

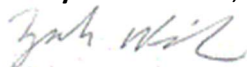
Test Report # TR 317406 NFMI

Equipment Under Test: Human Headphone (Left & Right)

Test Date(s): 1/17/- 3/18/2019

Prepared for: Human Inc.
Attn: Jingping Ma
3100 Airport Way 25-512
Seattle, WA 98134

Report Issued by: Zach Wilson, EMC Engineer

Signature: 

Date: 4/8/2019

Report Reviewed by: Adam Alger, Quality Manager

Signature: 

Date: 4/8/2019

Report Constructed by: Zach Wilson, EMC Engineer

Signature: 

Date: 2/8/2019

This test report may not be reproduced, except in full, without written approval of Laird Technologies, Inc.

Company: Human Inc.	Page 1 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

CONTENTS

Contents	2
Laird Technologies Test Services in Review	3
1 Test Report Summary	4
2 Client Information	5
2.1 Equipment Under Test (EUT) Information	5
2.2 Product Description	5
2.3 Modifications Incorporated for Compliance.....	5
2.4 Deviations and Exclusions from Test Specifications	5
2.5 Programming Information	6
3 References	7
4 Uncertainty Summary	8
5 Test Data	9
5.1 Radiated Emissions	9
5.2 AC Mains Conducted Emissions	23
6 Revision History	29

Laird Technologies Test Services in Review

The Laird Technologies, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein, unless otherwise noted.



Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492



Innovation, Science and Economic Development Canada

ISED Site listing of two 3 meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4

File Number: IC 3088A-2

File Number: IC 3088A-3

Company: Human Inc.	Page 3 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

1 TEST REPORT SUMMARY

During **1/17/19-3/18/19** the Equipment Under Test (EUT), **Human Headphones (Left & Right)**, as provided by **Human Inc.** was tested to the following requirements:

Federal Communications Commission Title 47

Requirements	Description	Specification	Method	Compliant
15.209 (a)	Radiated Emissions - Fundamental	30 $\mu\text{V}/\text{m}$ @ 30m	ANSI C63.10	Yes
15.209 (c)	Radiated Emissions – Spurious	Spurious \leq Fundamental	ANSI C63.10	Yes
15.207 (a)	Conducted AC Emissions	See Section 5.2	ANSI C63.10	Yes
2.1049	Occupied Bandwidth	Reported	ANSI C63.10	Reported

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	Human Inc.
Contact Person	Jingping Ma
Address	3100 Airport Way 25-512 Seattle, WA 98134

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Human Headphones
Model Number Left	1701
FCC ID Left	2ARJG-1701
Model Number Right	1702
FCC ID Right	2ARJG-1702
Serial Numbers	7406, 7354

2.2 Product Description

Left (model 1701) and right (model 1702) ear headphone units. The unit has two modes of operation; amplify mode when both ears are together and headphone mode when the units are on the user's head. The units use 10.5 MHz NFMI when in headphone mode to communicate with each other and 14.8 MHz NFMI while in amplify mode. The right ear unit receives audio via Bluetooth classic and input commands via BLE. The left ear unit receives OTA updates via BLE/BT.

The units are powered via 3.7 VDC Li-ion batteries. They are charged via a 5-pin charging port connected to a wall wart capable of an input voltage of 100-240 VAC, 50-60 Hz. The antenna for BLE/BT is a custom monopole antenna with a peak gain of 2.5 dBi. The manufacturer declared tune up tolerance is ± 1 dB.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

Company: Human Inc.	Page 5 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

2.5 Programming Information

Two software applications were used to program the radios. Airoha AB152C Lab Test Tool, v2.1.1.15730 and Docklight v2.2.8.

Company: Human Inc.	Page 6 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

3 REFERENCES

Publication	Edition	Date
ANSI C63.10	-	2013
CFR Title 47	-	2018

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	1x10 ⁻⁷	0.55x10 ⁻⁷
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Radiated Emissions

<p>Description of Measurement</p>	<p>The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna.</p> <p>The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values.</p> <p>The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.</p>
<p>Example Calculations</p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB</p>

Block Diagram



5.1.1 Radiated Fundamental Emissions (Headset Mode 10.5 MHz NFMI)

Operator	Anthony Smith
QA	Zach Wilson
Test Date	1/17/2019, 1/21/2019
Location	Chamber 3
Temp. / R.H.	78.3°F/31.5%, 77°F/19.6%
Requirement	FCC 15.209
Method	ANSI C63.10

Limits: 29.5 dBμV/m @ 30m

Test Parameters

Frequency	10.5 MHz
Distance	3m
RBW	9 kHz
VBW	90 kHz
EUT Mode	Headset mode with NFMI Transmit at 10.5 MHz
EUT Orientations	Flat, Side, Vertical
Notes	Measurement extrapolated to limit distance. See Table
Example Calculation	$16.2 \text{ dB}\mu\text{V}/\text{m} = 39.8 \text{ dB}\mu\text{V}/\text{m} - 40 \log\left(\frac{4.5}{3}\right) - 20 \log\left(\frac{30}{4.5}\right)$ Limit for a frequency of 10.5 MHz From ANSI C63.10 Section 6.4.4.2 (equation 2)

Instrumentation



Date: 11-Jan-2019 Test: NFMI Tx Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960006	Antenna - Active Loop	EMCO	6502	9205-2753	8/28/2017	8/28/2019	Active Calibration
2	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
3	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/24/2018	4/24/2019	Active Calibration

