[KW36, Hybrid]多个蓝牙 LE 连接+通用 FSK 演示应用程序

USL: https://community.nxp.com/docs/DOC-344510

文档目的

该文档通过描述一个与 GFSK (通用频移键控)进行并行通信的多低功耗蓝牙连接节点拓扑, 提供了一个混合应用程序 (Wireless_UART + GFSK Advertising)的示例。这是 SDK 之外的 另一个附加示例, SDK 中我们定义了一个混合应用程序, 演示了与 GFSK 并行通信的蓝牙 LE 广播和扫描。

读者

该文档的目的是为想要在低功耗蓝牙应用程序中使用、适配和集成 GFSK 功能的软件开发者提供指南。

搭建开发环境

工具链:

-IAR Embedded Workbench 8.32 或更高版本;

https://www.iar.com/iar-embedded-workbench/

SDK:

-此版本的固件已使用 SDK_2.2.1_FRDM-KW36 进行了测试,可以使用以下

链接下载: <u>http://mcuxpresso.nxp.com/en/select</u>

(请考虑选择 Toolchain/IDE: All toolchains);

NKP MCUXpresso	DK Builder						
SDK Dashboard	Select Development Board Search for your board or kit to get started.						
Select Board							
Q, Explore	Search by Name			Hardware Details			
	FRDM-KW36			Board	FRDM-KIV36		
ADMINISTRATION				Core Type / Max Freq	Cortex-MOP / 40MHz		
Notifications	Select a Device, Board, or Rit			Device Memory Size	512 KB Flash		
Preferences	· Boards 2				64 KB RAM		
	PHEMA KWOS			Actions			
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硬件:

-2到5 块 FRDM-KW36 开发板: <u>https://www.nxp.com/demoboard/FRDM-KW36</u>

操作流程:

此演示应用程序是针对 FRDM-KW36 平台设计的,可以轻松集成到使用 KW35/36 系列 MCU 的 任何电路板上。

该功能基于 SDK (移动无线系统-MWS 模块)上的共存机制。基于硬件链路层的实现,低功耗 蓝牙具有比 GFSK 协议更高的优先级,因此,GFSK 通信在低功耗蓝牙的空闲状态(非活动时段)内执行。

有关 MWS 模块的更多详细信息,请参阅 SDK 中的连接框架文档(Connectivity Framework Reference Manual.pdf)。

低功耗蓝牙同时支持 central 和 peripheral 两个角色。

KW36 SDK 的集成

 一下载的
 附件
 并解压

 到…\SDK_2.2.1_FRDM-KW36\boards\frdmkw36\wireless_examples\hybrid 文件夹:

SDK_2.2.1_FRDM-KW36_2019_07_19 > boards	> frdmkw36 > wirele	ess_examples > hy	/brid
Name	Date modified	Туре	Size
ble gfsk adv	9/2/2019 3:33 PM	File folder	
ble_w_uart_gfsk	9/3/2019 10:02 AM	File folder	

-打开 IAR 项目

(SDK_2.2.1_FRDM-KW36_2019_07_19\board\frdmkw36\wireless_examples\hybrid\ble_w_ uart_gfsk\freertos\iar\ble_w_uart_gfsk_freertos.eww)。

-该项目的组织方式如下:

Workspace	▼ # ×	fsl_os_abstraction_free_rtos.c app_preinclude.h genfsk_adv.h MWS.h gatt_uuid128.h app_config.c ble_genfsk_advertising.c ble_genfsk_advertising.h
Debug	~	App_Init()
Files	• •	Private type definitions Private type definitions Private memory declarations Private memory declarations Private functions prototypes Private functions Private functions
ble w ust ofsk freetor		/* Init Serial interface */
ue_w_uai_gisk_ireenus		×

Configuration is up-to-date.

功能

开关功能:

-该功能在 main. c 文件中的 BleApp_Handle Keys 函数中定义;

-FRDM-KW36:

-SW2-开始扫描- Central 设备;

-长按 SW2-开始扫描-peripheral 设备; (长按 SW2 指按住 SW2 键 3 秒钟以上) -SW3-启动/停止 GFSK TX 操作(扫描);

-长按 SW3-启动/停止 GFSK RX 操作(长按 SW3 指按住 SW3 键 3 秒钟以上)

日志:

-串口输出电路板的不同状态;

-波特率 115200;

验证

该解决方案已使用1个主设备和4个从设备进行了验证,如下所示:

