Technical information for filing for iBurst Pilot

June 16, 2006

1 Antenna radiation pattern AZ and El (Particularly above zero degree elevation)

The antenna system consists of 12 identical antennas.
For the pilot deployment, only Omni directional antenna (in azimuth) will be used.
The 3 dB elevation pattern is about 7°, and the antenna gain is in order of 11dBi.
This pattern may be Down tilted (-6°), according to the coverage requirement for a particular site. Such an elevation pattern is represented on figure 1.

A typical antenna set up is given by the figure 2

The gain of this typical antenna system is the addition (in dB) of the antenna element gain (11dB) and the Array gain ,(about10* Log(N)), or 11dB, therefore 22 dBi.
However, the exact pattern depends of many parameters, as it is the result of the SDMA real time optimisation process.

2 &3 Max Tx power and EIRP

A/ Bts

The Typical Maximum EIRP per SDMA Channel is 55 dBmw.
The max Tx power per antenna and per SDMA channel is therefore 33 dBmw or 2 W.
However the EIRP is settled in real time for each user according to his specific propagation condition (Power Control Function with a range of 20 dB).

The detail Tx specifications are as follows:

Item	Specification	Comments
Composite Output Power	44.6 dBm	
Rated Stream Power	33.8 dBm/stream	Avg. power over an active time slot
Minimum Stream Power	13.8 dBm/stream	
Transmit Power Error		
Composite Output Power	±2.0 dB	
Rated Stream Power	±3.0 dB	
Transmit Power Control Step Size	1.0 dB Max.	
Transmit Power Control Non-Linearity	1.0 dB_{p-p}	
Adjacent Carrier Power		
625 kHz offset	–9.2 dBm/ch Max.	With a single signal of 33.8 dBm transmitted power
1,250 kHz offset or more	–16.2 dBm/ch Max.	
In-Band Multicarrier Intermodulation Products	–6.2 dBm/ch Max.	With 8 carriers of 44.6 dBm composite transmitted power
Out-of-Band Spurious Emission		
9 kHz < f ≤ 150 kHz	–36.0 dBm/1 kHz Max.	With a single signal of 33.8 dBm transmitted power
150 kHz < f ≤ 30 MHz	–36.0 dBm/10 kHz Max.	
30 MHz < f ≤ 1 GHz	–36.0 dBm/100 kHz Max.	
1 GHz < f ≤ 3.7 GHz	–20.0 dBm/100 kHz Max.	
3.7 GHz < f ≤ 12.75 GHz	–30.0 dBm/100 kHz Max.	
Out-of-Band Non-Spurious Emission		
f_{off} < –5 MHz	–20.0 dBm/100 kHz Max.	With a single signal of 33.8 dBm or 8 carriers of 44.6 dBm composite transmitted power (33.8 dBm for each antenna)
–5 MHz ≤ f_{off} < –0.4 MHz	–16.0 dBm/100 kHz Max.	
–0.4 MHz ≤ f_{off} < 0 Hz	–3.0 dBm/100 kHz Max.	
0 Hz < f_{off} ≤ 0.4 MHz	–3.0 dBm/100 kHz Max.	
0.4 MHz < f_{off} ≤ 5 MHz	–16.0 dBm/100 kHz Max.	
5 MHz < f_{off}	–20.0 dBm/100 kHz Max.	
Transmit OFF Power		
In-Band	–60.0 dBm/1 MHz Max.	With receive mode
Frequency error	$\pm 5 \times 10^{-8}$	With GPS locking
Modulation accuracy	3.5 $\%_{rms}$	
Occupied bandwidth	625 kHz Max.	
Transmit burst timing error	±2 μsec	
Ramp Up/Down transmit power	+6.0 dB/10 μsec	
Guard time transmit power	–6.0 dBm/1 MHz Max.	

