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This Acoustical Analysis Report was prepared at the request of the Josephine County Airport Manager and the Illinois Valley Airport Advisory Board.

Purpose:

To perform and record representative acoustical measurements during the skydiver demonstration flight on Monday, August 27th, 2012 at the Illinois Valley Airport, as performed by Eugene Skydivers LLC. Baseline and maximum full spectrum Sound Pressure Level (SPL in dBA) readings will be captured. One-twelfth Octave Real Time Spectrum Analysis (RTA) will also be employed in order to visualize and record the characteristic frequency content "fingerprint" of the noise at several stages of the demonstration, along with many baseline SPL & RTA measurements of background sound levels taken at various locations in the Illinois Valley (some of which were captured on the following Thursday, August 30th).

Analysis, explanation and interpretation of the data will also be provided, along with references for background information that will be helpful for anyone who may be reading this report. Please refer to the Glossary on page 7 for a brief description of the terminology used in this report.

Baseline and Maximum Sound Pressure Level readings (dBA):

Winds that we measured, gusting up to about 20 mph on the afternoon of the demonstration created a bit of a challenge for most who were present, especially the pilots and skydivers. We were able to capture accurate, realistic baseline SPL measurements by repeatedly taking readings during the brief quiescent periods between the stronger wind gusts. We were able to reliably establish a baseline of 42 to 43 dBA. The maximum reading of 90.4 dBA (automatically recorded) was captured as the Cessna 182 aircraft passed directly in front of our equipment during takeoff, at a distance of approximately 200 feet.

Real Time Spectrum Analysis readings:

Several Real Time Analysis plots were recorded on the day of the skydiver demonstration flight. Some of them were overrun by the wind noise impinging on our instrumentation microphones. We have included the plots that clearly demonstrate data relevant to the assigned purpose of our task.

On the following Thursday, August 30th we recorded Real Time Analysis plots at sixteen diverse locations in the Illinois Valley for the purpose of establishing representative background sound readings for reference and comparison. All of these readings were taken midday, between approximately noon and 3:00 PM. All were automatically time-stamped by our instrumentation as the readings were captured. Some were in more populated areas near or on the 199 corridor. Others were recorded in less populated corners of the Valley, which proved to be very quiet and serene. O'Brien, Takilma, Holland Loop, Caves Highway, Kerby, Selma, and Cave Junction were included in this survey. Interestingly, no aircraft were seen or heard during the Thursday sound survey.

Analysis of the RTA readings:

Figure 1 shows the RTA "baseline" reading taken at the IV Airport with no aircraft noise content. There is a noticeable hump in the graph centered at about 100Hz that clearly bears the round-topped signature of wind noise. The 8-10 dB spikes at 434 and 460 Hz. were actually a shout by one of the personnel preparing for the skydiving flight. The SPL reading of 46.3 dBA taken simultaneously, is 3-4 dB above some of the lower SPL-only readings that were also taken for the purpose of establishing a baseline SPL level.

Figure 2 shows the clearly defined noise signature of the airplane as it passed in front of our instruments during takeoff, at a distance of approximately 200 feet. Comparing the simultaneous dBA reading of this plot with the independent maximum reading made with a different instrument that recorded the actual SPL maximum level, revealed that the RTA snapshot was not taken at the instant of maximum SPL, but slightly before or after. The RTA snapshot accurately recorded the noise fingerprint, but the amplitudes (vertical scale) were lower than the actual maximums. The easily identifiable spikes (below the black arrows) define the recognizable noise profile of this aircraft. Much of the noise above 1 KHz. is the mid to high frequency "hash" caused by the propeller screwing into the air mass at high rotational speed. This mid to high noise dissipates with distance and altitude more easily than the the lower frequency engine noise spikes which remain audible for many miles. Make particular note that some of the engine noise spikes in this plot are in excess of 50 dB in amplitude.

Figure 3 is <u>remarkable</u> for a number of reasons. It was taken while the aircraft was passing almost directly over the airport, just before the skydivers exited the plane at an altitude of about 7500 feet AGL (above ground level). There was virtually no wind noise at ground level at the airport at this moment. Note that, even from an altitude of in excess of 7000 feet AGL, aircraft engine noise peaks in excess of 20-25 dB were still evident on the RTA plot! Virtually all of the signature engine noise peaks from Figure 2 are also clearly evident on this plot. During the entire flight of approximately 50 miles, we were paying close attention to the fact that there was NEVER a time when the aircraft was inaudible, even when it was many miles from the airport. We were frankly quite surprised that the engine noise was disturbingly evident throughout the planes descent even though it was supposedly at a low throttle setting. If one were to

superimpose the upper 30 dB of the noise spikes of this plot in place over most of the baseline RTA sound level plots that we captured on Thursday, August 30th it would not present a pretty picture. In the vast majority of these cases, the engine noise profile of this plane, even from an altitude of over 7000 feet AGL would completely dominate the sound field, and clearly pose a serious noise problem that would be devastating to most people in these normally quiet areas. Flight at a lower altitude would be substantially more problematic. Oregon Skydivers' could also have more than one plane in the air at a time. Noise from multiple aircraft would combine in unpredictable ways due to differences in altitude, location, throttle settings, Doppler Effects, etc. It is entirely within the realm of possibility that noise from multiple planes could sum together in very undesirable ways that would magnify the engine noise spectrum.

The fact that the skydivers ejected from the aircraft at 7500 feet AGL for this particular demonstration (a number that we verified with JoCo Airport Manager Larry Graves) begs a bit of further contemplation here, for several reasons. We couldn't help overhearing several experienced local pilots commenting after the flight, that this Cessna 182 actually seemed somewhat less noisy than "normal" during the demo flight. Could it have been possible that this lower than normal jump altitude was intentional, for the purpose of executing a gentler climb at a lower throttle setting, even though the climb to jump altitude took the normal length of time? We would have absolutely no problem monitoring another flight made under strictly controlled flight parameters, if anyone should deem this to be appropriate.

Figures 4 through 19: Sound Survey (SPL - dBA and RTA) taken throughout the Illinois Valley on Thursday, August 30th. Note: All Figures include note areas that contain automated time & date stamp information, locations, along with pertinent notes and comments.

Discussion:

We're sure that one of the more "fun" aspects of the skydiving experience is the enjoyment of the view while the aircraft climbs to jump altitude. The pilots are likely to want to aid in this experience by giving an improvised trip over some of the more attractive points of interest on the way "up". Restaurants, lodging, wineries, historical attractions, unique places like the Oregon Caves National Monument, the Takilma Treehouses, the Siskiyou Field Institute, and other outdoor tourist attractions are the kind of things that come to mind that would be of great interest to the visiting skydivers. Unfortunately, this is exactly the kind of noisy airborne tourism that disturbs all of the other visitors and residents who cherish this region for its unusual serenity and quiet. It's no surprise that more and more National Parks and other outdoor natural attractions have implemented strict regulations that expressly forbid similar aircraft-based tourism anywhere near their vicinity. Remember: People do not live here in the Illinois Valley, recreate here or visit here for the purpose of "enjoying" noise pollution.

It has been said by proponents that the skydiving flights could avoid the more populated parts of the Illinois Valley. Does this mean that they will therefore be targeting the lower population-density areas for more of the over-flight? All this would do is unduly persecute those residents who so deeply cherish the most peaceful and quietest locations where they have chosen to make their homes. This would be an unfortunate, egregious criminal invasion of their right to peace and refuge in their own homes!

There are some people who do actually thrive in noisy environments. Most often, they have been conditioned in this behavior for most of their lives. Many have suffered serious hearing losses due to high levels of noise at work, or due to long exposure to highly amplified music, or simply through the fate of heredity. Interestingly, some of these same people claim to enjoy aircraft noise and are vocally in favor of increased air traffic here. Many of them are easily identified by their conspicuous use of hearing aids. Ironically, they still cherish the sounds (and noise) that they can remember, but can no longer easily hear. Treasure & protect your hearing; most hearing losses are permanent.

The harmful effects of noise pollution on human and animal health are well known and fully documented. Feel free to peruse some of the informative references that we have listed at the end of this report on this and related subjects. Many links are included that document other communities' bad experiences with skydiving flight noise (LOTS more available via Google & Dogpile searches: "Skydiving Noise", "Noise Pollution", etc.).

We are occasionally criticized because of our belief that it is wise to protect some of the last few remaining quiet places. Because of our several decades of experience and expertise in this field, we are most often able to accurately predict the deleterious effects of noise pollution in an area, even before they are allowed to happen. Our goal is to always make scientific readings in the most accurate and honest manner possible, using state-of-the-art instrumentation. We also strive to provide sensible, factual analysis of the scientific data, along with appropriate relevant interpretation, discussion and explanation, so that the average person can grasp what has been measured. We are 100 percent confident that any other qualified professional in our field would be able to duplicate our measurements with the appropriate equipment, and come to similar conclusions, after analysis of the scientific data.

We are always available upon request for questions about this report from the IVAAB and Josephine County Officials.

Respectfully Submitted,

Robert H. Ziller,
Audio Engineering

R. H. Ziller & Co., Inc., O'Brien, Oregon
Electronics, Mechanical and Manufacturing Engineering since 1976

Recommended web references:

http://en.wikipedia.org/wiki/Noise_Pollution

http://en.wikipedia.org/wiki/Health_effects_from_noise

http://en.wikipedia.org/wiki/Aircraft_noise

http://en.wikipedia.org/wiki/A-weighting

http://en.wikipedia.org/wiki/Sound_pressure

http://bmb.oxfordjournals.org/content/68/1/243.full

http://www.adventure-journal.com/2012/02/crater-lake-national-park-given-power-to-ban-sightseeing-flights/