Table

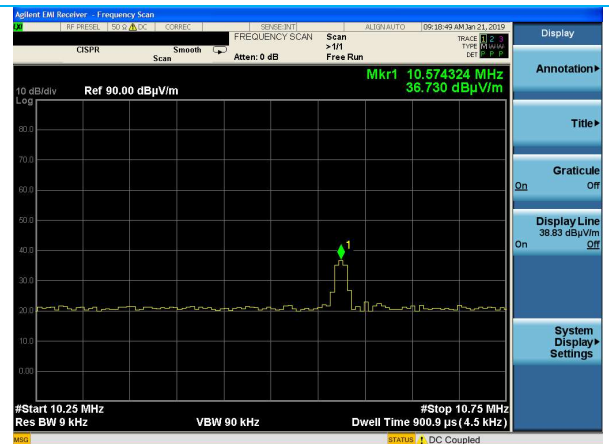
Left Headphone												
Frequency (kHz)	Frequency (MHz)	dnear field	Limit Distance	EUT Orientation	Antenna Orientation	Conversion	Antenna Height (m)	Azimuth (degree)	Field Strength @ 3 m (dBµV/m)	Calculated Field Strength @ 30 m (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10574.3	10.5743	4.5	30	Vertical	Perpendicular	-24	0.80	185	31.8	8.2	29.5	21.3
10574.3	10.5743	4.5	30	Flat	Perpendicular	-24	0.80	303	36.5	12.9	29.5	16.6
10574.3	10.5743	4.5	30	Flat	Flat	-24	0.80	29	29.2	5.6	29.5	23.9
10574.3	10.5743	4.5	30	Vertical	Flat	-24	0.80	115	31.0	7.5	29.5	22.0

Right Headphone												
Frequency (kHz)	Frequency (MHz)	dnear field	Limit Distance	EUT Orientation	Antenna Orientation	Conversion	Antenna Height (m)	Azimuth (degree)	Field Strength @ 3 m (dBµV/m)	Calculated Field Strength @ 30 m (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10583.3	10.5833	4.5	30	Flat	Parallel	-24	0.80	341	39.8	16.3	29.5	13.2
10583.3	10.5833	4.5	30	Vertical	Parallel	-24	0.80	283	37.8	14.3	29.5	15.2
10583.3	10.5833	4.5	30	Vertical	Perpendicular	-24	0.80	355	32.4	8.9	29.5	20.6
10583.3	10.5833	4.5	30	Flat	Perpendicular	-24	0.80	59	36.6	13.1	29.5	16.4

Plots (Left Headphone)



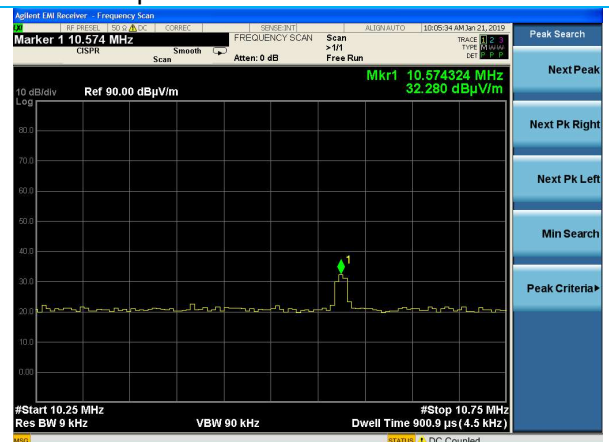
10.5 MHz Fundamental, Vertical EUT Orientation
 Perpendicular Antenna Polarization



