Application Note

Determination of TDA5240 and TDA5235 Signal and Noise Detector Thresholds

Version 1.2
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Procedure for determination of Thresholds for ASK

Use this test application in the way as it is used in the real application
Do not apply any RF signal to the application (Info: In a noisy lab environment an EMC chamber can be used for excluding unintentional RF signals)
Configure the receiver chip with the intended setting
Set the receiver chip into Run Mode Slave

Select the "**Signal Detector only**" mode in x_NDCONFIG register
Readout the **SPWR** register 200 times and calculate average (AVG) and standard deviation (SDEV)
Calculate SIGDET = AVG + 2 * SDEV (default)
Note: For better FAR (False Alarm Rate) performance use: SIGDET = AVG + x * SDEV, where x = (2,3]
Note: For slightly high sensitivity use: SIGDET = AVG + x * SDEV, where x = [1,2), may result in increased FAR
Put the calculated SIGDET value in the registers x_SIGDET0 (RMS) and/or x_SIGDET1 (SPM)
Save configuration with these SIGDET values
Download this configuration file to the receiver chip
Enjoy receiving !!!

Procedure for determination of Thresholds for FSK

Use this test application in the way as it is used in the real application
Do not apply any RF signal to the application (Info: In a noisy lab environment an EMC chamber can be used for excluding unintentional RF signals)
Configure the receiver chip with the intended setting
Set the receiver chip into Run Mode Slave

Select the "**Signal Detector and Noise Detector simultaneously**" mode in x_NDCONFIG register
Readout the **SPWR** register 200 times and calculate average (AVG) and standard deviation (SDEV)
Calculate SIGDET = AVG + 2 * SDEV (default)
Note: For better FAR (False Alarm Rate) performance use: SIGDET = AVG + x * SDEV, where x = (2,3]
Note: For slightly high sensitivity use: SIGDET = AVG + x * SDEV, where x = [1,2), may result in increased FAR
Put the calculated SIGDET value in the registers x_SIGDET0 (RMS) and/or x_SIGDET1 (SPM)
Save configuration with these SIGDET values
Readout the **NPWR** register 200 times and calculate average (N_AVG) and standard deviation (N_SDEV)
Calculate NDTHRES = N_AVG - 2 * N_SDEV (default)
Note: For slightly higher sensitivity use: NDTHRES = N_AVG - x * N_SDEV, where x = [1,2), may result in increased FAR
Note: For large FSK deviation (e.g. above +/-40kHz) do not subtract 2*N_SDEV from the N_AVG of the NPWR AVG rather subtract only 1*N_SDEV
Put the calculated NDTHRES value in the registers x_NDTHRES
Save configuration with the SIGDET and NDTHRES values
Select the "**Signal Detector and Noise Detector simultaneously + SIGDETLO**" mode in x_NDCONFIG register
Set SFR bit x_SIGDETCFG.SDLORE to 1b (Source of SPWR readout = SIGDETLO (for minimal usable FSK deviation))
Set SFR bit group x_SIGDETSEL.SDLORSEL to 00b (SIGDETLO range selection factor = 2).
Apply FSK modulated RF signal with PRBS9 pattern (or 01 chip sequence), desired data rate + minimum FSK deviation at RF power level of desired sensitivity + 20dB.
Do 500 readouts of SFR **SPWR**.
Calculate average. If > 200dec (=0xC8), SIGDETSEL.SDLORSEL has to be increased to the next larger value.
Do another 500 readouts and calculate average, and if necessary further increase SIGDETSEL.SDLORSEL, till average < 200dec.
Calculate average and standard deviation
Threshold = (average – 3 * standard deviation) * 0.8
Use calculated threshold for SFR x_SIGDETLO
Reset SFR bit x_SIGDETCFG.SDLORE to 0b (Source of SPWR readout = SIGDET0/1)
Keep setting SFR bit group x_SIGDETSEL.SDLORSEL as used for this measurement.
Take care, that SFR bit group NDCONFIG.NDSEL remains set to 11b (SIGDET + NoiseDet + SIGDETLO).
Include all calculated values in your config file
Save configuration with the SIGDET, NDTHRES and SIGDETLO related values
Download this configuration file to the receiver chip
Enjoy receiving !!!

Note: Even a CW interferer has a slight frequency deviation, which can be interpreted as data (e.g. wake-up data) without usage of SIGDETLO.
So the threshold SIGDETLO for the minimum usable FSK deviation is introduced to eliminate this interpretation of wrong data.

Selection of Signal Recognition for an application using an ASK wake-up and FSK payload frame

Such ASK/FSK application can be handled using Self Polling Mode and selecting “Signal Recognition” mode “Signal and noise detection simultaneously + SIGDETLO”.
“Signal Detector Threshold – Wakeup Level” needs to be used for ASK.
“Signal Detector Threshold – RunMode Level” needs to be used for FSK together with “Noise Detector” and “SIGDETLO”.
Please note to select the corresponding modulation type for the threshold determination
(e.g. using Wizard page 1 + 5 and Explore page – Power Readout Statistic on TDA5240 Explorer Family).