http://www.pdkwatch.org/archive/GeraldASilver16Jul01.asp

http://www.mcpost.com/article.php?id=4336

http://www.youtube.com/watch?v=GA5FXE1lKCI

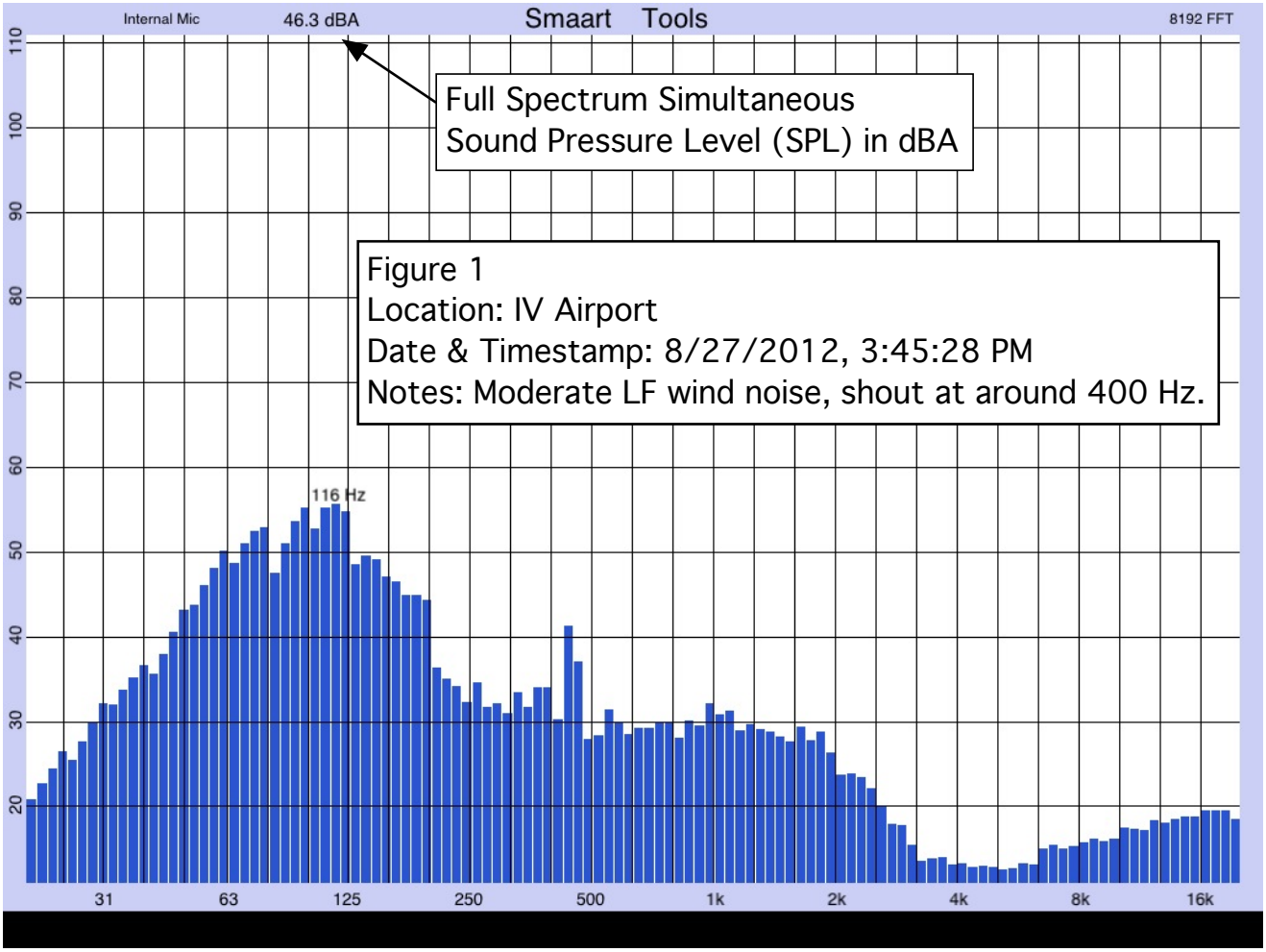
http://www.timescall.com/news/longmont-local-news/ci_19517981

http://www.freerangelongmont.com/2011/07/22/skydiving/

Books:

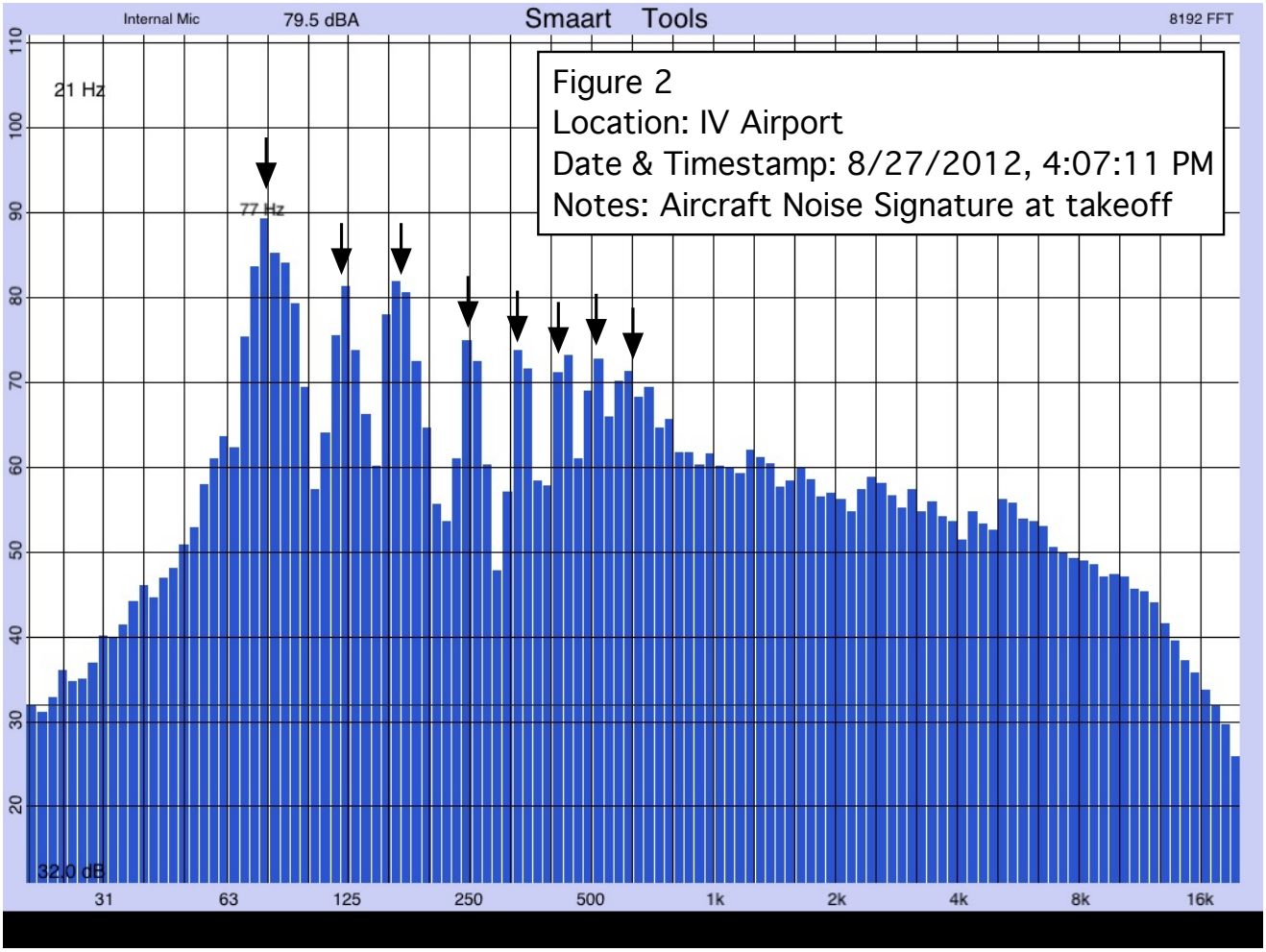
“One Square Inch of Silence”
Gordon Hempton & John Grossman

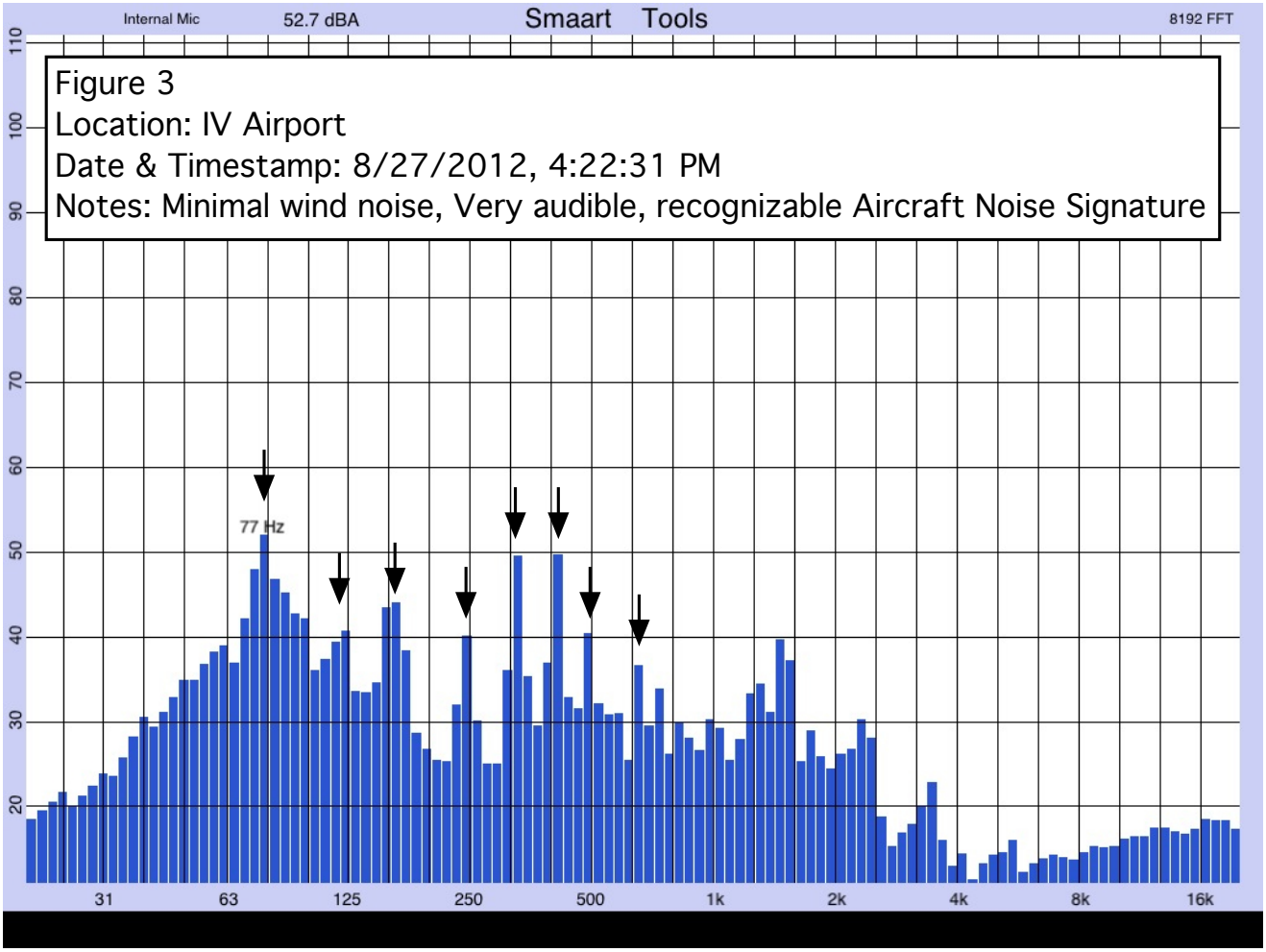
“Musicophilia”
Oliver Sacks



Vertical Scale (Logarithmic) = Sound Amplitude in dB
Every 10 dB increase represents a 10X increase in acoustic energy

