



element

Whites Electronics, Inc.

GMX

FCC 15.209:2019

Inductive Radio

Report # WHIT0074



NVLAP LAB CODE: 200630-0



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CERTIFICATE OF TEST

Last Date of Test: November 20, 2019
Whites Electronics, Inc.
Model: GMX

Radio Equipment Testing

Standards

Specification	Method
FCC 15.209:2019	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.4	Field Strength of Fundamental	Yes	Pass	
6.4, 6.5	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Kyle Holgate, 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

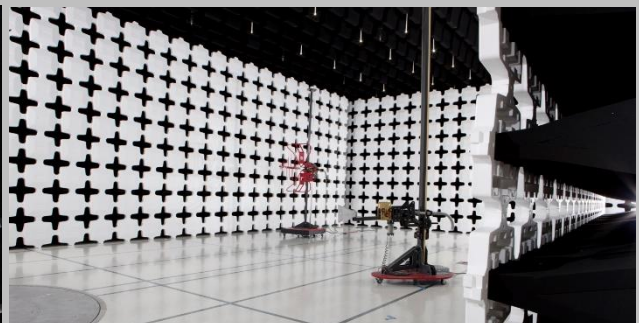
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th 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/RRR, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY

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.

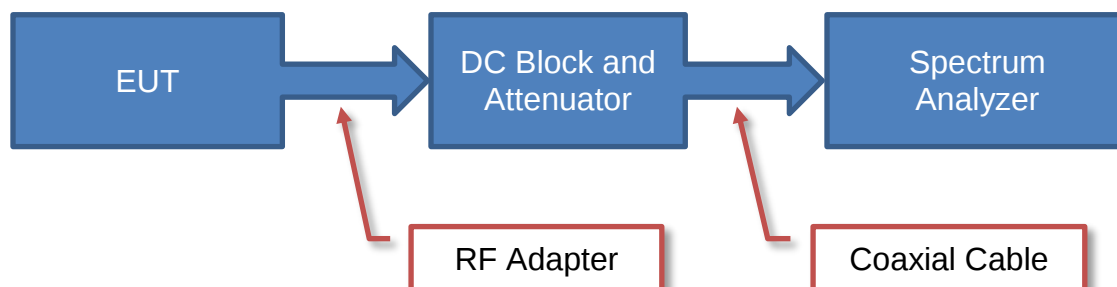
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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

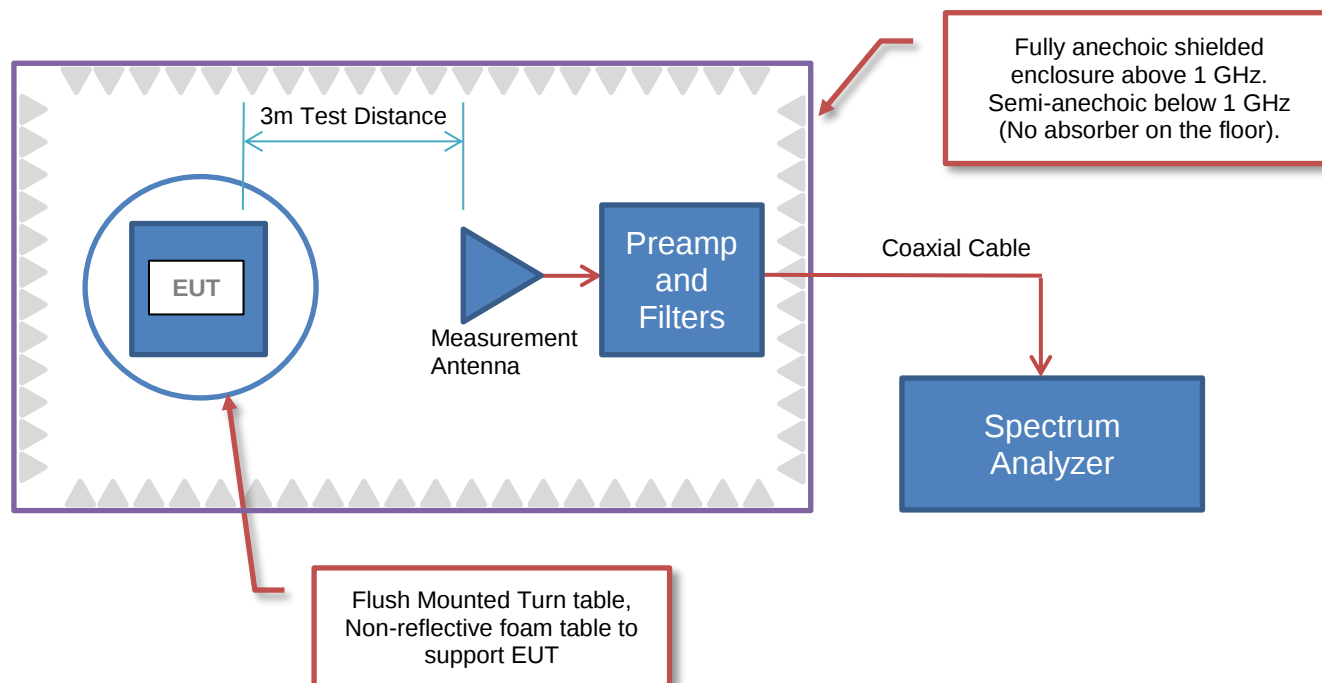
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Whites Electronics, Inc.
Address:	1011 Pleasant Valley Rod
City, State, Zip:	Sweet Home, OR 97386
Test Requested By:	Stephanie Powell
Model:	GMX
First Date of Test:	November 20, 2019
Last Date of Test:	November 20, 2019
Receipt Date of Samples:	November 20, 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:
Metal Detector
Testing Objective:
To demonstrate compliance of the inductive portion of the device to FCC Part 15.209 specifications.

