



SOLUTIONS FOR NETWORK ACCEPTANCE



SeeHawk™ Analytics Applied To Drive Test Data

Each wireless technology tsunami carries deployment challenges in its wake. At the heavy metal level, radio access network (RAN) elements must be delivered to GPS lat-long coordinates, backhaul facilities established, towers erected, and building permits acquired. In the background of delivery trucks rolling to sites, cement pouring, backhoe digging and cabling, though, carefully acquired data determines antenna tilting, parameter setting, power levels, and analyzes how each element and cell site interacts with each other. Drive test teams, using specialized test and measurement

equipment from Ascom, Accuver, and others collect data on the performance of the network to determine if agreed upon service levels (SLA's), and key performance indicators (KPI's) are being met and if the network infrastructure requires critical adjustments. This is the process referred to as Cell Site Acceptance or Commissioning. It requires the storage and analysis of historical and current data.

Figure One: PCTEL Scanning Receivers and TEMS Investigator



Figure Two:
Test and Measurement Systems
with PCTEL's Scanning Receiver

PCTEL performs Cell Site Acceptance using multiple aspects of its RF (Radio Frequency) or wireless expertise. PCTEL's scanning receivers, notably the IBflex®, the MXflex®, and the EXflex®, sample 80 parameters 50 times per second to deliver high definition profiles of network performance (see Figure One). These data, obtained by PCTEL scanning receivers integrated into Ascom and Accuver test and measurement systems (see Figure Two) are analyzed on a post-processing basis with PCTEL's SeeHawk Analytics system. Utilizing its map visualization capabilities, SeeHawk Analytics provides a "drill-down" of network and performance on a geographical, cell site, and sector-by-sector basis. As Figure Three illustrates, network performance is visually represented with respect to multiple KPI's – such as Interference, Dropped Calls, Blocked Calls, Signal to Noise Ratios (SNRs) and suggests specific



APPLICATION
NOTE

Cluster Acceptance Summary											
Devices	KEY PERFORMANCE INDICATOR (KPI)	PASS THRESHOLD	CLUSTER AVERAGE	PASS/FAIL RESULT	MEDIAN	MEAN	MIN	MAX	TOTAL ATTEMPTS	TOTAL SUCCESS	TOTAL SAMPLES
Device1 - Ping	setup time (msec)	<= 4500	510	Pass	510.00	648.00	0.00	2800.00			1800
	setup failure rate (%)	<= 2%	1.10	Pass					1900	1898	1900
	Latency (msec)	<= 70	57	Pass	57.00	99.00	26.00	4588.00			14500
Device2 - FTP DL	Avg PDSCH throughput (Mbps)	>= 6	9.80	Pass	7.96	9.80	0.00	33.47			26425
	Drop rate (%)	<= 2%	1.48	Pass					5421	80	5421
	Handover failure rate (%)	<= 2%	1.12	Pass					1074	1063	11
	Handover latency (msec)	<= 45	15.00	Pass	15.00	27.00	0.00	130.00			990
	Avg RSRP (dBm)	>= -105	-97.27		-98.21	-97.27	-115.00	-61.05			26254
	Avg SINR (dB)	>= 1.5	11.22		11.06	11.22	-0.80	26.73			26254
Device3 - FTP UL	Avg PUSCH throughput (Mbps)	>= 3.0	5.00	Pass	4.55	5.00	0.00	10.80			24229
	UE TX Power(dBm)	n/a	19.20		20.33	19.20	-7.50	25.00			24229

Figure Three: Acceptance Summary and Visualization Data

actions that network engineers need to take in order to comply with SLA performance objectives.

Cell Site Acceptance builds upon in-building network commissioning performed by PCTEL's Network Engineering Services (NES) team. Since 2011, PCTEL has delivered industry-leading benchmarking and commissioning services to the rapidly growing in-building wireless network market. NES benchmarks existing networks, recommends cellular, DAS, and Wi-Fi changes and, then, evaluates the networks after the implementation of those recommendations. This "commissioning" or quality acceptance service is, in principal, the same as the SeeHawk Analytics based macro cell site acceptance.

