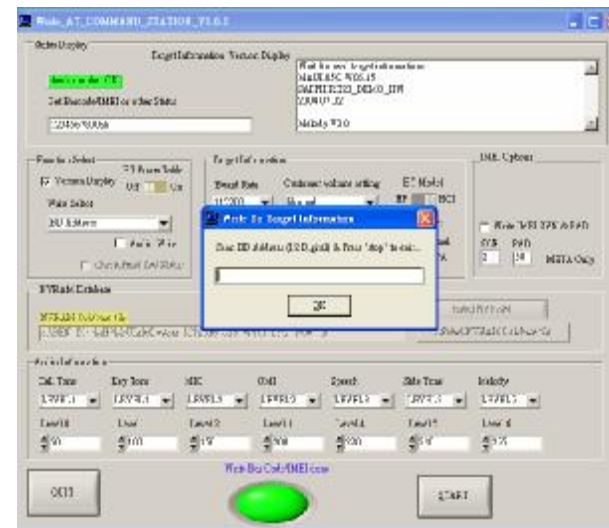
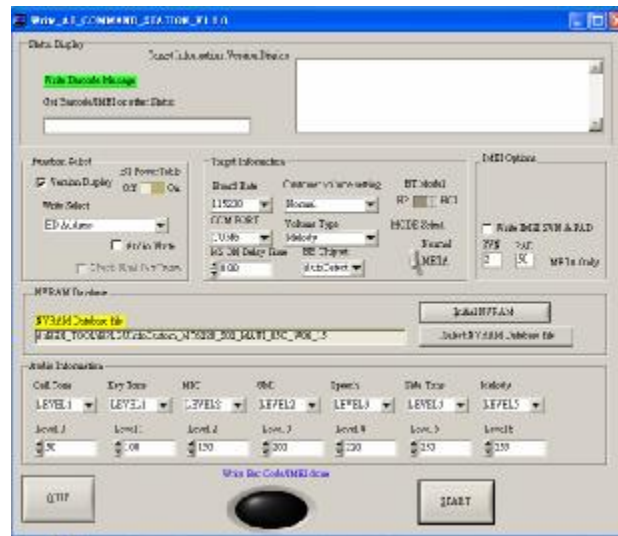


BT Factory Testing Flow (cont'd)



