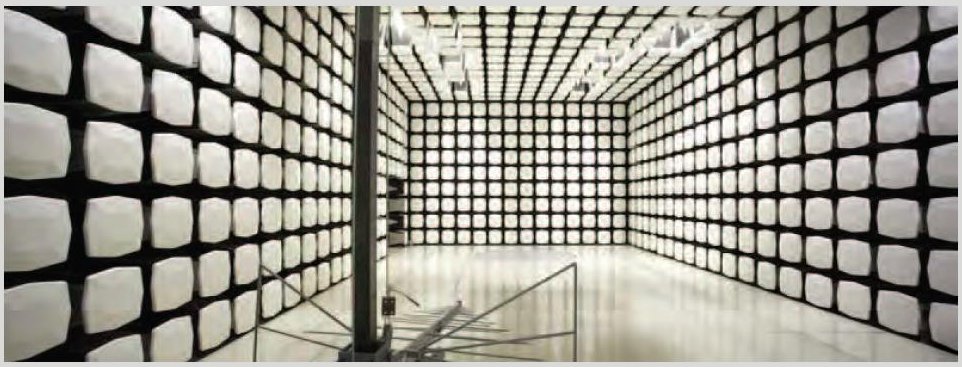
Preco, Inc.

Sentry® ST97and Side Defender® II SDII97

FCC 15.249:2018

24.05-24.25 GHz Low Power (SRD) Transceiver

Report # PRCO0085



NVLAP LAB CODE: 200630-0

CERTIFICATE OF TEST

Last Date of Test: November 16, 2018
Preco, Inc.
Model: Sentry® ST97and Side Defender® II SDII97

Radio Equipment Testing

Standards

Specification	Method
FCC 15.249:2018	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not requested.
6.5, 6.6	Field Strength of Harmonics and Spurious Radiated Emissions	Yes	Pass	
6.6	Field Strength of Fundamental	Yes	Pass	
7.5	Duty Cycle	No	N/A	Not requested.

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). Certification chambers and Open Area Test Sites are filed with ISED.

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

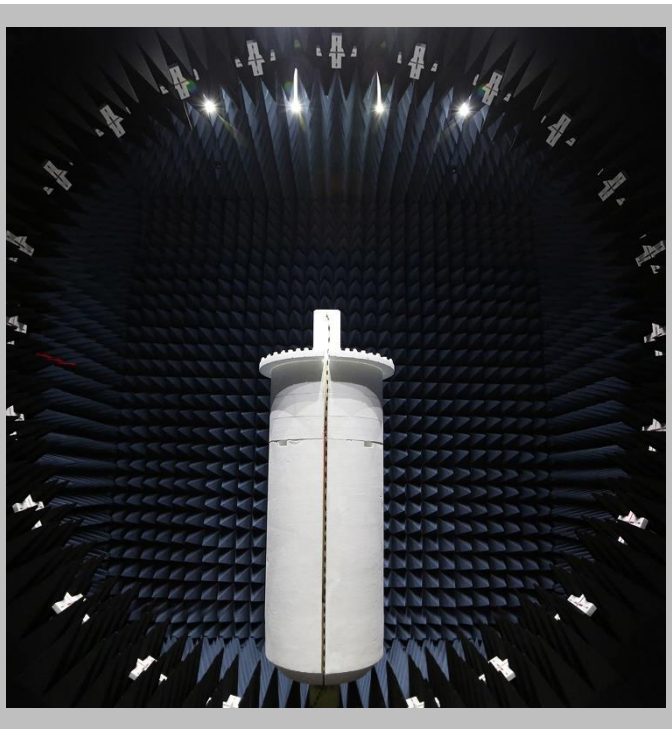
MIC – Recognized by MIC as a CAB for the acceptance of test data.

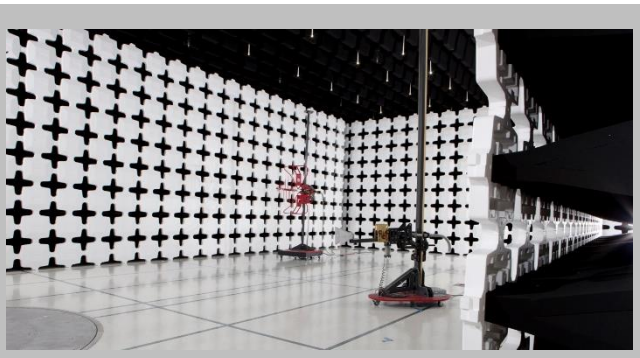
SCOPE

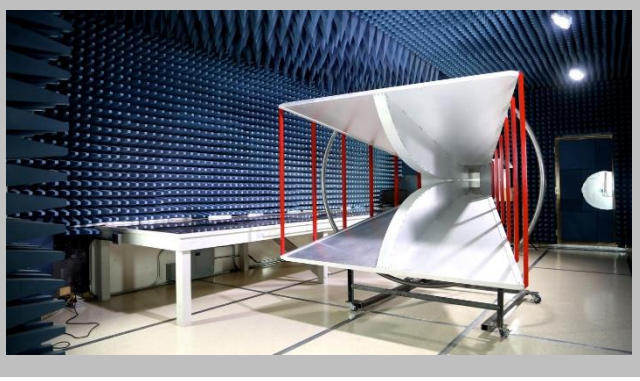
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	New York	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 NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	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: 200761-0	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	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	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.

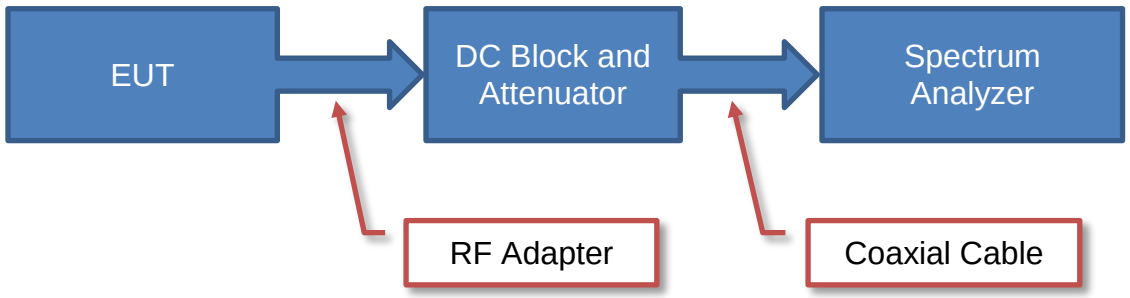
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