PCTEL acquired Nexgen Wireless in 2015 in order to fully utilize their analytics system (formerly Meridian, now SeeHawk Analytics) and associated drive-test and engineering resources to deliver Cell Site Acceptance Testing globally. Nexgen's experience with Sprint and Samsung demonstrated the power of SeeHawk Analytics' ability to store, process, and cross-correlate various information sources to identify compliance issues and to make specific recommendations to remediate those issues. In one project across multiple markets, Nexgen

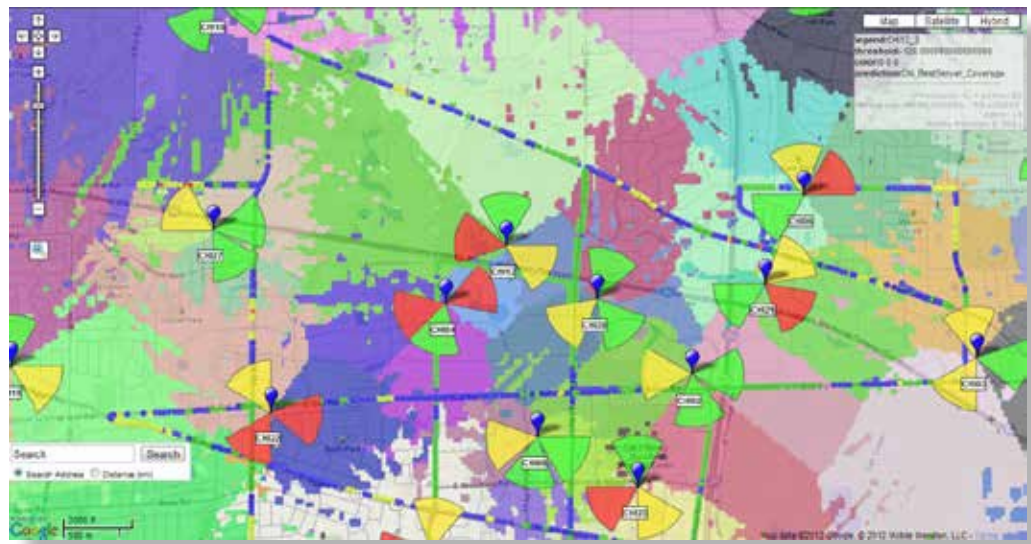


Figure Three: Prediction Data (Background Colors), Drive Test Data (Points/Dots), Network Data (Wedges)

conducted acceptance testing – and ongoing support and analysis – for over 13,000 cell sites. The cost for the analytics, storage, and drive testing was approximately \$50 per site for one technology with an additional \$25 for each technology during an 18 month period. Competent network acceptance saves, on average, \$1,000 per cell site in unproductive engineering services, licensing costs, and unnecessary network re-drives. Unproductive engineering services include truck rolls to solve problems of inadequate or missing data, lack of consistency and control over engineering best practices, and inefficiencies generated by using desktop based solutions. PCTEL estimates that carriers and OEM infrastructure vendors save a minimum of \$400,000 for network acceptance in a midsized market by

conducting timely acceptance tests using a centralized platform with ongoing support and maintenance for the duration of the project. In many cases, the evolving nature of networks requires ongoing analysis, Performance Engineering, and Configuration Management. Those engineering activities go beyond the scope, however, of cell site or network acceptance.

PCTEL provides portals to customers so that they are able to conduct custom investigations of stored data. We also provide Software as a Service (SaaS) in which our engineers maintain terabytes of fully sequestered customer data and monitoring via our Network Operations Center (NOC). We deliver specific reports upon request and have subject matter experts (SME's) who we can either place at the customer facilities or dedicate to a customer at one of our facilities. Figure Four illustrates our portal report capability, used by the customer or our NOC.

Summary

When carriers make a capital expenditure (CAPEX) commitment to deploy a new technology, there is an associated operating expense (OPEX) to ensure network performance and compliance with service level agreements (SLA). The underlying OPEX represents an enormous expense, often \$5,000 to \$10,000 per cell site per year. Drive test data processed with SeeHawk Analytics can reduce the manual processing cost of drive testing by 50 percent. The annual operating costs associated with Performance Engineering and Configuration Management can be much higher and are not included in this estimate.

Intelligent analysis of drive test data with SeeHawk Analytics permits network engineers to identify parameters that result in sub-optimal performance that is inconsistent with SLA's. Armed with these data – and the historical trends made possible with cloud-based storage – specific actions can be taken that ultimately reduce ongoing OPEX, ensure quality, and enhance the subscriber experience.

Figure Four: Portal Access to Acceptance Reports

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