

## Bandwidth and Quality Analysis Report for Vobal Technologies: S3 Base Station Solution

September 20, 2010

Vobal Technologies retained the IIT VoIP Lab to provide an independent, third-party measurement of Vobal's S3 base station solution for the following three parameters:

- Bandwidth utilization for voice calls
- Bandwidth utilization during "idle state", when calls are not being placed
- Measurement of the mean-opinion score for the voice calls

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The results from testing these three parameters in the IIT VoIP Lab at the Rice Campus are below.

Simultaneous Calls	Packet Headers: Ethernet and IP			Packet Headers: IP Only		
	Kilobits per second (kbps)	Megabytes per minute (MB/min)		Kilobits per second (kbps)	Megabytes per minute (MB/min)	
		MB as 1,048,576 bytes	MB as 1,000,000 bytes		MB as 1,048,576 bytes	MB as 1,000,000 bytes
One (Test 1)	6.1800	0.0442	0.0463	5.5851	0.0399	0.0419
Three (Test 2) for Each call	4.9467	0.0354	0.0371	4.7032	0.0336	0.0353

The measured bandwidth utilization includes media, signaling, and packet headers in both directions. Note that a megabyte as defined by the IEEE is 1,000,000 bytes and Inmarsat documentation utilizes 1,048,576 for the value of a megabyte.

The idle bandwidth utilized by the S3 base station with a private IP address (i.e. connecting to the public Internet via a NAT router) was 4.365 Megabytes per month with packets including Ethernet and IP headers and 3.462 Megabytes per month with packets including only IP headers. The MB definition used to make this calculation was 1 MB = 1,048,576 bytes.

The average mean opinion score for the calls under Test 1 (one simultaneous call) was 3.341. This score was calculated using E-model (ITU-T G.107). The test application was voipmonitor, from [www.voipmonitor.org](http://www.voipmonitor.org).

Sincerely,

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