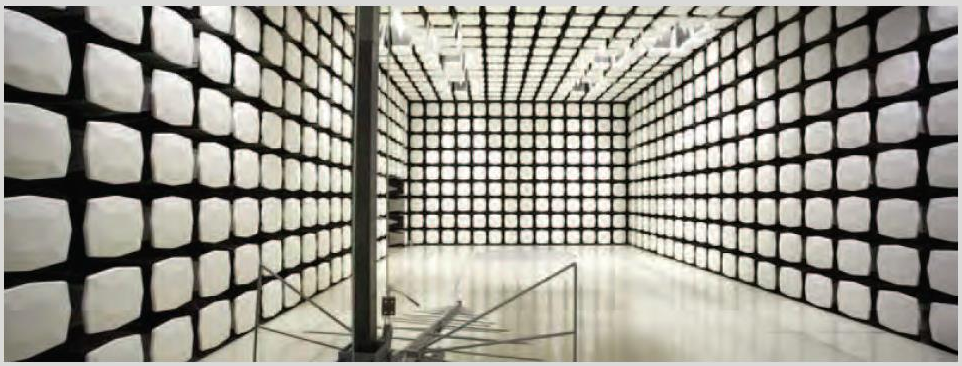
Williams Sound, LLC

FM T55

FCC 15.237:2019

Transmit only 72-76 MHz

Report # WILM0050.2



NVLAP LAB CODE: 200881-0

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CERTIFICATE OF TEST

Last Date of Test: September 3, 2019
Williams Sound, LLC
Model: FM T55

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2019	ANSI C63.10:2013
FCC 15.237:2019	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5	Field Strength of Fundamental	Yes	Pass	
6.5, 6.6	Field Strength of Harmonics and Spurious Radiated Emissions	Yes	Pass	
7.5	Occupied Bandwidth	Yes	Pass	
7.5	Duty Cycle	No	N/A	Not applicable. Assumes 100% on time.

Deviations From Test Standards

None

Approved By:

Matt Nuernberg, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

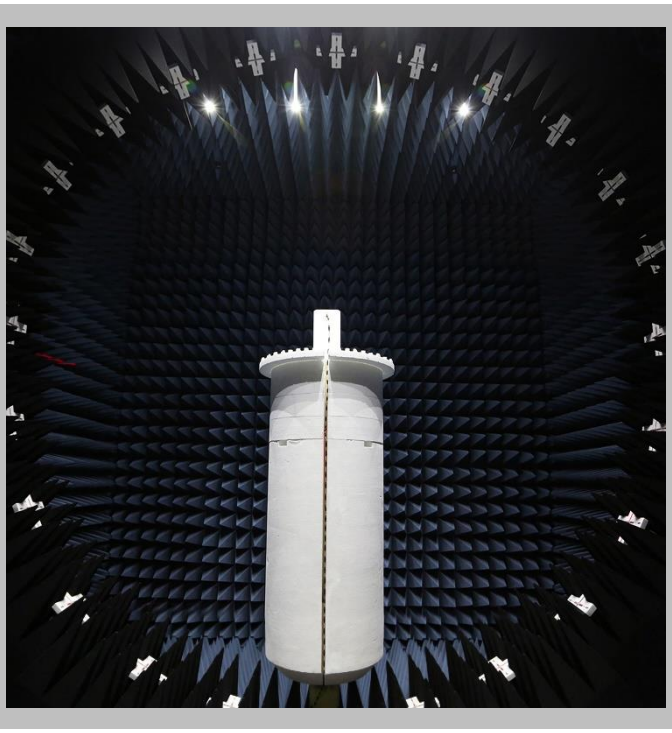
MIC – Recognized by MIC as a CAB for the acceptance of test data.

