

REPORT DOCUMENTATION PAGE			<i>Form Approved</i> <i>OMB No. 0704-0188</i>		
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1. REPORT DATE (DD-MM-YYYY) 7 May 2013		2. REPORT TYPE Consultative Letter		3. DATES COVERED (From – To) May 2012 – Feb 2013	
4. TITLE AND SUBTITLE Acoustical Evaluation of Transmission Monitoring at the 303 rd Intelligence Squadron, Osan AB, ROK			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Wells, Andrew T. Black, Jon E., Maj, USAF Jackson, Jerimiah M., TSgt, USAF Moll, Gene F., TSgt, USAF			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USAF School of Aerospace Medicine Department of Occupational and Environmental Health Consultative Services Division 2510 Fifth St. Wright-Patterson AFB, OH 45433-7913			8. PERFORMING ORGANIZATION REPORT NUMBER AFRL-SA-WP-CL-2013-0009		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A: Approved for public release; distribution is unlimited. Case Number: 88ABW-2012-2159, 7 May 2013					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT An acoustical assessment was performed on the 303IS transmission monitoring at Osan AB in May 2012. It was determined that personnel performing transmission monitoring duties were exposed to hazardous noise. Exposures at certain workstations were over the adjusted 12-hour exposure limit. Recommendations include enrolling personnel in the hearing conservation program, installing electronic filtering, use of noise cancellation headphones, and further investigation to determine root causes of hazardous noise levels.					
15. SUBJECT TERMS Noise, acoustical assessment, noise cancellation, octave band, hazardous noise					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Mr. Andrew T. Wells
U	U	U	SAR	13	19b. TELEPHONE NUMBER (include area code)



DEPARTMENT OF THE AIR FORCE
USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)
WRIGHT-PATTERSON AFB OH

7 May 2013

MEMORANDUM FOR 51 AMDS/SGPB
ATTN: MAJ JUNG LEE
UNIT 2060
APO AP 96278

FROM: USAFSAM/OEC
2510 Fifth Street
Wright-Patterson AFB, OH 45433

SUBJECT: Consultative Letter, AFRL-SA-WP-CL-2013-0009, Acoustical Evaluation of
Transmission Monitoring at the 303rd Intelligence Squadron, Osan AB, ROK

1. INTRODUCTION:

a. *Purpose:* On 21-25 May 2012, the United States Air Force School of Aerospace Medicine, Consultative Services Division (USAFSAM/OEC) and USAFSAM Detachment 3 (DET 3-USAFSAM/CD), at the request of 51 AMDS/SGPB, conducted an acoustical evaluation of transmission monitoring at various workstations within the 303 IS/DOA. This assessment was accomplished to help determine worker audiogram requirements in accordance with AFOSH Standard 48-20, *Occupational Noise and Hearing Conservation Program*. Assessment data were collected for two separate AFSCs—1N2X1C, Communication Signals Intelligence Analyst, and 1N3X1, Cryptologic Language Analyst—at five different workstations. Data were also collected in three different ambient locations within the area of the facility where transmission monitoring occurs. This consultative letter provides the results of the evaluation and recommends appropriate engineering controls.

b. *Survey Personnel:*

- (1) Chief, Occupational Health Services, DET 3-USAFSAM/CD
- (2) Flight Chief, Consultation Division, DET 3-USAFSAM/CD
- (3) Industrial Hygiene Consultant, USAFSAM/OECM
- (4) Senior Noise Engineer, USAFSAM/OECC

c. *Personnel Contacted:*

- (1) 303 IS/DO-1
- (2) Superintendent, Current Operations, 303 IS/DOA

d. *Equipment:*

- (1) Norsonic Real Time Analyzer, Type RTA 840, SN 18701
- (2) B&K Head and Torso Simulator, Type 4128C, SN 2425802
- (3) B&K Sound Level Calibrator, Type 4231, SN 2422533

2. METHODOLOGY:

a. USAFSAM personnel were not permitted to enter the room where transmission monitoring occurs due to compartmentalized security clearance requirements. Coordination prior to the assessment was accomplished to allow USAFSAM's equipment into the 303 IS facility. Due to this limitation, SMSgt Brown and MSgt Yi of the 303 IS were trained to operate the equipment and store the results of each assessment (see Attachment).

