

TEST REPORT #190909

STANDARD: FCC PART 15

SUBPART C--INTENTIONAL RADIATORS

SECTION 15. 247 OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHZ, AND 5725-5850 MHZ

LIMITED MODULAR APPROVAL FOR USE ONLY IN GRANTEES PRODUCTS

EQUIPMENT TESTED:

BODYSOUND TECHNOLOGIES, INC.

FCC ID: UJF ALNKA01

AIR LINK

MODEL: ALNK-A01

TEST DATE: 19 SEPTEMBER, 2009

1100 Falcon Avenue Glencoe, MN 55336



Prepared for: BodySound Technologies, Inc.

6321 Bury Drive, Suite 8 Eden Prairie, MN 55346

Test agent: International Certification Services, Inc.

1100 Falcon Avenue Glencoe, MN 55336 Tele: 320-864-4444 Fax: 320-864-6611

Test location: International Certification Services, Inc.

1100 Falcon Avenue Glencoe, MN 55336 Tele: 320-864-4444 Fax: 320-864-6611

Prepared by: International Certification Services, Inc.

1100 Falcon Avenue Glencoe, MN 55336

International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.

This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.



1.0 TEST SUMMARY

TEST REPORT: #190909

COMPANY: Body Sound Technologies, Inc.

AGENT: International Certification Services, Inc.

PHONE: 320-864-4444

TEST DATE: 19 September, 2009

EQUIPMENT UNDER TEST: Wireless audio transceiver for transmitting digital audio

data. Air Link Model: ALNK-A01

GENERAL TEST SUMMARY: The testing was performed at International Certification

Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336

VERIFICATION / CERTIFICATION The 2.4 Ghz Transmitter Air Link Model: ALNK-A01 was

STATUS:

found to be in compliance with the FCC Part 15 Subpart C,

Section 15.247 requirements.

MODIFICATIONS NECESSARY: None

ALXW Class

TESTED BY WRITTEN BY

Steve Wendlandt Duane R. Bagdons



Applicable Standards

47 CFR Ch.1 (10-1-98 Edition)

FCC Part 15 Radio Frequency Devices
Subpart C Intentional Radiators

Section 15.247 Operation within the bands 902-928 Mhz, 2400-2483.5 Mhz and 5725-5850 Mhz.

2.1 Referenced Standards

ANSI C63.4-2003 Methods of Measurement of Radio-Noise Emissions from Low-Voltage

Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz.

FCC DA 00-705 Filing and Measurement Guidelines for Frequency Hopping Spread

Spectrum Systems.

2.2 Equipment Units Tested

The equipment tested was an Air Link 2.4 Ghz transmitter model: ALNK-A01. This device uses a Nordic nRF24Z1 2.4 Ghz wireless audio streamer processing chip to drive an SST type SST12LP00 power amplifier chip coupled to a Pulse Company antenna P/N: W1030 that has a reverse SMA male coax connector. The Air Link is powered by its host device (BodySound Technologies, Inc. BodyLink Model: BLNK-A01) providing 5 VDC. The data format and frequency hopping activity are all created in the firmware built in to the Nordic nRF24Z1 processor chip. The transmit burst duration is controlled by the Nordic microprocessor to a length of around 1.30 mS. This time is controlled by the internal firmware of the Nordic chip. The Air Link is not a Spread Spectrum device, it is only a frequency hopping design. The Transmitter uses 20 channels. This meets the requirement of FCC 15.247 (1)(iii) of transmitting on a minimum of at least 15 channels. The actual transmitting burst signal is only 1.38 mS long and is controlled by the Nordic microprocessor chip.

2.3 Equipment and Cable Configuration

See photo of the EUT test configuration setup in Attachment A

2.4 List of Test Equipment

Test Equipment	<u>Model</u>	S/N	Calibration Date
Spectrum Analyzer	Hewlett-Packard 8566B	2421A 004 58	01/25/08
Preamp	Nextec NB0031	378	06/09/08
Horn Antenna (1-18 Ghz)		5697	08/30/07
Harmonic Mixer (18-26.5	HP11970K	3003A04385	10/10/08
Ghz)			
RF Amplifier (2-8 Ghz)	HP11975A	2738A01733	09/30/08
Horn Antenna (18-26	Alpha Industries 61932500	55	01/23/08
Ghz)			
·			



Measurement cable losses, and antenna correction factors are included in the data sheets. The Resolution BW was set at 1 Mhz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements over 1000 Mhz. Proper bandwidths were used as suggested in the FCC DA-00-705 guideline dated March 30-2000 for various measurements.