10.5 MHz Fundamental, Flat EUT Orientation
 Perpendicular Antenna Polarization

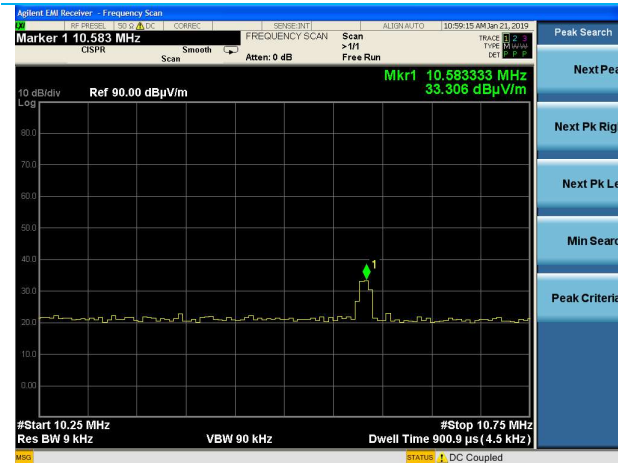


10.5 MHz Fundamental, Flat EUT Orientation
 Flat Antenna Polarization

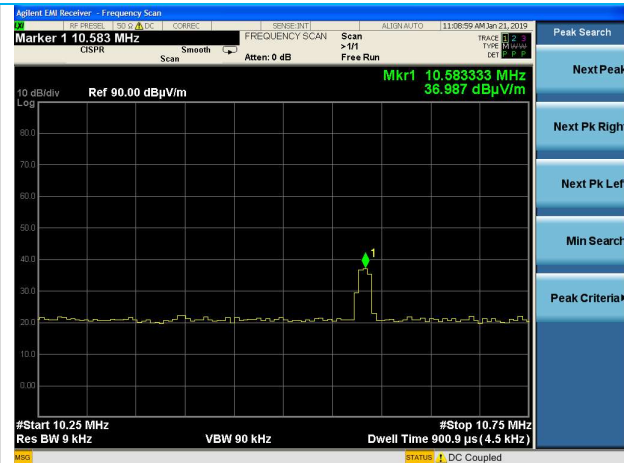


10.5 MHz Fundamental, Vertical EUT Orientation
 Flat Antenna Polarization

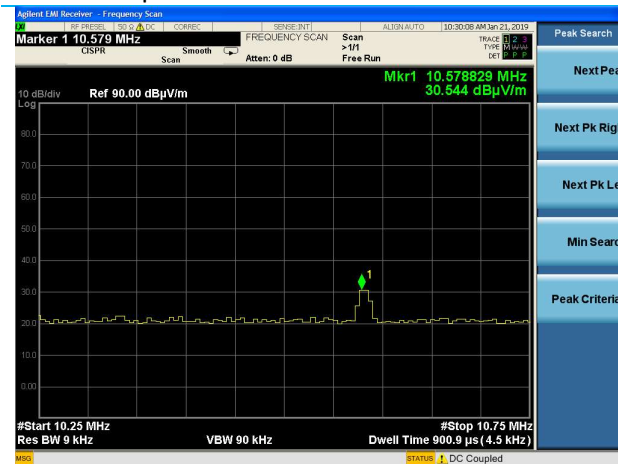
Plots (Right Headphone)



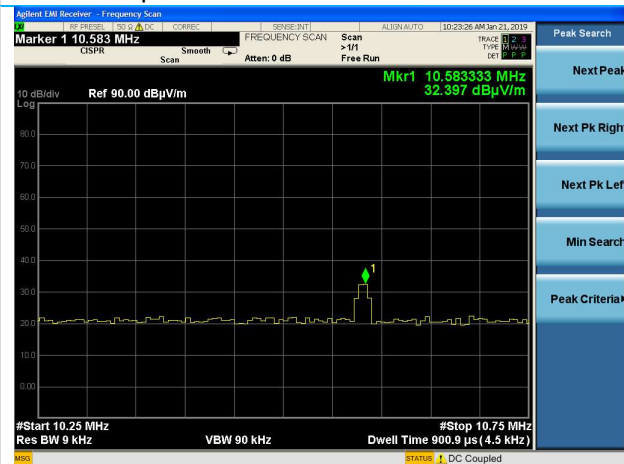
10.5 MHz Fundamental, Vertical EUT Orientation
Perpendicular Antenna Polarization



10.5 MHz Fundamental, Flat EUT Orientation
Perpendicular Antenna Polarization



10.5 MHz Fundamental, Flat EUT Orientation
Flat Antenna Polarization



10.5 MHz Fundamental, Vertical EUT Orientation
Flat Antenna Polarization

Company: Human Inc.	Page 13 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

5.1.2 Radiated Spurious Emissions (Headset Mode 10.5 MHz NFMI)

Operator	Anthony Smith
QA	Zach Wilson
Test Date	1/17/2019, 1/21/2019, 3/8/2019
Location	Chamber 3
Temp. / R.H.	78.3°F/31.5%, 77°F/19.6%
Requirement	FCC 15.209
Method	ANSI C63.10

Limits:

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

Test Parameters

Frequency	9 kHz – 200 MHz
Distance	3m
RBW	9-150 kHz: 200 Hz 150 kHz – 30 MHz: 9 kHz 30-200 MHz: 120 kHz
VBW	9-150 kHz: 2 kHz 150 kHz – 30 MHz: 90 kHz 30-200 MHz: 1.2 MHz
EUT Mode	Headset mode with NFMI Transmit at 10.5 MHz
EUT Orientations	Flat, Side, Vertical
Notes	No spurious emissions observed. Worst case of highest fundamental polarization/orientation (Perpendicular/Flat) shown. Limit line shows 15.209 limits. Table limit is based off of the highest fundamental.

Instrumentation



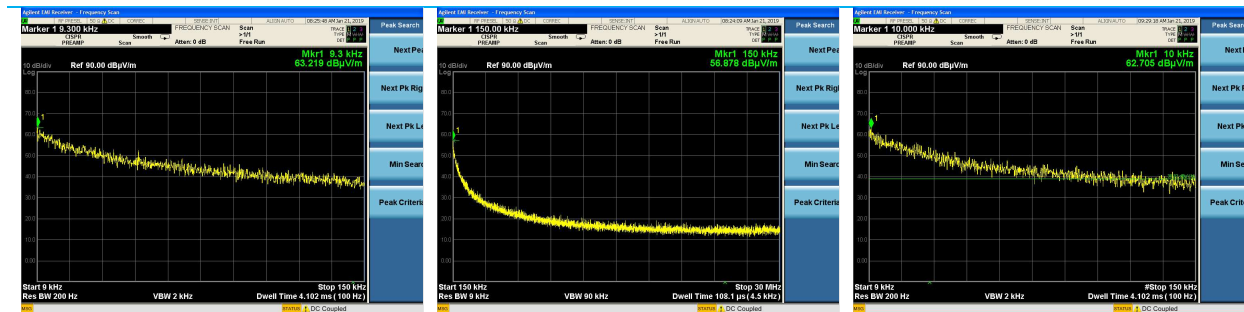
Date: 11-Jan-2019 Test: NFMI Tx Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960006	Antenna - Active Loop	EMCO	6502	9205-2753	8/28/2017	8/28/2019	Active Calibration
2	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
3	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/24/2018	4/24/2019	Active Calibration
4	AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	4/20/2018	4/20/2019	Active Calibration