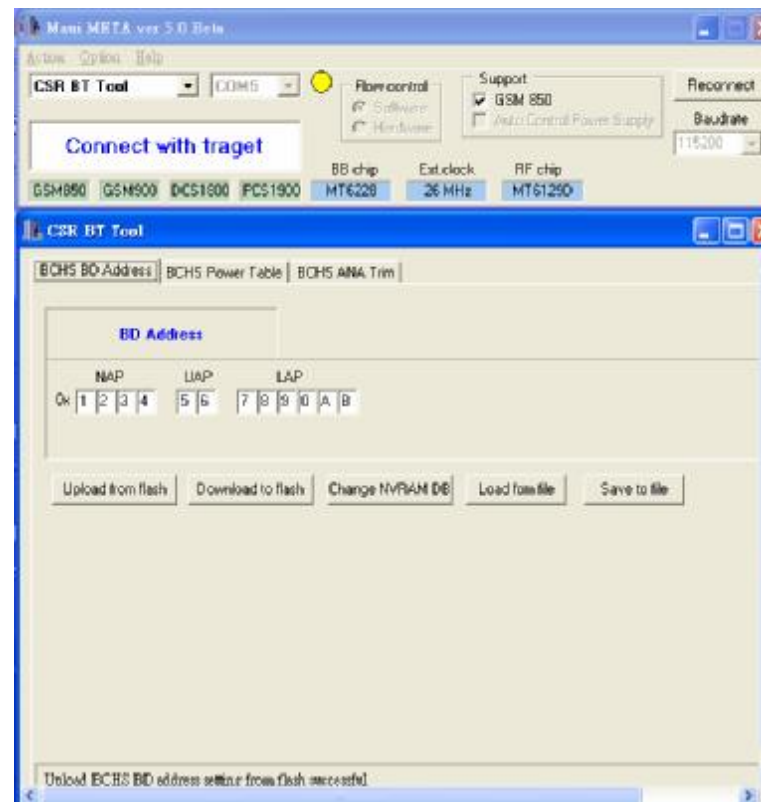
SN Station

- SN Station can write :
 - BCHS BD Address
 - PCM Loopback 1
 - PCM Loopback 2

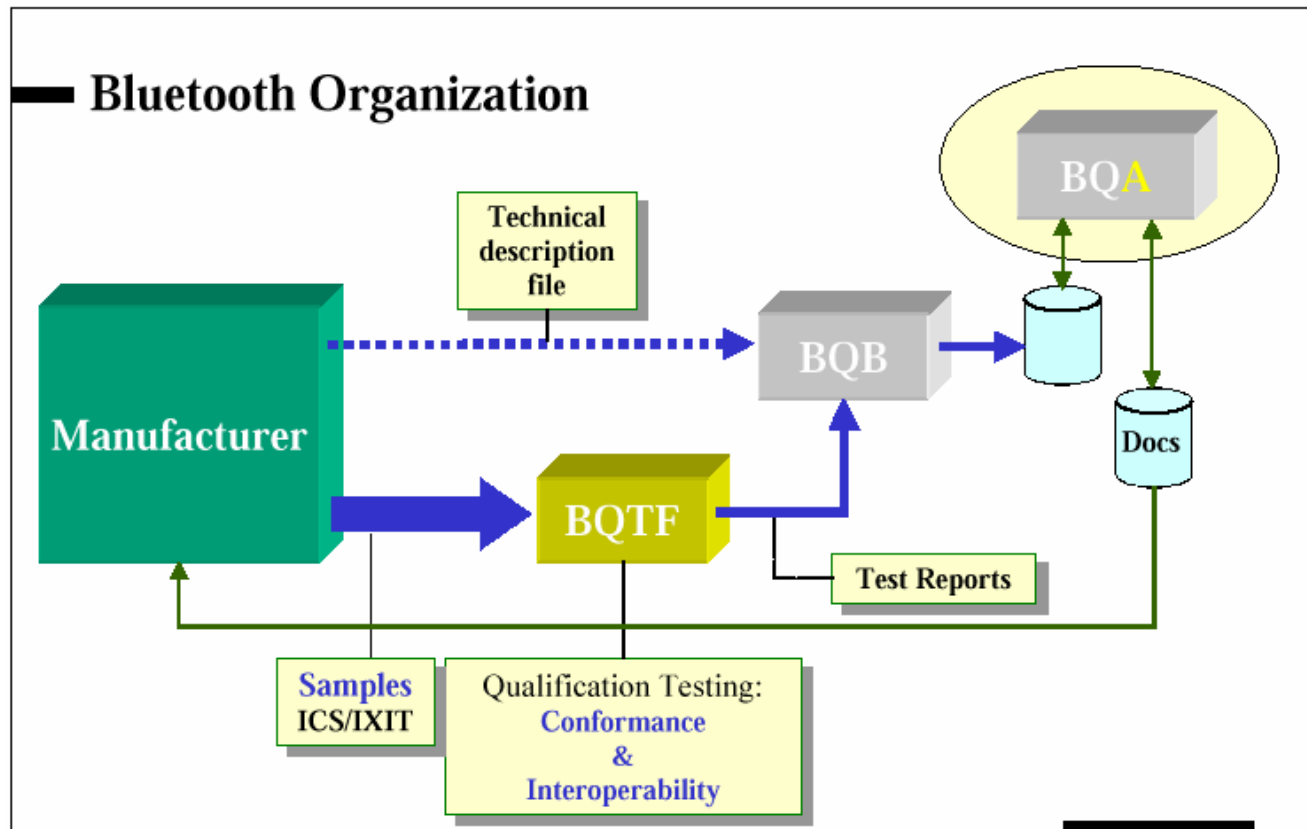


Meta Tool-CSR BT Tool

- Only use in RD size to fine tune RF performance.
- Meta CSR BT Tool can change :
 - BCHS BD Address
 - BCHS Power table
 - BCHS ANA Trim

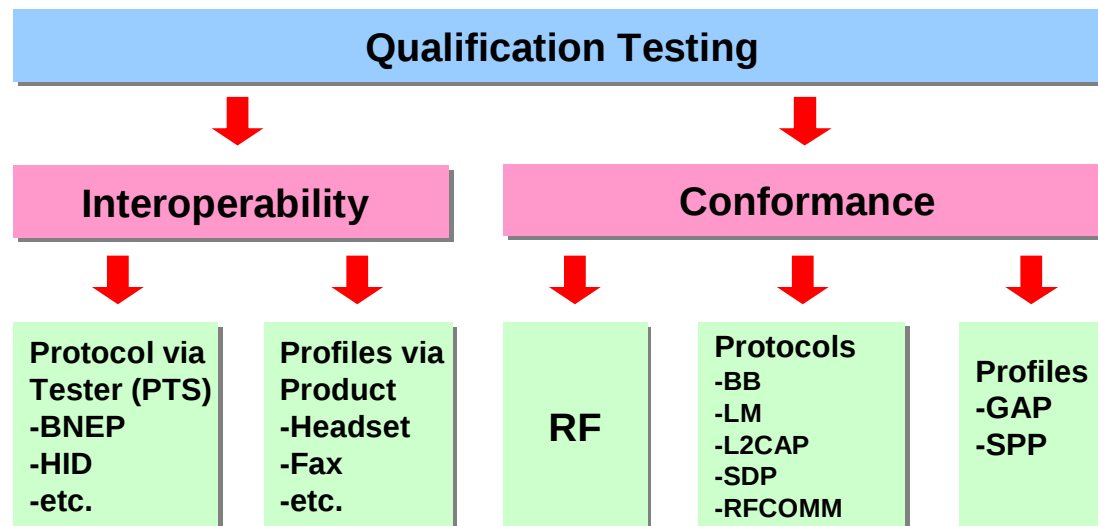


Bluetooth Organization



Bluetooth Qualification

- Bluetooth qualification involves:
 - RF conformance tests
 - Protocol conformance tests
 - Profile interoperability tests
 - Compliance declarations
 - Documentation review