2.5 Units of Measurement.

Measurements were taken in dBuV/m with the antenna located at 1 meter distance from the EUT or in dBm for the direct connection method for conducted measurements. Frequency measurements are recorded in Mhz

2.6 Location of Test Site

The open area test site (OATS) measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave in Glencoe, MN 55336. This site has been certified to be in spec of the normalized site attenuation per ANSI C63.4-2003.

2.7 Measurement Procedures

Radiated Emissions measurements were taken with an antenna placed at a distance of 1 meter from the EUT. The EUT was set on an insulating table in the OATS site and rotated through all angular orientations to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10th harmonic at an antenna height variation of from 1-4 meters. Conducted measurements were recorded in dBm with the EUT antenna connector connected directly to the spectrum analyzer. The EUT (Airlink Model: ALNK-A01) is plugged into a header connector on the main PC board of the BodyLink device.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B.

2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 10th harmonic are reported in the data sheets in Attachment B. This information is plotted against the limit of section 15.247 of FCC Part 15 subpart C. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed but all maximum signal strengths occurred in the Horizontal antenna polarity and at 1 meter antenna height.

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.



Example:

<u>Frequency</u>	<u>Level</u>	+	Factor	_ =	Corr Data	-	FCC Limit	=	<u>Margin</u>
(MHz)	(dBuV)	+	(dB)	=	(dBuV/m)	-	(dBuV/m)	=	(dB)
100.0	20.6	+	11.0	=	31.6	_	43.5	=	-11. 9

2.10 Operating Frequency Data for Intentional Radiators

All operating frequencies and harmonic frequencies and ambient temperature at which all data was taken at, is recorded in the data sheets in Attachment B.

2.11 Occupied Bandwidth Data for Intentional Radiators

The occupied BW data for the EUT is listed in the data sheets in Attachment B.

2.12 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart C, Section 15.247 with a maximum output power of 0.01156 Watts. This power was measured using the conducted measurement method at three frequencies in the band (low channel, middle channel, and high channel) against an allowable limit of 0.125 Watt as required by FCC 15.247 (a)(1) and (b)(1). A minimum of 20 channels are used in this device.

Freq (Mhz)	EUT Power Out (dBm)	EUT Power Out (W)	FCC 15.247 (b)(1) Limit (Watts)
2401.938	9.782249	0.00951	0.125
2441.062	10.45575	0.01111	0.125
2478.062	10.62775	0.01156	0.125



ATTACHMENT A

RADIATED MEASUREMENT TEST SET UP



BodySound Technologies, Inc. Air Link Model: ALNK-A01 Radiated Emissions





ATTACHMENT B

DETAILED TEST DATA SHEETS

Each radiated emissions plot indicates the receiving antenna measurement distance in meters and the emission amplitudes with respect to their applicable limits. The associated tabulation for each radiated plot lists the emission frequency, the final emission level, and the margin from the limit.



BodySound Technologies, Inc.

Air Link

Model: ALNK-A01

Temperature: 14.2 Deg C.

Humidity: 44 % R.H.

Test Technician: Duane R. Bagdons

Center Frequency: 2403.4 Ghz (low channel)

2441 Ghz (mid channel) 2479.1 Ghz (high channel)

Preliminary testing was done to determine what antenna polarity and antenna height generated the highest signal levels. Tests were performed at this test configuration and then each frequency was maximized to 0-360 degrees orientation and antenna height of 1-4 meters.

15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 Mhz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mS. The system shall hop to channel frequencies that are selected at the system hoping rate from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

The Microprocessor chip (Nordic Model: nRF24Z1) is an adaptable device that can be adapted to the Bluetooth frequency band. It has built in firmware to control the output protocol such as frequency usage and receiver bandwidths.



The Bandwidth measurements were made using the direct connected conducted power measurement method.

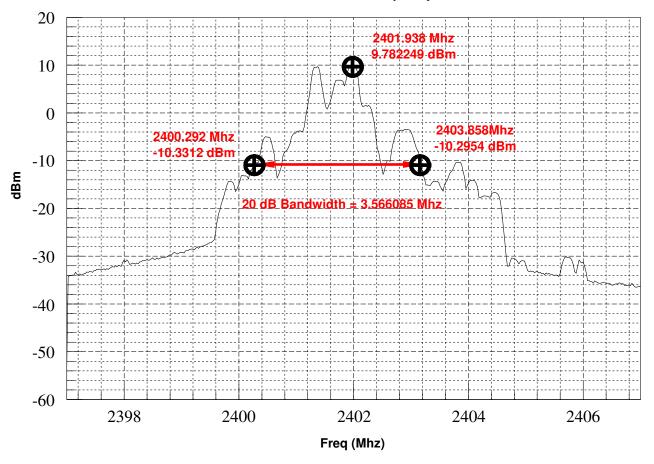
Channel	Frequency	Amplitude	20 dB BW
	(Ghz)	(dBm)	(Mhz)
Low Channel	2400.292	-10.3312	
	2401.938	9.782249	3.566085
	2403.858	-10.2954	
Mid Channel	2439.865	-9.55946	
	2441.062	10.45575	3.042394
	2442.908	-9.72163	
High Channel	2476.317	-9.71527	
	2478.062	10.62775	3.541147
	2479.858	-9.54943	