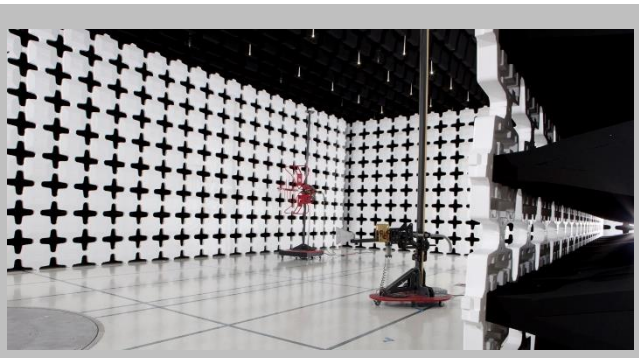
SCOPE

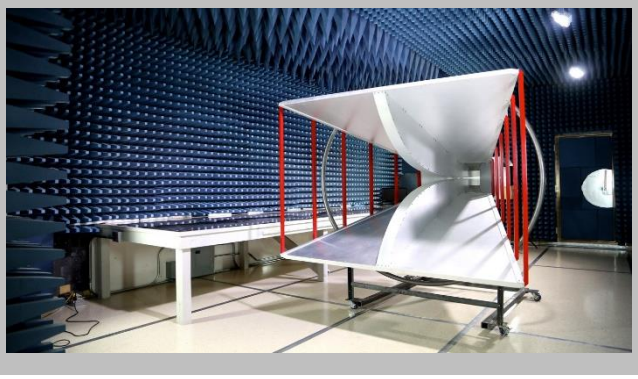
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

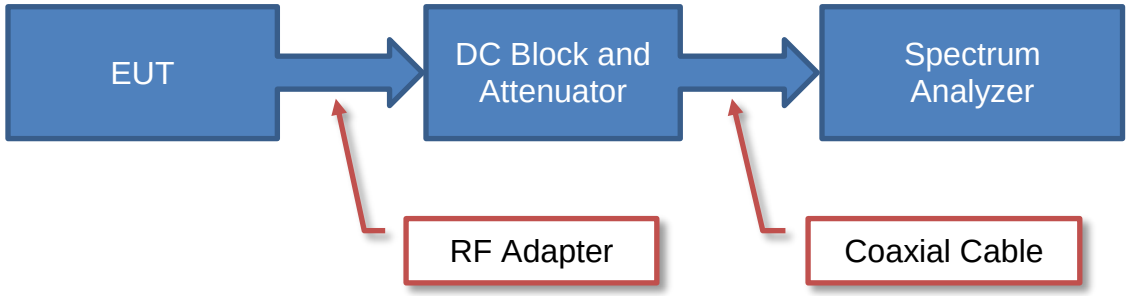
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

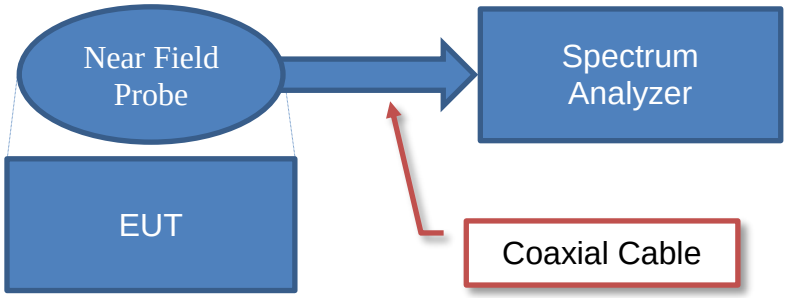
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams