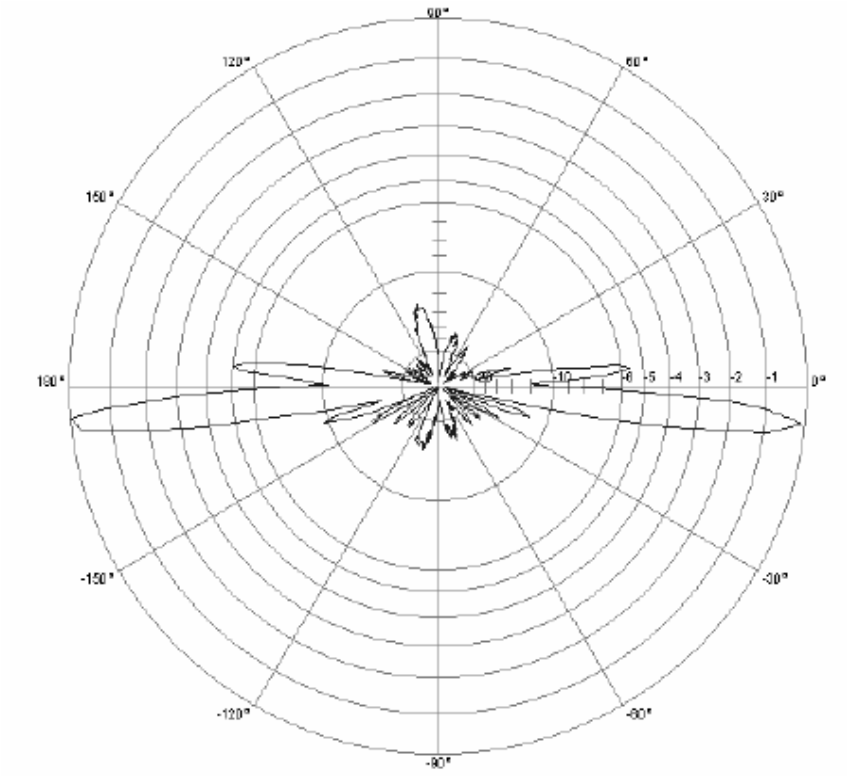
B/UTs

Various Classes of UTs are supported..
UTs are fitted with switch/Connectors to attach external antenna.
The PCMCIA UT has a typical Tx power of 22 dBm (Class 3 UT with 0 dBi antenna)
The Desktop UT has a typical Tx power of 26 dBm (Class 2 UT with 3dBi antenna)
(The Tx power is reduced when the upper Mod Class are used.)

Class 2 UT Tx Specification

Item	Specification	Comments
Maximum Transmit Power		
Mod Class = 0 to 1	27 dBm	
Mod Class = 2 to 5	26 dBm	
Mod Class = 6 to 7	25 dBm	
Minimum Stream Power	–20 dBm	
Transmit Power Error	±3.0 dB	
Transmit Power Control		
Step Size	1.0 dB	Tolerance: ±0.5 dB
Absolute Error	±6.0 dB	
Frequency error	±100 Hz Max. (±0.056 ppm)	Locked to BS
Transmit burst timing error	±0.25 Symbol Max.	
Modulation accuracy		
Mod Class = 0 to 3	10.0 $\%_{rms}$	
Mod Class = 4 to 5	9.0 $\%_{rms}$	
Mod Class = 6	7.0 $\%_{rms}$	
Mod Class = 7	6.0 $\%_{rms}$	
Occupied bandwidth	625 kHz Max.	
Adjacent Channel Power Ratio		
625 kHz offset	35.0 dBc/ch Min.	
1,250 kHz offset	45.0 dBc/ch Min.	
1,875 kHz offset or more	50.0 dBc/ch Min.	
Out-of-Band Spurious Emission		
9 kHz to 150 kHz	–36.0 dBm/1 kHz Max.	
150 kHz to 30 MHz	–36.0 dBm/10 kHz Max.	
30 MHz to 1 GHz	–36.0 dBm/100 kHz Max.	
1 GHz to 3.5 GHz	–23.0 dBm/100 kHz Max.	at Antenna terminal
3.5 GHz to 12.75 GHz	–30.0 dBm/100 kHz Max.	
Out-of-Band Non-Spurious Emission		
0 Hz ≤ $\lvert f_{off} \rvert$ < 1.0 MHz	–13.0 dBm/10 kHz Max.	
1 MHz ≤ $\lvert f_{off} \rvert$ < 5.0 MHz	–13.0 dBm/1 MHz Max.	
Ramp Up/Down transmit power	+6.0 dB/10 µsec	
Transmit OFF Power	–65.0 dBm/1 MHz Max.	

Figure 1: Typical elevation pattern with a down tilt of 6°



1800 MHz

Figure 3 : Omni directional antenna element (L =135 cm)

Figure 2 :Typical Array configuration

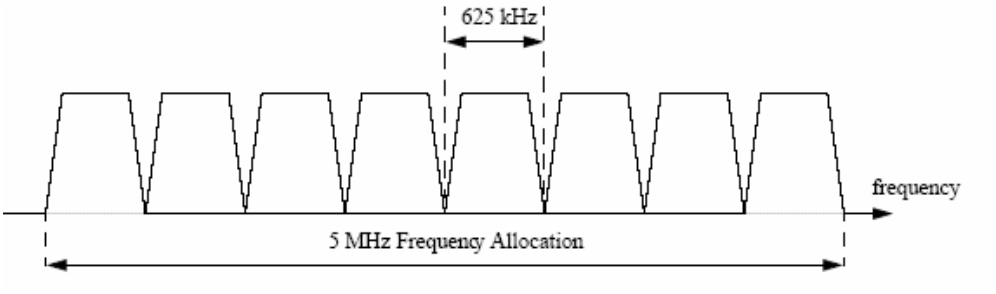
Frequency and bandwidth issues:

The following gives a global answer to the particular questions on frequency and bandwidth issues. It is difficult, out of context, to provide a good answer on each point. However, from the material presented here, each point may be addressed.