Bluetooth RF Test Specification

Transmitter

- Output Power
- Power Density
- Power Control
- TX Output Spectrum-Frequency Range
- TX Output Spectrum-20dB Bandwidth
- TX Output Spectrum-Adjacent Channel Power
- Modulation Characteristics
- Initial Frequency Tolerance
- Carrier Frequency Drift

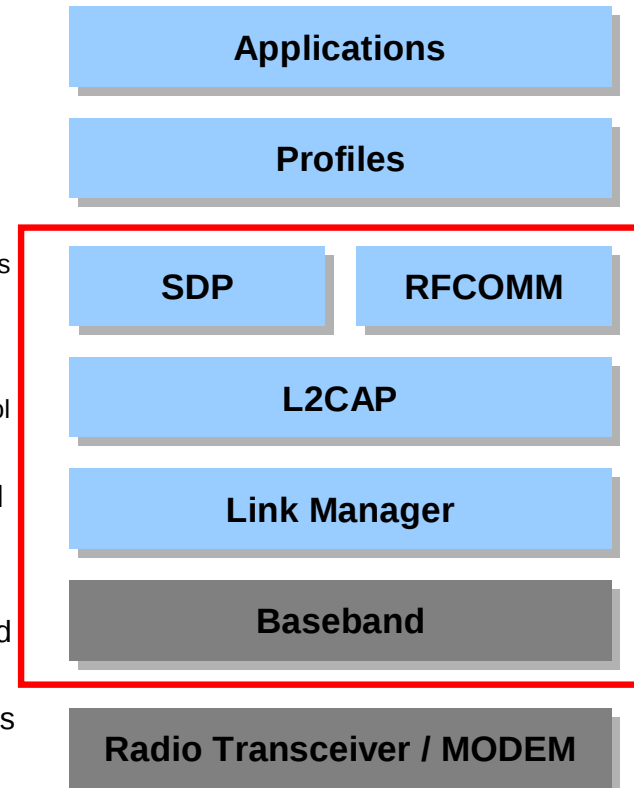
Receiver

- Sensitivity – Single-slot packets
- Sensitivity – Multi-slot packets
- C/I Performance
- Blocking Performance
- Intermodulation Performance
- Maximum Input Level