Tables

Frequency (kHz)	Frequency (MHz)	Unit	Antenna Height (m)	Azimuth (degree)	Quasi Peak Reading @ 3m (dBµV/m)	Calculated Quasi Peak Reading @ 30m (dBµV/m)	Limit @ 30m (dBµV/m)	Margin (dB)
7552.0	7.5520	Left	0.80	122	21.2	-5.3	12.9	18.2
7545.0	7.5450	Rigth	0.80	79	21.2	-5.3	16.3	21.6
4293.0	4.2930	Left	0.80	228	23.1	-8.3	12.9	21.2

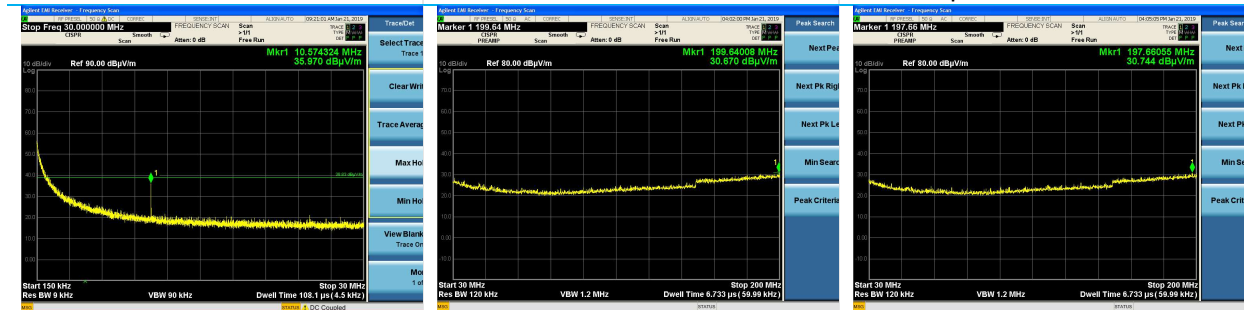
Plots (Left Headphone)



9-150 kHz, Noise Floor

150 kHz – 30 MHz, Noise Floor

9-150 kHz Flat EUT Perpendicular Antenna



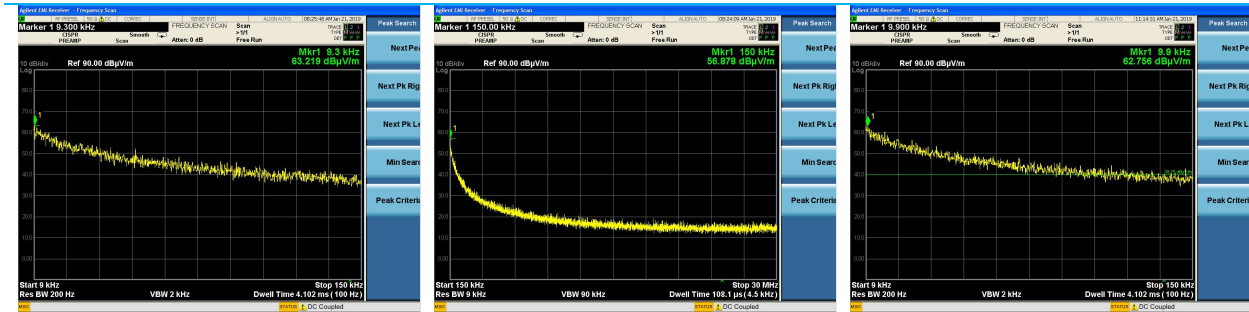
150 kHz – 30 MHz, Flat EUT Perpendicular Antenna

30-200 MHz, Flat EUT Vertical Antenna

30-200 MHz, Flat EUT Horizontal Antenna

Company: Human Inc.	Page 15 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

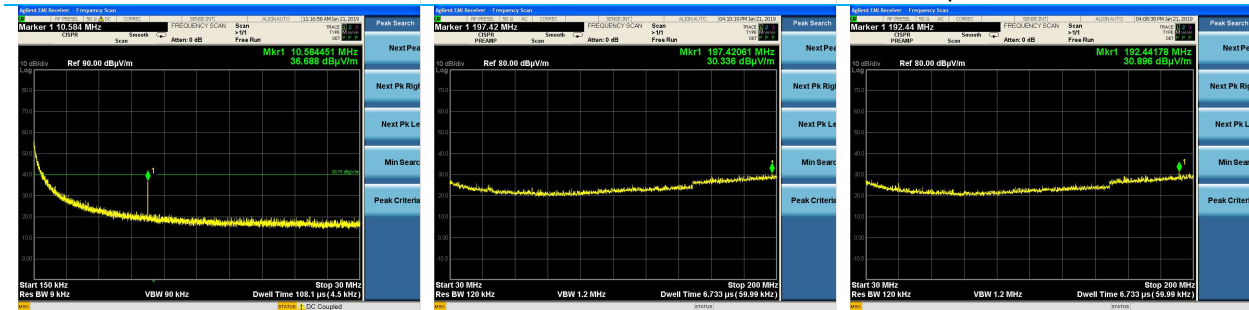
Plots (Right Headphone)