CONFIGURATIONS



Configuration WHIT0080- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
10 Inch Antenna	Whites Electronics, Inc.	GMT 24k	None
Metal Detector	Whites Electronics, Inc.	GMX	9283-0353-001-20F1

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Headphones	Whites Electronics, Inc.	SPORT	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Headphone Cable	Unknown	2.0m	No	Headphones	Metal Detector
Metal Detector Cable	Unknown	2.5m	No	Metal Detector	Antenna

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-11-20	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.
2	2019-11-20	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2019.05.10

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

On, Factory Default setting

POWER SETTINGS INVESTIGATED

Battery 12VDC Nominal

CONFIGURATIONS INVESTIGATED

WHIT0080 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 9 kHz Stop Frequency 100 kHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	19-Jun-2019	12 mo
Cable	None	3m Test Distance Cable	EVM	24-Jul-2019	12 mo
Antenna - Loop	EMCO	6502	AOA	6-Jul-2018	24 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

The fundamental carrier of the EUT was maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The reference point of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.5, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF FUNDAMENTAL

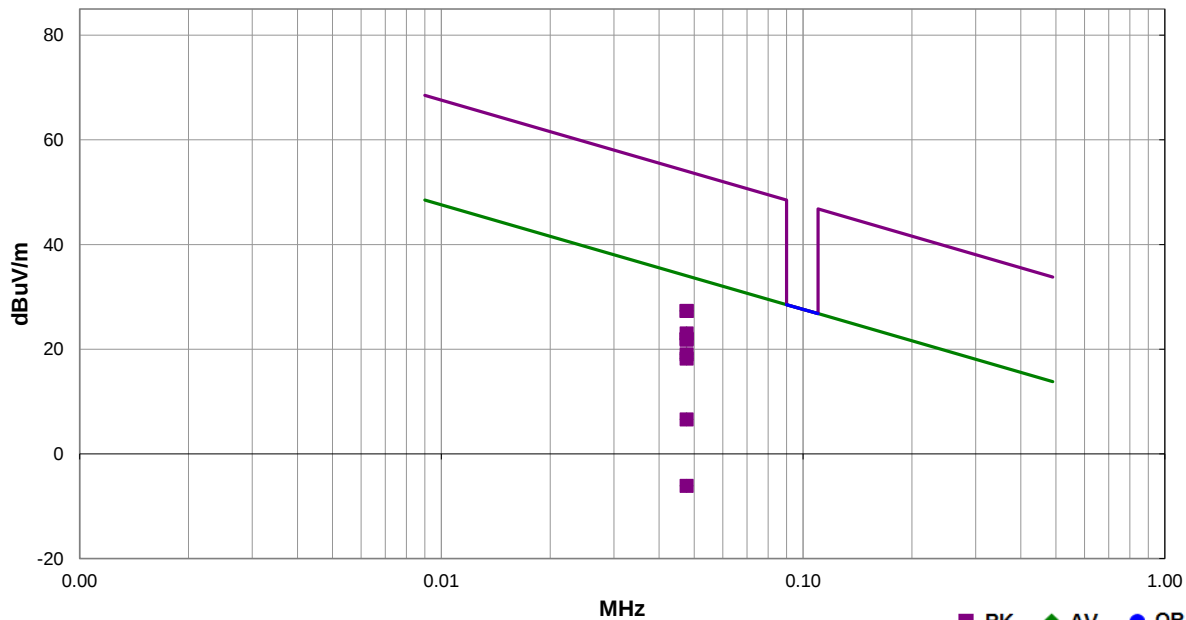


EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	WHIT0080	Date:	20-Nov-2019		
Project:	None	Temperature:	20 °C		
Job Site:	EV11	Humidity:	42.3% RH		
Serial Number:	9283-0353-001-20F1	Barometric Pres.:	1022 mbar	Tested by:	Brandon Hobbs
EUT:	GMX (new board layout)				
Configuration:	1				
Customer:	Whites Electronics, Inc.				
Attendees:	Mike Brindley				
EUT Power:	Battery 12VDC Nominal				
Operating Mode:	On, Factory Default setting while continuously transmitting at 47.6 kHz				
Deviations:	None				
Comments:	GMT 24k 10inch antenna attached.				

Test Specifications	Test Method
FCC 15.209:2019	ANSI C63.10:2013

Run #	1	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
0.048	94.8	12.5	1.0	282.0	3.0	0.0	Para to EUT	AV	-80.0	27.3	34.0	-6.7	EUT On Side