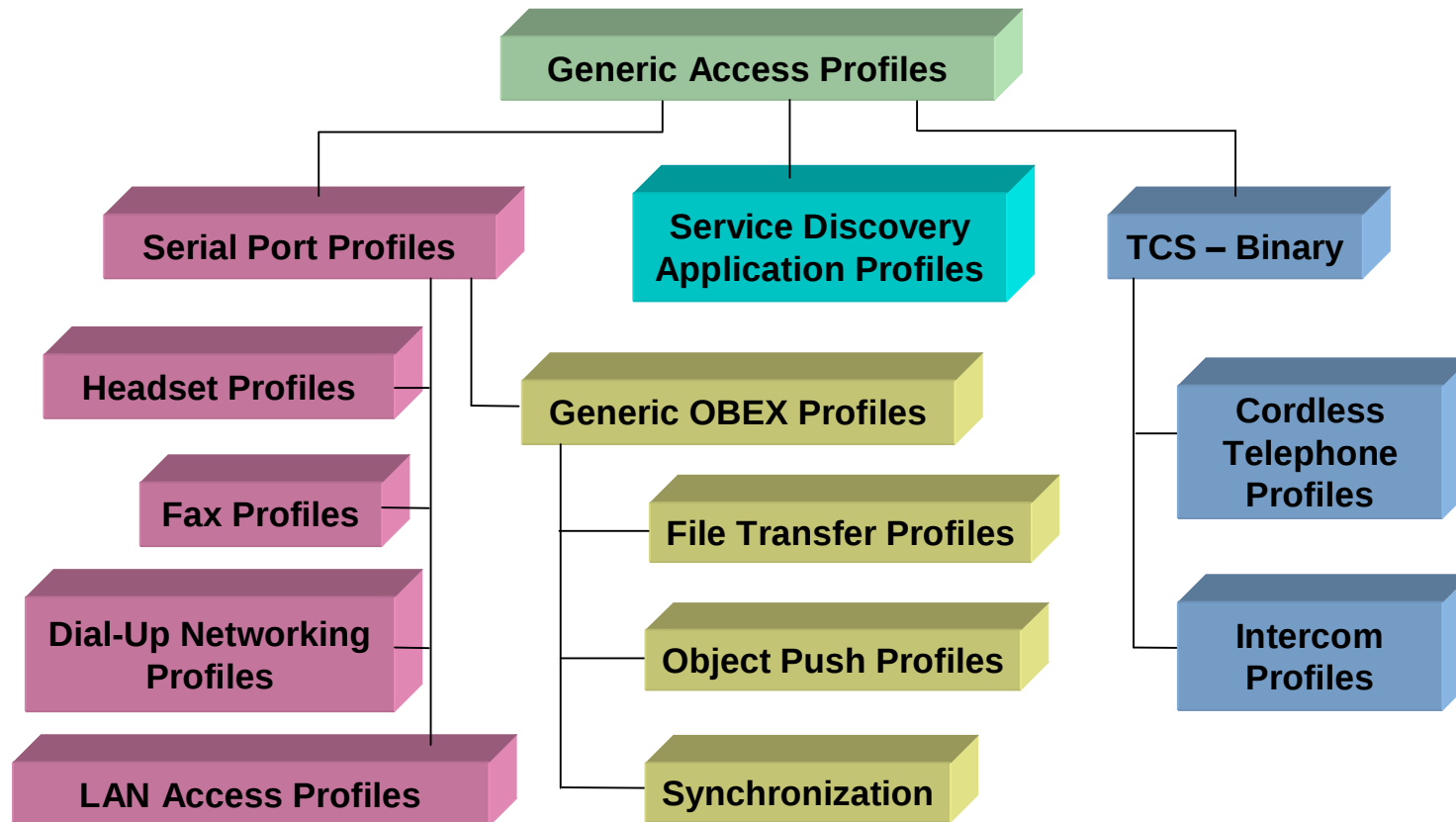


Bluetooth Protocol Test

- **Baseband**
 - Channel Coding and Decoding and low level timing control and management of the link within the same domain of a single data packet transfer
- **Link Controller**
 - Carrying out link level operations over several data packets durations in response to higher level commands from the Link Manager
- **LMP**
 - Link Manager Protocol is used by the Link Managers (on either side) for link set-up and control.
- **HCI**
 - Host Controller Interface provides a command interface to the Baseband Link Controller and Link Manager, and access to hardware status and control registers
- **L2CAP**
 - Logical Link Control and Adaptation Protocol supports higher level protocol multiplexing and packet segmentation and reassembly
- **RFCOMM**
 - Provides emulation of serial ports over the L2CAP protocol, based on the ETSI standard TS 07.10
- **SDP (Service Discovery Profile)**
 - Service Discovery Protocol provides a means for applications to discover which services are provided by or available through a Bluetooth device



Bluetooth Profile Tree



3 Classes of Bluetooth Changes

- Class 1
 - A software or hardware change that does not affect the compliance portion, and has no potential import on Bluetooth functionality or performance.
Ex. Updated product identification: housing or color change.
- Class 2
 - A software or hardware change that can be shown by inspection or by design analysis to have no negative material impact on Bluetooth functionality or performance.
Ex. Documentation showing no impact: component change.
- Class 3
 - A software or hardware change that may impact Bluetooth functionality, including: changes to protocol software; changes to active components which process the Bluetooth signal; and Bluetooth functionality enhancement.
Ex. BQB decides the amount of retesting: PCB change.

Bluetooth Test Labs

Test Lab	Tester	RF Conformance Testing	Protocol Conformance Testing	Profile Conformance Testing	EDR Test	Chip on PCB RF Test (US\$)
	Cetecom Bite & Sniffer	Yes	Yes	Yes	Yes	5000
	R&S TS8960	Yes	Yes	Yes	No	5000
	Agilent	Yes	Yes	Yes	No	4000

	BT Module	End Product (BT Module)	End Product (Chip on Board)
RF Test	USD\$10,000	USD\$0	USD\$10,000
Profile Review	USD\$0	USD\$400 per profile	USD\$400 per profile
BQB Review	USD\$1,500	USD\$1,500	USD\$1,500
Listing	USD\$5,000 (Associate member)	USD\$10,000 (Adoptive member)	USD\$10,000 (Adoptive member)
Total	USD\$16,500	USD\$13,100 (4 profiles)	USD\$23,100 (4 profiles)