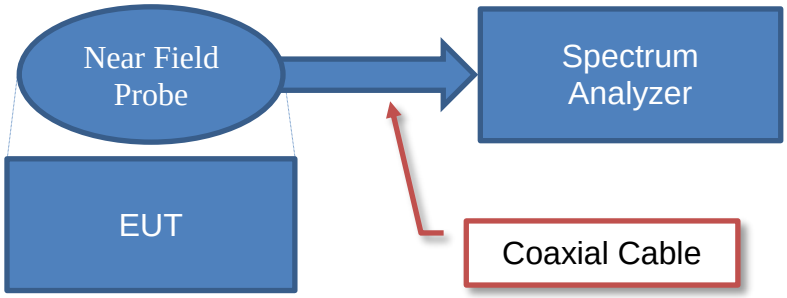
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams

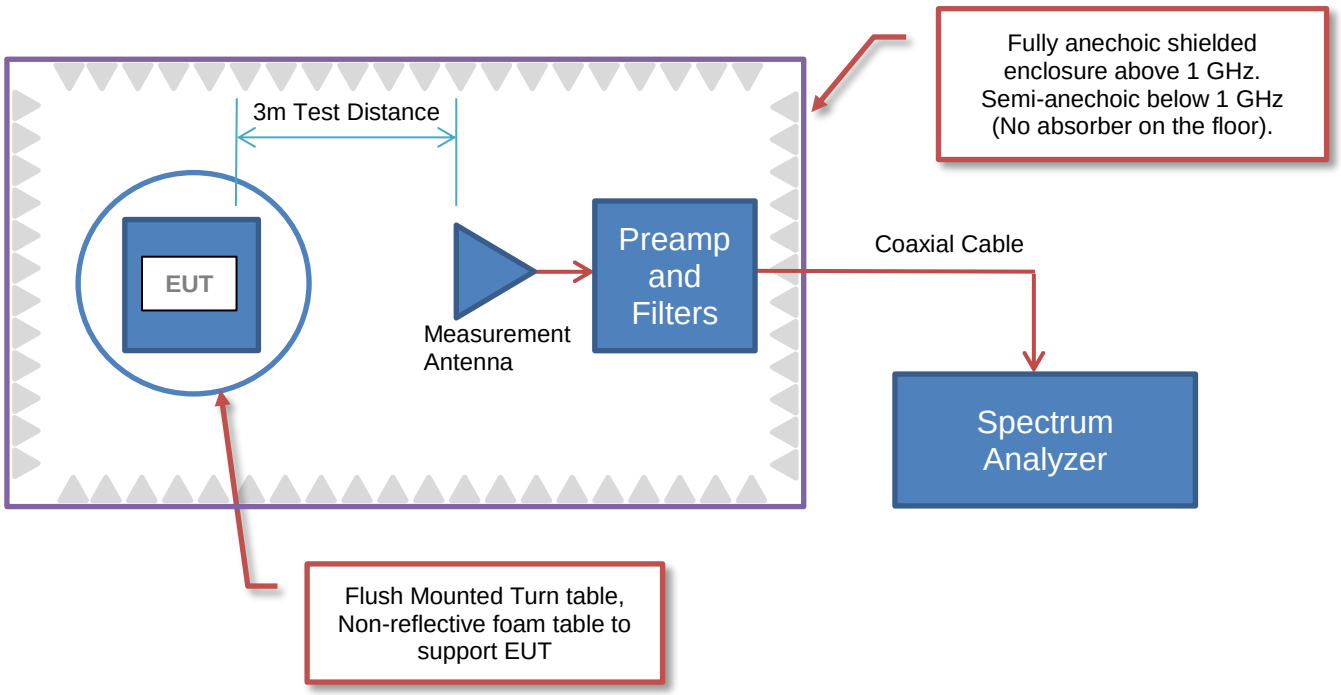
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Preco, Inc.
Address:	10335 W Emerald St
City, State, Zip:	Boise, ID 83704-5018
Test Requested By:	John Fadgen
Model:	Sentry® ST97and Side Defender® II SDII97
First Date of Test:	November 14, 2018
Last Date of Test:	November 16, 2018
Receipt Date of Samples:	November 14, 2018
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Radar Unit

Seeking to demonstrate compliance to the Low Power SRD Transceiver under FCC 15.249:2018 for operation in the 24.05-24.25 GHz Band.

CONFIGURATIONS

Configuration PRCO0085- 1

Software/Firmware Running during test	
Description	**Version**
NextGen PET	1.7.9

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radar Unit 1	Preco Electronics, Inc.	None	1

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Linear Power Supply	TOPWARD ELECTRONIC INSTURMENTS	TPS 2000	TPD

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop	HP	ProBook 6545b	CND03005M8

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Main Harness	No	10 m	No	Main Harness to Serial	I/O Cable
I/O Cable	No	0.2 m	No	Main Harness	Radar Unit 1
DC Power	No	1.3 m	No	Main Harness	DC Linear Power Supply
Main Harness to Serial	No	1.3 m	No	Main Harness	Serial to USB
Serial to USB	Yes	0.8 m	No	Main Harness to Serial	Remote Laptop
AC Mains	No	1.8 m	No	DC Linear Power Supply	AC Mains

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-11-14	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	2018-11-15	Spurious Radiated 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.
3	2018-11-16	Field Strength of Harmonics	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 2018.07.27

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

Continuous Tx, Low Ch = 24056 MHz, Mid Ch = 24153 MHz, High Ch = 24247 MHz

POWER SETTINGS INVESTIGATED

12.0 VDC

CONFIGURATIONS INVESTIGATED

PRCO0085 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	24056 MHz	Stop Frequency	24247 MHz

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
Antenna - Standard Gain	ETS Lindgren	3160-09	AHY	NCR	0 mo
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	24-Aug-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-2018	12 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting and while set at the lowest channel, a middle channel, and the highest channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT and EUT antenna in 3 orthogonal planes.

The average values were calculated as per FCC KDB 890966 - Measurement Procedure for Level Probing Radars, Section 9. The steps for the calculation are as follows:

1. Calculate the dwell time, T_D, of the sweep frequency signal per MHz of the sweep frequency span:

   T_D = Ts/ΔF, where:

   Ts is the signal sweep frequency time in seconds
   ΔF is the signal sweep frequency span in MHz

2. Calculate the Average Factor:

   Average factor = (T_D) / cycle time, where:

   cycle time is the total time for a complete cycle of the signal including retrace and any other latency times.