Channel Separation (20 channels) = 4.98 Mhz

Referring to the above table of Bandwidths ranging from 3.042394 Mhz to 3.566085 Mhz, the Channel separation listed above meets this requirement.



BodySound Technologies, Inc. Air Link Transmitter Model: ALNK-A01 FCC 15.247 20 dB Bandwidth Low Channel Frequency

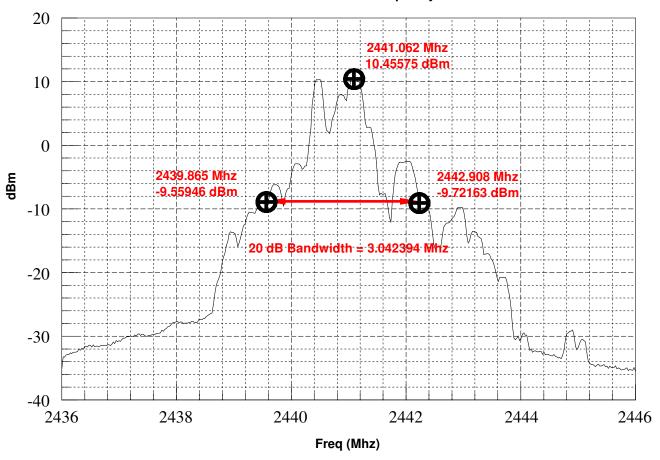


International Certification Services, Inc.

September 16, 2009



BodySound Technologies, Inc. Air Link Transmitter Model: ALNK-A01 FCC 15.247 20 dB Bandwidth Middle Channel Frequency

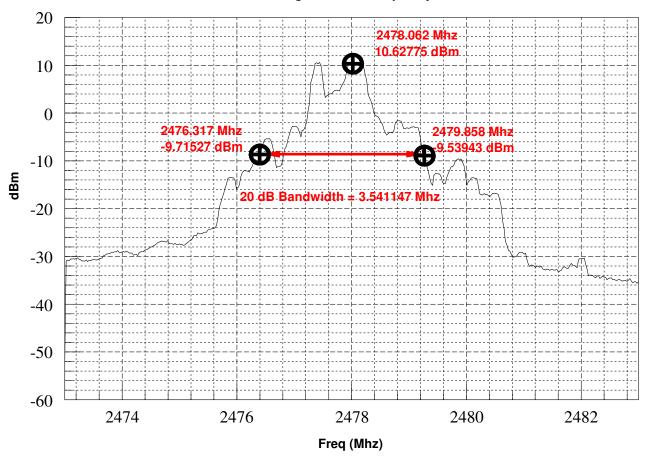


International Certification Services, Inc.

September 16, 2009



BodySound Technologies, Inc. Air Link Transmitter Model: ALNK-A01 FCC 15.247 20 dB Bandwidth High Channel Frequency

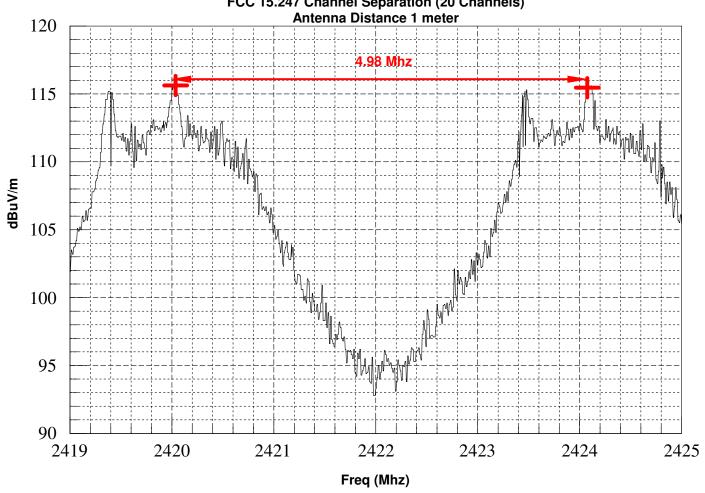


International Certification Services, Inc.