MTK Bluetooth Solution: Total Performance



Bluetooth Measurements: Tx

Item	BT Spec.	BC03 ROM	Delta* CR222
Output Power			
Avg. Power	0 dBm +4 / -6 dB	0 dBm	0 dBm
Max. Power Level	0 dBm +4 / -6 dB	N/A	N/A
Output Power Control Step			
Class 2	Step size of 2 ~ 8 dB	Control range 35 dB	
Initial Frequency Accuracy	< ± 75 kHz	Max 30 kHz	-4 kHz
Frequency Drift			
1-slot packet	< ± 25 kHz	7 kHz	8 kHz
3-slot packet	< ± 40 kHz	8 kHz	8 kHz
5-slot packet	< ± 40 kHz	8 kHz	9 kHz
Drift Rate	< ± 20 kHz / 50 μ s	< ± 8 kHz / 50 μ s	< ± 8 kHz / 50 μ s
Frequency Deviation			
00001111 Sequence (df1avg)	140 kHz < df1avg < 175 kHz	165 kHz	166 kHz
01010101 Sequence (df2max)	df2max > 115 kHz	135 kHz	136 kHz
01010101 Sequence (df2avg/df1avg)	df2avg/df1avg > 0.8	0.9	0.87
Spurious Emissions (In-Band)			
20 dB Bandwidth	< 1 MHz	790 kHz	785 kHz
± 2 MHz	< -20 dBm	< -35 dBm	< -36 dBm
± 3 MHz	< -40 dBm	< -45 dBm	< -45 dBm
Spurious Emissions (Out-Band)			
.03 ~ 1 GHz	< -36 dBm	< -36 dBm	< -36 dBm
1 ~ 12.75 GHz	< -30 dBm	< -30 dBm 2f0:-55	< -30 dBm
1.8 ~ 1.9 GHz	< -47 dBm	< -47 dBm	< -47 dBm
5.15 ~ 5.3 GHz	< -47 dBm	< -47 dBm	< -47 dBm

Bluetooth Measurements: Rx

Item	BT Spec.	BC03 ROM 6.5x6.5mm ²	Delta CR222 9.1x7.9x1.6 mm ³
Reference Sensitivity Level (BER=0.1%)	-70 dBm	-82 dBm	-81dBm
Co-Ch Interference C/I_{con} (Ref=-60 dBm)	11 dB	7 dB	8 dB
Adj-Ch Interference			
C/I _{adj} (1MHz) (Ref=-60dBm)	0 dB	-4 dB	-4 dB
C/I _{adj} (2MHz) (Ref=-60dBm)	-30 dB	-38 dB	-36 dB
C/I _{adj} (≥ 3 MHz)(Ref=-67 dBm)	-40 dB	-45dB	-45dB
Image ratio (Ref=-67 dBm)	-9 dB	-22dB	-22dB
Image ±1MHz ratio (Ref=-67 dBm)	-20 dB	-23dB	-23dB
Intermodulation Char. (Ref=-64dBm)	-39 dBm	-30dBm	-30dBm
Blocking			
0.03 ~ 2 GHz	< -10 dBm	< -10 dBm	< -10 dBm
2.0 ~ 2.4 GHz	< -27 dBm	< -27 dBm	< -27 dBm
2.5 ~ 3.0 GHz	< -27 dBm	< -27 dBm	< -27 dBm
3.0 ~ 12.75 GHz	< -10 dBm	< -10 dBm	< -10 dBm
Maximum Usable Level (BER=0.1%)	> -20 dBm	-15 dBm	-15 dBm
Receiver Signal Strength Indicator			
RSSI Accuracy	±6 dBm	N/A	N/A

Bluetooth Profiles Test

Bluetooth Profile		Dopod	Nokia	Samsung	SE	MTK
		700	6230	D608	W800i	Top6637
1	SPP	V	V	V	V	V
2	DUN	V	V	V	V	V
3	OPP	V	V	V	V	V
4	FTP	V	V	V	V	V
5	HSP	V	V	V	V	V
6	HFP	V	V	V	V	V
7	A2DP			V		V
8	GAVDP			V		V
9	Synchronization				V	
10	HID				V	
11	PAN	V				
12						
13						



Bluetooth Audio Gateway Test

2. PC Tool: A. Sony Ericsson BT Headset HBH-65

B. MTK 6627 Reference phone

Test Profile: Audio Gateway OK.



Top6637

More than 18 m

Dopod 700

18 m

Sony Ericsson T630

18 m

Nokia 6230

18 m

Samsung D608

18 m

Sony Ericsson W800i

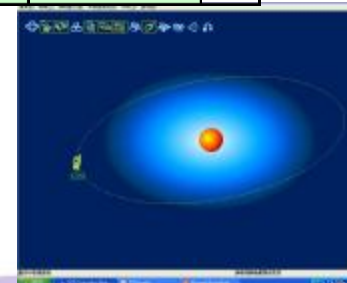
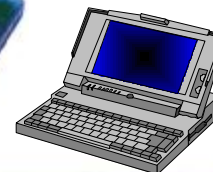
18 m

