NORBIT

Technical Note

Cansat TX

TN-090013

Revision	1					
Date	2009-03-13					
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Approved by						

1. Introduction

This note contains some ideas for implementation of a telemetry transmitter in the 860MHz band for low data rates up to 10km distance.

2. Transmission budgets

Transmission loss calculated from the free space loss equation (860MHz, 10km):

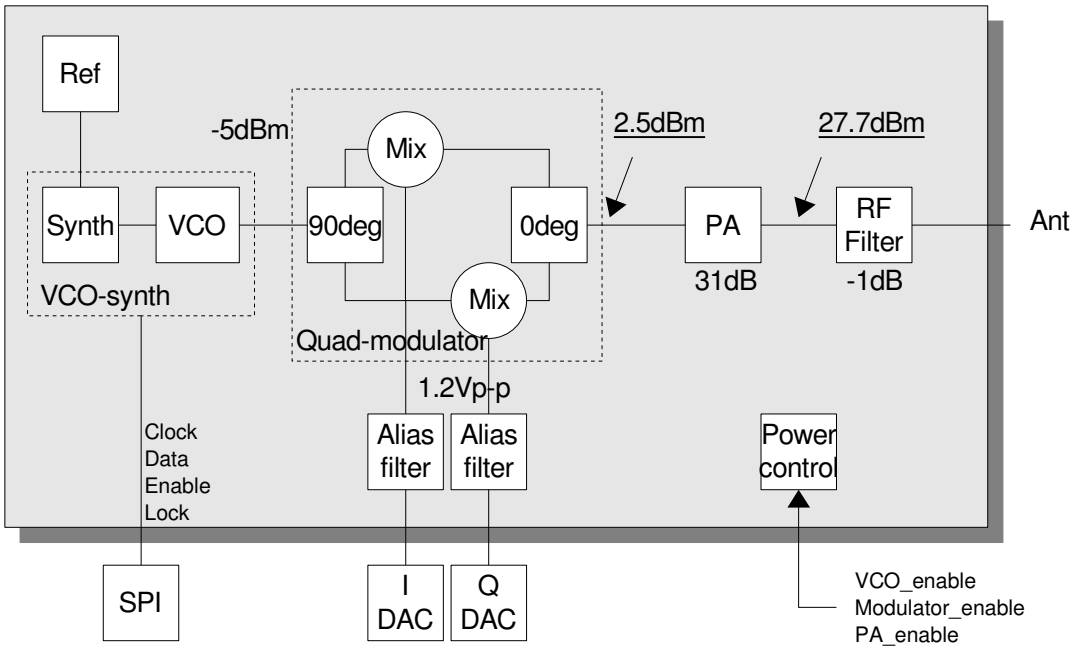
$$A = 20 \times \log\left(\frac{L}{4 \times \pi \times d}\right) = 20 \times \log\left(\frac{0.349\text{m}}{4 \times \pi \times 10000\text{m}}\right) = -111.1\text{dB}$$

and the thermal noise:

$$P = k \times t \times b = 1.38 \times 10^{(-23)} \times 300 = -173.8\text{dBm}/Hz$$

	dB	dBm	Comments
TX power		27	0.5W
TX antenna gain	0	27	
Free space loss	-111.1	-84.1	10km, 860MHz
RX antenna gain	0	-84.1	
	RX signal level	-84.1	Signal power at RX
Thermal noise		-173.8	ktb
RX bandwidth	37	-136.8	5kHz
RX noise figure	5	-121.8	Noise power at RX
Signal to noise	10	-126.8	Depends on BER
	RX sensitivity	-121.8	
	Link margin	37.7	

3. Block diagram



Legend:
Nom : ..dBm
Gain : ..dB
P-1 : ..dBm

4. Specifications

Frequency	: 860MHz band, programmable	
Accuracy	: +/-2ppm	
Transmit power	: 27dBm	0.5W
Power supply	: 3V, 85mA	
	: 5V, 240mA	
Modulation	: FM, PSK, AM	
Bandwidth	: DC .. 4kHz	narrow
	: DC .. 100kHz	wide-band
Programming	: 3-wire serial	

5. Components

Reference oscillator:
KQT, NOCVTS5-3-13.000M-TR
VCTCXO, 13MHz, +/-2ppm, -25-70deg. C
2.7 .. 3.3V, 2mA
Clipped sine, 0.7Vp-p

Synth & VCO:
Analog Devices, ADF4360-7
2 x -5dBm/50ohm outputs
350 .. 1800MHz
3 .. 3.6V, 40mA

Quad modulator:
Analog Devices, AD8345
140 .. 1000MHz
P-1: 2.5dBm
2.7 .. 5.5V, 65mA
LO: -10 .. 0dBm
I/Q: 1.2Vp-p differential high impedance

PA:
Avago, AV02-173EN
700 .. 1100MHz
Gain: 31dB
P-1: 27.7dBm
5V, 240mA

90deg. hybrid for the PA (2 of):
Minicircuits, QCN-12AD
800 .. 1250MHz, 50ohm, 0.4dB, 15W, 90deg

RF filter:
Minicircuits, LFCN-900
Pass: DC .. 850MHz
f-3dB: 1075MHz
f-20dB: 1275MHz
f-30dB: 1350 .. 4850MHz

Anti-alias filter (2 of):
Analog Devices, ADA4941-1
2.7-12V, 2.4mA

Test connector:
Murata, MM8430-2610B
50ohm, SP2T

Opt Quad modulator:
Linear Technology, LT5571
0.62 .. 1.1GHz
LO: -10 .. +5dBm
P-1 out : 0dBm
I/Q : 1Vp-p
5V, 100mA

Opt modulator (passive, requires 10dBm LO power):
Minicircuits SYIQ-895M+

868 .. 895MHz
LO: 10dBm
P-1: 1dBm

Opt driver:
Analog Devices, ADL5541
15dB
6GHz
P-1: 19.7dBm
5V, 90mA

Opt PA:
Analog Devices, ADL5322
700 .. 1000MHz
Gain: 20dB
P-1: 27dBm
5V, 320mA

Opt Anti-alias filter (2 of):
Analog Devices, AD8132
2.7 .. 5.5V, 10mA