Horizontal Scale (Logarithmic) = Frequency, corresponds roughly to the range of human hearing





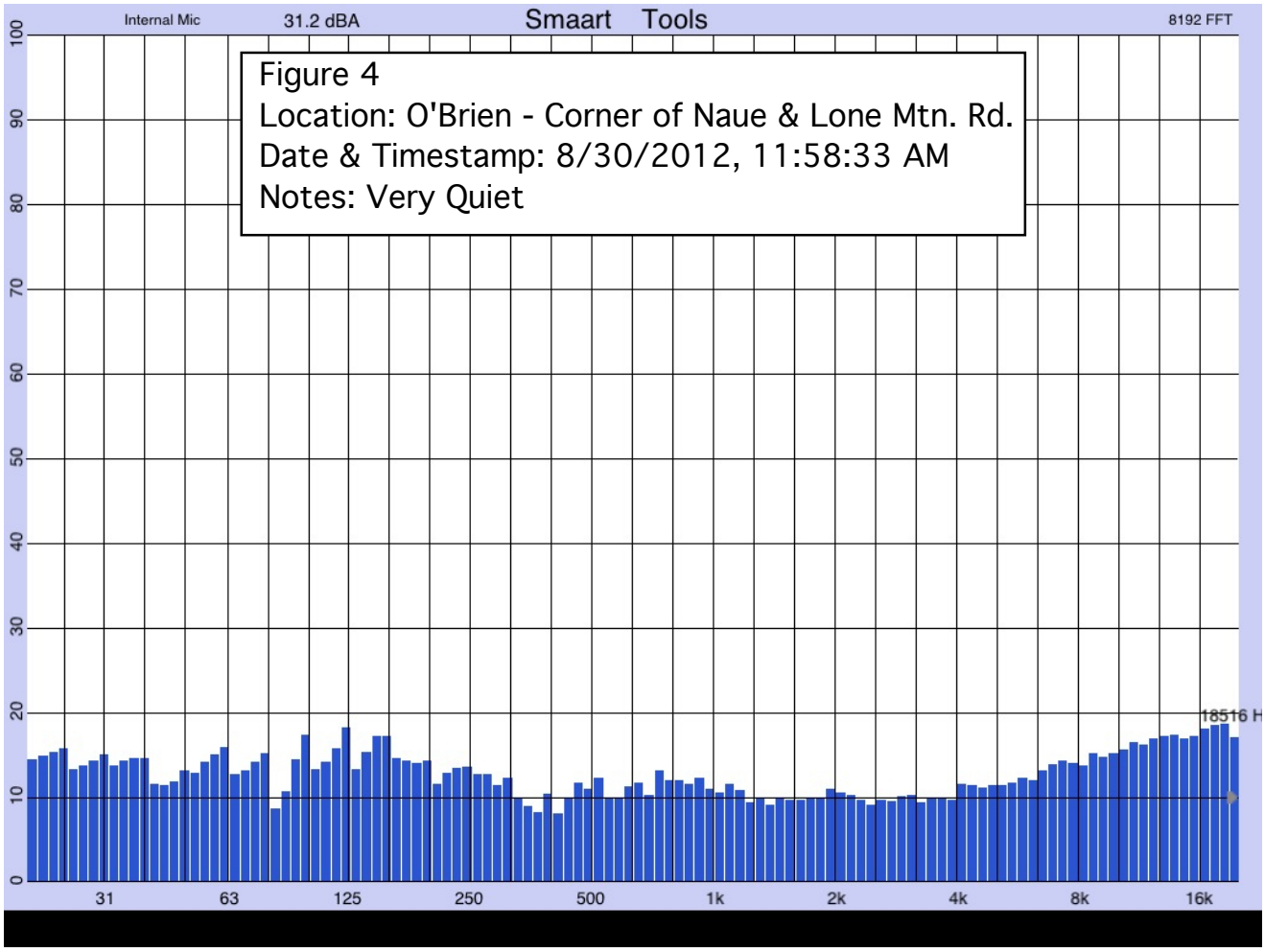
– A brief Glossary of terminology used in this report –

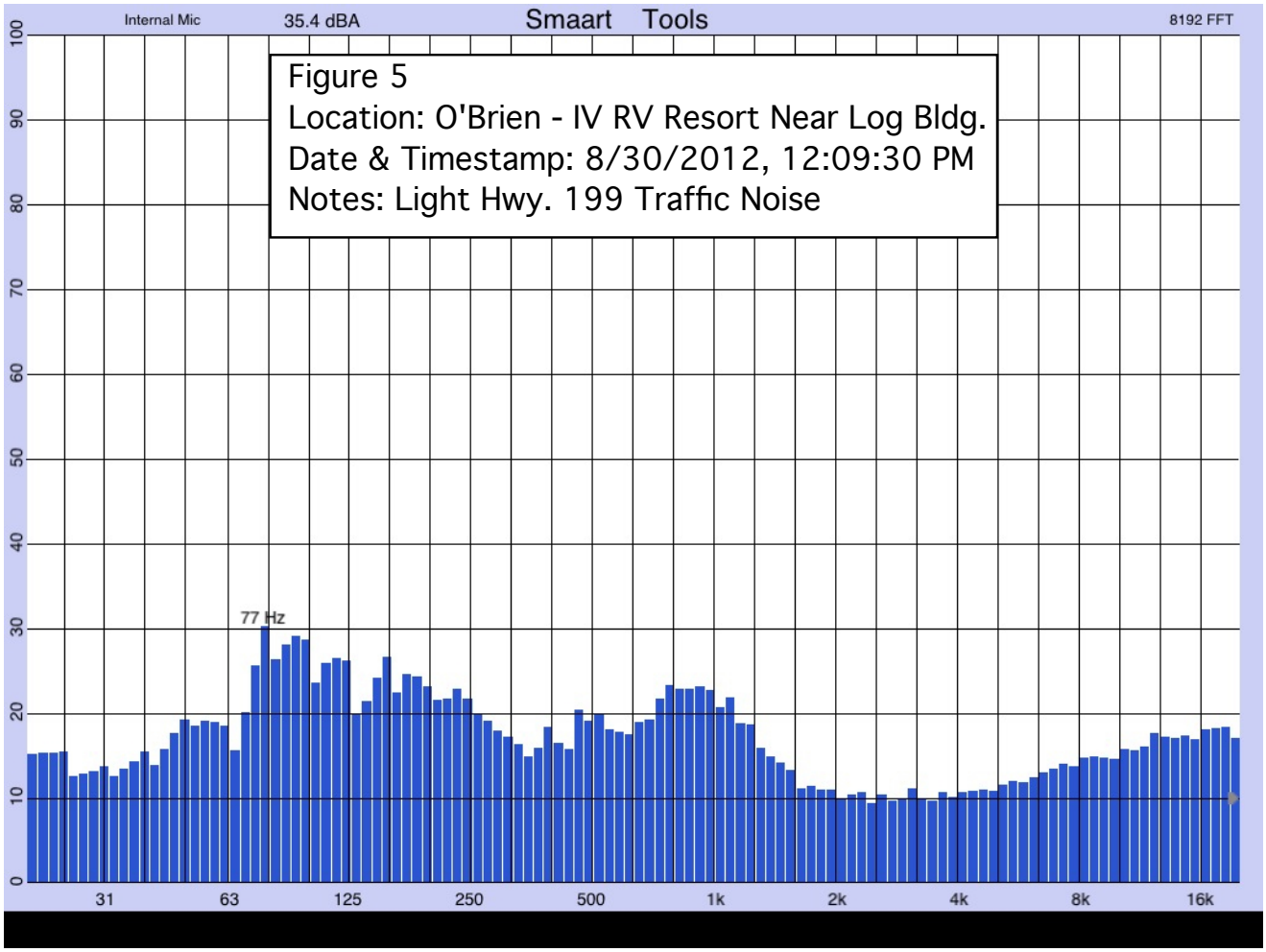
Frequency: The "pitch" of the sound measured in Hertz / abbr. Hz.

SPL: Sound Pressure Level, measured in dBA (decibels, "A" weighted). Used to measure the overall "volume" of a sound. It does not describe the frequency, "pitch" or character of the sound.

RTA: Real Time Spectrum Analysis. A method for measuring and displaying both the intensity and the tonality or character of a sound. It is usually represented graphically, plotting sound intensity on the vertical scale (dB) against the energy content of the individual frequency bands on the horizontal scale. Each band of a one-twelfth octave RTA plot roughly correspond to the pitches of the keys on a piano, low "notes" to the left and high "notes" to the right. Because of the logarithmic scale a 30 dB increase equates to a 1000X (or 10 to the 3rd power) increase in acoustic energy. RTA analysis is very useful for determining the characteristic "fingerprint" of a particular noise source.