3. Calculate the Duty Cycle Correctoin Factor (DCCF):

   DCCF = 10*log(Average Factor)

4. Apply the DCCF to the PK measurements to determine the AVG value

FIELD STRENGTH OF FUNDAMENTAL

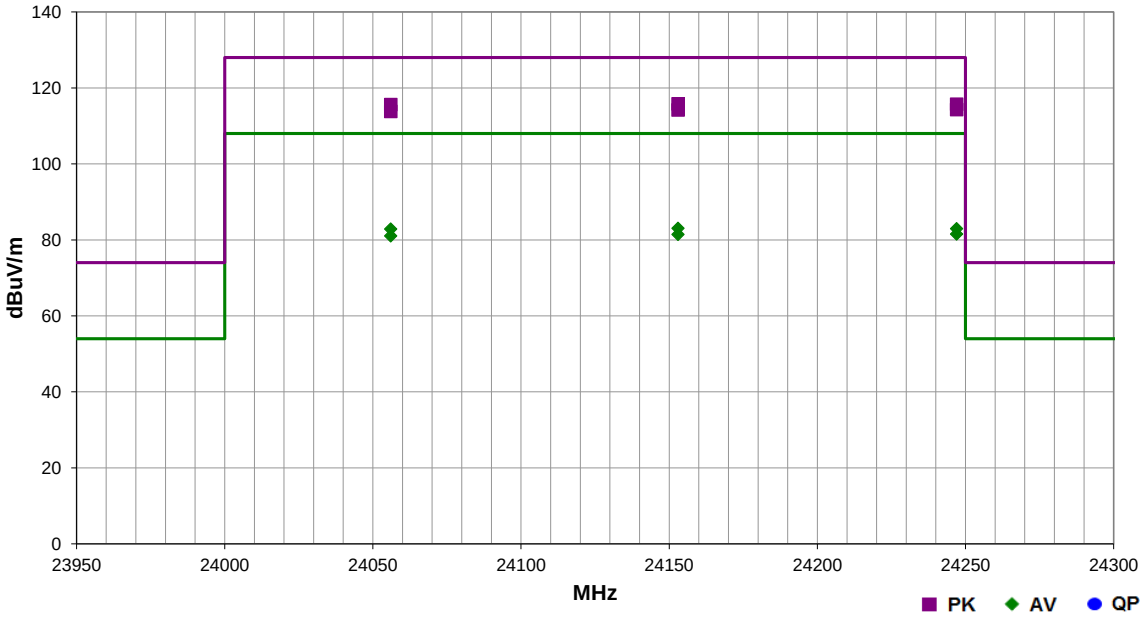
element

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	PRCO0085	**Date:**	14-Nov-2018		
Project:	None	**Temperature:**	20.3 °C		
Job Site:	EV01	**Humidity:**	40.7% RH		
Serial Number:	2	**Barometric Pres.:**	1030 mbar	**Tested by:**	Jeff Alcoke
EUT:	Sentry® ST97and Side Defender® II SDII97				
Configuration:	1				
Customer:	Preco, Inc.				
Attendees:	None				
EUT Power:	12.0 VDC				
Operating Mode:	Continuous Tx, Low Ch = 24056 MHz, Mid Ch = 24153 MHz, High Ch = 24247 MHz				
Deviations:	None				
Comments:	See comments below for Channel, Modulation type and EUT orientation. The radio employs FMCW modulation, the AVG values were calculated from the PK measurement as per FCC KDB 890966 Section F. The radio has a dwell time (T_D) of 5.86*10^-6 s/MHz, and a Cycle Time of 11.1 ms. The Average Factor = T_D/Cycle Time = 5.27*10^-4. The DCCF used to calculate the AVG value is 10*log(Average Factor) = -32.8 dB				

Test Specifications	**Test Method**
FCC 15.249:2018	ANSI C63.10:2013

Run #	9	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
24153.000	72.6	43.2	1.5	350.0		0.0	Vert	PK	0.0	115.8	128.0	-12.2	Mid Ch, CW, EUT on Side
24247.020	72.6	43.1	1.5	350.0		0.0	Vert	PK	0.0	115.7	128.0	-12.3	High Ch, CW, EUT on Side
24056.030	72.3	43.3	1.5	351.0		0.0	Vert	PK	0.0	115.6	128.0	-12.4	Low Ch, CW, EUT on Side
24247.000	71.2	43.1	1.6	352.0		0.0	Horz	PK	0.0	114.3	128.0	-13.7	High Ch, CW, EUT Horz
24153.020	71.0	43.2	1.7	355.0		0.0	Horz	PK	0.0	114.2	128.0	-13.8	Mid Ch, CW, EUT Horz
24056.020	70.5	43.3	1.7	351.0		0.0	Horz	PK	0.0	113.8	128.0	-14.2	Low Ch, CW, EUT Horz
24153.000	72.6	43.2	1.5	350.0	-32.8	0.0	Vert	AV	0.0	83.0	108.0	-25.0	Mid Ch, CW, EUT on Side
24247.020	72.6	43.1	1.5	350.0	-32.8	0.0	Vert	AV	0.0	82.9	108.0	-25.1	High Ch, CW, EUT on Side
24056.030	72.3	43.3	1.5	351.0	-32.8	0.0	Vert	AV	0.0	82.8	108.0	-25.2	Low Ch, CW, EUT on Side
24247.000	71.2	43.1	1.6	352.0	-32.8	0.0	Horz	AV	0.0	81.5	108.0	-26.5	High Ch, CW, EUT Horz
24153.020	71.0	43.2	1.7	355.0	-32.8	0.0	Horz	AV	0.0	81.4	108.0	-26.6	Mid Ch, CW, EUT Horz
24056.020	70.5	43.3	1.7	351.0	-32.8	0.0	Horz	AV	0.0	81.0	108.0	-27.0	Low Ch, CW, EUT Horz

FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable	OML, Inc.	S119BFSS100390443	SUN	NCR	NCR
Diplexer	OML, Inc.	DPL26	DAA	NCR	NCR
Antenna	OML, Inc.	M08HWAX	AIL	25-Aug-16	25-Aug-19
Antenna	OML, Inc.	M12HWAX	AIK	25-Aug-16	25-Aug-19
Antenna	OML, Inc.	M19HWAX	AIJ	25-Aug-16	25-Aug-19
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-18	18-Mar-19

TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. The EUT was transmitting with an unmodulated carrier. The testing was done at distances closer than 3m as called out in the data sheets. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna orientation and polarization, and manipulating the EUT and EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009). The specifiation limit was adjusted for the closer test distances at 20 dB per decade as called out in the following table:

	Spec limit						
	3m	1m	50cm	20 cm	10 cm	5 cm	2 cm
Average	68	77.54	83.56	91.5	97.5	103.6	111.5
Peak	88	97.54	103.56	111.5	117.5	123.6	131.5

The analyzer display was offset with the value of the test equipment losses (mixers, duplexers, and cables) specific to each band and the antenna factor per the following tables:

Low Frequency: 24056 MHz

Freq (MHz)	Antenna Gain (dBi)	Antenna Factor (dB/m)	lixer / Duplexer los (dB)	Analyzer Offset (dB)
48112.00	24.05	39.87	33.98	73.84
72168.00	24.05	43.39	39.59	82.97
96224.00	24.05	45.89	33.39	79.27