Bluetooth FTP Profile Test

Setup: A. IVT Corporation BlueSoleil software with BT dongle

B. MTK Top6637 mobile phone

BT dangle	Item	TOP6637	Samsung E758	Nokia 6230	SE W800i	
CSR	Connection-FTP Phone => PC dangle (Uplink)	44.14 	42.00	39.33	43.70	(kB)
CSR	Connection-FTP Phone <= PC dangle (Downlink)	35.17	36.35	24.86	41.60 	(kB)
RFMD	Connection-FTP Phone => PC dangle (Uplink)	51.50	45.54	68.67 	47.54	(kB)
RFMD	Connection-FTP Phone <= PC dangle (Downlink)	42.41 	43.26	41.20	43.26	(kB)
Broadcom	Connection-FTP Phone => PC dangle (Uplink)	51.50	45.06	61.80 	46.52	(kB)
Broadcom	Connection-FTP Phone <= PC dangle (Downlink)	42.41 	39.69	31.12	39.33	(kB)



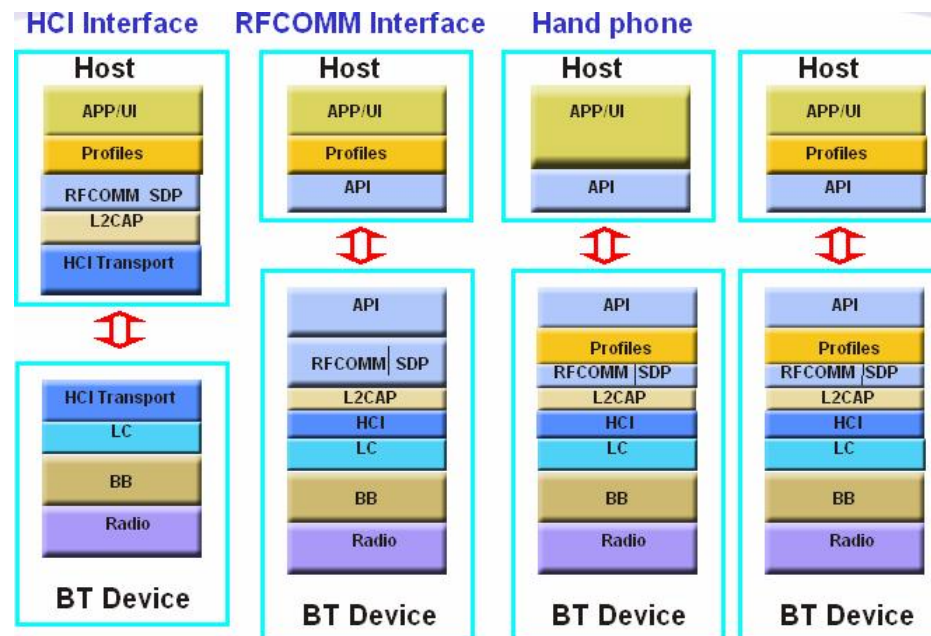
Summary

- MTK Bluetooth solution provides
 - Easy integration
 - 8 supported Bluetooth profiles
 - Low-cost stereo function
 - Good interoperability for BT devices
- MTK Bluetooth solution provides Tier One performance, comparable to Nokia, Samsung and Sony-Ericsson.

Q&A

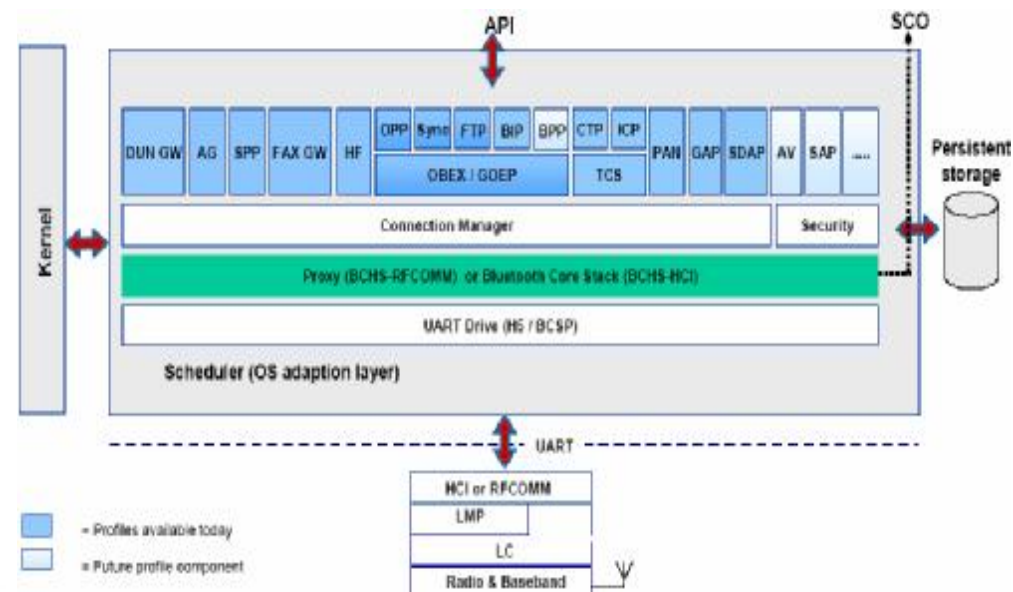
Q&A

- What is the difference between BC03ROM and a hand phone?
- Currently, MTK supports BC03 hand phones (FW:2.02) and BC03ROM HCI (FW:18.4). We suggest customers use the HCI solution for its more complete set of Bluetooth applications.