September 16, 2009







International Certification Services, Inc.

March 27, 2009

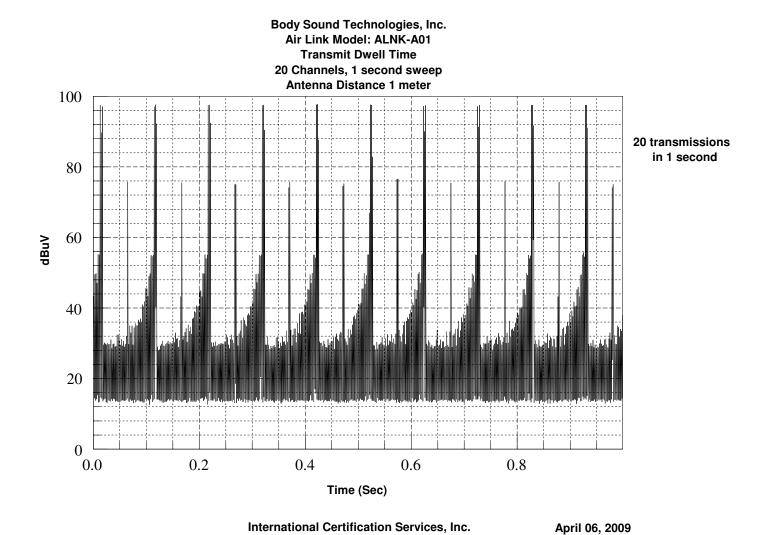
15.247 (a) (1) (i) N/A

15.247 (a) (1) (ii) N/A

15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 Mhz band shall use at least 20 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 20 channels are used.



"The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed."



20 Channels (minimum) 0.4 sec * 20 Channels = 8 Seconds maximum Maximum Allowed Occupancy time for 20 Channels = 0.4 seconds in 8 seconds.

Measured: Transmit Burst time = .0013 Seconds 20 Transmit Bursts per second

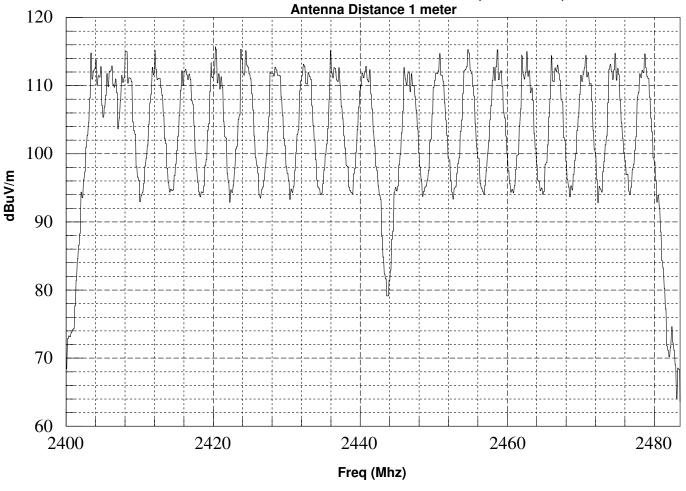
8 seconds = 160 transmit bursts

<u>Measured Occupancy time = 20 * 8 * 0.0013 seconds = 0.208 seconds for a 20 channel system</u>

15.247 (b) (1)	For frequency hopping systems operating in the 2400-2483.5 Mhz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 Mhz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 Mhz band: 0.125 watts.
15.247 (b)	The maximum peak conducted output power of the intentional radiator shall not exceed the following:
15.247 (a) (2)	N/A. This device uses frequency hopping as well as digital modulation.



BodySound Technologies, Inc. Air Link Model: ALNK-A01 FCC 15.247 Number of Channels Transmitted (20 Channels)



International Certification Services, Inc.

March 27, 2009

This device has a minimum of 20 channels in the 2400-2483.5 Mhz band, hence the allowable output power is 0.125 watts. The output power was measured using the conducted measurement method. See table below for results.

Freq (Mhz)	EUT Power Out (dBm)	EUT Power Out (W)	FCC 15.247 (b)(1) Limit (Watts)
2401.938	9.782249	0.00951	0.125
2441.062	10.45575	0.01111	0.125
2478.062	10.62775	0.01156	0.125



- 15.247 (b) (2) N/A, this device operates in the 2400-2483.5 Band.
- 15.247 (b) (3)

 For systems using digital modulation in the 902-928 Mhz, 2400-2483.5 Mhz and 5725-5850 Mhz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g. alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

N/A, the output power allowed for this device since it only uses 20 channels is 0.125 Watts as stated in FCC 15.247 (b)(1).