b. Sound pressure level (SPL) data were collected using a Brüel & Kjær Head and Torso Simulator (HATS) Type 4128C connected to a Norsonic Real-Time Analyzer (RTA) Nor-840. The RTA was set to slow response. The HATS and RTA were set up at a workstation used to monitor transmissions. A headphone from the 303 IS was placed on the head of the HATS to simulate the exposure to a workstation operator monitoring transmissions. The transmission signal was relayed to the HATS and the real operator simultaneously. If the operator adjusted the listening volume, the HATS would experience the same change. The RTA measured the 1/3 octave bands, equivalent overall SPLs for the given time of exposure, and the equivalent overall A-weighted SPL for the given time of exposure. This process was repeated at five different workstations: MB02, TA03, 212, 214, and 229.

c. SPLs using the HATS and RTA were also collected at three separate areas within the room where transmission monitoring occurs. These areas were identified as Conv, DGIF, and S&W by 303 IS personnel during the survey. The measurements were used to help determine if elevated background noise levels have an effect on listening volume inside the operators' headsets. During these measurements, the HATS system did not have a headphone attached.

d. Assessment data from workstation MB02 were collected while personnel with an AFSC of 1N2X1C performed monitoring duties. Assessment data from workstations TA03, 212, 214, and 229 were collected while personnel with an AFSC of 1N3X1 performed their duties.

e. Due to the typical 12-hour work shifts in this facility, the adjusted exposure limit is 83 dBA time-weighted average, in accordance with paragraph 3.1.2. of AFOSH Standard 48-20.

3. RESULTS:

a. Listed in Table 1 is the overall average SPL for each sampling event at each workstation, as well as employee, AFSC, and whether noise cancellation was in use during the sampling event. Also listed in Table 1 is the overall SPL for each of the three ambient areas that were measured.

b. Measured SPLs at workstation 214 were consistently well below the 12-hour exposure limit, while measured levels at workstation 212 were consistently well above the 12-hour exposure limit. At workstation MB02, two of the seven total sampling events exceeded the 12-hour exposure limit, and at workstation TA03 two of three exceeded the 12-hour exposure limit.

c. Measured ambient SPLs in the facility were consistent at the three locations tested and were not hazardous; however, interference from background noise may cause operators to increase signal levels to overcome interference from background noise.

d. Hazardous noise levels were observed for 1N2X1C and 1N3X1 AFSCs while performing transmission monitoring duties.

Table 1. Measurement Summary

Employee	Workstation	AFSC	Average Sound Pressure Level (dBA)	Noise Cancellation (On, Off, N/A)
Johnston	MB02	1N2X1C	80.9	N/A
Johnston	MB02	1N2X1C	85.3	N/A
Rapoza	MB02	1N2X1C	75.8	N/A
Rapoza	MB02	1N2X1C	87.7	N/A
York	MB02	1N2X1C	71.9	N/A
Unnamed Operator #1	MB02	1N2X1C	80.6	N/A
Ashford	MB02	1N2X1C	80.2	N/A
Burns	TA03	1N3X1	85.7	N/A
Burns	TA03	1N3X1	77.8	N/A
Unnamed Operator #2	TA03	1N3X1	86.7	N/A
Jacobson	229	1N3X1	78.5	On
Jacobson	229	1N3X1	82.9	Off
Bergmann	214	1N3X1	64	On
Bergmann	214	1N3X1	72.2	Off
Andrews	212	1N3X1	88.9	Off
Andrews	212	1N3X1	96.8	On
N/A	Ambient, Conv	N/A	70.4	N/A
N/A	Ambient, DGIF	N/A	69.7	N/A
N/A	Ambient, S&W	N/A	70.1	N/A

4. DISCUSSION: **All current and future 303 IS personnel should be trained about the risk of hearing loss and their ability to reduce their own exposures** by avoiding headset volume settings louder than necessary to accomplish the mission.