0.048	94.8	12.5	1.0	281.0	3.0	0.0	Para to EUT	AV	-80.0	27.3	34.0	-6.7	EUT Vert
0.048	90.5	12.5	1.0	269.0	3.0	0.0	Para to GND	AV	-80.0	23.0	34.0	-11.0	EUT Horz
0.048	89.5	12.5	1.0	324.0	3.0	0.0	Perp to EUT	AV	-80.0	22.0	34.0	-12.0	EUT Vert
0.048	89.3	12.5	1.0	240.0	3.0	0.0	Perp to EUT	AV	-80.0	21.8	34.0	-12.2	EUT On Side
0.048	86.5	12.5	1.0	281.0	3.0	0.0	Para to GND	AV	-80.0	19.0	34.0	-15.0	EUT Vert
0.048	85.7	12.5	1.0	284.0	3.0	0.0	Para to GND	AV	-80.0	18.2	34.0	-15.8	EUT On Side
0.048	94.8	12.5	1.0	282.0	3.0	0.0	Para to EUT	PK	-80.0	27.3	54.0	-26.7	EUT On Side
0.048	94.8	12.5	1.0	281.0	3.0	0.0	Para to EUT	PK	-80.0	27.3	54.0	-26.7	EUT Vert
0.048	74.1	12.5	1.0	205.0	3.0	0.0	Para to EUT	AV	-80.0	6.6	34.0	-27.4	EUT Horz
0.048	90.5	12.5	1.0	269.0	3.0	0.0	Para to GND	PK	-80.0	23.0	54.0	-31.0	EUT Horz
0.048	89.5	12.5	1.0	324.0	3.0	0.0	Perp to EUT	PK	-80.0	22.0	54.0	-32.0	EUT Vert
0.048	89.3	12.5	1.0	240.0	3.0	0.0	Perp to EUT	PK	-80.0	21.8	54.0	-32.2	EUT On Side
0.048	86.5	12.5	1.0	281.0	3.0	0.0	Para to GND	PK	-80.0	19.0	54.0	-35.0	EUT Vert
0.048	85.7	12.5	1.0	284.0	3.0	0.0	Para to GND	PK	-80.0	18.2	54.0	-35.8	EUT On Side
0.048	61.4	12.5	1.0	267.0	3.0	0.0	Perp to EUT	AV	-80.0	-6.1	34.0	-40.1	EUT Horz
0.048	74.1	12.5	1.0	205.0	3.0	0.0	Para to EUT	PK	-80.0	6.6	54.0	-47.4	EUT Horz
0.048	61.4	12.5	1.0	267.0	3.0	0.0	Perp to EUT	PK	-80.0	-6.1	54.0	-60.1	EUT Horz

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

On, Factory Default setting while continuously transmitting 47.6 kHz

POWER SETTINGS INVESTIGATED

Battery 12VDC Nominal

CONFIGURATIONS INVESTIGATED

WHIT0080 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	9k MHz	Stop Frequency	30 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	None	3m Test Distance Cable	EVM	24-Jul-2019	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	19-Jun-2019	12 mo
Antenna - Loop	EMCO	6502	AOA	6-Jul-2018	24 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height (where applicable) and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The reference point of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.5, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