9-150 kHz, Noise Floor

150 kHz – 30 MHz, Noise Floor

9-150 kHz Flat EUT
Perpendicular Antenna



150 kHz – 30 MHz, Flat EUT
Perpendicular Antenna

30-200 MHz, Flat EUT
Vertical Antenna

30-200 MHz, Flat EUT
Horizontal Antenna

Company: Human Inc.	Page 16 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

5.1.3 Radiated Fundamental Emissions (Amplify Mode 14.8 MHz NFMI)

Operator	Jon Dilley
QA	Shane Dock
Test Date	1/22/2019
Location	Chamber 3
Temp. / R.H.	25.7C/27%
Requirement	FCC 15.209
Method	ANSI C63.10

Limits: 29.5 dBμV/m @ 30m

Test Parameters

Frequency	14.8 MHz
Distance	3m
RBW	9 kHz
VBW	90 kHz
EUT Mode	Headset mode with NFMI Transmit at 10.5 MHz
EUT Orientations	Flat, Side, Vertical
Notes	Measurement extrapolated to limit distance. See Table Unit only functions in 14.8 MHz mode when both units are together. Therefore, the below plots and data are taken with both units transmitting at the same time in the chamber.
Example Calculation	$8.3 \text{ dB}\mu\text{V}/\text{m} = 28.9 \text{ dB}\mu\text{V}/\text{m} - 40 \log\left(\frac{3.2}{3}\right) - 20 \log\left(\frac{30}{3.2}\right)$ Limit for an emission at 14.8 MHz From ANSI C63.10 Section 6.4.4.2

Instrumentation



Date: 11-Jan-2019 Test: NFMI Tx Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960008	Antenna - Active Loop	EMCO	8502	9205-2753	8/28/2017	8/28/2019	Active Calibration
2	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
3	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/24/2018	4/24/2019	Active Calibration

Table

Frequency (kHz)	Frequency (MHz)	dnear field	Limit Distance	EUT Orientation	Antenna Orientation	Conversion	Antenna Height (m)	Azimuth (degree)	Field Strength @ 3 m (dBµV/m)	Calculated Field Strength @ 30 m (dBµV/m)	Limit (dBµV/m)	Margin (dB)
14821.2	14.8212	3.2	30	Vertical	Perpendicular	-21	0.80	285	28.9	8.3	29.5	21.2
14821.2	14.8212	3.2	30	Vertical	Parallel	-21	0.80	296	28.5	7.9	29.5	21.6
14821.2	14.8212	3.2	30	Vertical	Flat	-21	0.80	230	28.4	7.8	29.5	21.7

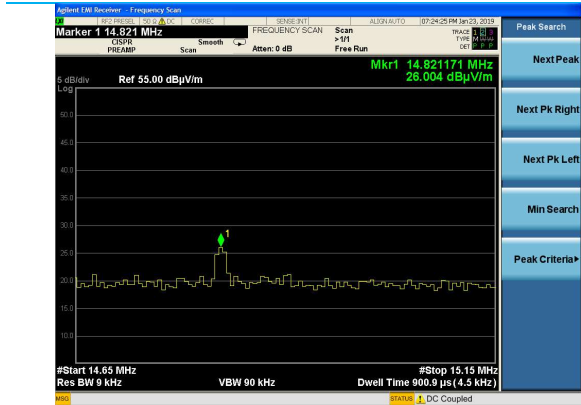
Plots



14.8 MHz Fundamental, Vertical EUT Orientation
 Perpendicular Antenna Polarization



14.8 MHz Fundamental, Flat EUT Orientation
 Parallel Antenna Polarization



14.8 MHz Fundamental, Flat EUT Orientation
 Flat Antenna Polarization

Company: Human Inc.	Page 18 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

5.1.4 Radiated Spurious Emissions (Amplify Mode 14.8 MHz NFMI)

Operator	Jon Dilley
QA	Shane Dock
Test Date	1/17/2019, 1/21/2019, 3/8/2019
Location	Chamber 3
Temp. / R.H.	78.3°F/31.5%, 77°F/19.6%
Requirement	FCC 15.209
Method	ANSI C63.10

Limits:

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

Test Parameters

Frequency	9 kHz – 200 MHz
Distance	3m
RBW	9-150 kHz: 200 Hz 150 kHz – 30 MHz: 9 kHz 30-200 MHz: 120 kHz
VBW	9-150 kHz: 2 kHz 150 kHz – 30 MHz: 90 kHz 30-200 MHz: 1.2 MHz
EUT Mode	Amplify mode with NFMI Transmit at 14.8 MHz, on charger
EUT Orientations	Flat, Side, Vertical
Notes	Worst case of highest fundamental polarization/orientation (Perpendicular/Flat) shown. Limit line shows 15.209 limits. Unit only functions in 14.8 MHz mode when both units are together. Therefore, the below plots and data are taken with both units transmitting at the same time in the chamber while on the charger. Noise in the 30-200 MHz range from charger.