5. RECOMMENDATIONS:

a. Based on the results and the observed variability in overall SPLs at the different workstations, **USAFSAM/OEC recommends that all personnel, regardless of AFSC, who conduct transmission monitoring at this 303 IS facility should be enrolled in the hearing conservation program and receive audiograms.** Paragraph 2.15.4. of AFOSH Standard 48-20 states that Public Health will “enroll personnel identified by supervisors as occupationally exposed to hazardous noise (by BE survey and recommended by OHWG) into a testing program that includes pre-placement, periodic (at least annually), and termination audiograms.”

b. **Install and use electronic filtering.** For certain operations, it may be possible to filter the incoming signals electronically to reduce SPLs inside a headset. This would be particularly helpful while performing duties where the incoming transmission has a very narrow range of audible frequencies of interest. For example, if an incoming transmission signal has an audible frequency range of 500 Hz – 2.5 kHz, electronic filtering would remove any signals that fall outside this range. This may also reduce distractions and help the workers focus on what they are trying to monitor.

c. **Evaluate the workstations where hazardous SPLs were measured to identify sources contributing to elevated noise levels.** Workstation 212 should be the first priority. The operator was the same for both measurements at this workstation, so operator technique should be considered, as well as the process performed and equipment specific to this workstation.

d. **The use of noise canceling equipment does not appear to have a significant impact on the reduction of SPLs inside the headphones.** The use of this equipment should be based on operational requirements, as well as individual user preference; however, its availability to all personnel is recommended.

6. CONCLUSION: **Request a follow-up assessment after the installation of engineering controls or implementation of administrative controls is complete.** The assessment would determine the overall effectiveness of the controls to reduce the SPL below the maximum allowed for continuous noise.

7. We greatly appreciated the assistance of the 303 IS in accomplishing this assessment. If you have any further questions regarding this report, please contact Mr. Andrew Wells at DSN 798-3306 or andrew.wells@us.af.mil. Please direct any questions or comments regarding Industrial Hygiene Consultative support to Lt Col Sonntag at DSN 798-3328 or david.sonntag@us.af.mil. To improve our services, please complete and return the critique provided with this report.



JON E. BLACK, Maj, USAF, BSC
Chief, Bioenvironmental Engineering Consulting Branch

Attachment:
1/3 Octave Band Noise Data

Attachment
1/3 Octave Band Noise Data, 303 IS/DOA

Position		MB02														
Name		Johnston														
Duration(H:MM)		1:22														
Headset Mfg		Sennheiser					Noise Cancellation					N/A				
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	57.2	60.7	64.5	62.4	63.5	63.3	61.4	60.5	59.5	59.5	58.5	59.1	57.4	55.8	56.4	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	61.2	62.9	64.9	67.5	75.4	74.0	74.2	65.3	44.3	41.6	41.3	41.9	42.8	44.0	45.6	47.0
Linear	A-Weighted															
80.8	80.9															

Position		MB02														
Name		Johnston														
Duration(H:MM)		11:55														
Headset Mfg		Sennheiser					Noise Cancellation					N/A				
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	57	59.9	63.7	62.7	64.6	64	61.5	59.7	58.9	59.3	58.1	60.1	61.4	63.4	64.1	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	65	66.6	68.2	70.6	74.9	75.6	80	78.2	68.5	50.4	42.7	42.6	43	44	45.6	47
Linear	A-Weighted															
84.6	85.3															

Position		MB02														
Name		Rapoza														
Duration(H:MM)		1:59														
Headset Mfg:		Sennheiser					Noise Cancellation:					N/A				
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	60.4	61.5	63.3	63.8	65.8	66.1	65.4	64.7	64.6	61.6	59.2	58.1	57.5	57.6	58.7	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	59	58.7	59.2	60.5	62.9	64.7	69	70.1	63.5	58.1	52.5	48.9	47.1	47.6	46.1	47.6
Linear	A-Weighted															
77.6	75.8															