1. 创建网络

a. 打开所有设备的串行通讯。重置后,您将看到以下消息:

P COM111 - PuTTY	_	\times
		^
Hybrid Wireless Uart - GFSK Adv demo		

b. 在 Central 设备上, 按 SW2 开始扫描;

c. 在 peripheral 设备上,长按 SW2 开始广播并等待串口上的确认;

B COM111 - PuTTY	-	\times	P COM102 - PuTTY
Hybrid Wireless Uart - GFSK Adv demo		^	Hybrid Wireless Uart - GFSK Adv demo
BLE: Scanning Connected to device 0 as master.			BLE: Advertising Connected to device 0 as slave.

d. 在所有从设备上重复步骤 b 和 c。

e. 当 Central 设备的网络成功创建时,您将看到以下内容:



f.检查空中链路(连接间隔=312.5ms):



2. 验证低功耗蓝牙的功能:

-从每个从设备(peripheral)的串口写入一条消息(例如: testslaveX)并检查该消息是否 打印在主设备的串口上。

-在主设备(Central)的串口终端上进行相同的测试。

COM111 - PuTTY	- 🗆 X	COM102 - PuTTY	-	α ×	P COMIDI - PUTTY	- 0
Hybrid Wireless Uart - GFSK Adv demo		Nybrid Wireless Uart - GFSK	Adv demo		Hybrid Wireless Uart - GTSK Adv demo	
BLE: Scanning Connected to device 0 as master.		BLE: Advertising Connected to device 0 as sla			BLE: Advertising Connected to device 0 as slave.	
BLE: Scanning Connected to device 1 as master.		BLE:SOO-M]: testmaster[]			BLE:S00-M]: testmaster[]	
BLE: Scanning Connected to device 2 as master.						
BLE: Scanning Connected to device 3 as master,						
BLE:[00-M]: testslavel BLE:[01-M]: testslave2 BLE:[03-M]: testslave3 BLE:[03-M]: testslave4]						
		× .				
COM72 - PUTTY		- 🗆 ×	COMI10 - PuTTY		- D ×	
Nybrid Wireless Vart	- GFSK Adv demo		Dybrid Wireless Dart - GFSK Adv demo			
BLE: Advertising Connected to device 0		1	LE: Advertising Connected to device 0 as slave.			
BLE:S00-M}: testmaste		1				

-以下是该步骤的示例:



fune 20.139 Londo @ LEBS @ LEBS1 @ LEDS1A LLDD four	Unfilterer LE BB	I Info Errori LE PKT LE ADV		Find:	ATT	≤ ,,,,,,,,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,	Summa	y: ATT		LE BB wi	th Auto-traverse
- NESH 0	R Fiam	all Role	Oncode	Harde	LILIO	Database	Direction	Enorcode	Fiam	Delta	Timestano
- SN. 0	10.00	t fina	Judda Command	14	University 10.05 (0.01/01)	04202-04040	Hard		40	000000	0/2/2010 10 12 22 2000
- S70+NE 570 0	10.00	1 Sigve	whe consorts		University to the foreign	04202000(4)	Here		40	00.00.00.0	9/3/2019 10 12 32 / 3060
MD: 0	10.00	2 Claure	Initia Command	14	University 10,000 [000101]	04002-0404	Here		40	00.00.00.0	9/2/2019 10 12 22 00211
- FMT: No Supplemental	10.0	t Claus	Julite Command	14	Unknown ULED ID-01011	0420240450	Mart		46	00:00:00.6	9/3/2019 10 12 23 69759
- Payload Length 8	10.0	Citure	Inline Commond	1.4	University (ULIO ID-0101)	200-0195M	Mart		45	00.00.02.2	9/2/2019 10 12 25 09500
E-LICAP	19.9	it Slave	White Command	14	Unknown ULID (Dv0101)	490-9195M	Mars		46	0000000	9/3/2019 10 12 35 89560
- PUULERIGN 8	19.94	t Claum	Julia Command	14	Universe ULIO ID-01013	490-9195M	Mart		46	00:00:00:2	9/2/2019 10 12 26 20268
- Charver D. Social (Instant Protects)	10.00	22 Claure	Initia Command	14	University 10.00 (0.0101)	490-9196M	Mart		40	00.00.00.0	9/2/2019 10 12 26 20010
Data Martin	20.0	K Siwe	White Command	14	Unknown ULUD ID-01011	490-9195M	Mars		46	00.00.01.5	9/3/2019 10 12:37 72007
Construction Descert Ro	20.00	12 Claure	Links Command	14	Unknown ULIO (0-0101)	-490-9195M	Mart		46	00.00.00.2	9/2/2019 10 12:20 09257
-PDU two or Demond Ven	20.0	IK Slave	White Command	14	Unknown UEED ID-01011	490-9195M	Mers		46	00.00.00.0	9/3/2019 10 12 38 08309
Opcoder Wate Contrained	20.0	S Slave	Lable Command	14	Unknown ULUD (0x0101)	-190-9195MI	Mars		46	00.00.00.3	9/3/2019 10 12 39 29507
- "Cetabase: 84252 a8d51	20.0	7 Slave	Write Command	14	Unknown URID (0x0101)	(90-9195M)	Merts		46	00.00.00.0	9/3/2019 10 12 38 29558
- Attibute Handler 14	20.0	E Claue	Write Command	14	Uningen ULIO ID-0101	(90-9195M)	Mert		46	00.00.00.6	9/3/2019 10 12 29 02007
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	20.13	1 Master	White Command	14	Unicoun ULED ID-0101	04707+0451	Mark		46	00:00:00.0	9/2/2019 10 12 42 12404
	20.1	23 Master	Wite Command	14	Lisknown ULUD (0x0101)	8426248451	Acch		46	00.00.00.0	9/3/2019 10 12 42 12537
	20.5	Master	Wite Command	14	Link rown 10.00 (0x0101)	(20210-0195/5)	Mars		46	00.00.00.0	9/3/2019 10 12 42 14494
	20.12	77 Martin	Write Commond	14	Usknown ULUD ID401011	/90-9195/51	Moos		46	00:00:00:0	9/3/2019 10 12 42 145%