8 Operating Frequency

And 6 Instantaneous bandwidth
9 Occupied Bandwidth
11 Channel Bandwidth:

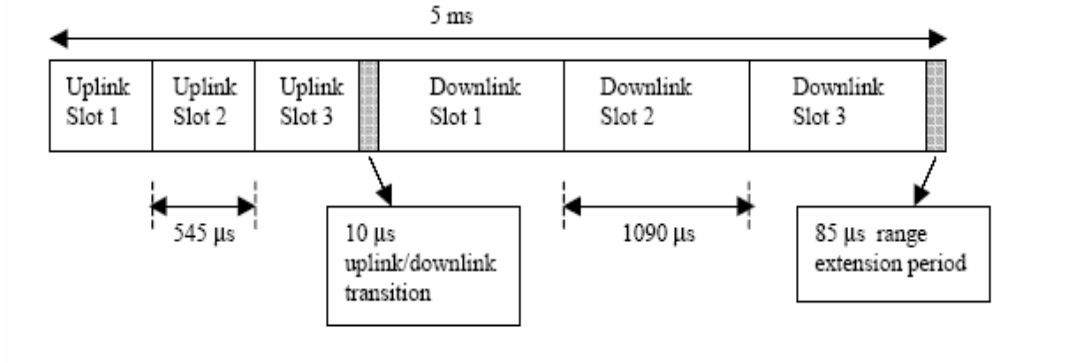
The Pilot system operates in a 5 MHz band at: 1790-1795 MHz
The operation mode is :TDD.
The following drawing defines the use of the overall 5 MHz band



The band is subdivided into 8 channels of 625 KHz each.

Each channel is SCPC, with a symbol modulation rate of 500 Ks/s : The signal is filtered with a Root Raised Cosine Filter with a0.25 roll-off ratio

To provide a good understanding of the signal structure the frame format is also given/



4 modulation

The iBurst system uses 9 modulation Classes. (Only 8 are used by the UT for transmission,(no 24 QAM))

The quoted data rate assumed an aggregation of all 3 times slots

ModClass	Modulation Method	Down Link		Up Link	
		Data Rate (kbps)	Required CNR[*1] (dB)	Data Rate (kbps)	Required CNR (dB)
0	BPSK	106	**1.1**	19	**0.2**
1	BPSK+	149	**2.9**	38	**1.8**
2	QPSK	245	**4.0**	77	**3.5**
3	QPSK+	379	**7.0**	130	**6.4**
4	8PSK	485	**8.8**	173	**8.6**
5	8PSK+	595	**11.3**	216	**10.9**
6	12QAM	787	**13.2**	293	**12.9**
7	16QAM	922	**14.6**	346	**14.2**
8	24QAM	1061	**16.6**		

The quoted data rate are net data rate,(excluding all training/sync sequences, and coding overhead). In the Up link the maximum rate is

7 BW Efficiency:

To derive the BW efficiency, one has to take into account that each channel is reused up to 3 times in each cell; these are the SDMA channels. The iBurst operates 24 SDMA channels over a 5Mhz band.
The maximum efficiency is then: (24X(1.061+345))/5, **about 6.5 Bps/s/Hz/Cell.**
In a real deployment, all users cannot benefit from the upper mod class, and the operational efficiency figure is quoted to be better than 4 Bps/s/Hz/Cell .

11 Frequency stability:

The base stations are synchronized on the basis of GPS: A BTS is fitted with 2 GPS receivers for frequency tuning and timing (Cells are all synchronized on GPS Time).
The transmit frequency of the User device (or UT) is locked on the BTS signals: The UT transmit frequency is within 100Hz from nominal in static conditions. When the terminal is in motion, the Doppler effect may induce a bias in the UT tuning.
In summary the transmit error is within 400Hz, for typical application

12 &13

Make: Kyocera
Model: iBurst Base Station Type I.
User Terminals UTC (PCMCIA Card)
UTD (Desktop Bridge)
UTU (USB Bridge)

UTs have FCC type approval.

Environment Impact Statements have been filed in Australia.
Environment Impact Statements are being filed in the USA, independently, by commercial third parties.

14 Any peculiar technical data that…….

iBurst has many specific features that mitigate some of Interference situations:

iBurst BTS can reject interferences from other systems, falling in the iBurst operating band. This is an important aspect with respect to site engineering, when collocation with other telecom equipment is to be anticipated.
On the other hand, interference from iBurst BTS to other systems has also to be analysed according to a statistical approach: due to the Adaptive Antenna technology, BTS EIRP is 'beamed' only in direction of users. Further, the fact that it is an all-IP network, the applications and nature of the traffic need to be considered, for the definition of an activity factor, on top of the TDD TX/RX ratio.