15.247 (b) (4)

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

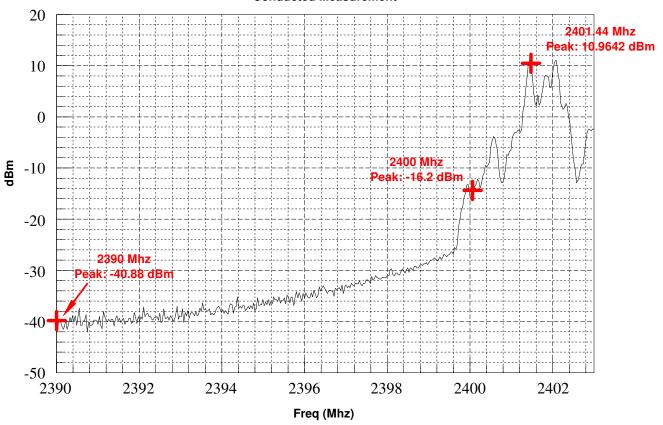
The internal antenna of this device is non directional and does not exceed 6 dBi (The antenna gain is 2.0 dBi) hence the power limit listed in the above table is acceptable.

- 15.247 (c) N/A The antenna in this device does not have a gain of greater than 6 dBi. (The antenna gain is 2 dBi)
- In any 100 Khz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional Radiator shall be at least 20 dB below that in the 100 Khz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209 (a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in

section 15.205 (a), must also comply with the radiated emissions limits specified in Section 15.209 (a) (see Section 15.205 (c)).

Frequency (Mhz)	Measured Amplitude (dBm)	-20 dB Limit	Margin (dB)
2401.44	10.9642		
2400	-16.2	-9.04	-7.16
2478.03	12.4879		
2483.5	-33.864	-7.51	-26.35

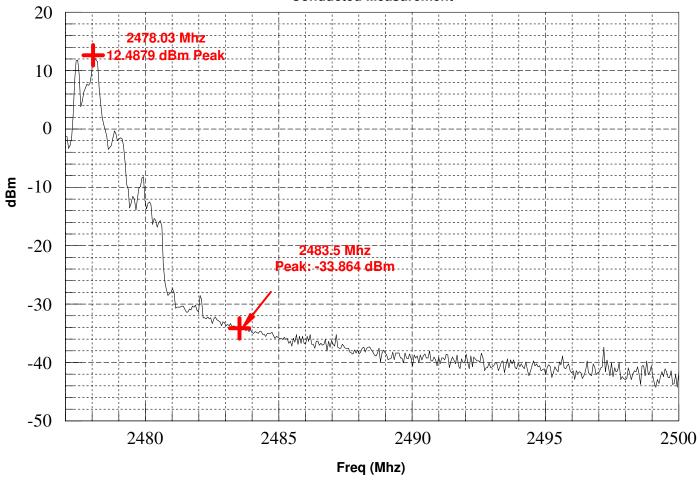
BodySound Technologies, Inc. Model: ALNK-A01 FCC 15.247 Low Band Edge Conducted Measurement



International Certification Services, Inc.



BodySound Technologies, Inc. Model: ALNK-A01 FCC 15.247 High Band Edge Conducted Measurement



International Certification Services, Inc.



Harmonic Frequencies observed:

Low Frequency Channel:

Freq (Mhz)	Cond Power measurement dBm	VHP-39 High Pass Filter (dB)	C044 cable (dB)	Corr Data (dBm)	Max In Band Power (dBm)	Limit	Margin (dB)	
2401.938	8.49		1.3	9.79	9.79	9.79		Fundamental
4802.92	-19.67	1.87	2	-15.8		-10.21	-5.59	Harmonic 1
7206.18	-31.17	5.56	2.6	-23.01		-10.21	-12.80	Harmonic 2
9600.48	-36.17	7.18	2.6	-26.39		-10.21	-16.18	Harmonic 3
12007.9	-41.17	3.48	3.3	-34.39		-10.21	-24.18	Harmonic 4
14409.42	No signal observed	3.92	3.2	No signal observed		-10.21		Harmonic 5
16810.9	No signal observed	4.56	3.8	No signal observed		-10.21		Harmonic 6
19212.3	No signal observed	4.7		No signal observed		-10.21		Harmonic 7
21613.86	No signal observed	4.7		No signal observed		-10.21		Harmonic 8
24019.27	No signal observed	4.7		No signal observed		-10.21		Harmonic 9
26421.3	No signal observed	4.7		No signal observed		-10.21		Harmonic 10



Middle Frequency Channel:

Freq (Mhz)	dBm	VHP-39 High Pass Filter (dB)	C044 cable (dB)	Corr Data (dBm)	Max In Band Power (dBm)	Limit	Margin (dB)	
2441.062	9.32		1.3	10.62	10.62	10.62		Fundamental
4882	-19.83	1.87	2	-15.96		-9.38	-6.58	Harmonic 1
7323	-35	5.56	2.6	-26.84		-9.38	-17.46	Harmonic 2
9764	-37.17	7.18	2.6	-27.39		-9.38	-18.01	Harmonic 3
12205.1	No signal observed	3.48	3.3	No signal observed		-9.38		Harmonic 4
14646.24	No signal observed	3.92	3.2	No signal observed		-9.38		Harmonic 5
17087.36	No signal observed	4.56	3.8	No signal observed		-9.38		Harmonic 6
19528.48	No signal observed	4.7		No signal observed		-9.38		Harmonic 7
21969.6	No signal observed	4.7		No signal observed		-9.38		Harmonic 8
24410	No signal observed	4.7		No signal observed		-9.38		Harmonic 9
26.851	No signal observed	4.7		No signal observed		-9.38		Harmonic 10

High Frequency Channel:

Freq (Mhz)	dBm	VHP-39 High Pass Filter (dB)	C044 cable (dB)	Corr Data (dBm)	Max In Band Power (dBm)	Limit	Margin (dB)	
2478.062	9.64		1.3	10.94	10.94	10.94		Fundamental
4919.12	-22.5	1.87	2	-18.63		-9.06	-9.57	Harmonic 1
7360.2	-40.17	5.56	2.6	-32.01		-9.06	-22.95	Harmonic 2
9801.36	-35.83	7.18	2.6	-26.05		-9.06	-16.99	Harmonic 3
12242.48	-41.33	3.48	3.3	-34.55		-9.06	-25.49	Harmonic 4
14683.6	No signal observed	3.92	3.2	No signal observed		-9.06		Harmonic 5
17124.72	No signal observed	4.56	3.8	No signal observed		-9.06		Harmonic 6
19565.84	No signal observed	4.7		No signal observed		-9.06		Harmonic 7
22006.96	No signal observed	4.7		No signal observed		-9.06		Harmonic 8
24780.63	No signal observed	4.7		No signal observed		-9.06		Harmonic 9
26932.1	No signal observed	4.7		No signal observed		-9.06		Harmonic 10

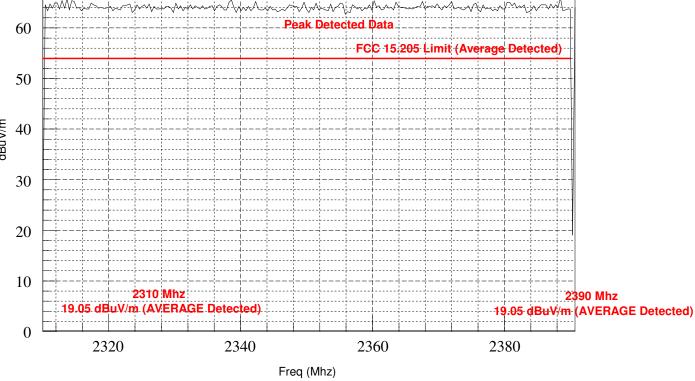


15.205 Restricted Bands

All restricted bands from 0.09 Mhz to 21400 Mhz were observed and no signals other than the above harmonics listed were found. Frequency scans were taken in the restricted bands listed in FCC 15.205 in the bands where harmonics were possible. These bands were 2310 to 2390 Mhz, 2483.5 to 2500 Mhz, 4500 to 5150 Mhz, 7250 to 7750 Mhz, 10600 to 12700 Mhz and 17700 to 21400 Mhz. The frequency graphs are shown in Peak Detected data but since there were no signals observed and the frequency graph was a straight line, only the beginning and end of the scan was detected with the AVERAGE detector and this data is listed on each of the graphs.

Body Sound Technologies, Inc.
Model: ALNK-A01
FCC 15.205 Radiated Emissions
Restricted Bands (2310-2390 Mhz)
Antenna Distance 1 meter

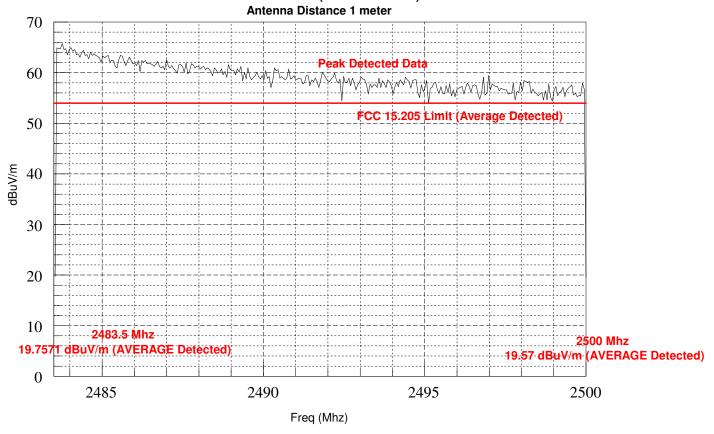
70
Peak Detected Data



International Certification Services, Inc.