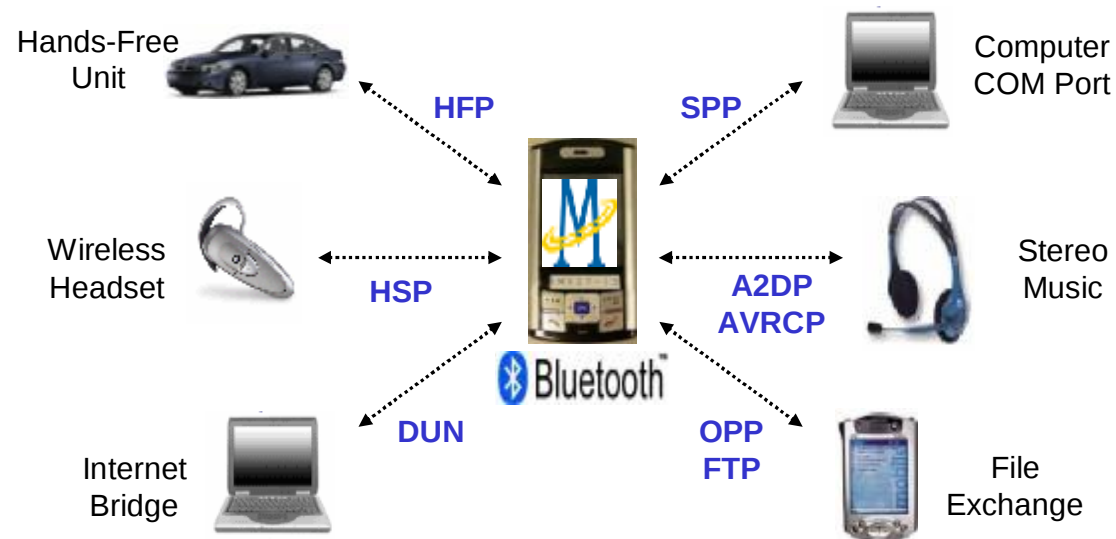
Q&A (cont'd)

- How is CSR BCHS SW licensed?
- When the Bluetooth functionality is required, please contact your software project manager.
 - The SWPM releases the BT object code to the customer.
 - MTK contacts CSR and informs them of the BT software user.
 - The customer pays only the chip price to CSR.



Q&A (cont'd)

- Does the MT6219 baseband chip support A2DP?
- No. Because of a lack of MIPS and DSP resources, only MT622X supports A2DP.
 - MT621X supports SPP, DUN, HFP, HSP, OPP, FTP.
 - MT622X supports SPP, DUN, HFP, HSP, OPP, FTP, A2DP, AVRCP.



Q&A (cont'd)

- Why does MTK suggest using the BT module (instead of COB)?
- Currently, MTK recommends the BT module for 3 reasons:
 - No need for calibration and testing
 - No need to qualify BQB RF portion
 - Faster BT MP time

	BT Module	End Product (BT Module)	End Product (Chip on Board)
RF Test	USD\$10,000	USD\$0	USD\$10,000
Profile Review	USD\$0	USD\$400 per profile	USD\$400 per profile
BQB Review	USD\$1,500	USD\$1,500	USD\$1,500
Listing	USD\$5,000 (Associate member)	USD\$10,000 (Adoptive member)	USD\$10,000 (Adoptive member)
Total	USD\$16,500	USD\$13,100 (4 profiles)	USD\$23,100 (4 profiles)



Q&A (cont'd)

- Other suggested BT modules?

2nd Source-CSR BC03 ROM (HCI)

CSR PN:BC313143A18 Firmware:18.4

With Crystal



Samsung

BGA Package

DFBM-CR222(FR4 Base)
(w/o EEPROM)
(9.1 × 7.9x1.5mm)
ES : now
MP : Q4/2005

MP

CSP Package

LBMA465EX3-TEMP
(w/ EEPROM)
(6.4 × 6.3x1.5mm)
ES : now
MP : Q4/2005

ES

DFBM-CS224(FR4 Base)
(w/o EEPROM)
(6.4 × 6x1.5mm)
ES : now
MP : Q4/2005

ES

FC01UAX
(w/o EEPROM)
(5 × 6x1.5mm)
ES : now
MP : Q4/2005

MP

BTVZ0502SA
(w/o EEPROM)
(6.4 × 6x1.5mm)
ES : now
MP : Q4/2005

MP

Q&A (cont'd)

- Other suggested BT modules?