Instrumentation



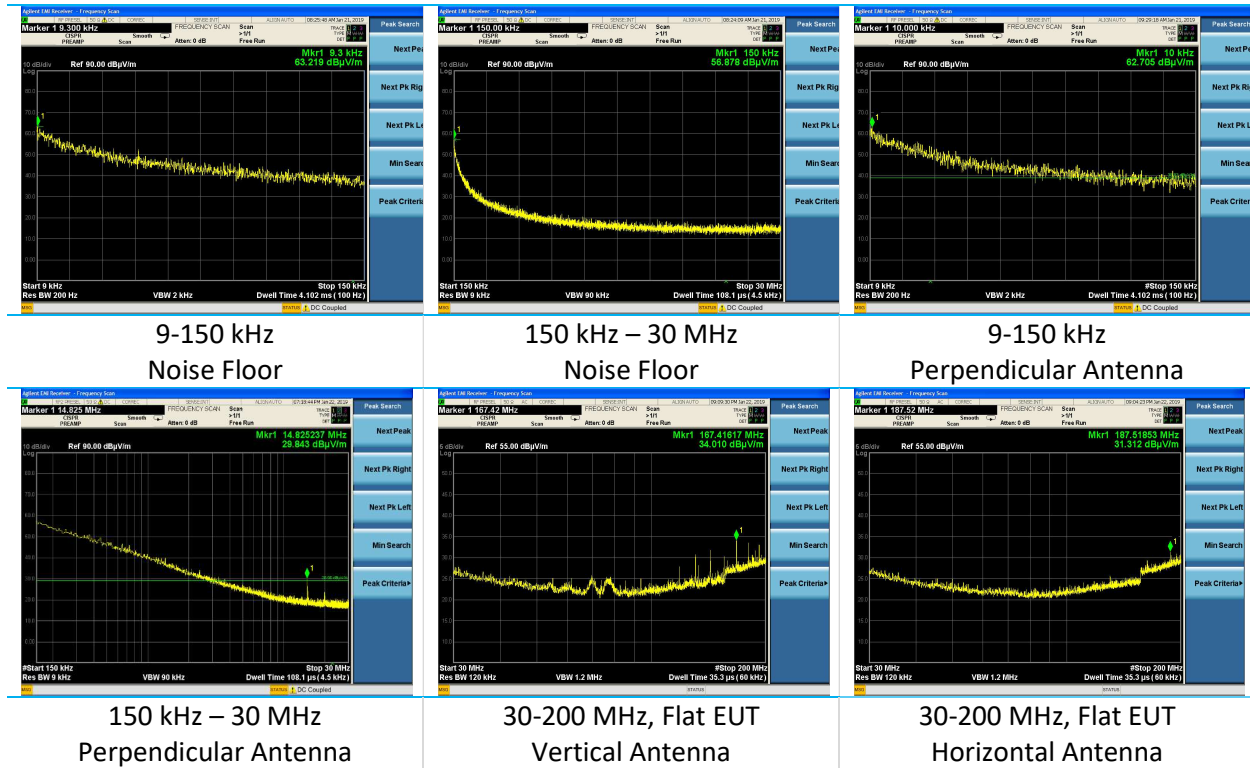
Date: 11-Jan-2019 Test: NFMI Tx Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960006	Antenna - Active Loop	EMCO	6502	9205-2753	8/28/2017	8/28/2019	Active Calibration
2	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
3	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/24/2018	4/24/2019	Active Calibration
4	AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	4/20/2018	4/20/2019	Active Calibration

Table

Frequency (kHz)	Frequency (MHz)	Unit	Antenna Height (m)	Azimuth (degree)	Quasi Peak Reading @ 3m (dBµV/m)	Calculated Quasi Peak Reading @ 30m (dBµV/m)	Limit @ 30m (dBµV/m)	Margin (dB)
29900.0	29.9000	Both	0.80	341	39.8	0.3	8.3	8.0

Plots



5.1.5 99% Occupied Bandwidth (10.5 and 14.8 MHz NFMI)

Operator	Zach Wilson
QA	Adam Alger
Test Date	3/18/2019
Location	Radio Bench
Temp. / R.H.	20.8°C / 32.1% RH
Requirement	2.1049
Method	ANSI C63.10 Section 6.9.3

Test Parameters

Frequency	10.5 MHz and 14.8 MHz
RBW	10.5 MHz Units: 20 Hz 14.8 MHz Unit: 10 kHz
VBW	10.5 MHz Units: 62 Hz 14.8 MHz Unit: 30 kHz
EUT Mode	Headset mode with NFMI Transmit at 10.5 MHz, Amplify Mode at 14.8 MHz

Instrumentation



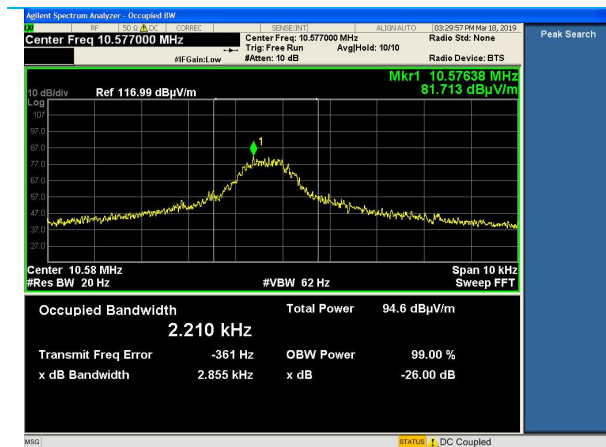
Date: 18-Mar-2019 Test: 99% BW Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960006	Antenna - Active Loop	EMCO	6502	9205-2753	8/28/2017	8/28/2019	Active Calibration
2	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/24/2018	4/24/2019	Active Calibration

