Prepared (also subject responsible if other)		No.		
ERA/RKN/TR Larry Lindström		B5KPKRC1311005-1		
Approved	Checked	Date	Rev	Reference
KI/ERA/RKN/TR (L Lindström)		2001-12-20	A	

Exhibit 12 – Cover Sheet

Contents

1 2.1033(c) Circuit Description

1.1 (2) FCC Identifier: B5KPKRC1311005-1

This dTRU (double Tranceiver Radio Unit) consist of two synthesized transmitters (TRX) operating in the frequency band of 869 to 894 MHz.
There are 124 Channels available with a channel spacing of 200 KHz. This is a constant envelop transmitter using GMSK 0.3 modulation, which is MSK filtered with a Gaussian filter ,having a BT product of 0.3. The transmitter is capable of operation in a TDMA (Time Division Multiple Access) system. For each channel there are 8 time slots available,each containing digital speech or data.
The dTRU have a hybrid combiner included which can be used to increase the number of TRX:s per antenna. This combiner is connected before the cavity band pass filter in the combining system.

1.2 (4) Type of Emission: 245KGXW

1.3 (5) Frequency range: 869 to 894 MHz

1.4 (6) Range of Operating Power:

This transmitter is designed to supply a nominal power level of 46.5 dBm at the antenna connector. The power level can be set at 16 power levels, each with a 2 dB increment. The power levels are labeled P(0) to P(15) where P(0) is the highest power level.

1.5 (7) Maximum Power Rating:

The maximum power rating with one TRX under environmental and supply voltage variations is equal to 46.5 dBm plus a power level tolerance of + 1.5 dB. Therefore the maximum output power is 48 dBm equal to 63.1 W at the antenna connector of the radio base station.

1.6 (8) Final Amplifier Voltage and Current in normal operation

	P (0)	P (15)
Collector Voltage	26.0 Volt DC	26.0 Volt DC
Collector Current	6.5 Amps DC	0.8 Amps DC

1.7 (10) Frequency Stabilizing Circuit Description

The transmitter in each TRX contains three synthesized oscillators. One PLL gives a 90 MHz signal to the I/Q modulator. The two other generate a 779 to 804 MHz signal to the mixer where the modulated signal is converted to the transmit frequency. Two oscillators are needed in frequency hopping mode, one is retuning while the other is active. All three synthesized oscillators have a reference of 13 MHz, which is downmixed by 2, generated in a central synthesized oscillator (PLL) of 26 MHz in the LTU part of the dTRU. This PLL frequency reference is extracted from the 13 MHz signal on the Y-link, which is generated and distributed, by the DXU (Distribution Switch Unit), to all dTRU:s in the basestation.

The frequency reference 13 MHz in the DXU is generated in a voltage controlled oscillator placed in an oven together with and phase-locked to a long term stable oven heated oscillator. As an option can the oscillator be phase-locked to the incoming PCM-link frequency or an incoming GPS-link frequency.

1.8 (10) Spurious and Harmonic Suppression

Spurious and harmonic suppression is achieved by using two separate bandpass filters of ceramic type in the exciter. A filter module at the output works like a bandpass filter around the carrier. In addition to these filters, the output signal passes a cavity band pass filter in the combining system.

1.9 (10) Limiting Power

The TRU measures the output power at its output connector via a RF-detector and the detected value is used by the power loop control block to steer two variable gain amplifiers beteween the modulator and the power amplifier.

1.10 (10) Digital Modulation

The modulation description is given in PN3389 Air Interface: Volume 1 section 4.

PN3389 Air Interface: Volume 1 JTC(AIR)/94.10.31-231 R5

4. Modulation

This chapter defines the theoretical requirements of the modulator, inclusive of the differential encoder. The modulator receives the bits from the encryption unit and produces an RF modulated signal. The information bits are first differentially encoded and then passed to the modulator. The modulation is GMSK (Gaussian Minimum Shift Keying) with a BT product of 0.3.