Position		MB02														
Name		Rapoza														
Duration(H:MM)		10:50														
Headset Mfg:		Sennheiser					Noise Cancellation: N/A									
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	58.4	60.1	62.8	62.9	64.9	64.7	63.1	60.1	60.1	59.3	59.6	58.3	59.6	58.3	61.2	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	72.9	73	73.7	75.8	80.3	77.6	79.5	80.4	74.8	57.6	52.3	49	43.2	44.1	45.6	47.0
Linear	A-Weighted															
	87.3		87.7													

Position		MB02														
Name		York														
Duration(H:MM)		5:00														
Headset Mfg:		Sennheiser					Noise Cancellation: N/A									
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	58	60	62.7	62.8	64.8	64.8	63.1	59.9	60.4	59.8	59.7	57.7	57.9	60	59.6	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	59.1	58	61.2	61.6	60.1	62	65.8	62.5	56.6	41.6	41.3	42	42.7	43.8	45.5	47.1
Linear	A-Weighted															
	75.2		71.9													

Position		TA03														
Name		Burns														
Duration(H:MM)		4:58														
Headset Mfg:		Sennheiser					Noise Cancellation: N/A									
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	64.2	69.2	62	62.8	60.5	64.7	61.7	60.3	58.9	59.2	57.3	57.4	57.6	59.3	63.8	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	61.4	62	66.1	69.3	68.5	71.1	78.5	78.2	80.5	60.4	43.9	42.4	43	44.2	45.6	47.1
Linear	A-Weighted															
	84.9		85.7													

Position		TA03																
Name		Burns																
Duration(H:MM)		5:02																
Headset Mfg		Sennheiser					Noise Cancellation					N/A						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	64.4	68.4	63.2	64.1	64.3	68.6	71.8	73.4	72.4	69.7	67.4	66.9	66.7	62.4	59.8			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	59.7	59.3	60.1	61.4	62.9	65.5	70.2	72.3	68.7	54.9	43.4	42.2	43	44.2	45.6	47.1		
Linear	A-Weighted																	
	81.7		77.8															

Position		Conv																
Name		N/A																
Duration(H:MM)		2:16																
Headset Mfg		None					Noise Cancellation					N/A						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	68.6	68.6	63	64.5	64.5	66.6	62.1	59.3	58.6	58.3	56.5	56.3	55.9	56	57.8			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	60.3	59.7	57.1	55.2	54.8	57.2	59.6	52.1	61.3	59	54.5	53.8	55.3	56.8	55	52.6		
Linear	A-Weighted																	
	75.6		70.4															

Position		229																
Name		Jacobson																
Duration(H:MM)		0:15																
Headset Mfg		Bose					Noise Cancellation					On						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	58.6	58.6	54.1	54.3	54.7	54.5	53.9	54.6	55.1	57.3	62.8	60.6	58.4	59.2	65.8			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	62.4	64.3	58.7	58.8	61.2	68.2	71.6	72.5	69.6	54	44.1	42.1	42.7	43.8	45.5	47.1		
Linear	A-Weighted																	
	78.3		78.5															

Position	229																	
Name	Jacobson																	
Duration(H:MM)	0:18																	
Headset Mfg	Bose								Noise Cancellation								Off	
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	61.8	64.7	62.1	64.1	65.7	66.2	65.6	65.5	63.4	63.8	61.9	60.3	60.7	60.1	66.8			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	66	70	69.2	67.7	66.9	71.5	74.3	76.6	75.5	61.8	54	44.7	42.9	43.9	45.5	47		
Linear	A-Weighted																	
	82.8		82.9															

Position	214																	
Name	Bergmann																	
Duration(H:MM)	0:19																	
Headset Mfg	Bose								Noise Cancellation								On	
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	64	67.8	68.1	68.2	69.3	62.4	58.4	54.3	51.1	50	45.6	46.8	47.2	46	47.9			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	49.8	49.1	47.1	47	48.3	52.8	56.6	56.7	53.9	49.3	51	42.2	42.9	44	45.6	47.2		
Linear	A-Weighted																	
	75		64															