2nd Source-CSR BC03 ROM (Handphone)

CSR PN:BC313143A13 Firmware:2.02 With Crystal

BGA Package

muRata

DELTA

DLBM-CH120 (LTCC base)
(w/o EEPROM)
(9.1 × 7.9x1.5mm)
ES : now
MP : now

MP

DFBM-CH120(FR4 Base)
(w/o EEPROM)
(9.1 × 7.9x1.5mm)
ES : now
MP : now

MP

CSP Package

LBCA465DJ9-TEMP
(w/o EEPROM)
(6.4 × 6.3x1.5mm)
ES : now
MP : Q4/2005

ES

DFBM-CS120(FR4 Base)
(w/o EEPROM)
(6.4 × 6.0x1.5mm)
ES : now
MP : Q4/2005

ES

射频和天线设计培训课程推荐

易迪拓培训(www.edatop.com)由数名来自于研发第一线的资深工程师发起成立,致力并专注于微波、射频、天线设计研发人才的培养;我们于 2006 年整合合并微波 EDA 网(www.mweda.com),现已发展成为国内最大的微波射频和天线设计人才培养基地,成功推出多套微波射频以及天线设计经典培训课程和 ADS、HFSS 等专业软件使用培训课程,广受客户好评;并先后与人民邮电出版社、电子工业出版社合作出版了多本专业图书,帮助数万名工程师提升了专业技术能力。客户遍布中兴通讯、研通高频、埃威航电、国人通信等多家国内知名公司,以及台湾工业技术研究院、永业科技、全一电子等多家台湾地区企业。

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射频工程师养成培训课程套装

该套装精选了射频专业基础培训课程、射频仿真设计培训课程和射频电路测量培训课程三个类别共 30 门视频培训课程和 3 本图书教材;旨在引领学员全面学习一个射频工程师需要熟悉、理解和掌握的专业知识和研发设计能力。通过套装的学习,能够让学员完全达到和胜任一个合格的射频工程师的要求...

课程网址: <http://www.edatop.com/peixun/rfe/110.html>

手机天线设计培训视频课程

该套课程全面讲授了当前手机天线相关设计技术,内容涵盖了早期的外置螺旋手机天线设计,最常用的几种手机内置天线类型——如 monopole 天线、PIFA 天线、Loop 天线和 FICA 天线的设计,以及当前高端智能手机中较常用的金属边框和全金属外壳手机天线的设计;通过该套课程的学习,可以帮助您快速、全面、系统地学习、了解和掌握各种类型的手机天线设计,以及天线及其匹配电路的设计和调试...

课程网址: <http://www.edatop.com/peixun/antenna/133.html>



WiFi 和蓝牙天线设计培训课程



该套课程是李明洋老师应邀给惠普 (HP) 公司工程师讲授的 3 天员工内训课程录像,课程内容是李明洋老师十多年工作经验积累和总结,主要讲解了 WiFi 天线设计、HFSS 天线设计软件的使用,匹配电路设计调试、矢量网络分析仪的使用操作、WiFi 射频电路和 PCB Layout 知识,以及 EMC 问题的分析解决思路等内容。对于正在从事射频设计和天线设计领域工作的您,绝对值得拥有和学习!...

课程网址: <http://www.edatop.com/peixun/antenna/134.html>

CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出,是最全面、系统、专业的 CST 微波工作室培训课程套装,所有课程都由经验丰富的专家授课,视频教学,可以帮助您从零开始,全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装,还可超值赠送 3 个月免费学习答疑...

课程网址: <http://www.edatop.com/peixun/cst/24.html>



HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程,是迄今国内最全面、最专业的 HFSS 培训教程套装,可以帮助您从零开始,全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装,更可超值赠送 3 个月免费学习答疑,随时解答您学习过程中遇到的棘手问题,让您的 HFSS 学习更加轻松顺畅...

课程网址: <http://www.edatop.com/peixun/hfss/11.html>

ADS 学习培训课程套装

该套装是迄今国内最全面、最权威的 ADS 培训教程,共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解,并多结合设计实例,由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS,迅速提升个人技术能力,把 ADS 真正应用到实际研发工作中去,成为 ADS 设计专家...

课程网址: <http://www.edatop.com/peixun/ads/13.html>



我们的课程优势:

- ※ 成立于 2004 年,10 多年丰富的行业经验,
- ※ 一直致力并专注于微波射频和天线设计工程师的培养,更了解该行业对人才的要求
- ※ 经验丰富的一线资深工程师讲授,结合实际工程案例,直观、实用、易学

联系我们:

- ※ 易迪拓培训官网: <http://www.edatop.com>
- ※ 微波 EDA 网: <http://www.mweda.com>
- ※ 官方淘宝店: <http://shop36920890.taobao.com>