Model: DCT4960 Cordless Phone
Technical Specification

Specifications
Circuit Diagrams
Technical Description

Ver. 1.1

TABLE OF CONTENTS

I. Introduction

The DCT4960 Cordless Telephone is a frequency hopped spread spectrum transmitter to be compliance with US (FCC Part 15.247) and Canadian (RSS-210) regulations for license free use in the 2400-2483.5MHz ISM band.

The DCT4960 Cordless Telephone operates in the ISM (Industrial Scientific and Medical) band (2400 ~ 2483.5 MHz). The 20dB bandwidth of the hopping channels used in DCT4960 is less than 1MHz. And the number of hopping channels used in DCT4960 is 75. It complies with FCC part 15.247(a)(1)(ii). The DCT4960 is a frequency hopper, it uses the full available frequencies in the ISM band for operation and can make it difficult for other 2400MHz devices to operate correctly.

The 20dB bandwidth of the hopping channels is about 670 KHz and any two consecutive channels are separated by a bandwidth greater than 670 KHz. It complies with FCC part 15.247(a)(1).

The maximum power used in DCT4960 base station and handset are 11.0 mW and 7.08 mW respectively. It complies with FCC part 15.247(b)(2).

Each DCT4960 base station supports up to four handsets and uses Time Division Duplex to distinguish the four handsets.

II. Specifications

Operating Frequency Range:	2400 ~ 2483.5 MHz
Number of Used Channels:	75
RF Output Power:	7.08mW (Handset) / 11.0mW (Base)
Range:	90m/600m (In Door/Out Door)
Type of Spread Spectrum:	Frequency Hopped Spread Spectrum
Bandwidth of Channel:	≤ 1MHz (It is 670 KHz.)
Channel Separation:	≥ 670KHz (It is 863 KHz.)
Duplexing:	Time Division Duplex
Power Supply:	3.6 VDC (Handset) / 120VAC Adapter (Base)

III. Technical Description

1. General

The DCT4960 Cordless Telephone is a frequency hopped spread spectrum transmitter to be compliance with US (FCC Part 15.247) and Canadian (RSS-210) regulations for license free use in the 2400-2483.5MHz ISM band. The DCT4960 is a multiple-handset, single-base cordless telephone system, which provides a full-integrated mobility solution for your business. The DCT4960 handset allows you to freely move around your working space while on a call, and still maintain access to all your telephone system features.

The DCT4960 telephone uses advanced digital frequency hopping spread spectrum (FHSS) technology to provide a quality audio path over a 2400MHz radio link. Establishing a call over a radio link is comparable to a wire line communication.

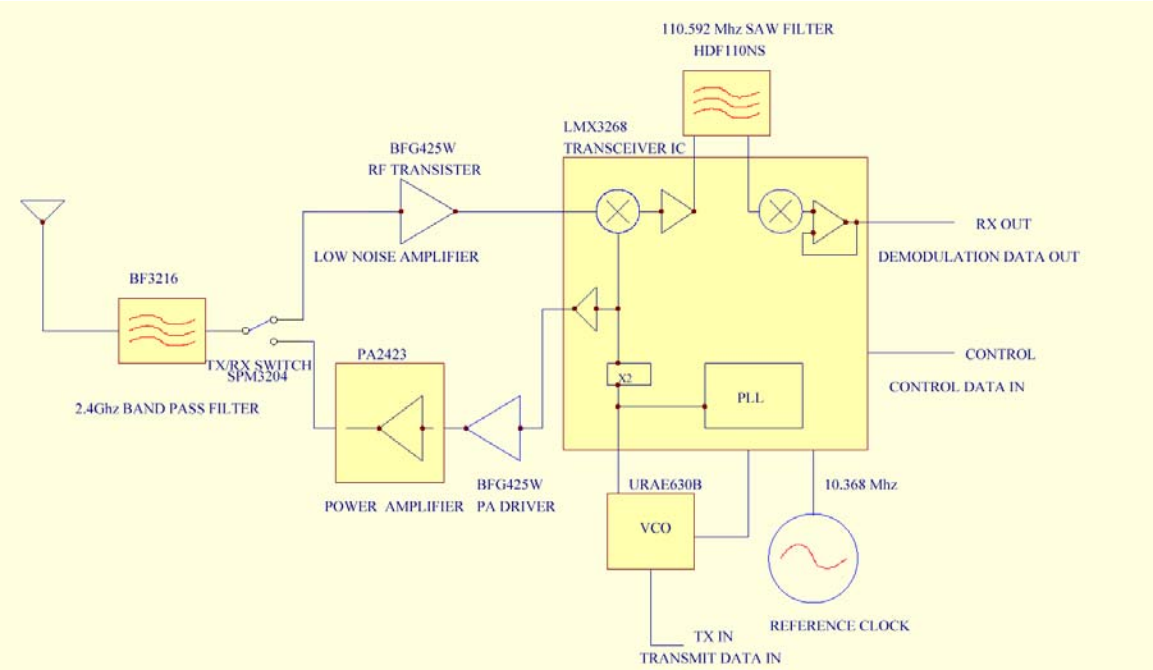
The frequency band is divided into 75 channels in DCT4960. And 75 channels are used for each DCT4960 base and handset. Each message from DCT4960 base to handset is four frames in length. That is the message from DCT4960 base to handset hops on four different channels. The DCT4960 handset receiver gets the message from four different hopping channels.