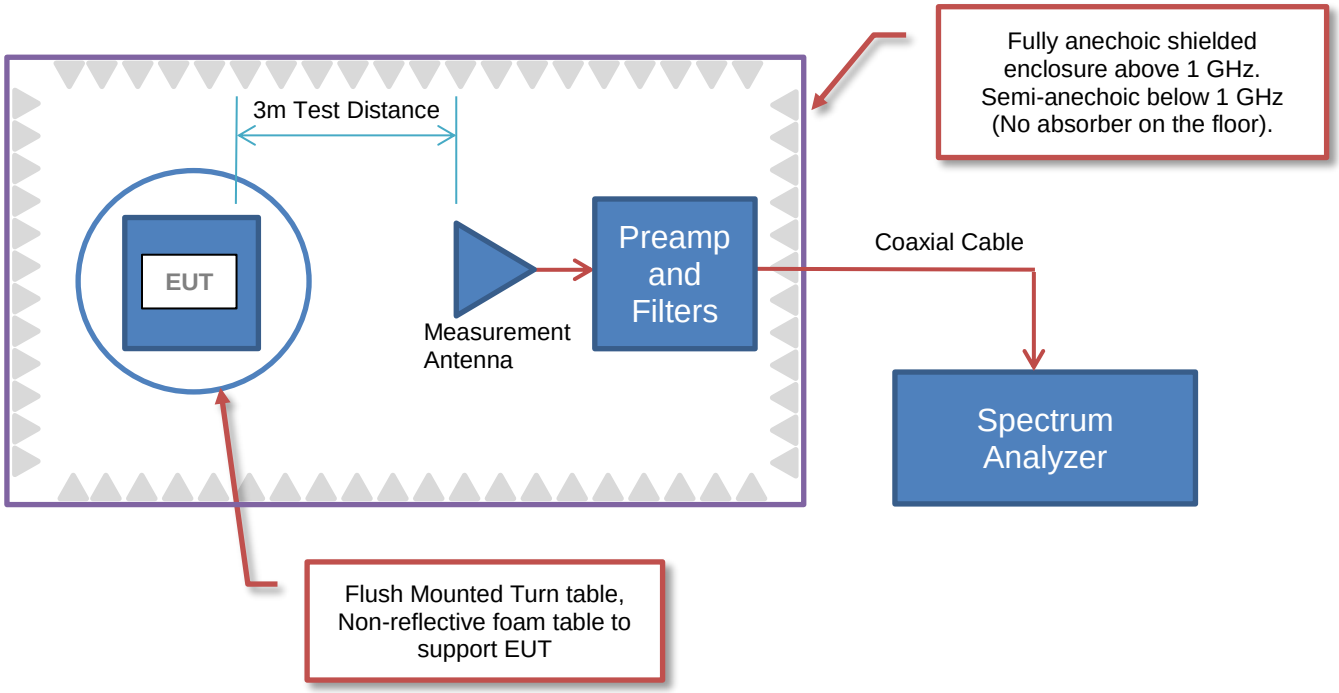
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Williams Sound, LLC
Address:	10300 Valley View Road
City, State, Zip:	Eden Prairie, MN 55344
Test Requested By:	Gregg Abram
Model:	FM T55
First Date of Test:	August 26, 2019
Last Date of Test:	September 3, 2019
Receipt Date of Samples:	August 26, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
The FM T55 is a Wideband base station FM transmitter operating on 17 channels between 72-76MHz. At full power, the transmitter has up to 1000 foot transmission range using an ANT 005 antenna. When used as a system with compatible FM receivers, it provides for hearing assistance by allowing a group of people to listen directly to the sound source without interference from background noise or distance.

Testing Objective:
Seeking to demonstrate compliance under FCC 15.237:2019 for operation in the 72-76 MHz Band.

CONFIGURATIONS

Configuration WILM0050- 4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply	GlobTek, Inc.	GTM96180-1830,6.0-T3	754795125/18
Antenna 4	Williams Sound, LLC	ANT025	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Router	Cisco	RV130	CCQ223006GC
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Cable	No	2.3 m	No	AC Mains	Power Supply
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CE)	No	>3.0 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)

CONFIGURATIONS

Configuration WILM0050- 5

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply 2	SL Power Electronics	CENB1020A2403F01	N/A
Antenna 4	Williams Sound, LLC	ANT025	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Router	Cisco	RV130	CCQ223006GC
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Cable	No	2.3 m	No	AC Mains	Power Supply
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CE)	No	>3.0 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)

CONFIGURATIONS

Configuration WILM0050- 6

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply	GlobTek, Inc.	GTM96180-1830,6.0-T3	754795125/18
Antenna 4	Williams Sound, LLC	ANT025	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A
Audio Generator	GW	GAG-810	EF911826
Surge Protector	Tripp-Lite	AGIB6946	2145AS0

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CAT 5)	Yes	1.8 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)
AC Cable (Audio Generator)	No	2.3 m	Yes	Audio Generator	Surge Protector
AC Cable (Surge Protector)	No	3.5 m	Yes	Surge Protector	AC Mains
AC Cable	No	2.3 m	No	Surge Protector	FM T55
Ethernet Cable	No	> 3.0 m	No	Router	LAN

CONFIGURATIONS

Configuration WILM0050- 7

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply	GlobTek, Inc.	GTM96180-1830,6.0-T3	754795125/18
Antenna 3	Williams Sound, LLC	ANT024	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A
Audio Generator	GW	GAG-810	EF911826
Surge Protector	Tripp-Lite	AGIB6946	2145AS0

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CAT 5)	Yes	1.8 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)
AC Cable (Audio Generator)	No	2.3 m	Yes	Audio Generator	Surge Protector
AC Cable (Surge Protector)	No	3.5 m	Yes	Surge Protector	AC Mains
AC Cable	No	2.3 m	No	Surge Protector	FM T55
Ethernet Cable	No	> 3.0 m	No	Router	LAN