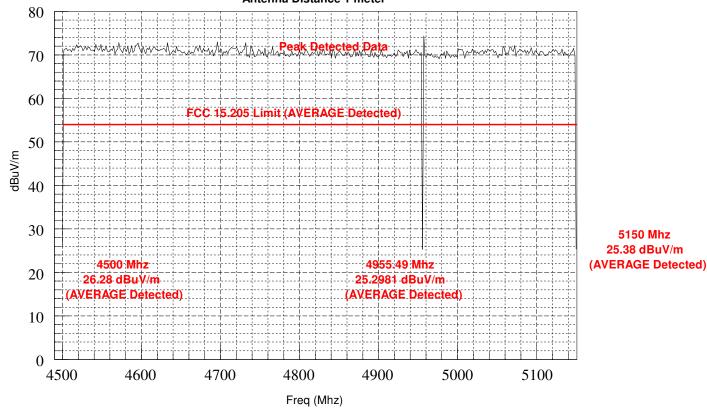
Body Sound Technologies, Inc. Model: ALNK-A01 FCC 15.205 Radiated Emissions Restricted Bands (2483.5-2500 Mhz)



International Certification Services, Inc.



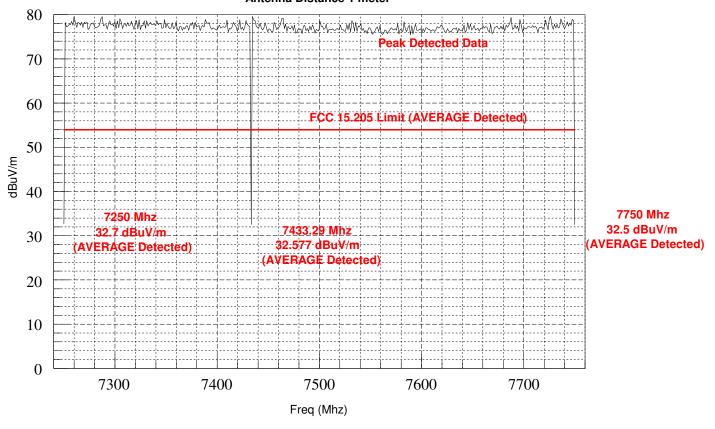
Body Sound Technologies, Inc. Model: ALNK-A01 FCC 15.205 Radiated Emissions Restricted Bands (4500-5150 Mhz) Antenna Distance 1 meter



International Certification Services, Inc.



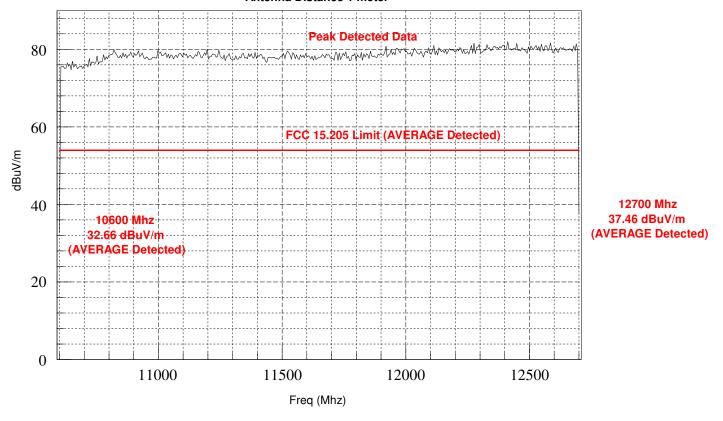
Body Sound Technologies, Inc. Model: ALNK-A01 FCC 15.205 Radiated Emissions Restricted Bands (7250-7750 Mhz) Antenna Distance 1 meter



International Certification Services, Inc.