Noise: Undesireable sound (analagous to: weeds are undesireable plants)


Internal Mic
31.2 dBA
Smaart Tools
8192 FFT
Figure 4
Location: O'Brien - Corner of Naue & Lone Mtn. Rd.
Date & Timestamp: 8/30/2012, 11:58:33 AM
Notes: Very Quiet
18516 H
100
90
80
70
60
50
40
30
20
10
0
31
63
125
250
500
1k
2k
4k
8k
16k


Internal Mic
35.4 dBA
Smaart Tools
8192 FFT
Figure 5
Location: O'Brien - IV RV Resort Near Log Bldg.
Date & Timestamp: 8/30/2012, 12:09:30 PM
Notes: Light Hwy. 199 Traffic Noise
77 Hz
100
90
80
70
60
50
40
30
20
10
0
31
63
125
250
500
1k
2k
4k
8k
16k

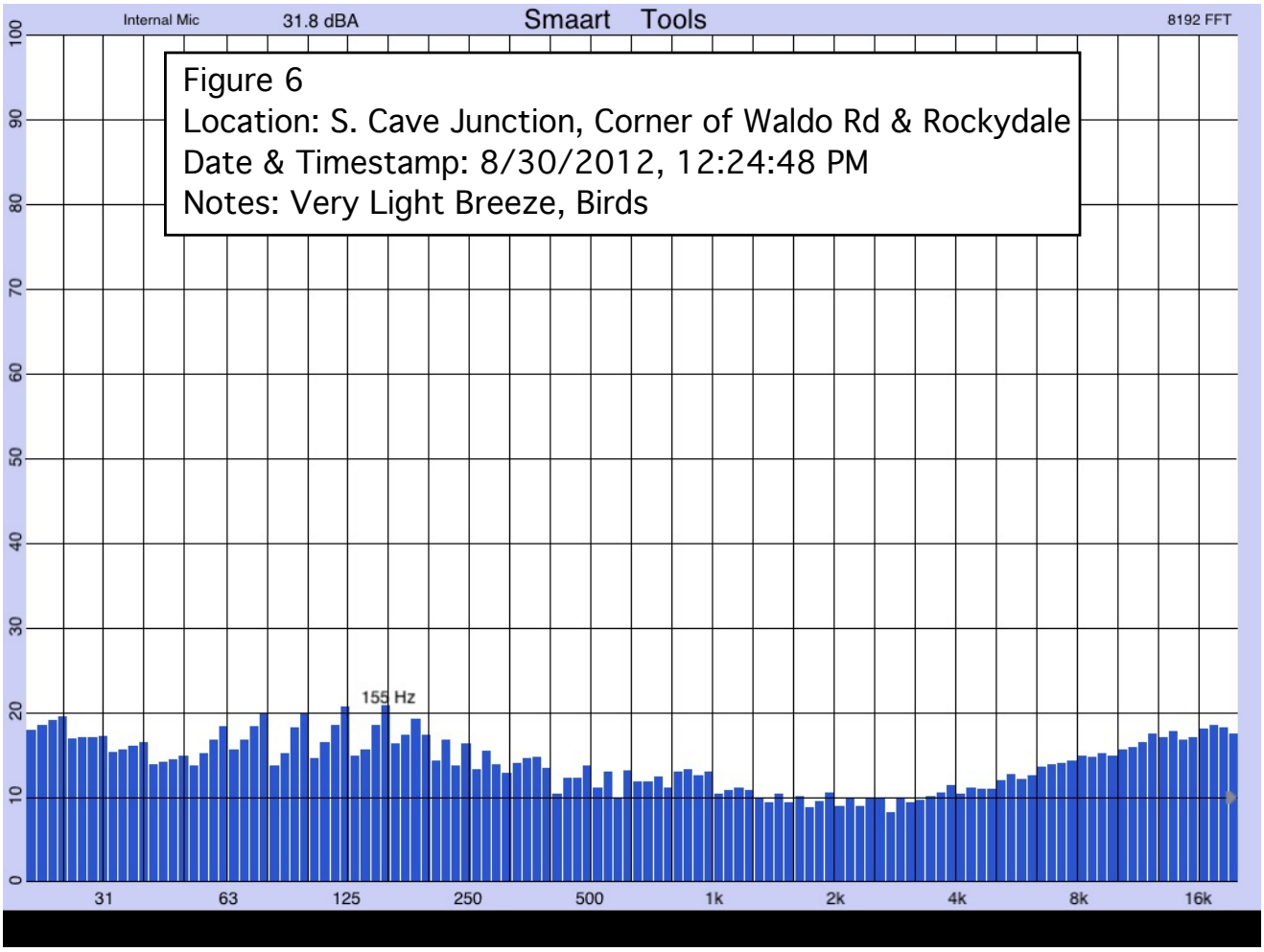


Figure 6
Location: S. Cave Junction, Corner of Waldo Rd & Rockydale
Date & Timestamp: 8/30/2012, 12:24:48 PM
Notes: Very Light Breeze, Birds

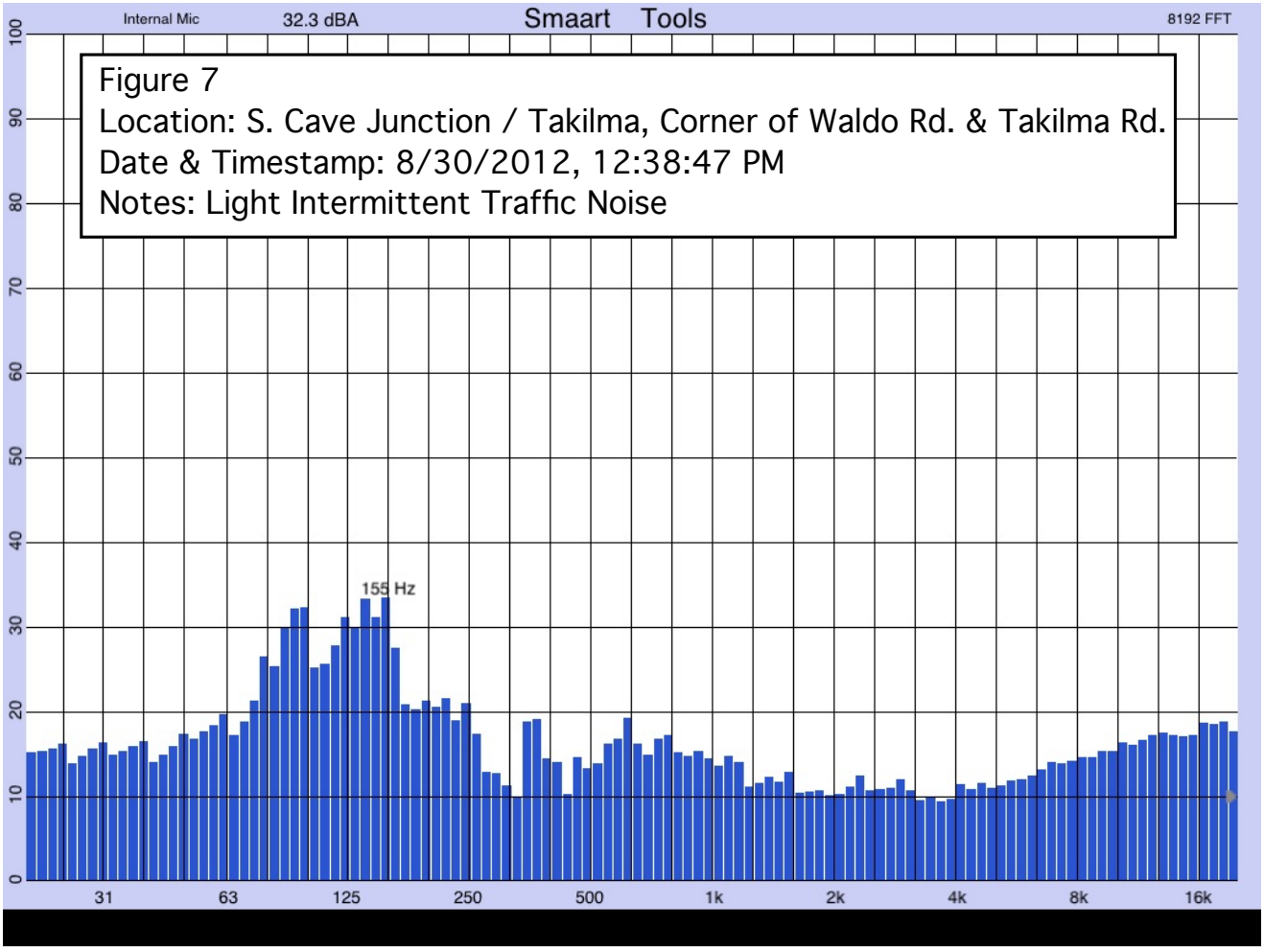


Figure 7
Location: S. Cave Junction / Takilma, Corner of Waldo Rd. & Takilma Rd.
Date & Timestamp: 8/30/2012, 12:38:47 PM
Notes: Light Intermittent Traffic Noise

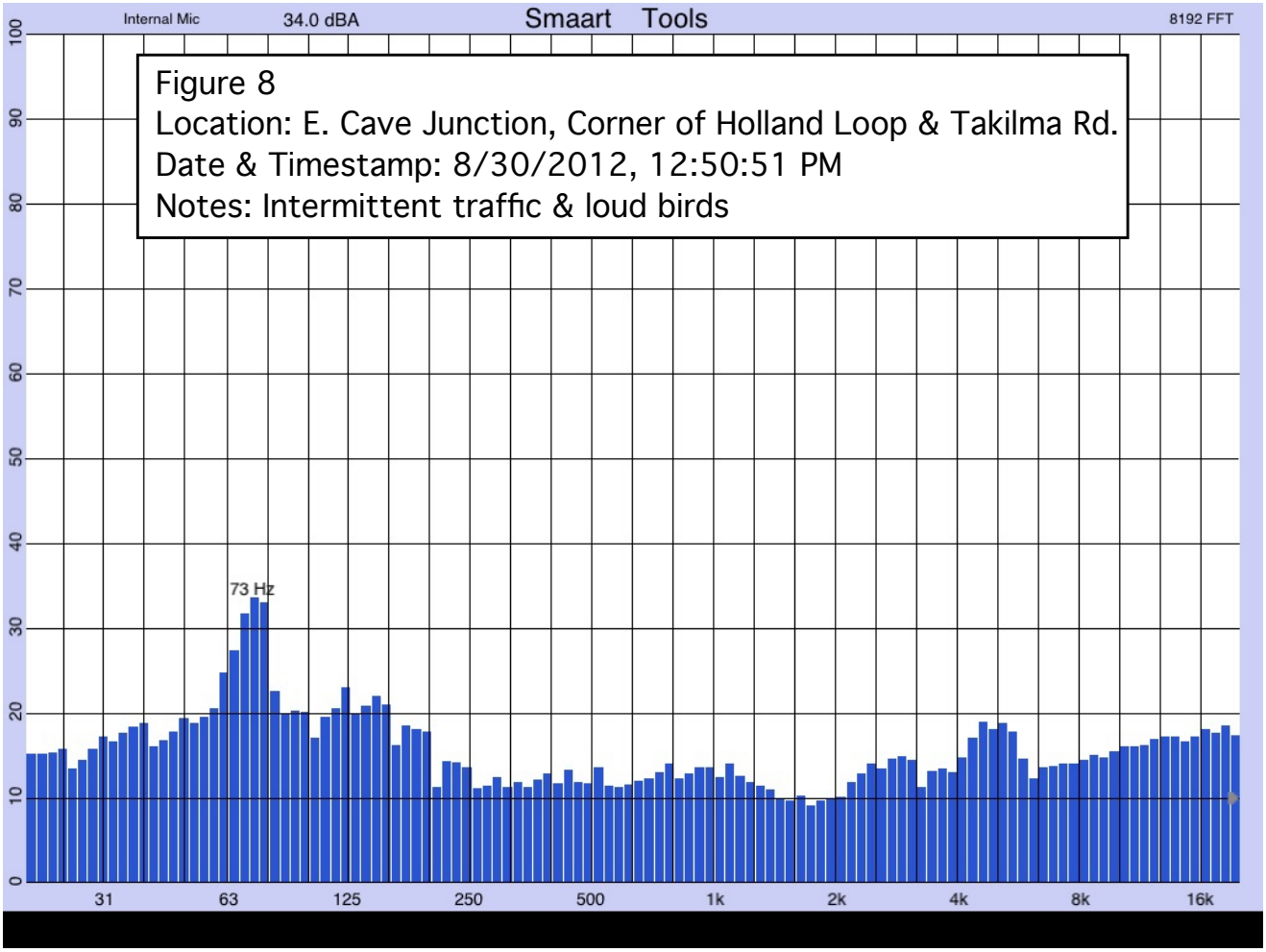


Figure 8
Location: E. Cave Junction, Corner of Holland Loop & Takilma Rd.
Date & Timestamp: 8/30/2012, 12:50:51 PM
Notes: Intermittent traffic & loud birds