The message from DCT4960 handset to base is six frames in length. That is the message from DCT4960 handset to base hops on six different channels. The DCT4960 base receiver receives the message from six different hopping channels. It complies with FCC part 15.247(g).

DCT4960 base and handset use same algorithm to control the hopping sequence. The key of the hopping sequence bases on the "System Security Code". When DCT4960 base chooses a System Security Code, it will hop in a sequence calculated from the algorithm accordingly. DCT4960 handset hops using the same sequence and tries to synchronize to DCT4960 base. That is the hopping sequence selected within DCT4960 is controlled by the base station and is not coordinated in any way with devices outside of DCT4960. It complies with FCC part 15.247(h).

Each base station has a unique security code. All four handsets registered to the base station must share the same security code. Each of the four handsets assigned to a base station must also have a unique identification. Each base station provides four independent time compression multiplexing (TCM) line connections to the telephone system.

2. Block Diagram of RF Module



RF Module Circuit Characteristics:

Antenna：Receive 2.4GHZ signal。

2.4 GHZ Band Pass Filter：Filter 2.4GHZ outband signal。

F_C=2450MHZ。 Pass Band=2400 ~ 2500MHZ。

Insertion Loss=2.5dB (max)。

TX/RX Switch(SPM3204)：Switch TX path and RX path

TX MODE：TR_SW=High，

Insertion Loss=0.5 ~ 1.0dB。

RX MODE：TR_SW=Low，

Insertion Loss=0.5 ~ 1.0dB。

Low Noise Amplifier（BFG425W/BFP420）：

◦ Use low noise amplifier to receive weak signal.The LNA use the LMX3268 regulator 2.7 voltage ◦

V=2.7V。

I=30 ~ 35mA。

G=12dB。

Power Amplifier：Used to boost up transmit signal

V=3.6V。

I=110 ~ 160mA。

G=20 ~25dB。

Transceiver (LMX3268)：Transceiver，work in 2.4GHZ band ， intergrade PLL、Frequency Doubler，Mixer、IF Amplifier、IF Limiter、Frequency Discriminator and RSSI function，it's high intergrade RF IC。

MIXER：F_{RF}=2.4 ~ 2.5GHZ，F_{IF}=110.592MHZ，G=17dB。

IF Amplifier：G=24dB。

TXMODE：$I_{LMX3268}$=27mA。

RX MODE：$I_{LMX3268}$=50mA。

Discriminator：$V_{OUT(PK-PK)}$ =400 ~ 460mV，V_{DC} =1.2 ~1.4V。

Frequency Doubler： $F_{OUT(TX)}=F_{VCO}*2$。

$F_{OUT(RX)}=F_{VCO}*2+110.592MHZ$。

P_{OUT}=-7.5dBm。

VCO： Voltage control Oscilator 。

RX-Band freq=1144-1190 Mhz

TX-Band freq=1199-1245 Mhz

Reference Clock：support 10.368MHZ reference clock to LMX3268。

SAW Filter(HDF 110NS)：used to filtered IF outband signal and improve Adjacent Channel Interferers.

IF Center Frequency=110.592 MHZ。

3dB Bandwidth=1.4MHZ (typical)。 Insertion Loss=4.5 dB (max)。

3. Functional Description

3.1. Radio Section

The radio uses GMSK modulation at 576k bits per second, and utilizes channels of 670KHz bandwidth. All transmissions are hopped over 75 channels chosen from a pseudo-random table, with equal transmission time on all channels.The length of frame is typically of 10 ms duration on a given channel, and never exceed 400 ms in 10 seconds period. The radio is TDMA full-duplex; meaning it is either receiving or transmitting at any given time. These comply with FCC 15.247(a).

3.1.1. Antenna

The antenna used is a vertical mono-pole antenna that protrudes from the top of the handset unit. Because of its small size and the limited size of the “ground plane” in the antenna system, the gain of this antenna configuration is -3dBi.

3.1.1.1. 10.368 MHz Crystal circuit

A crystal circuit at 10.368 MHz with 10.368MHz crystal is used as the reference frequency for the phase-lock loop. This reference oscillator is specified to be accurate to within ±10ppm over the temperature range of 0 to +50° C.

3.1.1.2. Voltage Controlled Oscillator

The local oscillator signal originates in the voltage controlled oscillator, which is tuned between 1144 and 1245 MHz .