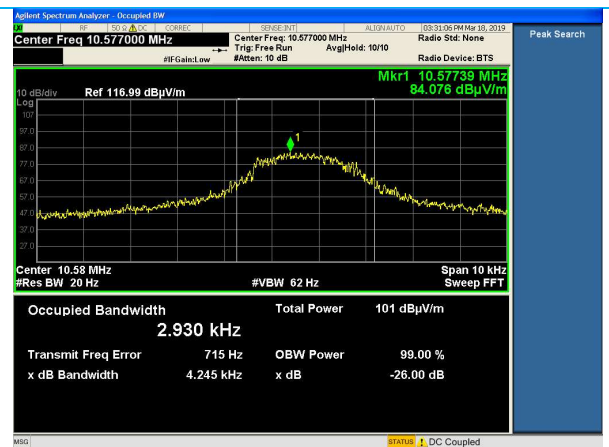
Table

Unit	Frequency (MHz)	99% Occupied Bandwidth (kHz)
Left	10.57	2.21
Right	10.57	2.93
Both	14.82	670.49

Plots



99% BW, Left Unit @ 10.5 MHz



99% BW, Right Unit @ 10.5 MHz



99% BW, Both Units @ 14.8 MHz

5.2 AC Mains Conducted Emissions

A line impedance stabilization network (LISN) or artificial mains network (AMN) allows the emissions of the power supply conductors to be measured while isolating the EUT from the supply mains.

Description of Measurement

The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

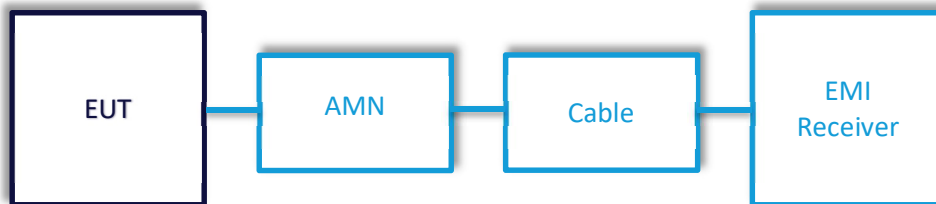
Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)

Example Calculations

Measurement (dB μ V) + Cable factor (dB) + Other (dB) = Corrected Reading (dB μ V)

Margin (dB) = Limit (dB μ V) - Corrected Reading (dB μ V)

Block Diagram



5.2.1 AC Mains Conducted Emissions (Headset Mode 10.5 MHz NFMI)

Operator	Zach Wilson
QA	Adam Alger
Test Date	3/15/2019
Location	Bench
Temp. / R.H.	30.1%RH / 20.6°C
Requirement	FCC 15.207
Method	ANSI C63.10

Limits: 15.207

Frequency (MHz)	Quasi Peak Limit (dB μ V)	Average Limit (dB μ V)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Test Parameters

Frequency	150 kHz – 30 MHz
Distance	80cm from Ground Plane
RBW	9 kHz
VBW	90 kHz
Detectors	Max peak hold for plots. Quasi peak and average detectors for final measurements.
EUT Mode	Headset mode with NFMI transmit at 10.5 MHz
EUT Configuration	EUT on charger

Instrumentation



Date: 11-Jan-2019 Test: CE NFMI Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
2	EE 960162	LISN	COM-POWER	LI-215A	191969	4/23/2018	4/23/2019	Active Calibration

Table

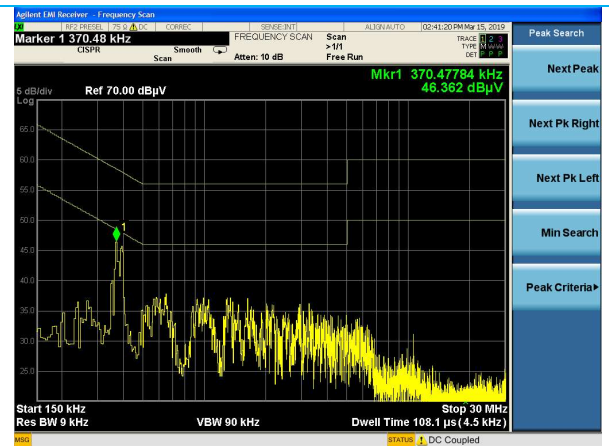
NFMI 10.5 MHz, (Left)							
Line	Frequency (MHz)	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
1	0.177	43.5	64.6	21.1	33.8	54.6	20.8
1	0.231	42.0	62.4	20.4	33.0	52.4	19.5
1	0.380	44.6	58.3	13.7	33.4	48.3	14.9
2	0.371	43.1	58.5	15.4	28.2	48.5	20.3
2	0.649	33.2	56.0	22.9	20.8	46.0	25.2
2	0.964	33.7	56.0	22.3	21.1	46.0	24.9

NFMI 10.5 MHz (Right)							
Line	Frequency (MHz)	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
1	0.388	44.6	56.0	11.4	34.0	46.0	12.0
1	0.155	44.9	56.0	11.2	34.4	46.0	11.6
1	0.506	35.8	56.0	20.2	26.1	46.0	19.9
2	0.371	44.5	56.0	11.5	29.5	46.0	16.5
2	0.240	35.0	56.0	21.0	23.6	46.0	22.4
2	1.009	34.1	56.0	21.9	21.2	46.0	24.8

Plots (Left)