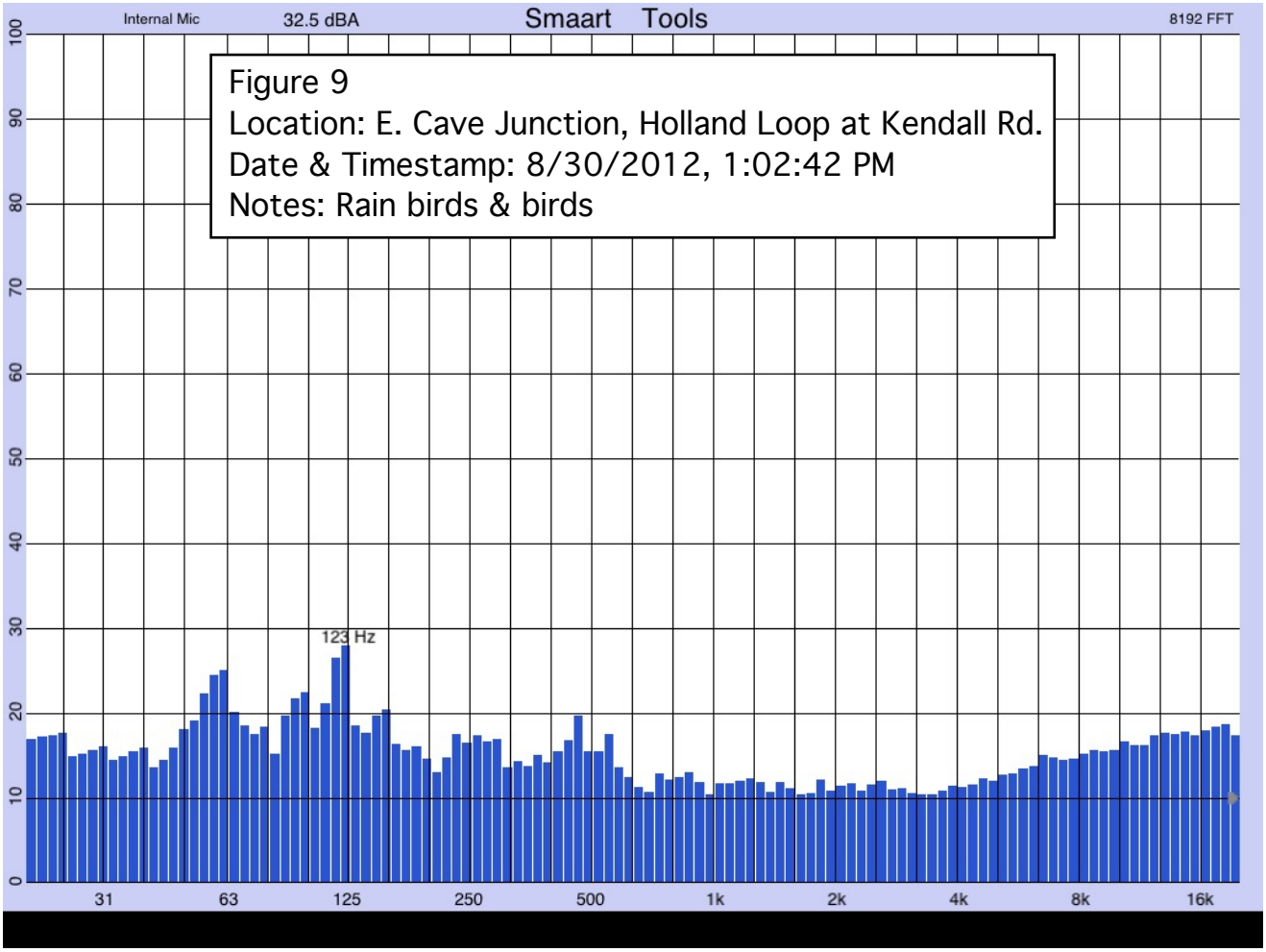


Figure 9
Location: E. Cave Junction, Holland Loop at Kendall Rd.
Date & Timestamp: 8/30/2012, 1:02:42 PM
Notes: Rain birds & birds

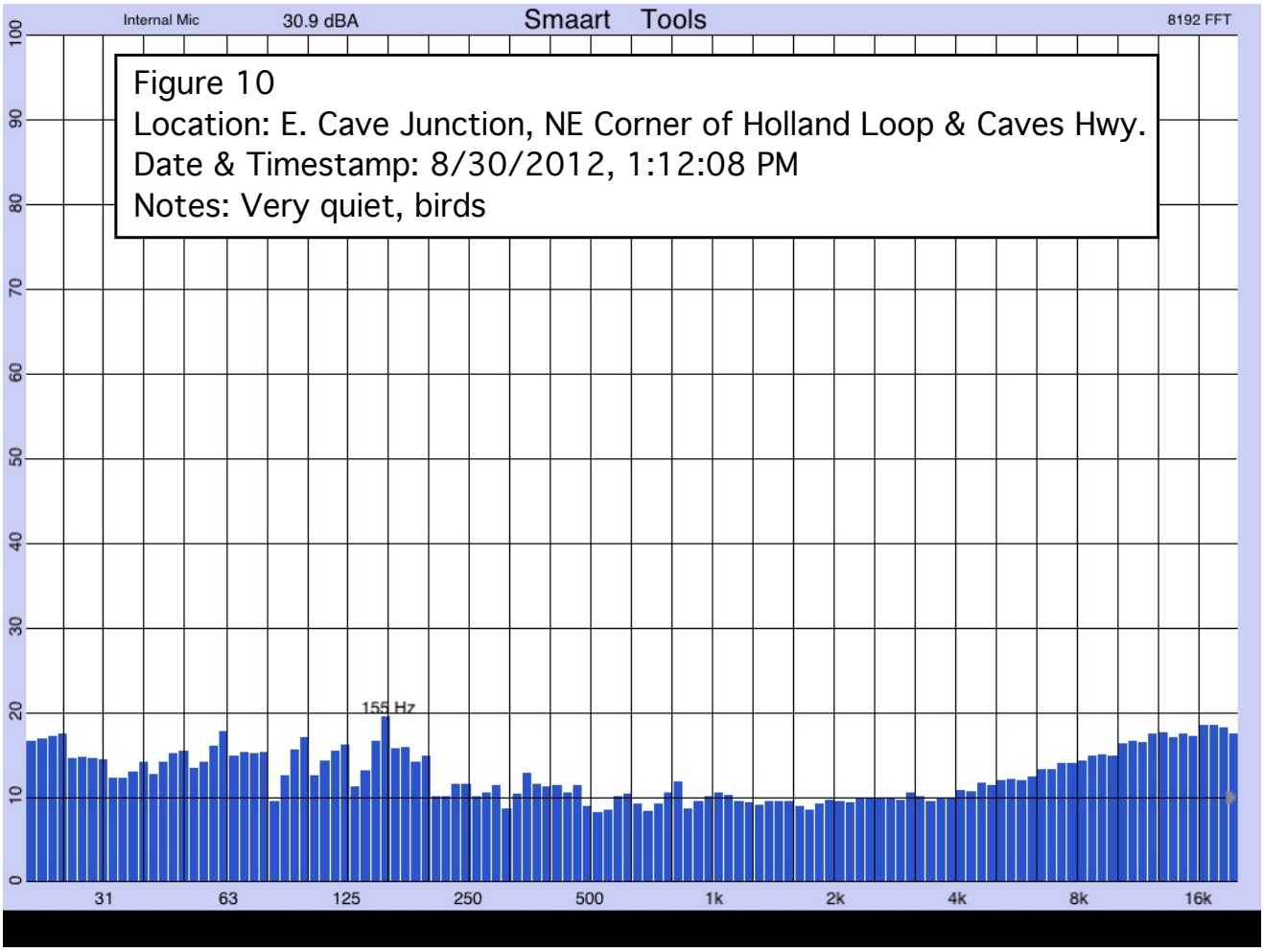


Figure 10
Location: E. Cave Junction, NE Corner of Holland Loop & Caves Hwy.
Date & Timestamp: 8/30/2012, 1:12:08 PM
Notes: Very quiet, birds