SPURIOUS RADIATED EMISSIONS

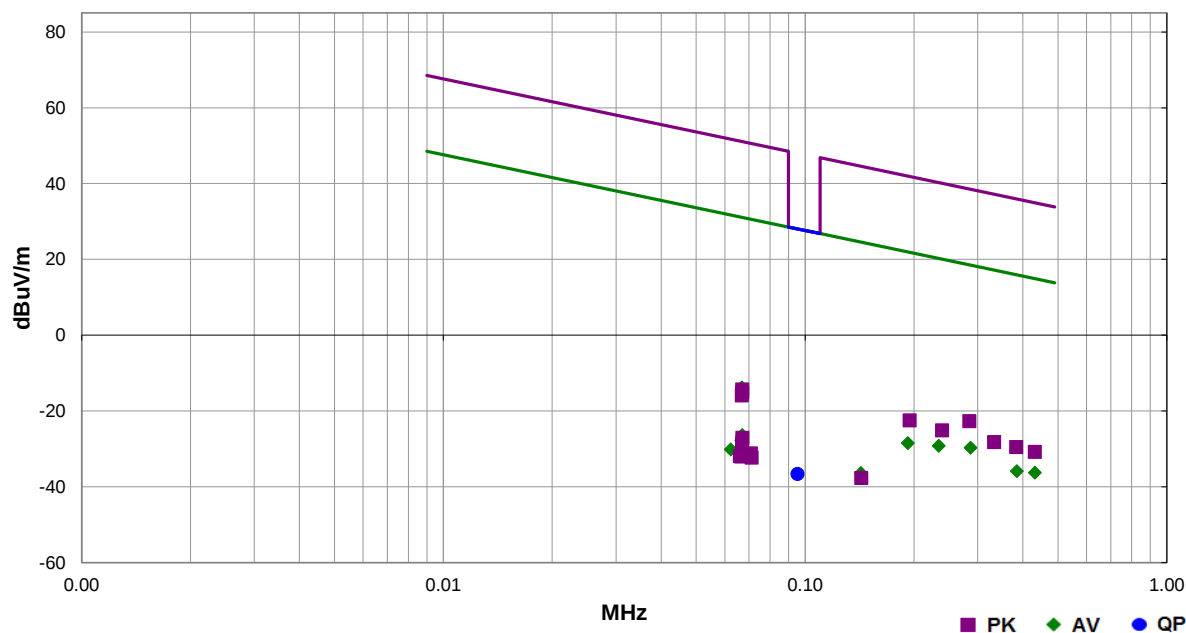


EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	WHIT0080	Date:	20-Nov-2019	
Project:	None	Temperature:	20 °C	
Job Site:	EV11	Humidity:	42.3% RH	
Serial Number:	9283-0353-001-20F1	Barometric Pres.:	1022 mbar	Tested by: Brandon Hobbs
EUT:	GMX (new board layout)			
Configuration:	1			
Customer:	Whites Electronics, Inc.			
Attendees:	Mike Brindley			
EUT Power:	Battery 12VDC Nominal			
Operating Mode:	On, Factory Default setting			
Deviations:	None			
Comments:	GMT 24k 10inch antenna attached.			