3. 启动 GFSK 通讯:

-在其中的一块开发板上按 SW3 开始 GFSK TX 操作(AdvAddress = 0909090909 的广播数据 包); 每隔 1 秒钟(gGenFskApp_Txlnterval_c)在空中发送一个 ADV 数据包。

-选择另一块开发板并长按 SW3 以启动 GFSK RX 操作(RX 间隔 = 100ms = gGenFskApp_Rxlnterval_c)

-收到来自地址 = 0909090909 的 ADV 数据包时, 它将在串口上打印出来, 如下所示:



-空中 GFSK TX 数据包被列为 ADV_NONCONN_IND:

- June 2001 (and) (150) - 0°E1 - 0	ାର୍ଲ ଭ୍	Summ	nary: 🔝	ADV	LE BB with Auto-traverse
Meets Predefined Filer Otens for 81 low energy devices: Yes 8 Formell Data Time Add InduliGrand Add -	646	Len	Fram	Delta	Timestano
Receive Status Received without entrs 27 Afric Annumental Jun (white)	0.00000000000	27	76	00.00.00.050926	9/2/2019 10 15 01 7/760
Deciption Initiated No 20.000 27 2	0.09090909090909	37	2	00.00.00.000026	9/3/2019 10 15 01 / 4/50.
- PHY Type: TM 23,52.3 37 AVY_NUNCURN_IND (0.06)	0x090909090909	3/	10	00.00.00.930400	9/3/2019 10.15/02/6//90
- Presible Duss	08090909090909	3/	10	00.00.00.018775	3/3/2013 10 15 02 65667
- Access Addess: Oxfel/BedG	06090909090909	34	0	00.00.00.050500	3/3/2013 10 15:02 /4/60
-RSSI: 43.000 dBn (nedum) (906)	05090909090909	30	3	00 00 00 300405	9/3/2019 10 15 03 6/901
PDU Length: 33 23:557 37 ADV_NONCUNN_IND [pdg]	0.090909090909	31	12	00 00 00 018765	9/3/2019 10 15:00 69677
E LE PKT 23960 37 ADV, NORCON, IND (56)	0.090909090909	34	10	00.00.00.050941	9/3/2019 10 15:03 /4//1
Preattile Ova 23(85) 37 ADV, NORCON, IND [pdb]	0x090909090909	31	75	00.00.00.330333	9/3/2019 10 15:04.67811
Access Addes:: Doletithed6 23386 37 ADV_NONCONV_IND [pub]	0x090909090909	37	75	00.00.00.018767	9/3/2019 10.15.04.69687
ERC 0/dba57a 23/987 37 ADV_NONCONN_IND (pxb)	0x090909090909	37	75	00.00.00.050947	9/3/2019 10.15/04.74782
B LE ADV. 24,012 37 ADV_NONCONN_IND (pxb)	0x090909090909	37	75	00.00.00.930397	9/3/2019 10.15.05.67822
-Channel Selecton 82 Not Supported 24,013 327 ADV_NONCONN_IND [pub]	0x090909090909	37	75	00.00.00.018757	9/3/2019 10 15:05:69697
-PEU Type ADV_NONCONN_IND (pub)	0x090909090909	37	75	00:00:00:050941	9/3/2019 10:15:05:74791
-Advettise Address Type public (public 24.039 37 ADV_NONCONN_IND (public)	0x090909090909	37	75	00.00.00.930412	9/3/2019 10 15:06 67833
Pawad Length 37 24.040 37 ADV_NONCONN_IND (px8)	0x090909090909	37	75	00.00.00.018737	9/3/2019 10 15:06:69706
24,041 37 ADV_NONCONV_IND (pub)	0x09090909090909	37	75	00.00.00.050957	9/3/2019 10:15:06 74802