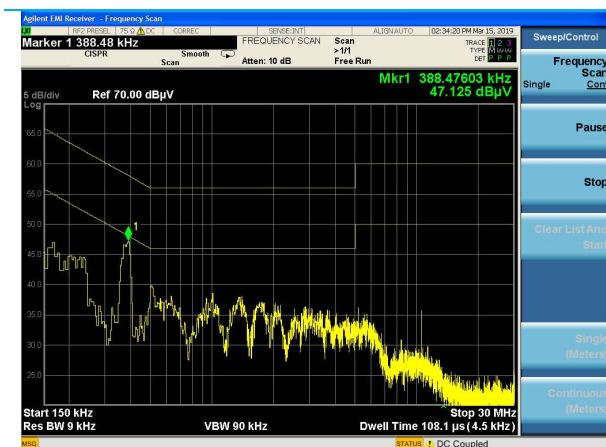


150 kHz – 30 MHz, Line 1



150 kHz – 30 MHz, Line 2

Plots (Right)



150 kHz – 30 MHz, Line 1



150 kHz – 30 MHz, Line 2

Company: Human Inc.	Page 26 of 29	Name: Human Headphones (Left & Right)
Report: TR 317406 NFMI		Model: 1701, 1702
Job: C-2951		Serial: 7406, 7354

5.2.2 AC Mains Conducted Emissions (Amplify Mode 14.8 MHz NFMI)

Operator	Zach Wilson
QA	Adam Alger
Test Date	3/15/2019
Location	Bench
Temp. / R.H.	30.1%RH / 20.6°C
Requirement	FCC 15.207
Method	ANSI C63.10

Limits: 15.207

Frequency (MHz)	Quasi Peak Limit (dB μ V)	Average Limit (dB μ V)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Test Parameters

Frequency	150 kHz – 30 MHz
Distance	80cm from Ground Plane
RBW	9 kHz
VBW	90 kHz
Detectors	Max peak hold for plots. Quasi peak and average detectors for final measurements.
EUT Mode	Amplify mode with NFMI transmit at 14.8 MHz
EUT Configuration	EUT on charger

Instrumentation



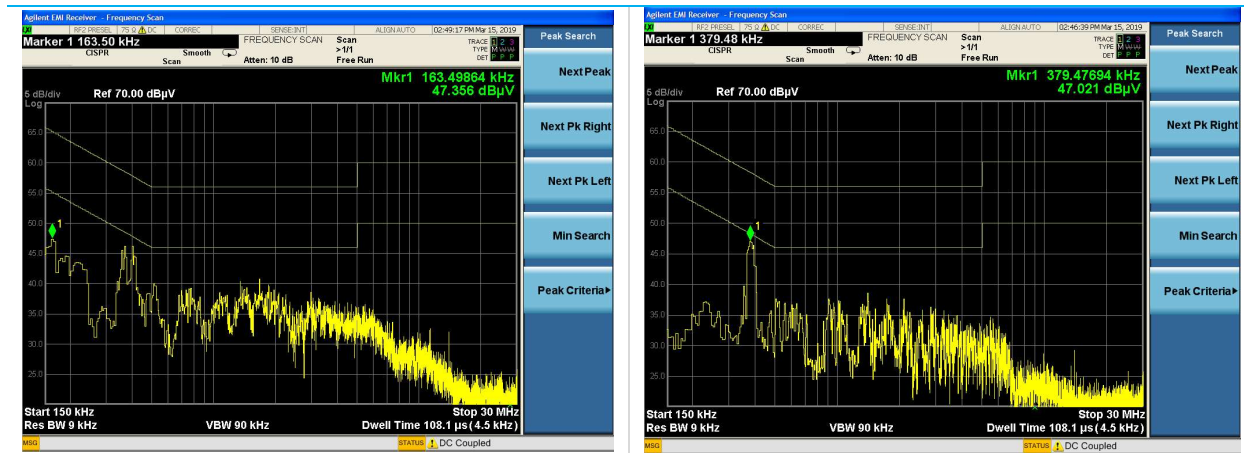
Date: 11-Jan-2019 Test: CE NFMI Job: C-2951
 PE: Zach Wilson Customer: Human Inc. Quote: 317406

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2018	4/24/2019	Active Calibration
2	EE 960162	LISN	COM-POWER	LI-215A	191969	4/23/2018	4/23/2019	Active Calibration

Table

Both 14.8 (Both Units)							
Line	Frequency (MHz)	Q-Peak Reading (dBμV)	Q-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Reading (dBμV)	Average Limit (dBμV)	Average Margin (dB)
1	0.164	44.0	65.3	21.3	33.9	55.3	21.4
1	0.371	42.8	58.5	15.7	30.5	48.5	18.0
1	0.402	44.0	57.8	13.9	32.8	47.8	15.0
2	0.380	44.0	58.3	14.3	29.1	48.3	19.2
2	0.592	33.8	56.0	22.2	21.0	46.0	25.0
2	1.405	33.2	56.0	22.8	20.7	46.0	25.3

Plots



150 kHz – 30 MHz, Line 1

150 kHz – 30 MHz, Line 2

6 REVISION HISTORY

Version	Date	Notes	Person
v0.0	3-8-19	Initial Draft	Zach Wilson
v0.1	3-8-19	Second Draft	Zach Wilson
v1.1	3-15-19	NFMI report contains both headset data sets now. No longer two reports. Removed the secondary "A, B" designation from report name.	Zach Wilson
v1.2	3-18-19	Extrapolated data to limit distance in tables. Added 99% BW data. Added more accurate frequencies in tables.	Zach Wilson
v1.3	3-19-19	Ready to issue	Zach Wilson
v1.4	4-8-19	Changed tables to reflect spurious emissions being compared to the fundamental per TCB comments.	Zach Wilson

END OF REPORT