CONFIGURATIONS

Configuration WILM0050- 8

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply	GlobTek, Inc.	GTM96180-1830,6.0-T3	754795125/18
Antenna 2	Williams Sound, LLC	ANT021	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A
Audio Generator	GW	GAG-810	EF911826
Surge Protector	Tripp-Lite	AGIB6946	2145AS0

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CAT 5)	Yes	1.8 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)
AC Cable (Audio Generator)	No	2.3 m	Yes	Audio Generator	Surge Protector
AC Cable (Surge Protector)	No	3.5 m	Yes	Surge Protector	AC Mains
AC Cable	No	2.3 m	No	Surge Protector	FM T55
Ethernet Cable	No	> 3.0 m	No	Router	LAN

CONFIGURATIONS

Configuration WILM0050- 9

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
FM T55	Williams Sound, LLC	T55	Tom 2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply	GlobTek, Inc.	GTM96180-1830,6.0-T3	754795125/18
Antenna 1	Williams Sound, LLC	ANT005	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (Router)	DVE	DSA-24PFM-12 FUS	N/A
Audio Generator	GW	GAG-810	EF911826
Surge Protector	Tripp-Lite	AGIB6946	2145AS0

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	1.5 m	No	Power Supply	FM T55
Ethernet Cable (CAT 5)	Yes	1.8 m	No	FM T55	Router
DC Cable	No	1.8 m	No	Router	Power Supply (Router)
AC Cable (Audio Generator)	No	2.3 m	Yes	Audio Generator	Surge Protector
AC Cable (Surge Protector)	No	3.5 m	Yes	Surge Protector	AC Mains
AC Cable	No	2.3 m	No	Surge Protector	FM T55
Ethernet Cable	No	> 3.0 m	No	Router	LAN

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-08-26	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-08-28	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-08-28	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-09-03	Field Strength of Harmonics and Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	2018-12-13	2019-12-13

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

WILM0050-4

MODES INVESTIGATED

FM max power at 72.1 MHz

POWERLINE CONDUCTED EMISSIONS

EUT:	FM T55	Work Order:	WILM0050
Serial Number:	Tom 2	Date:	2019-08-26
Customer:	Williams Sound, LLC	Temperature:	21.6°C
Attendees:	Lawrence Herrington, Tom Lake	Relative Humidity:	63.2%
Customer Project:	None	Bar. Pressure:	1011 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	WILM0050-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	6	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