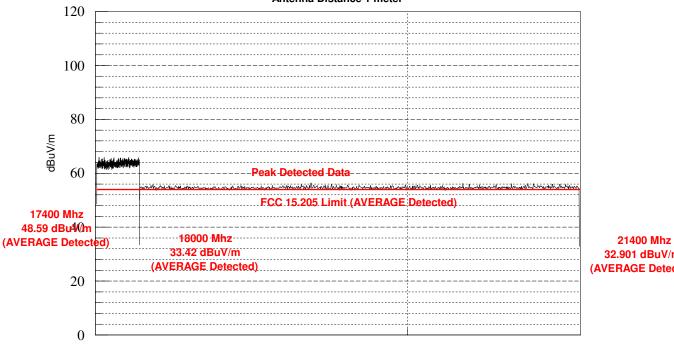
Body Sound Technologies, Inc. Model: ALNK-A01 FCC 15.205 Radiated Emissions Restricted Bands (10600-12700 Mhz) Antenna Distance 1 meter



International Certification Services, Inc.



Body Sound Technologies, Inc. Model: ALNK-A01 FCC 15.205 Radiated Emissions Restricted Bands (17700-21400 Mhz) Antenna Distance 1 meter



32.901 dBuV/m (AVERAGE Detected)

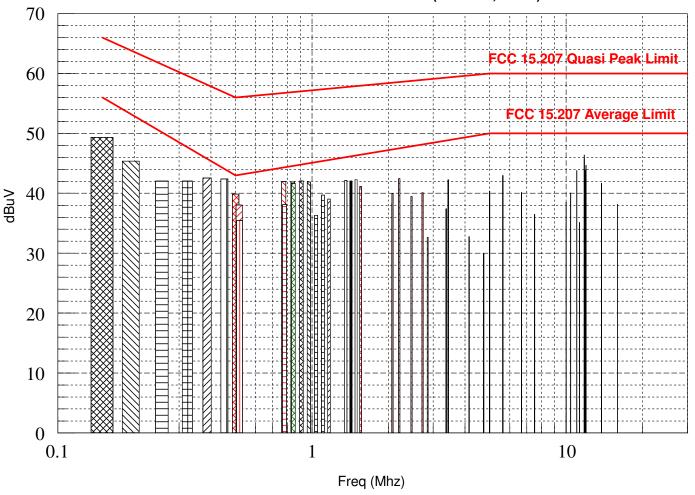
Freq (Mhz)

International Certification Services, Inc.



15.207 Conducted Emissions

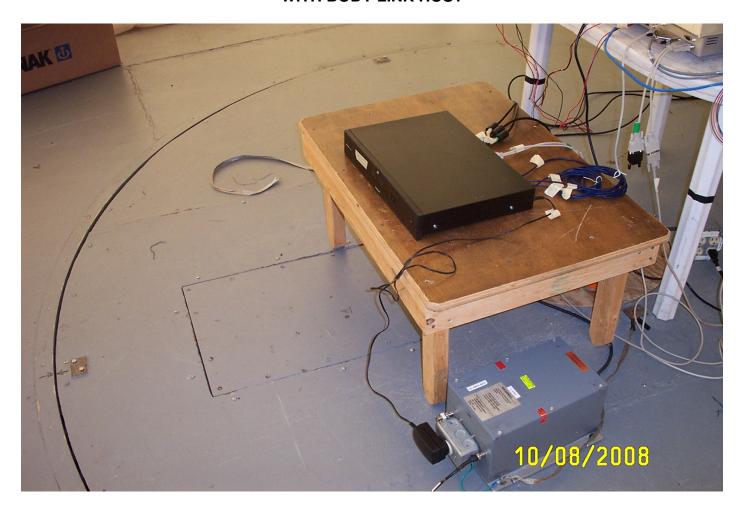
Body Sound Technologies, Inc. Air Llnk Model: ALNK-A01 Host is Body Link Model: BLNK -01 FCC 15.207 Conducted Emissions (120 VAC, 60 Hz)



International Certification Services, Inc.



CONDUCTED EMISSIONS TEST SET UP WITH BODY LINK HOST





ATTACHMENT C

PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS SUPPLIED BY THE CUSTOMER



COMPANY NAME: Bo	dySound Tech	nnologies, Inc.
CUSTOMER REPRESENTA	TIVE: Ir	nternational Certification Services, Inc.
EQUIPMENT DESCRIPTION	1: Air Link	
MODEL NUMBER: ALNK	·A01	
SERIAL NUMBER: N/A		
X		Perification e (Please describe exact changes below) ample (Audit Test)
OSCILLATOR FREQUENCI 26 Mhz	ES:	
POWER INTERFACE: Frequency: DC Voltage: 5.0 VDC		
POWER CABLE: None		POWER LINE FILTER: None

SOFTWARE AND / OR OPERATING MODES:

Nordic ChipSet: See datasheet: nRF24Z1.

PRODUCT SHIELDING PROVISION:

I/O CABLES: NONE

Metal Enclosure