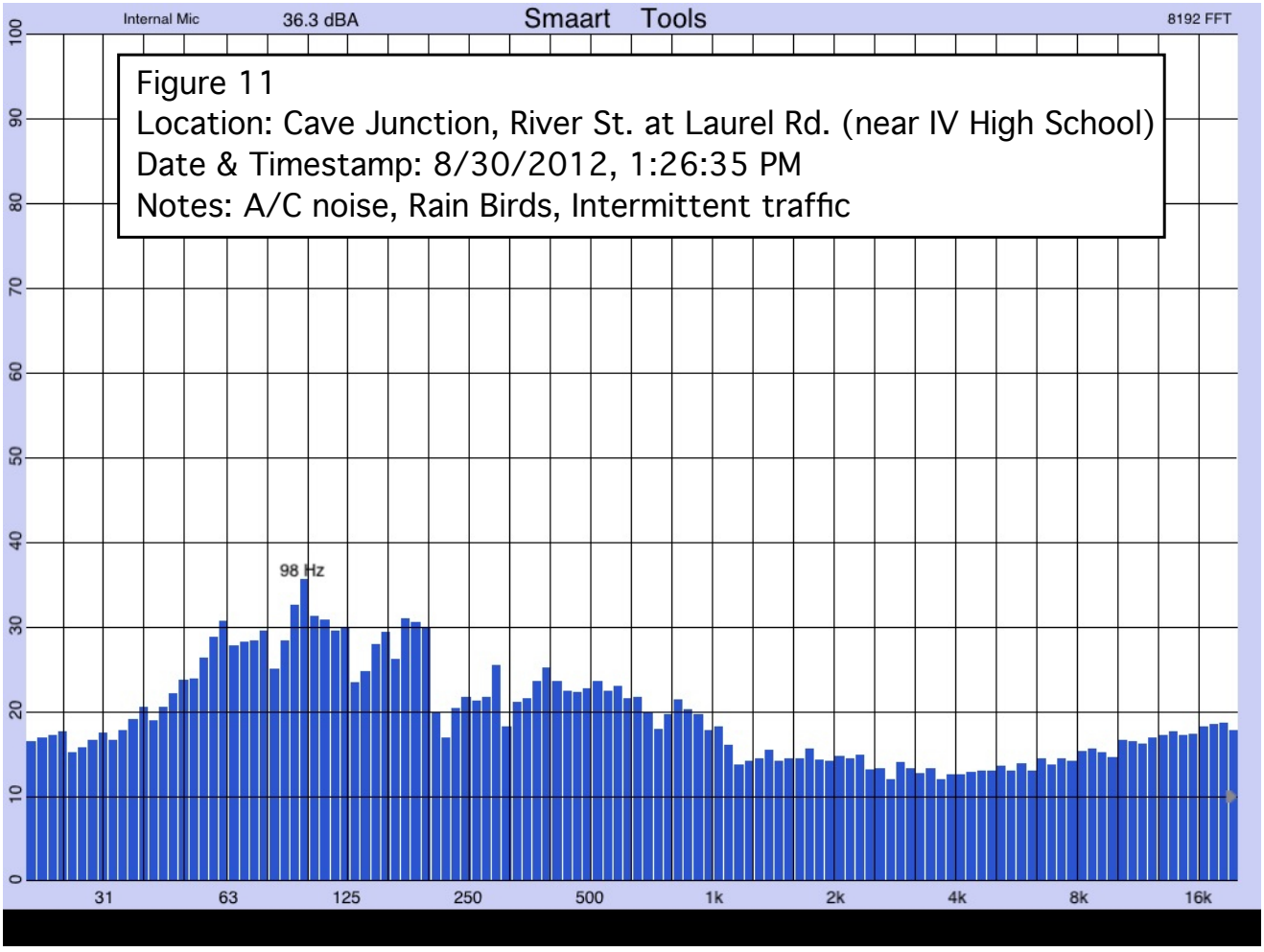


Figure 11
Location: Cave Junction, River St. at Laurel Rd. (near IV High School)
Date & Timestamp: 8/30/2012, 1:26:35 PM
Notes: A/C noise, Rain Birds, Intermittent traffic

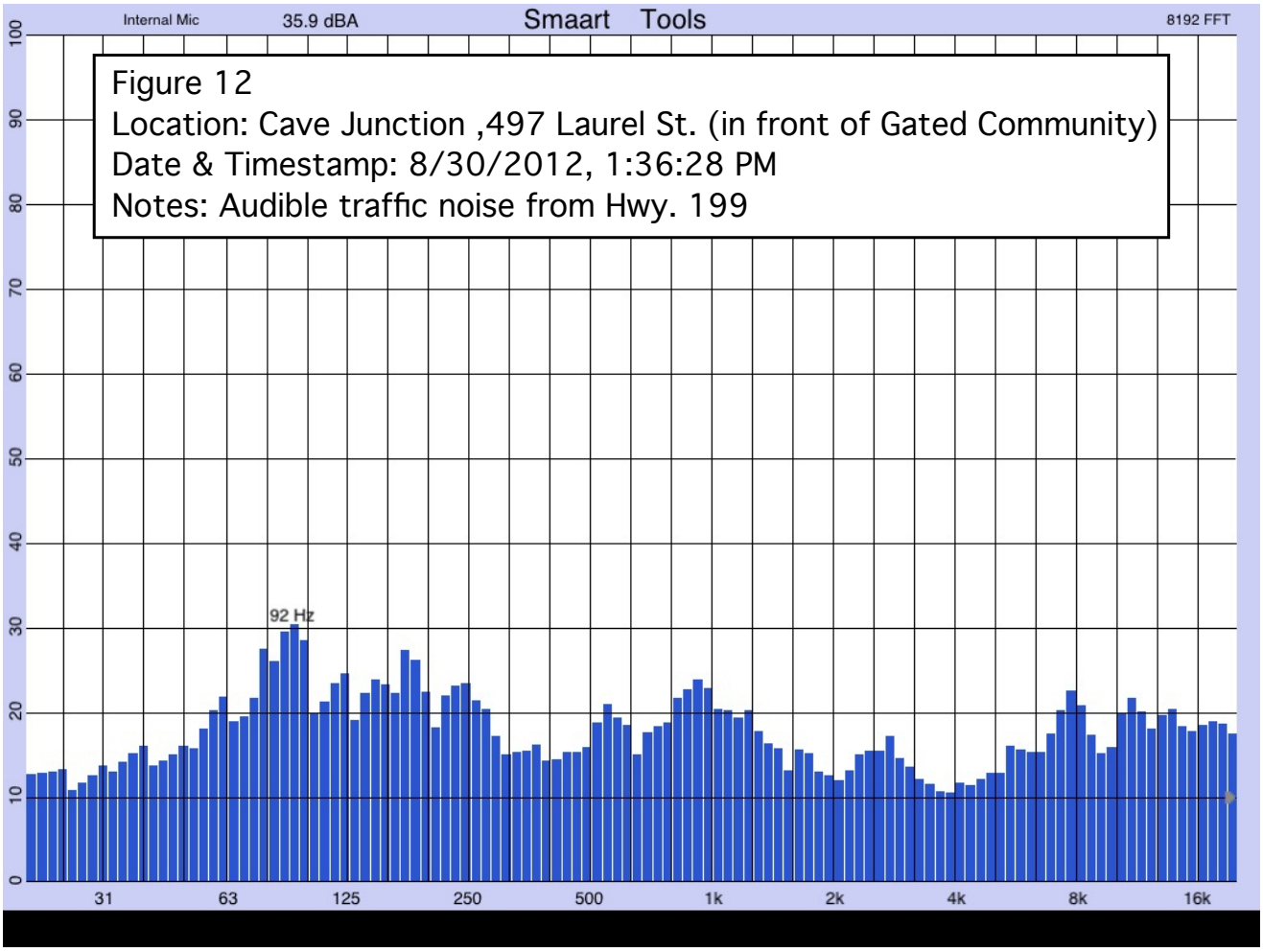


Figure 12
Location: Cave Junction ,497 Laurel St. (in front of Gated Community)
Date & Timestamp: 8/30/2012, 1:36:28 PM
Notes: Audible traffic noise from Hwy. 199