Mid Frequency: 24153 MHz

Freq (MHz)	Antenna Gain (dBi)	Antenna Factor (dB/m)	lixer / Duplexer los (dB)	Analyzer Offset (dB)
48306.00	24.05	39.90	30.37	70.25
72459.00	24.05	43.42	40.27	83.72
96612.00	24.05	45.92	34.17	80.12

High Frequency: 24257 MHz

Freq (MHz)	Antenna Gain (dBi)	Antenna Factor (dB/m)	lixer / Duplexer los (dB)	Analyzer Offset (dB)
48494.00	24.05	39.93	30.14	70.07
72741.00	24.05	43.46	40.16	83.62
96988.00	24.05	45.95	34.95	80.90

FIELD STRENGTH OF HARMONICS

element

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EUT:	Sentry® ST97and Side Defender® II SDII97			**Work Order:**	PRCO0085
Serial Number:	1			**Date:**	16-Nov-18
Customer:	Preco, Inc.			**Temperature:**	20.3 °C
Attendees:	None			**Humidity:**	41.7% RH
Project:	None			**Barometric Pres.:**	1026 mbar
Tested by:	Jeff Alcoke	**Power:**	12.0 VDC	**Job Site:**	EV01

TEST SPECIFICATIONS	**Test Method**
FCC 15.249:2018	ANSI C63.10:2013

COMMENTS

EUT was maximized on all three (x,y,z) orientations.

DEVIATIONS FROM TEST STANDARD

None

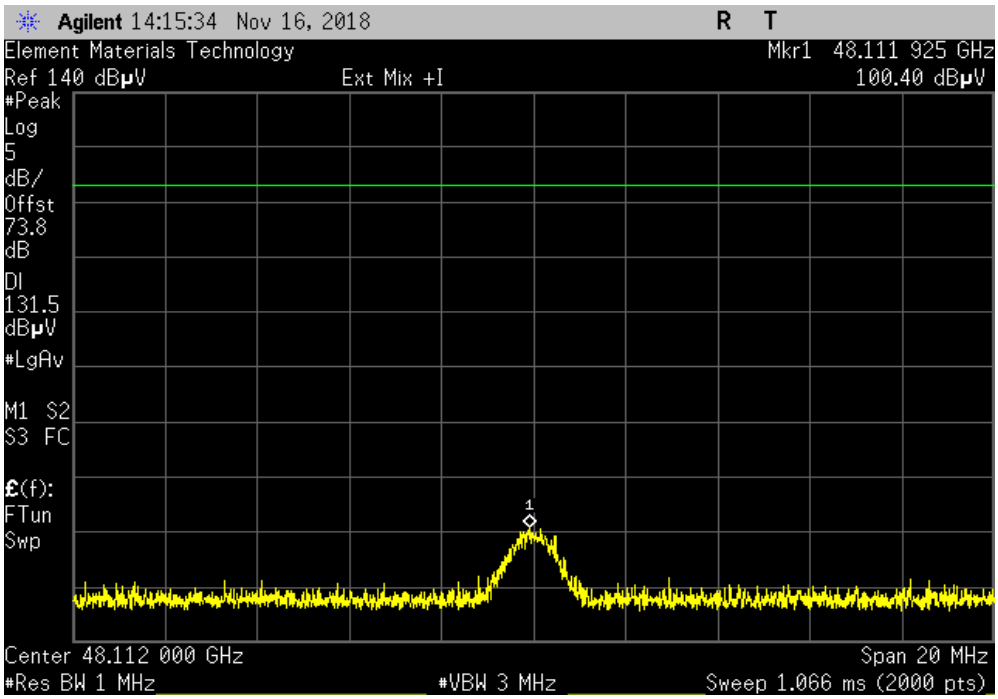
Configuration #	1	*Signature*

	Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
Continuous TX, 24056 MHz - 24247 MHz					
2nd Harmonic					
Low Ch. 24056 MHz					
Peak	100.4		100.4	131.5 @ 2 cm	Pass
Average	91.33		91.33	111.5 @ 2 cm	Pass
Mid Ch. 24153 MHz					
Peak	94.72		94.72	131.5 @ 2 cm	Pass
Average	87.51		87.51	111.5 @ 2 cm	Pass
High Ch. 24247 MHz					
Peak	94.33		94.33	131.5 @ 2 cm	Pass
Average	86.24		86.24	111.5 @ 2 cm	Pass
3rd Harmonic					
Low Ch. 24056 MHz					
Peak	106.18		106.18	131.5 @ 2 cm	Pass
Average	93.74		93.74	111.5 @ 2 cm	Pass
Mid Ch. 24153 MHz					
Peak	107.77		107.77	131.5 @ 2 cm	Pass
Average	93.32		93.32	111.5 @ 2 cm	Pass
High Ch. 24247 MHz					
Peak	106.63		106.63	131.5 @ 2 cm	Pass
Average	93.15		93.15	111.5 @ 2 cm	Pass
4th Harmonic					
Low Ch. 24056 MHz					
Peak	104.19		104.19	131.5 @ 2 cm	Pass
Average	90.41		90.41	111.5 @ 2 cm	Pass
Mid Ch. 24153 MHz					
Peak	105.51		105.51	131.5 @ 2 cm	Pass
Average	91.61		91.61	111.5 @ 2 cm	Pass
High Ch. 24247 MHz					
Peak	106.63		106.63	131.5 @ 2 cm	Pass
Average	91.37		91.37	111.5 @ 2 cm	Pass

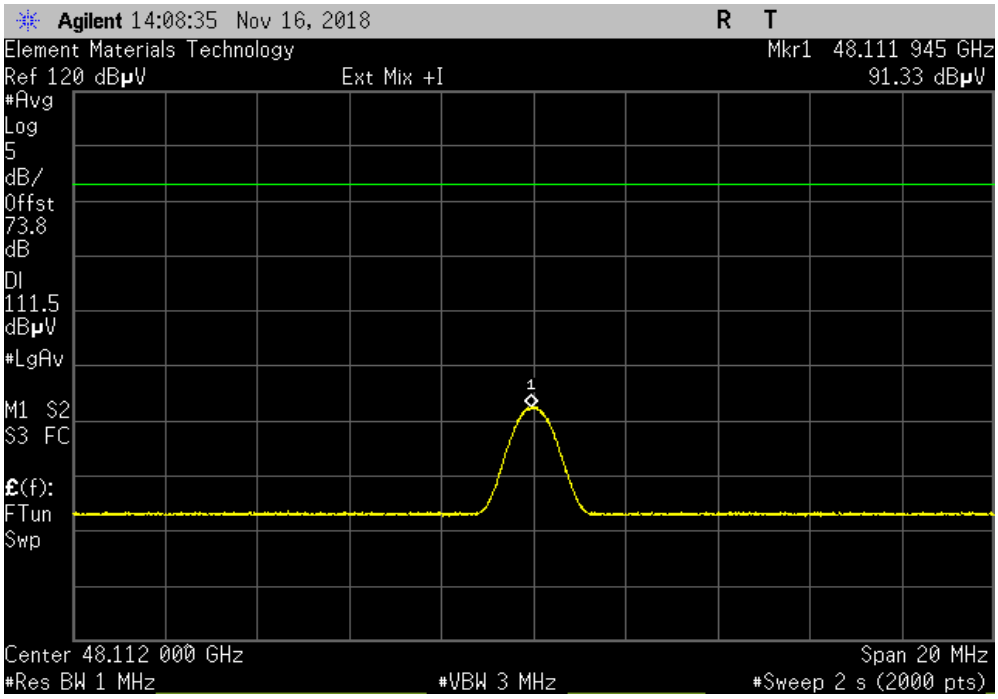
FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, Low Ch. 24056 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		100.4		100.4	131.5 @ 2 cm	Pass