Test Specifications	Test Method
FCC 15.209:2019	ANSI C63.10:2013

Run #	2	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
0.067	54.3	11.9	1.0	85.0	3.0	0.0	Perp to EUT	AV	-80.0	-13.8	31.1	-44.9	EUT Vert
0.067	54.0	11.9	1.0	360.0	3.0	0.0	Perp to EUT	AV	-80.0	-14.1	31.1	-45.2	EUT On Side
0.067	53.8	11.9	1.0	29.0	3.0	0.0	Perp to EUT	AV	-80.0	-14.3	31.1	-45.4	EUT Horz
0.333	40.6	11.1	1.0	166.0	3.0	0.0	Perp to EUT	AV	-80.0	-28.3	17.2	-45.5	EUT Vert
0.287	39.2	11.1	1.0	21.0	3.0	0.0	Perp to EUT	AV	-80.0	-29.7	18.5	-48.2	EUT Vert
0.234	39.6	11.2	1.0	75.0	3.0	0.0	Perp to EUT	AV	-80.0	-29.2	20.2	-49.4	EUT Vert
0.192	40.3	11.2	1.0	280.0	3.0	0.0	Perp to EUT	AV	-80.0	-28.5	21.9	-50.4	EUT Vert
0.432	32.5	11.2	1.0	-5.0	3.0	0.0	Perp to EUT	AV	-80.0	-36.3	14.9	-51.2	EUT Vert
0.385	33.0	11.1	1.0	232.0	3.0	0.0	Perp to EUT	AV	-80.0	-35.9	15.9	-51.8	EUT Vert
0.067	41.7	11.9	1.0	333.0	3.0	0.0	Para to EUT	AV	-80.0	-26.4	31.1	-57.5	EUT On Side
0.067	40.3	11.9	1.0	270.0	3.0	0.0	Para to GND	AV	-80.0	-27.8	31.1	-58.9	EUT On Side
0.143	32.3	11.3	1.0	218.0	3.0	0.0	Perp to EUT	AV	-80.0	-36.4	24.5	-60.9	EUT Vert
0.066	38.2	11.9	1.0	230.0	3.0	0.0	Para to EUT	AV	-80.0	-29.9	31.2	-61.1	EUT Horz
0.284	46.2	11.1	1.0	21.0	3.0	0.0	Perp to EUT	PK	-80.0	-22.7	38.5	-61.2	EUT Vert
0.066	37.7	11.9	1.0	11.0	3.0	0.0	Para to GND	AV	-80.0	-30.4	31.1	-61.5	EUT Vert
0.062	37.7	12.1	1.0	287.0	3.0	0.0	Para to GND	AV	-80.0	-30.2	31.7	-61.9	EUT Horz
0.067	36.8	11.9	1.0	280.0	3.0	0.0	Para to EUT	AV	-80.0	-31.3	31.1	-62.4	EUT Vert
0.195	46.3	11.2	1.0	280.0	3.0	0.0	Perp to EUT	PK	-80.0	-22.5	41.8	-64.3	EUT Vert

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
0.095	31.8	11.6	1.0	306.0	3.0	0.0	Perp to EUT	QP	-80.0	-36.6	28.0	-64.6	EUT Vert
0.239	43.7	11.2	1.0	75.0	3.0	0.0	Perp to EUT	PK	-80.0	-25.1	40.0	-65.1	EUT Vert
0.067	53.8	11.9	1.0	360.0	3.0	0.0	Perp to EUT	PK	-80.0	-14.3	51.1	-65.4	EUT On Side
0.333	40.7	11.1	1.0	166.0	3.0	0.0	Perp to EUT	PK	-80.0	-28.2	37.2	-65.4	EUT Vert
0.383	39.4	11.1	1.0	232.0	3.0	0.0	Perp to EUT	PK	-80.0	-29.5	35.9	-65.4	EUT Vert
0.432	38.0	11.2	1.0	-5.0	3.0	0.0	Perp to EUT	PK	-80.0	-30.8	34.9	-65.7	EUT Vert
0.067	53.0	11.9	1.0	29.0	3.0	0.0	Perp to EUT	PK	-80.0	-15.1	51.1	-66.2	EUT Horz
0.067	52.2	11.9	1.0	85.0	3.0	0.0	Perp to EUT	PK	-80.0	-15.9	51.1	-67.0	EUT Vert
0.067	41.0	11.9	1.0	333.0	3.0	0.0	Para to EUT	PK	-80.0	-27.1	51.1	-78.2	EUT On Side
0.067	39.6	11.9	1.0	270.0	3.0	0.0	Para to GND	PK	-80.0	-28.5	51.1	-79.6	EUT On Side
0.071	37.0	11.8	1.0	287.0	3.0	0.0	Para to GND	PK	-80.0	-31.2	50.6	-81.8	EUT Horz
0.143	31.0	11.3	1.0	218.0	3.0	0.0	Perp to EUT	PK	-80.0	-37.7	44.5	-82.2	EUT Vert
0.071	35.9	11.8	1.0	230.0	3.0	0.0	Para to EUT	PK	-80.0	-32.3	50.5	-82.8	EUT Horz
0.067	36.1	11.9	1.0	280.0	3.0	0.0	Para to EUT	PK	-80.0	-32.0	51.1	-83.1	EUT Vert
0.066	36.1	12.0	1.0	11.0	3.0	0.0	Para to GND	PK	-80.0	-31.9	51.2	-83.1	EUT Vert