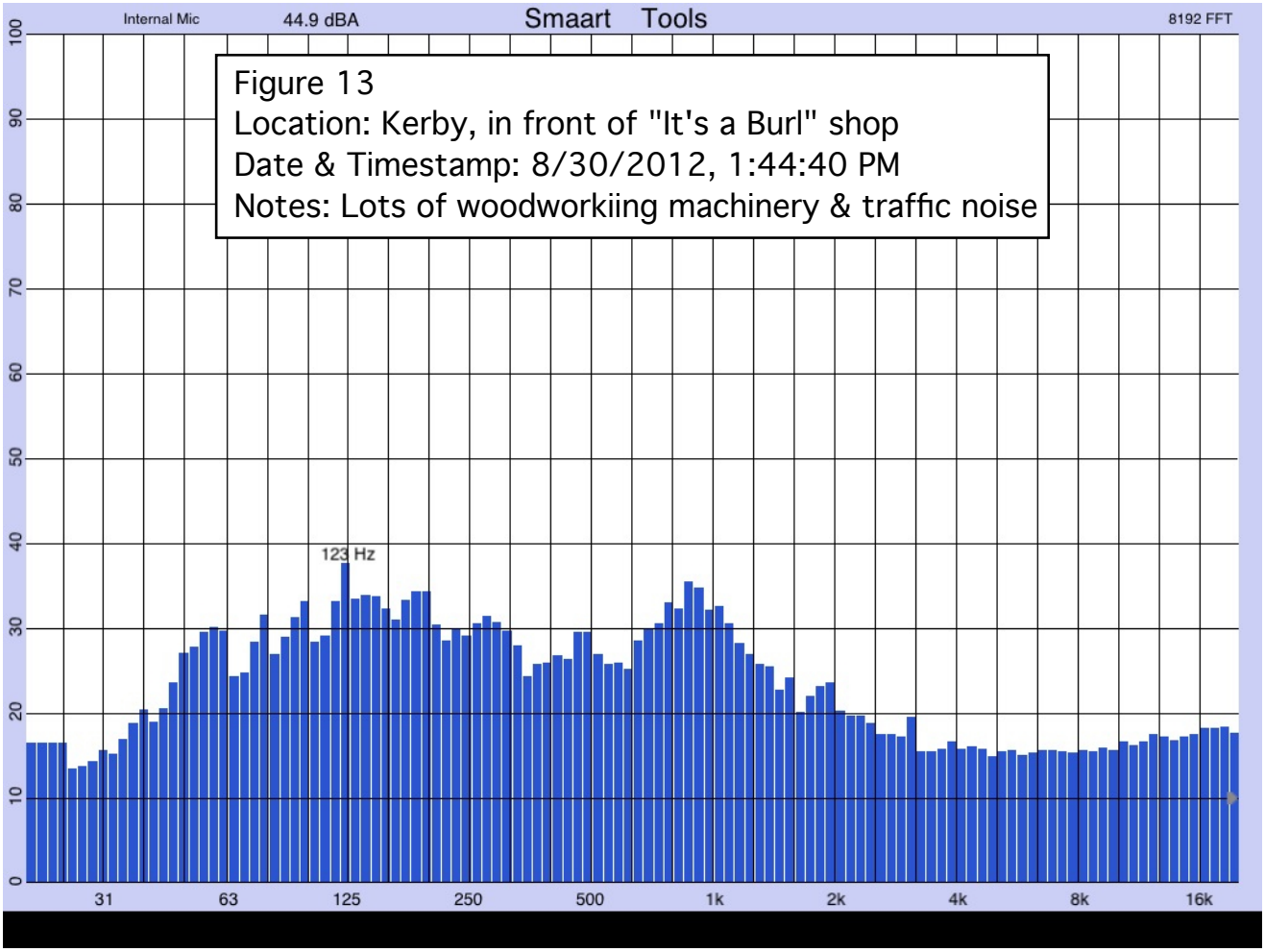
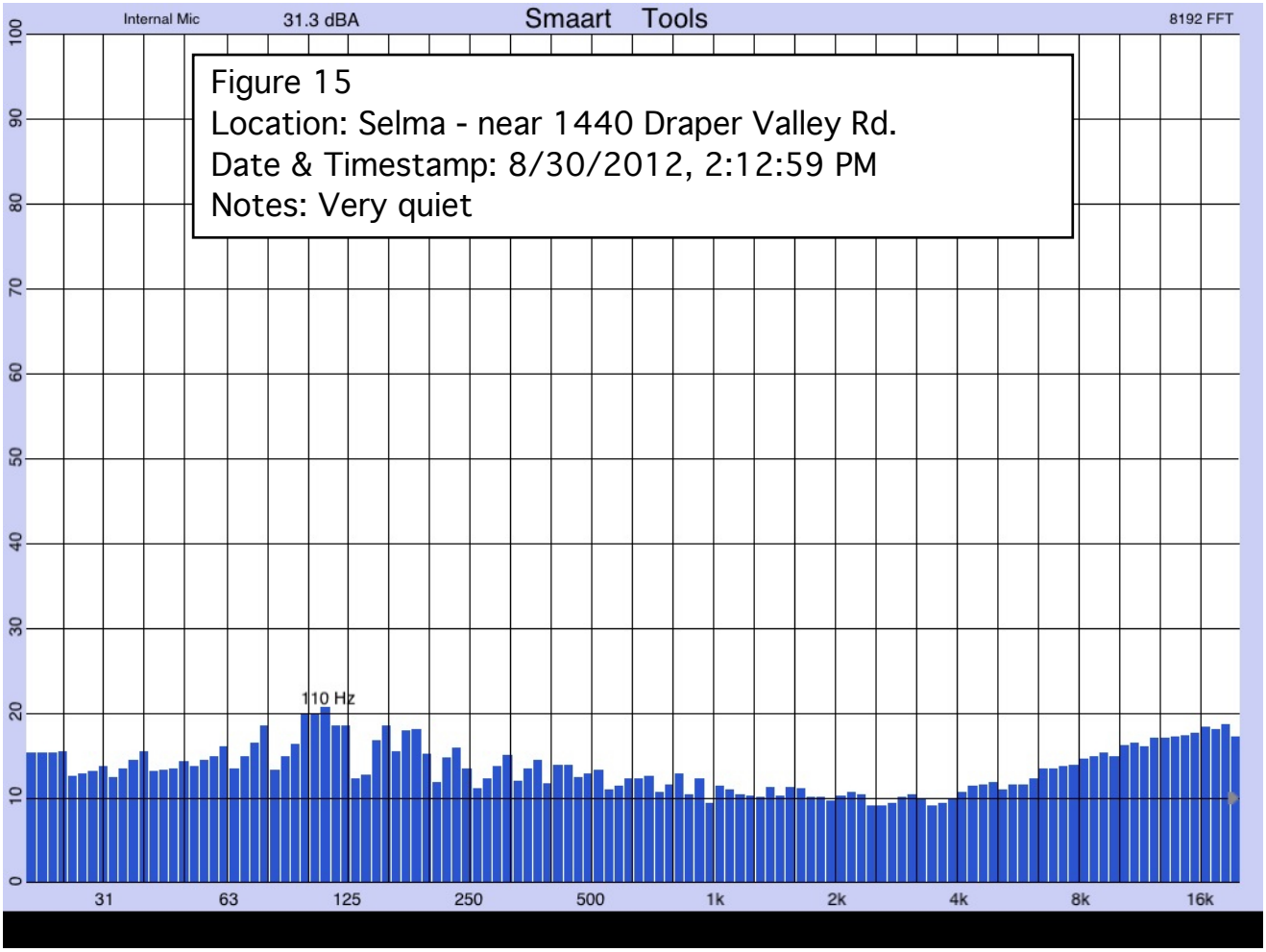


Figure 13
Location: Kerby, in front of "It's a Burl" shop
Date & Timestamp: 8/30/2012, 1:44:40 PM
Notes: Lots of woodworkiing machinery & traffic noise


Internal Mic
39.5 dBA
Smaart Tools
8192 FFT
Figure 14
Location: Selma Market parking lot
Date & Timestamp: 8/30/2012, 1:56:21 PM
Notes: Hwy. 199 traffic noise, customers coming & going
174 Hz
100
90
80
70
60
50
40
30
20
10
0
31
63
125
250
500
1k
2k
4k
8k
16k


Internal Mic
31.3 dBA
Smaart Tools
8192 FFT
Figure 15
Location: Selma - near 1440 Draper Valley Rd.
Date & Timestamp: 8/30/2012, 2:12:59 PM
Notes: Very quiet
110 Hz
100
90
80
70
60
50
40
30
20
10
0
31
63
125
250
500
1k
2k
4k
8k
16k

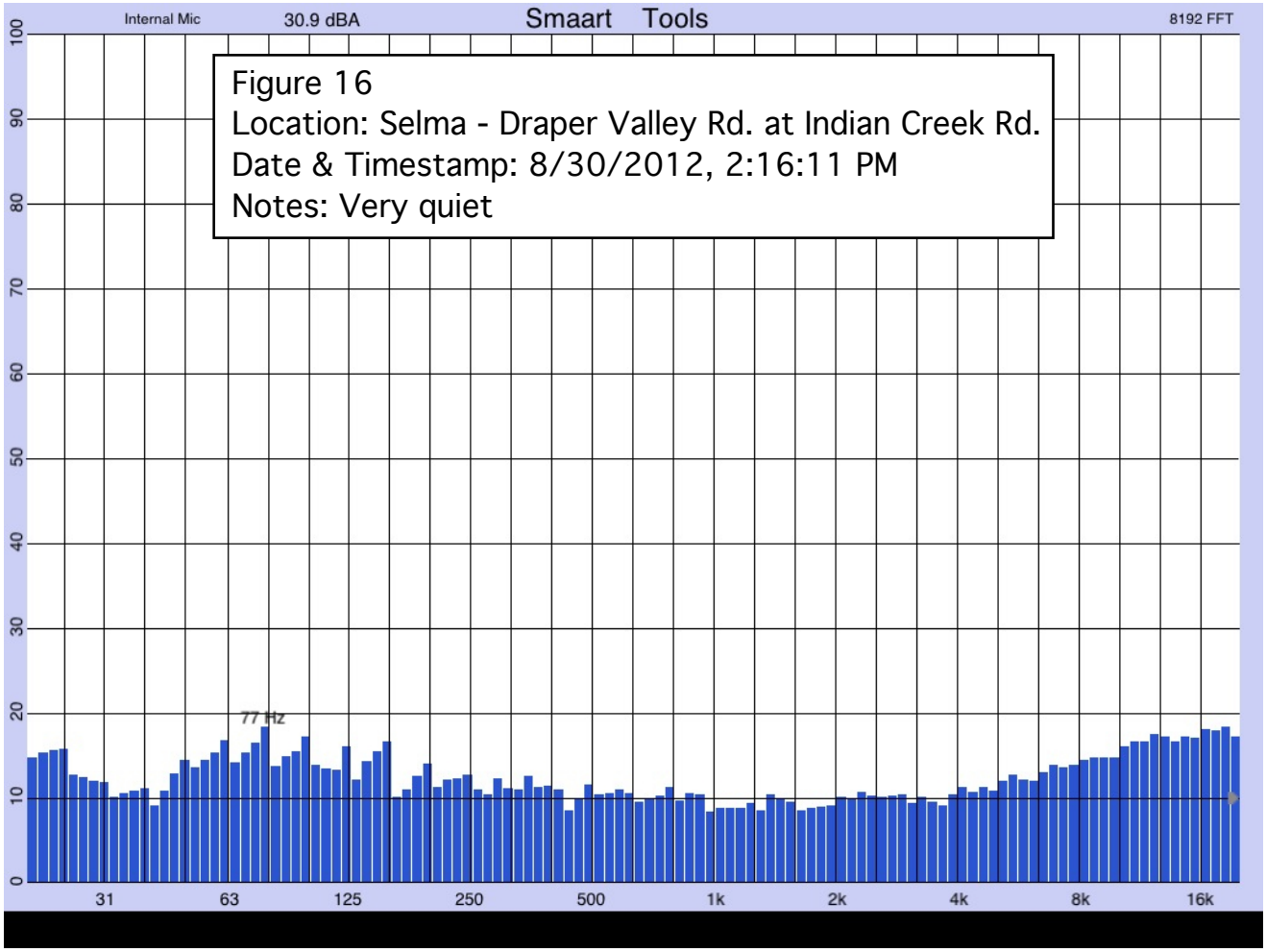


Figure 16
Location: Selma - Draper Valley Rd. at Indian Creek Rd.
Date & Timestamp: 8/30/2012, 2:16:11 PM
Notes: Very quiet