E AD UNA 24,065 37 ADV, NONCONN, IND [p.k]	0x090909090909	37	75	00.00.00.930418	9/3/2019 10 15:07:67844
24.067 37 ADV_NONCONN_IND [pub]	0x090909090909	37	75	00 00 00 018726	9/3/2019 10 15 07 69716
24,072 37 ADV, NONCONN, IND [p.d]	0.090909090909	37	75	00.00.00.050963	9/3/2019 10 15:07 74812
24.097 37 ADV NONCONN IND (publ.)	0x090909090909	37	75	00:00:00 930421	9/3/2019 10 15 08 67855
24100 37 ADV NONCONN IND (948)	0x0909090909090	37	75	00:00:00:018718	9/3/2019 10 15 OR 69726
24 100 27 ADV NONCONN IND	0x09090909090909	37	75	00:00:00 050967	9/3/2019 10 15 08 74823
24.128 37 ADV NONCTON IND (ref)	0x09090909090909	37	75	00.00.00 \$30418	9/3/2019 10 15 09 52955
1 mode 27 24 129 27 ADV NONCTIAN IND (mail	0,09090909090909	37	25	00:00:00:018219	9/3/2019 10 15 09 69727
40 Tone Manufacture Search: 24.130 37 ADV MDN/TAN UID (INN)	0,09090909090909	37	75	00.00.00.050969	9/3/2019 10 15 09 74834
24.195 37 ADV NDN/TON IND	0,09090909090909	37	- 75	00.00.00.930420	9/3/2019 10 15 10 52825
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24,100 % MAL MORE THE BASIS	0,09090909090909		- ALC		SZ SZ ALTS THE TS THE SS ZES
- Additional Data: Sector 03 00 00 00 00 00 00 00 00 00 00 00 00	0x090909090909	30	705	00.00.00.050967	9/3/2019 10 15 10 65/46

4. 验证 GFSK 和 Bluetooth LE 并行能力:

-在主设备(Central)串口上写一条消息,并检查从设备(peripheral)串行终端上的反馈:

COM111 - PuTTY	COM72 - PuTTY	B COM110 - PuTTY
	GF5K: 09090925028E89BED6	
Hybrid Wireless Uart - GFSK Adv demo	GFSK: 09090925028E89BED6	Hybrid Wireless Uart - GFSK Adv demo
BLE: Scanning Connected to device 0 as master.	GFSK: 09090925028889BED6 master2testmaster2 GFSK: 09090925028E89BED6	BLE: Advertising Connected to device 0 as slave.
BLE: Scanning Connected to device 1 as master.	GFSK: 09090925028E89BED6	BLE:S00-M]: testmaster GFSK: Start TX <mark>testmaster2testmaster2]</mark>
BLE: Scanning Connected to device 2 as master.	GFSK: 09090925028E89BED6	
BLE: Scanning Connected to device 3 as master.	GFSK: 09090925028E89BED6	
BLE:[00-M]: testslavel BLE:[01-M]: testslave2 BIF:[02-M]: restslave2	GFSK: 09090925028E89BED6	
BLE:[03-M]: testslave4]	GFSK: 09090925028E89BED6 GFSK: 09090925028E89BED6	

附上此应用程序的源代码。 真挚的问候 Ovidiu

附件

BLE+GFSK_Demo_application.zip(<u>https://community.nxp.com/pwmxy87654/attachments/</u>pwmxy87654/wireless-connectivity%40tkb/253/1/BLE+GFSK_Demo_application.zip)