Position	214																	
Name	Bergmann																	
Duration(H:MM)	0:21																	
Headset Mfg	Bose								Noise Cancellation								Off	
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400			
Measured Leq	61.9	64.3	63.4	64.9	67.5	64	62.5	61.2	61.2	63.5	62.8	66.3	62.6	56.6	57.6			
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K		
Measured Leq	59.5	59.5	57.7	55.7	58	62	64	63.4	61.3	60.4	61	46.3	42.9	43.9	45.5	47.1		
Linear	A-Weighted																	
	76.5		72.2															

Position		212														
Name		Andrews														
Duration(H:MM)		0:24														
Headset Mfg		Bose				Noise Cancellation				Off						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	59.8	65.1	62	64.6	69.8	66.7	63.4	62.8	61.2	65	64.4	66.4	66.3	66.7	68.1	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	70.3	72.5	73.9	74	73.9	76.5	80.9	82.9	81.6	68.1	55	44.3	43.4	44.7	45.6	47.1
Linear	A-Weighted															
	88.2		88.9													

Position		212														
Name		Andrews														
Duration(H:MM)		0:27														
Headset Mfg		Bose				Noise Cancellation				On						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	62.6	69.3	67.6	68.3	71.3	66	64.3	67.5	68.4	69.3	70.8	72.1	73.2	74.3	75.2	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	76.3	75.7	74.5	77	79.9	85.6	90.3	91.1	88.2	75.5	71.8	57.3	49.2	52.4	47.4	47
Linear	A-Weighted															
	95.9		96.8													

Position		DGIF														
Name		N/A														
Duration(H:MM)		0:27														
Headset Mfg		N/A				Noise Cancellation				N/A						
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	60.1	63.6	60.4	62.3	65.1	66.2	64.2	62.7	60.3	60	57.5	58.4	57.5	55.3	55.9	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	56.8	58.1	56	57.6	55	56.1	59.6	62.2	61.4	57.5	54	49.5	48	48.2	46.7	47.4
Linear	A-Weighted															
	74.7		69.7													

Position		S&W														
Name		N/A														
Duration(H:MM)		2:22														
Headset Mfg		N/A					Noise Cancellation									N/A
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	57.7	64.6	63.3	64.8	64.3	64.1	65.5	64.5	56.7	57.3	57.1	57.4	56	55.2	57.3	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	57.8	59.1	57.3	57.8	56	58.3	59.4	62.4	61.3	57.4	54.1	50.5	47.6	48.1	46.8	47.6
Linear	A-Weighted															
	74.9	70.1														

Position		TA03														
Name		Unnamed Operator #2														
Duration(H:MM)		5:42														
Headset Mfg		Sennheiser					Noise Cancellation									N/A
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	64.9	68.7	61.7	63.8	62	65.3	60.7	59.5	58.4	59	59.9	66	73.7	74.2	74.3	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	73.4	73.1	74.4	73.5	74.8	75.8	78.5	78.8	75.8	73.5	71.4	62.6	56.2	55.6	49.7	47.1
Linear	A-Weighted															
	86.8	86.7														

Position		MB02														
Name		Unnamed Operator #1														
Duration(H:MM)		6:13														
Headset Mfg		Sennheiser					Noise Cancellation									N/A
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	56.4	59.3	63	61.9	64.4	64	60.9	59.1	57.4	58.9	56.1	56	53.6	55.6	59.9	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	66.5	69.5	68.4	67.7	68.1	70.5	72.9	75.3	61.9	45.1	41.6	42	42.8	43.8	45.5	47
Linear	A-Weighted															
	80.6	80.6														

Position		MB02														
Name		Ashford														
Duration(H:MM)		2:18														
Headset Mfg		Sennheiser					Noise Cancellation					N/A				
Frequency (Hz)	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Measured Leq	56.7	59.5	63	62.4	65	64.1	60.8	59.4	57.9	58.4	56.3	56.4	54.9	56.9	61.1	
Frequency (Hz)	500	630	800	1K	1.25	1.6	2K	2.5	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K
Measured Leq	66.8	68.4	67.9	66	68.4	70.4	71.3	74.1	59.7	47.2	41.7	42.1	42.8	43.8	45.5	47
Linear	A-Weighted															
80.2	80.2															