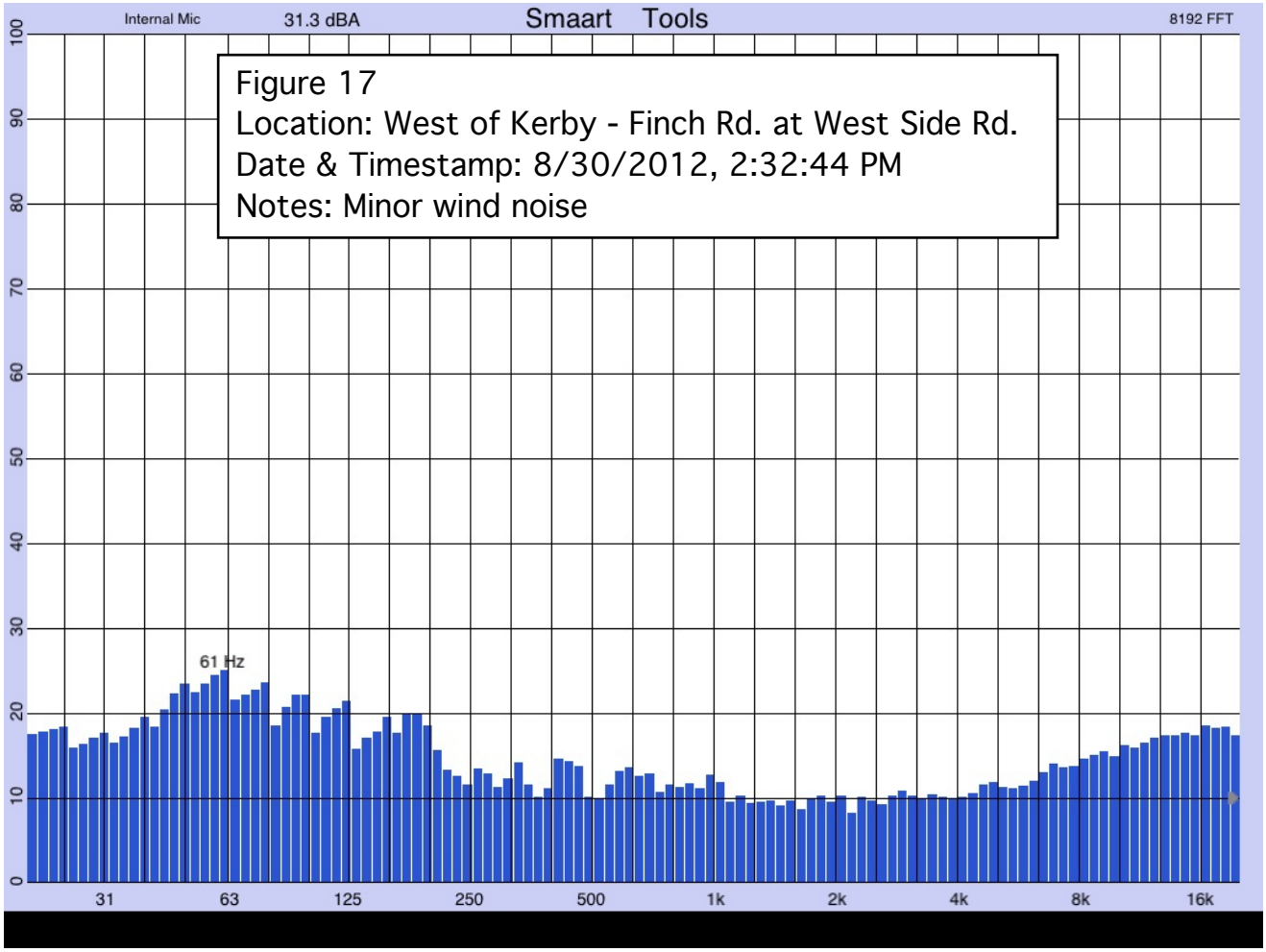


Figure 17
Location: West of Kerby - Finch Rd. at West Side Rd.
Date & Timestamp: 8/30/2012, 2:32:44 PM
Notes: Minor wind noise

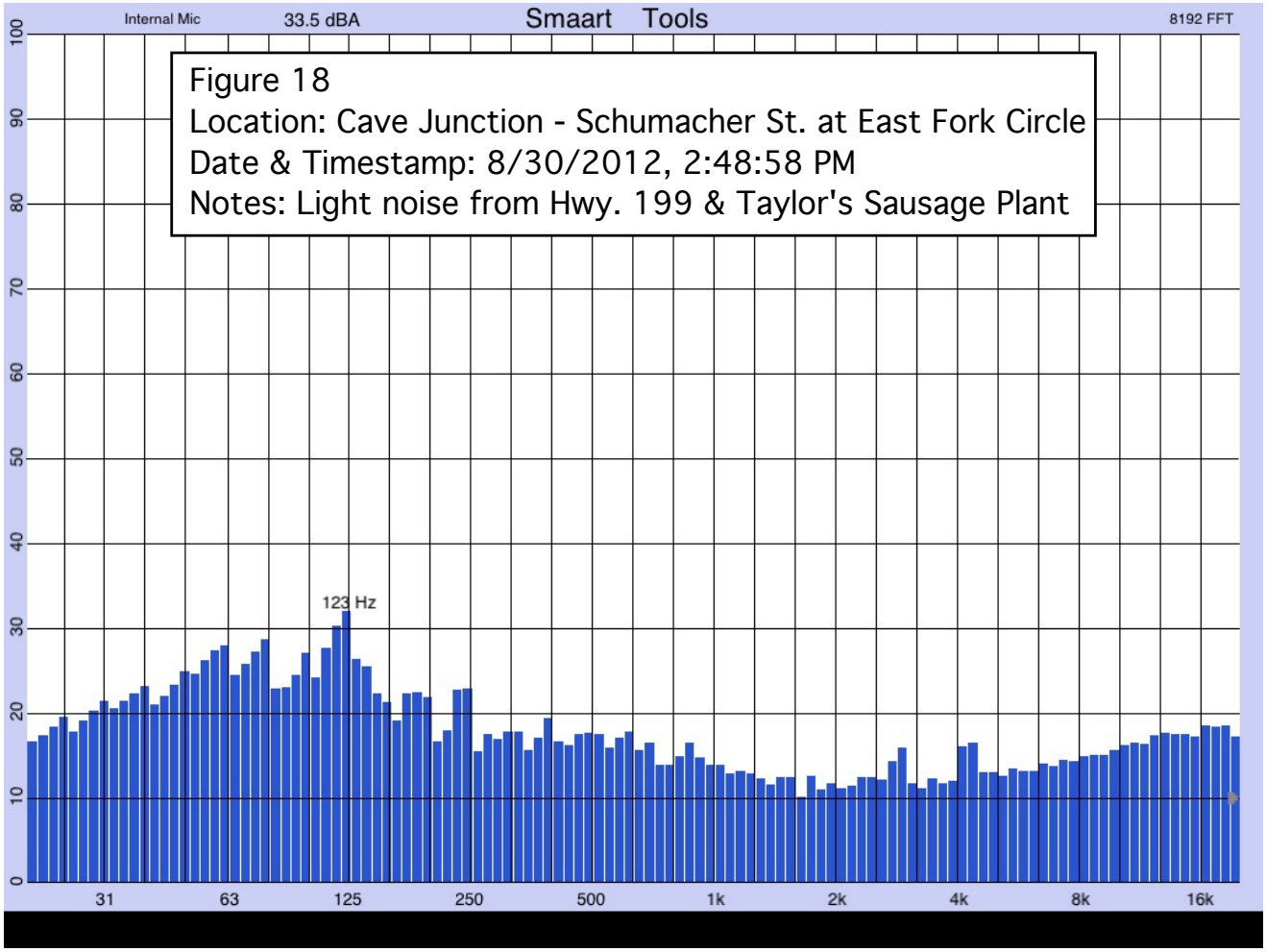


Figure 18
Location: Cave Junction - Schumacher St. at East Fork Circle
Date & Timestamp: 8/30/2012, 2:48:58 PM
Notes: Light noise from Hwy. 199 & Taylor's Sausage Plant

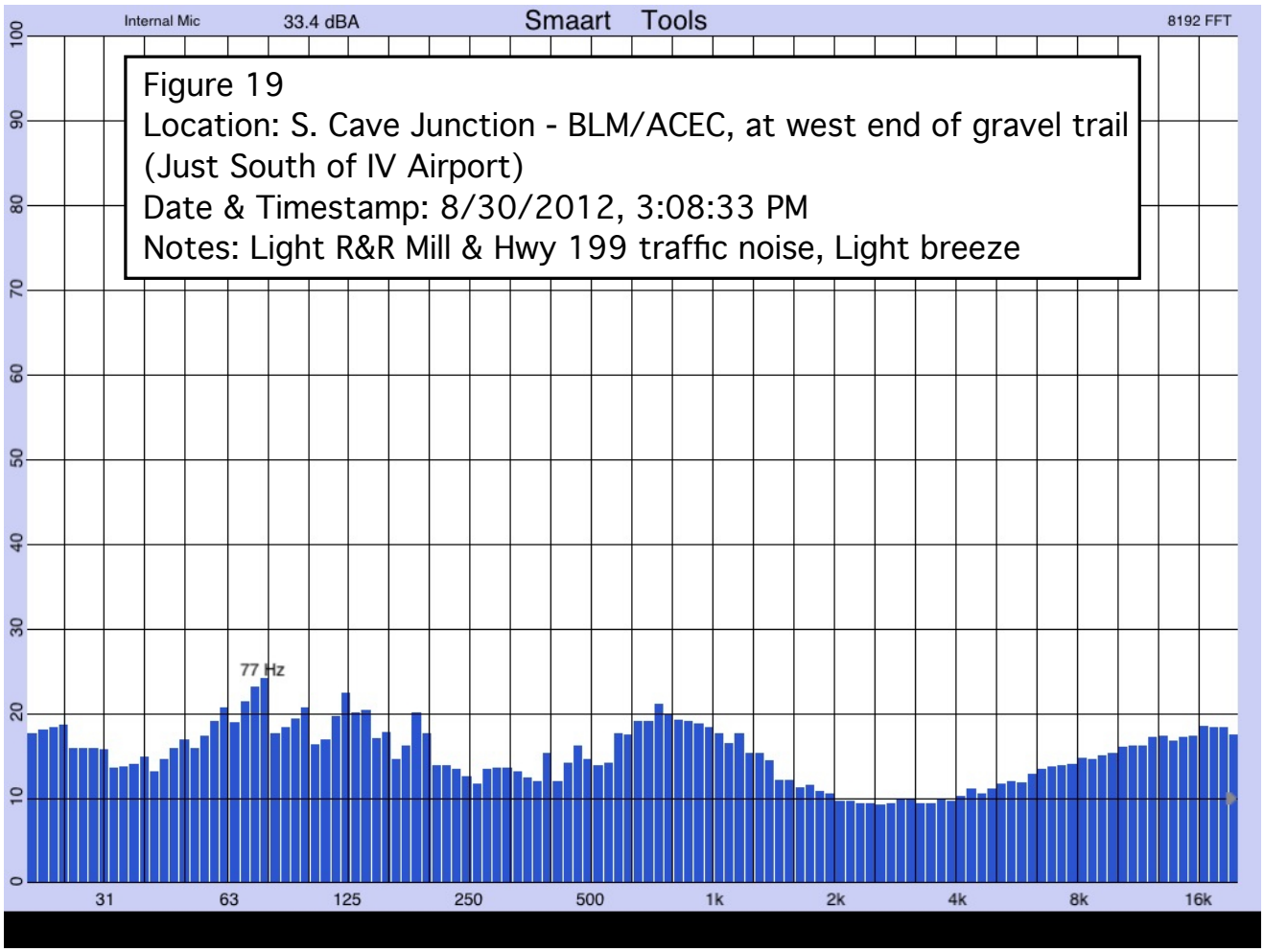


Figure 19
Location: S. Cave Junction - BLM/ACEC, at west end of gravel trail (Just South of IV Airport)
Date & Timestamp: 8/30/2012, 3:08:33 PM
Notes: Light R&R Mill & Hwy 199 traffic noise, Light breeze