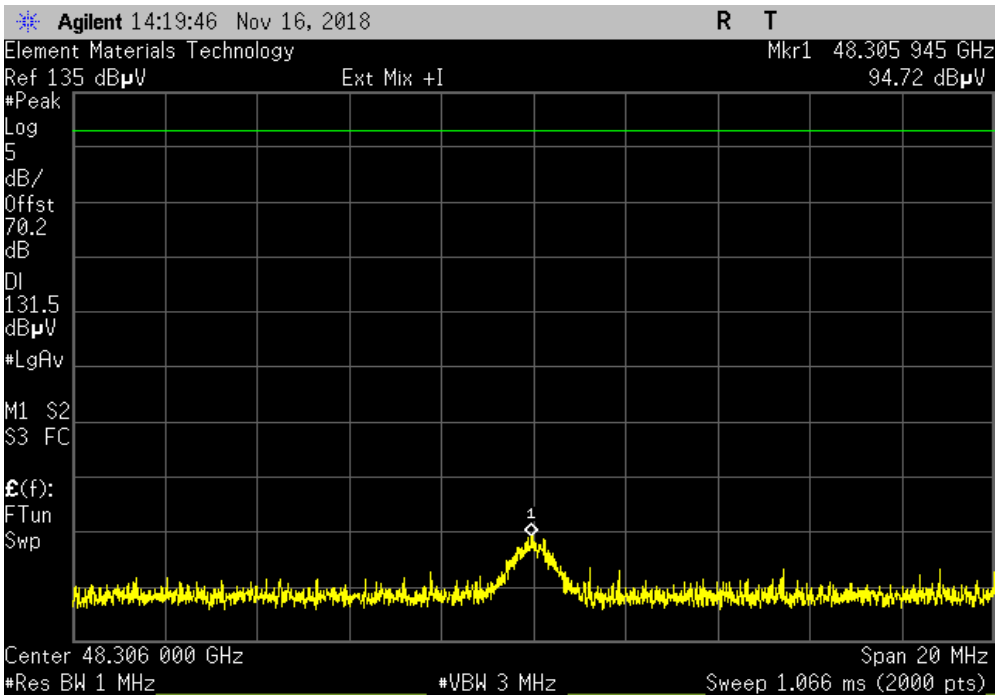
Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, Low Ch. 24056 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		91.33		91.33	111.5 @ 2 cm	Pass



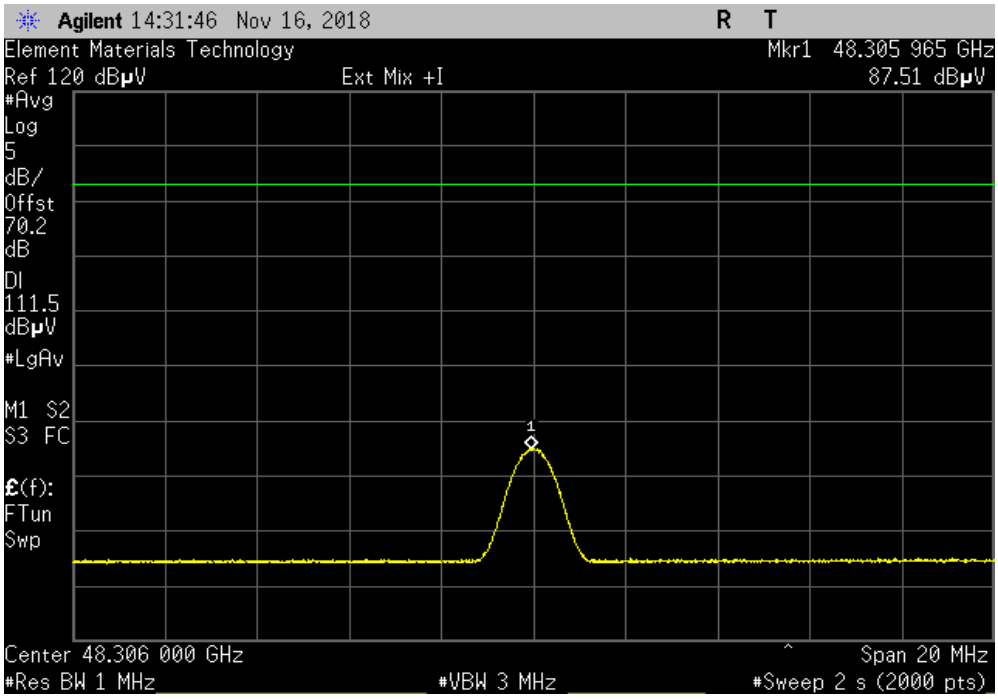
FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, Mid Ch. 24153 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		94.72		94.72	131.5 @ 2 cm	Pass



