

Objective: Validate and Calibrate Bluetooth-Low Energy Transceiver

(1. Project Overview and Goals)

- Bluetooth Low Energy (BLE)
 - Hops among 40 2-MHz channels
 - Gaussian Frequency Shift (GFSK) Modulation
 - 1Mbps bit rate
 - Applications in smart homes, wearables etc.
- Test** Bluetooth-LE v4.2 in 2.4GHz band in presence of in-band adjacent/alternate channel interference under variable settings

Modulation	Bit Rate	Clock Frequency
GFSK	250kbps	32MHz
BLE	500kbps	26MHz
MSK	1Mbps	

- Optimize** transceiver driver settings to meet performance targets

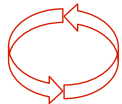
Target Ratio Measure	Condition
BLE Packet Error Rate <30.8%	Various operational settings
NXP Carrier to interference Ratio <-50dB	At interferer frequency offsets >= 3MHz

(2.Procedure)



Build Hardware Measurement Setups:

- Replicate GFSK and MSK sensitivity setup
- Develop BLE and GFSK selectivity setup



Collect Received Packet Statistics:

- Collect #good, #bad, #missing packets
- Modify and add calibration functions



Interpret and Visualize Data:

- Iterate/generate PER plots
- Cross check with teams in France

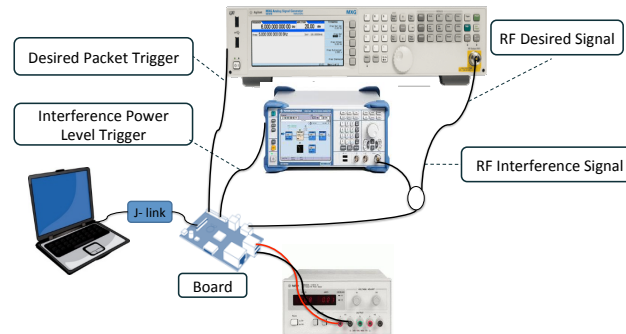


Conclusions



(3. Selectivity Setup and Measurements)

- Desired signal along with interference signal which varies in frequency offsets/power



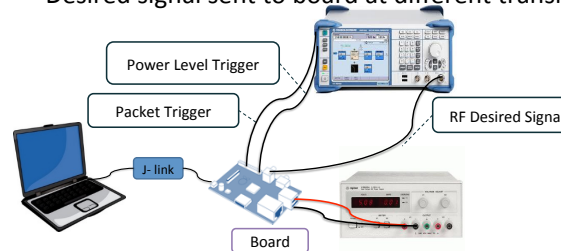
Threshold	Board A	Board B	Board C	Board D
AGC Trial Setting 1	-29	-30	-45	-29
AGC Trial Setting 2	-29	-34	-46	-39
AGC Trial Setting 3	-49	-54	-46	-29
AGC Trial Setting 4	-52	-55	-47	-43

DC Calibration DC Profiling and Optimization

Threshold	Board A	Board B	Board C	Board D
AGC Trial Setting 1	-53	-52	-50	-51
AGC Trial Setting 2	-52	-52	-48	-51
AGC Trial Setting 3	-50	-54	-50	-51
AGC Trial Setting 4	-52	-55	-47	-51

(4. Sensitivity Setup and Measurements)

- Desired signal sent to board at different transmission power level to verify C/I Ratio



- Sending 1500 BLE packets
- Operating at different settings
- Sweeping TX power 100dBm till 10dB

(5. Sensitivity and Selectivity)

Applications: smart energy home area networks security systems

Data Rate (kbps)	Sensitivity level (dBm)
1000	-94
500	-98
250	-99

Interferer freq. offset (MHz)	C/I Ratio (dB)	Interference power where PER>30.8% (dB)
-3	-54	-13.5
-2	-47	-19.5
3	-47	-19.5
2	-55	-11.5