4.1 Modulation Format

4.1.1 Modulating Bit Rate

The modulating bit rate is 1/T = 1625/6 kb/s (approximately 270.633 kb/s).

4.1.2 Start And Stop Of The Burst

The bits contained within a burst are defined in chapter 2. For the purpose of the modulator specification that follows, the bits entering the differential encoder prior to the first bit of the burst and following the last bit of the burst are consecutive logical ones and are denoted by the term dummy bits which define the start and end points of the useful and active parts of the burst as shown in Figure 4.1. The actual state of these bits is left to the manufacturer’s implementation subject to the requirement that all performance specifications of this volume are met. Nothing is specified about the actual phase of the modulator output signal outside of the useful part of the burst. Figure 4.1 depicts the relationship between the active and useful part of the burst, the tail bits and dummy bits for a normal burst. The useful part of the burst lasts for 147 modulating bits.

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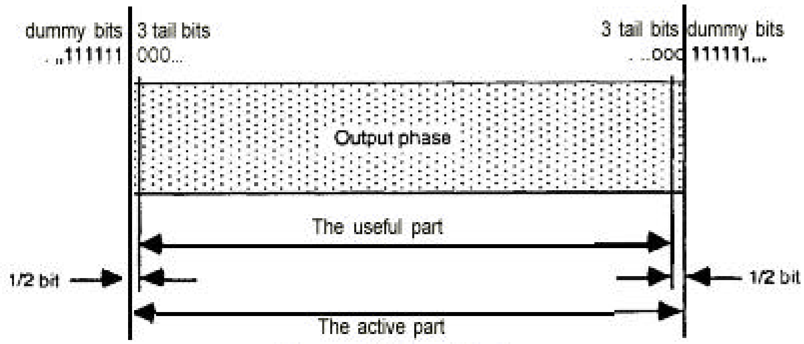

Figure 4.1: Normal Burst

4.1.3 Differential Encoding

Each data value d_i=[0,1] is differentially encoded. The output of the differential encoder is:

$$\hat{d}_i = d_i \oplus d_{i-1}$$

where $\oplus$ denotes modulo 2 addition.

The modulating data value a_i input to the modulator is:

$$a_i = 1 - 2\hat{d}_i$$

where $a_i \in \{-1,1\}$

4.1.4 Filtering

The modulating data values a_i as represented by Dirac pulses excite a linear filter with impulse response defined by:

$$g(t) = h(t) * \mathrm{rect}\frac{t}{0^T}$$

where the function rect(x) is defined by:

$$\mathrm{rect}\frac{t}{0^T} = \frac{1}{T} \text{ for } |t| < \frac{T}{2}$$

$$\mathrm{rect}\frac{t}{0^T} = 0 \text{ otherwise}$$

and ∗ means convolution. h(t) is defined by:

$$h(t) = \frac{e^{\left(\frac{-t^2}{2s^2T^2}\right)}}{\sqrt{2p}\,sT} \text{ where } s = \frac{\sqrt{\ln(2)}}{2pBT} \text{ and BT=0.3}$$

where B is the 3 dB bandwidth of the filter with impulse response h(t), and T is the duration of one input data bit.

4.1.5 Output Phase

The phase of the modulated signal is:

$$j(t') = \sum_i a_i ph \int_{-\infty}^{t'-iT} g(u)du$$

where the modulating index h is l/2 (maximum phase change in radians is π/2 per data interval).
The time reference t' = 0 is the start of the active part of the burst as shown in Figure 4.1. This is also the start of the bit period of bit number 0 (the first tail bit) as defined in chapter 2.

4.1.6 Modulation

The modulated RF carrier, except for start and stop of the TDMA burst may therefore be expressed as:

$$x(t') = \sqrt{\frac{2E_c}{T}} \cos(2pf_0 t' + j(t') + j_0)$$

where E_c is the energy per modulatrng bit, f_o is the center frequency and φ_o is a random phase and is constant during one burst.