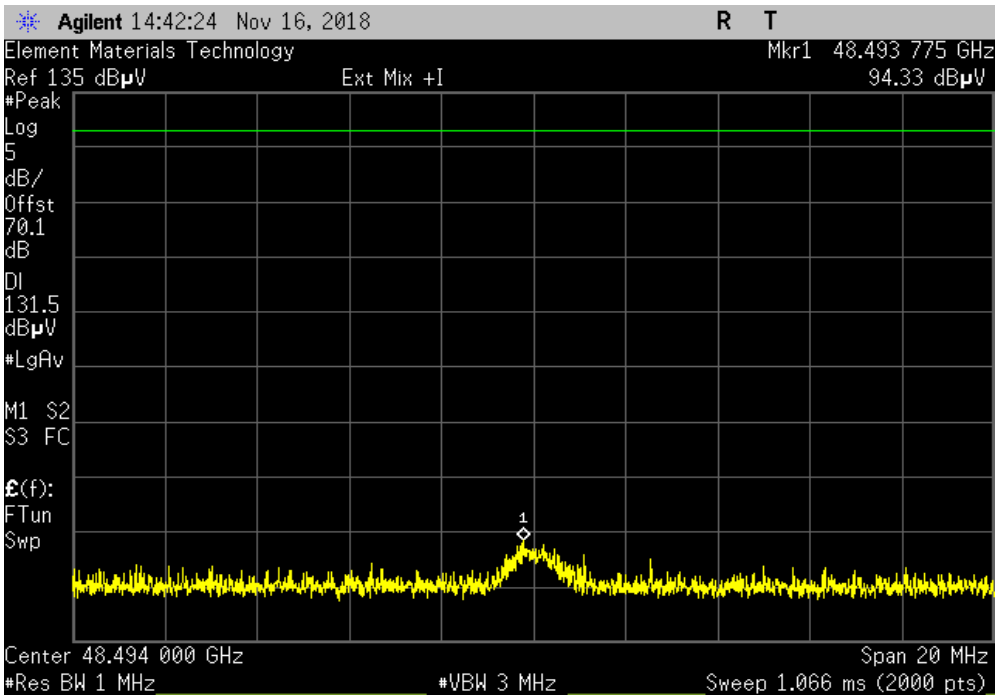
Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, Mid Ch. 24153 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		87.51		87.51	111.5 @ 2 cm	Pass



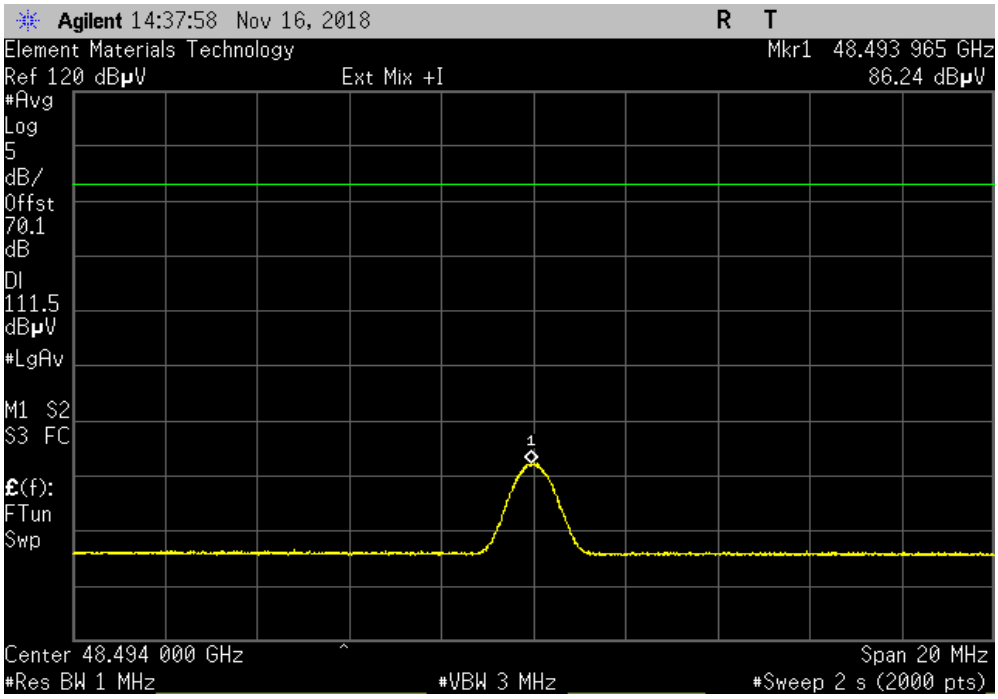
FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, High Ch. 24247 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		94.33		94.33	131.5 @ 2 cm	Pass



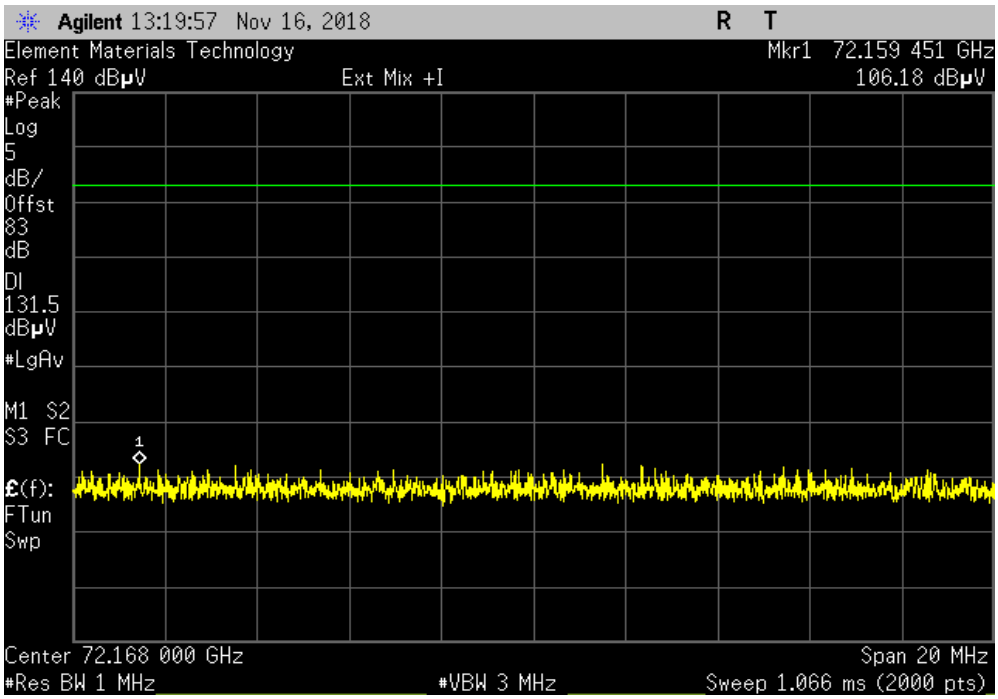
Continuous TX, 24056 MHz - 24247 MHz, 2nd Harmonic, High Ch. 24247 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		86.24		86.24	111.5 @ 2 cm	Pass