3.1.1.3. Phase Lock Loop

The phase-lock loop integrated circuit tunes the voltage-controlled oscillator to a given channel based on the control words received from the microprocessor. Tuning is achieved in 300μs.

3.1.2. Receiver

The receiver architecture is down-conversion, with intermediate frequencies of 110.592 MHz. The conversion is performed in theTranciver Chip,. The bandwidth of receiving channel 670 KHz. The channel separation is 863 KHz.

3.1.2.1. 2400-2450 MHz Ceramic Band-pass Filter

A ceramic band-pass filter has been used at the antenna port of the radio receiver front-end. Note that this filter also appears in the transmission signal path. The selected filter has excellent out-of-band rejection to eliminate undesired signals received at the antenna, and to reduce emissions other than the desired RF output during transmission.

3.1.2.2. Transmit/Receive Switch

The RF switch ic are used to switch the antenna between transmit and receive functions. The unit does not transmit and receive simultaneously.

3.1.2.3. SAW Band-pass Filter

The IF circuit utilizes an external surface-acoustic-wave (SAW) band-pass filter between its IF amp and mixer to reduce image noise and further reduce the receiver's susceptibility to out-of-band signals.

3.1.3. Transmitter

In a manner quite analogous to the receiver, the transmitter uses GMSK architecture. The signal is modulated at VCO and finally to the desired RF frequency in the 2400 to 2483.5 MHz range. Transmit power is typically 7.07mW for Handset and 11.0mW for Base at the antenna port with the antenna gain is -3dBi.

3.1.3.1. 2400-2500 MHz Ceramic Band-pass Filter

To reduce the levels of the local oscillator and image signals produced in the second up-conversion mixer, a band-pass filter is used between the mixer and the PA driver.

3.1.3.2. PA Driver

One stage of amplifiers, designed by the NPN transistor, are to amplify the signal from the tranciver ic to 4 dBm radio output power.

3.1.3.3. Power Amplifier

An integrated circuit power amplifier boost the transmission signal level to nominal 20dBm for Handset and 20dBm for Base at the radio output port.

3.1.3.4. 2400-2500 MHz Ceramic Band-pass Filter

As mentioned above in the receiver section, this final filter in the transmission chain is also shared with the receive chain. The selected filter has excellent out-of-band rejection to reduce undesired emissions.

3.2. Digital Section

A baseband modem, an audio modem and a controller are all integrated onto the baseband processor. The baseband processer perform all of the protocol, data formatting, spread spectrum and audio processing in conformance with United States FCC regulation Part 15.247.

The baseband processer portion of the digital section is composed of an 16-bit single-chip microprocessor. The functions performed include control of the radio section (frequency tuning and transmit/receive control), receive data decoding, transmit data generation, and control of ADPCM, LED indicator, ringing signal and key scanning.

3.3. Frequency Plan

The transmitter can be set to operate on any one of 75 frequency channels in the 2400 ~ 2483.5MHz ISM band. Each frequency is used equally by the spread spectrum transmitter in a pseudorandom sequence. The frequency plan is in the following table.

FREQUENCY TABLE

0: 2402.784	1: 2403.648	2: 2404.512	3: 2405.376
4: 2406.240	5: 2407.104	6: 2407.968	7: 2408.832
8: 2409.696	9: 2410.560	10: 2411.424	11: 2412.288
12: 2413.152	13: 2414.016	14: 2414.880	15: 2415.744
16: 2416.608	17: 2417.472	18: 2418.336	19: 2419.200
20: 2420.064	21: 2420.928	22: 2421.792	23: 2422.656
24: 2423.520	25: 2424.384	26: 2425.248	27: 2426.112
28: 2426.976	29: 2427.840	30: 2428.704	31: 2429.568
32: 2430.432	33: 2431.296	34: 2432.160	35: 2433.024
36: 2433.888	37: 2434.752	38: 2435.616	39: 2436.480
40: 2437.344	41: 2438.208	42: 2439.072	43: 2439.936
44: 2440.800	45: 2441.664	46: 2442.528	47: 2443.392

48: 2457.216	49: 2458.080	50: 2458.944	51: 2459.808
52: 2460.672	53: 2461.536	54: 2462.400	55: 2463.264
56: 2464.128	57: 2464.992	58: 2465.856	59: 2466.720
60: 2467.584	61: 2468.448	62: 2469.312	63: 2470.176
64: 2471.040	65: 2471.904	66: 2472.768	67: 2473.632
68: 2474.496	69: 2475.360	70: 2476.224	71: 2477.088
72: 2477.952	73: 2478.816	74: 2479.680	

4. Precautions Taken to Avoid Interference

4.1. RF Filtering

The transmit signal passes through a ceramic bandpass filter before reaching the output port. These filters greatly reduce spurious signals, harmonics, and out-of-band transmitter phase noise.

4.2. Shielding

The circuit boards are contained in a shielded enclosure formed by metal housing, which also provides the antenna ground plane.