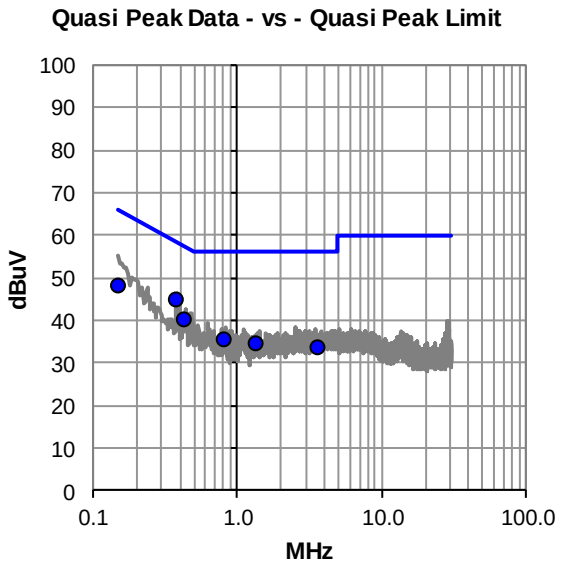
Tom 2, PCA 293 #3

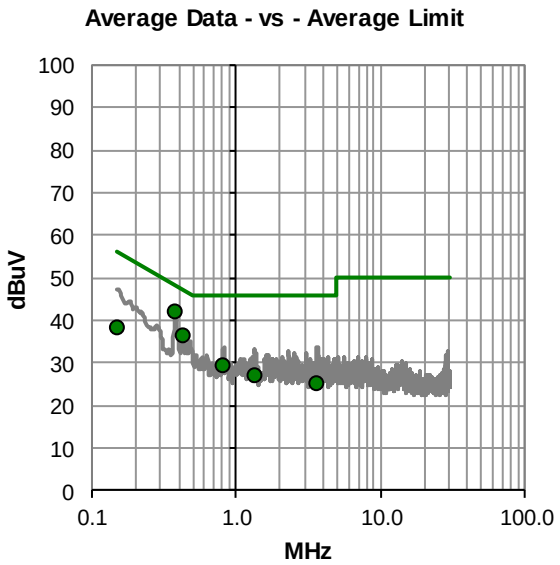
EUT OPERATING MODES

FM max power at 72.1 MHz

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.387	24.2	20.6	44.8	58.1	-13.3
0.435	19.2	20.6	39.8	57.1	-17.3
0.150	26.9	21.0	47.9	66.0	-18.1
0.823	14.6	20.6	35.2	56.0	-20.8
1.356	13.6	20.6	34.2	56.0	-21.8
3.645	12.8	20.8	33.6	56.0	-22.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.387	21.5	20.6	42.1	48.1	-6.0
0.435	15.8	20.6	36.4	47.1	-10.7
0.823	8.8	20.6	29.4	46.0	-16.6
0.150	17.3	21.0	38.3	56.0	-17.7
1.356	6.5	20.6	27.1	46.0	-18.9
3.645	4.0	20.8	24.8	46.0	-21.2

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	FM T55	Work Order:	WILM0050
Serial Number:	Tom 2	Date:	2019-08-26
Customer:	Williams Sound, LLC	Temperature:	21.6°C
Attendees:	Lawrence Herrington, Tom Lake	Relative Humidity:	63.2%
Customer Project:	None	Bar. Pressure:	1011 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	WILM0050-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

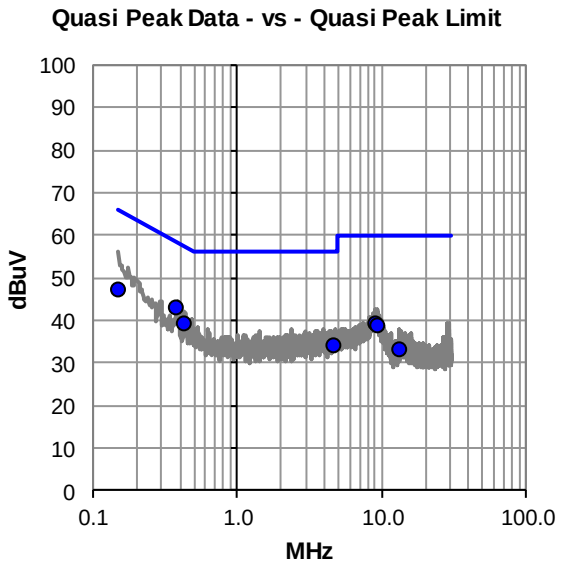
Tom 2, PCA 293 #3

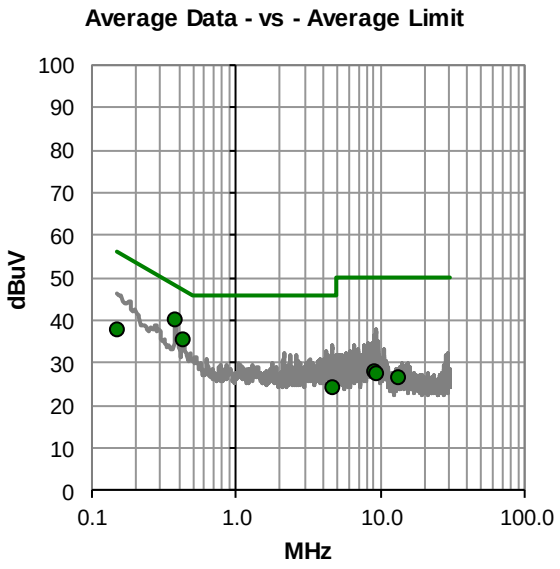
EUT OPERATING MODES

FM max power at 72.1 MHz

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #7

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.386	22.2	20.6	42.8	58.2	-15.4
0.435	18.4	20.6	39.0	57.2	-18.2
0.150	26.0	21.0	47.0	66.0	-19.0
9.277	18.0	20.9	38.9	60.0	-21.1
9.346	17.8	20.9	38.7	60.0	-21.3
4.658	13.0	20.7	33.7	56.0	-22.3
13.358	11.9	20.9	32.8	60.0	-27.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.386	19.3	20.6	39.9	48.2	-8.3
0.435	14.8	20.6	35.4	47.2	-11.8
0.150	16.5	21.0	37.5	56.0	-18.5
4.658	3.5	20.7	24.2	46.0	-21.8
9.277	7.0	20.9	27.9	50.0	-22.1
9.346	6.5	20.9	27.4	50.0	-22.6
13.358	5.6	20.9	26.5	50.0	-23.5

CONCLUSION

Pass

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