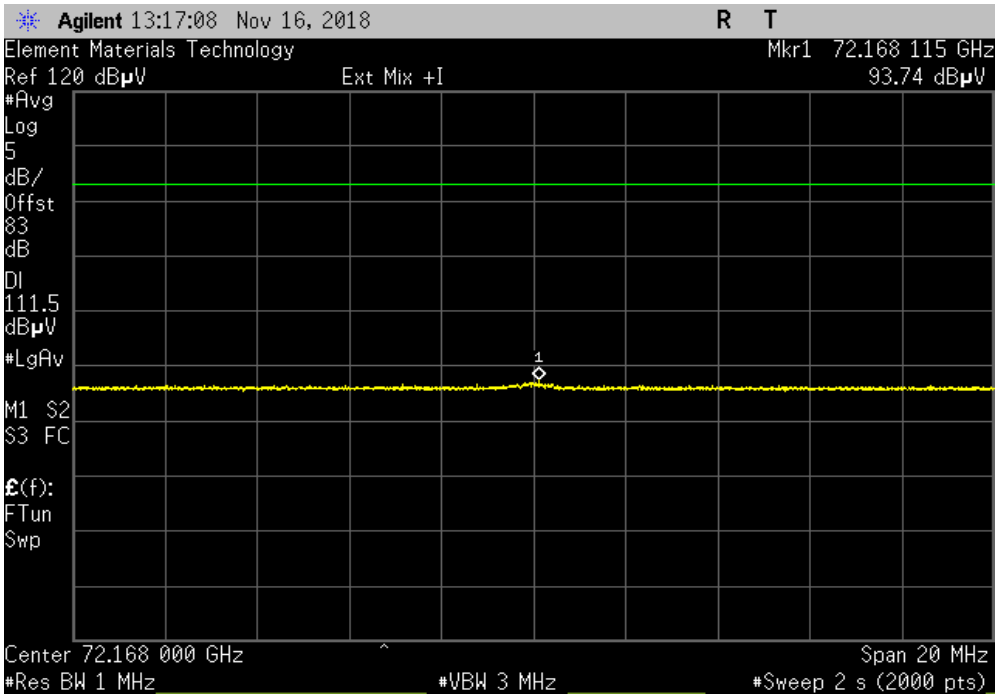
FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

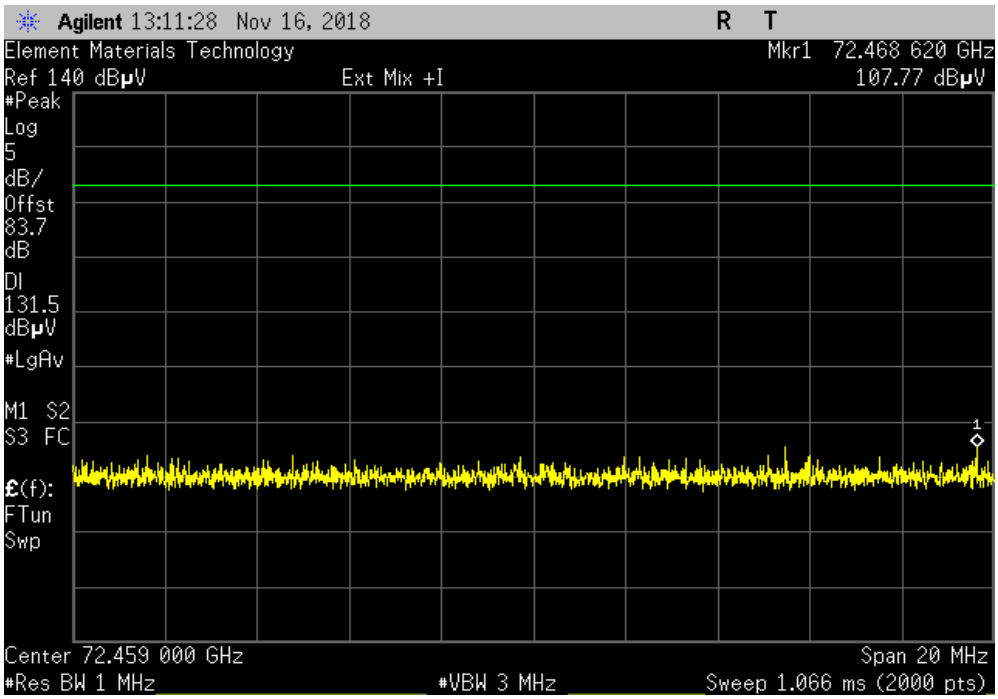
Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, Low Ch. 24056 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		106.18		106.18	131.5 @ 2 cm	Pass



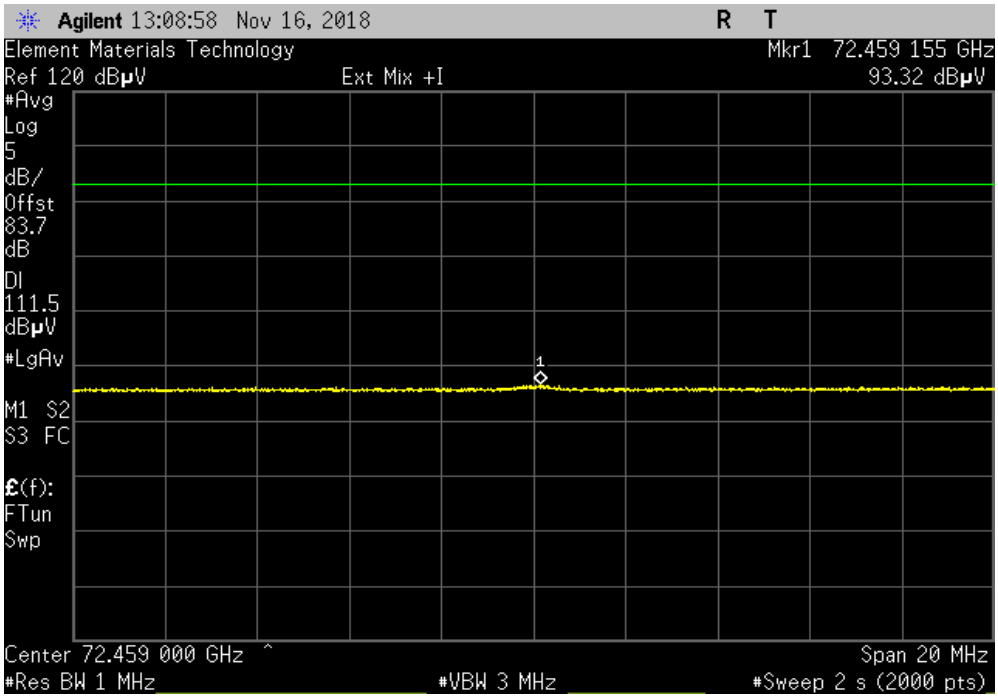
Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, Low Ch. 24056 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		93.74		93.74	111.5 @ 2 cm	Pass



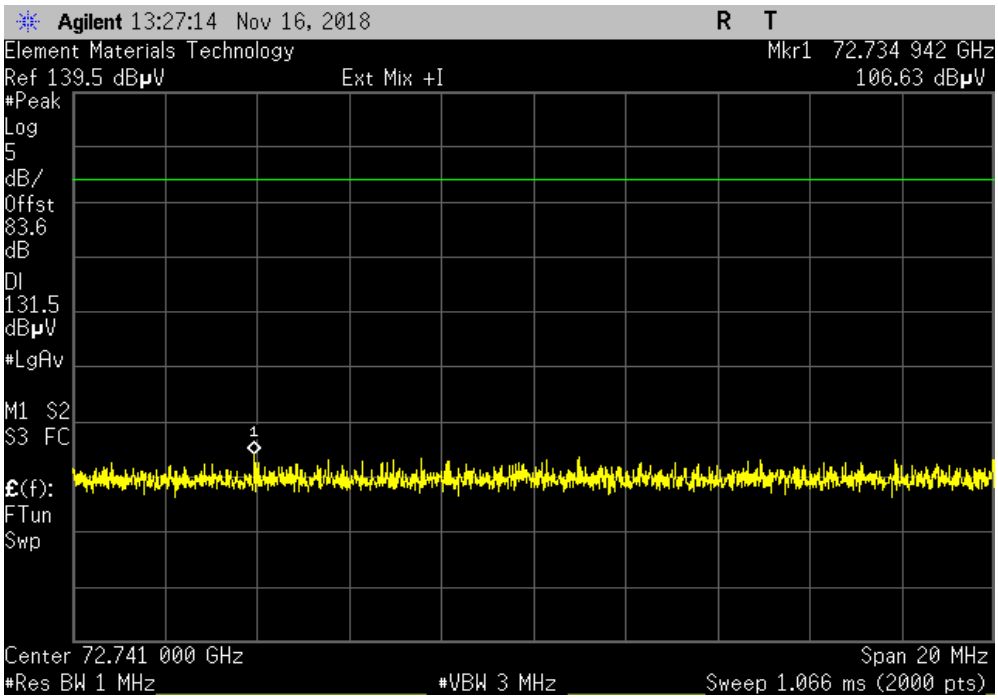
Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, Mid Ch. 24153 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		107.77		107.77	131.5 @ 2 cm	Pass



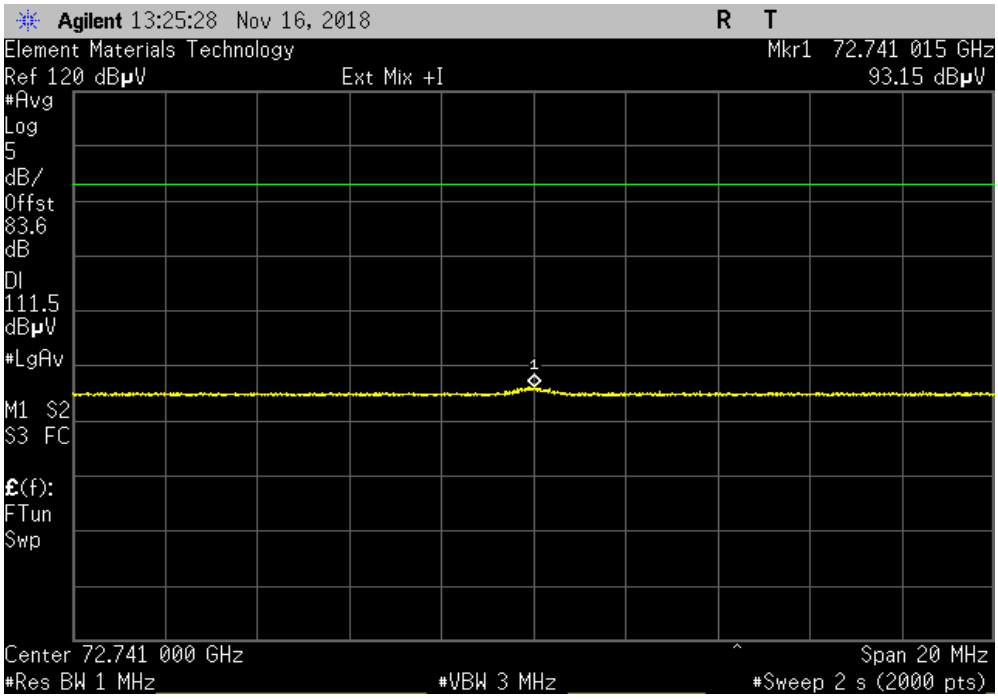
Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, Mid Ch. 24153 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		93.32		93.32	111.5 @ 2 cm	Pass



Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, High Ch. 24247 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		106.63		106.63	131.5 @ 2 cm	Pass



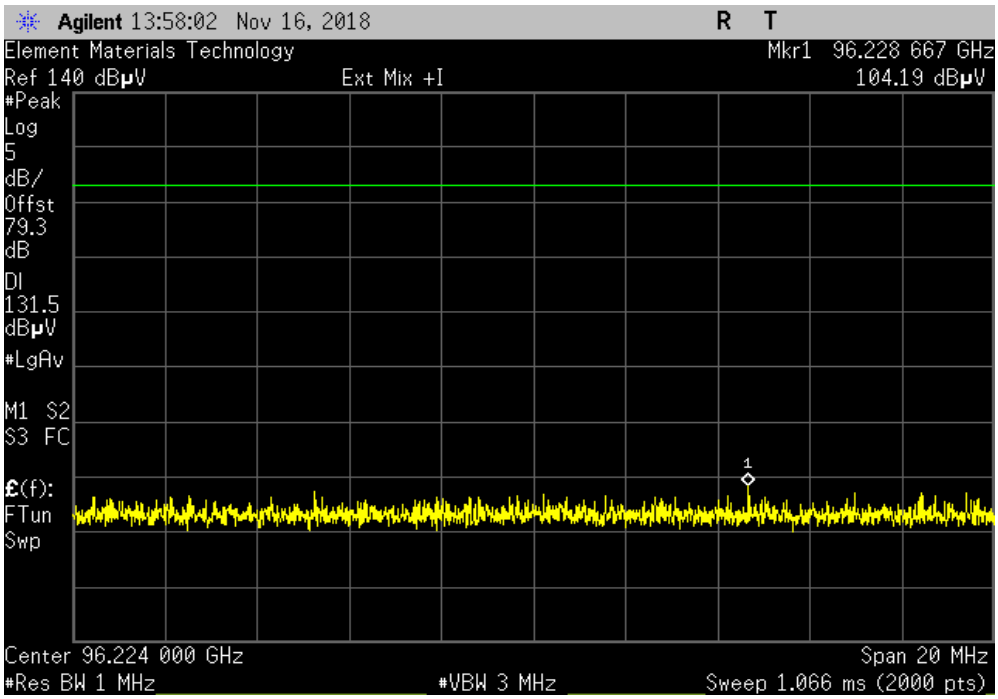
Continuous TX, 24056 MHz - 24247 MHz, 3rd Harmonic, High Ch. 24247 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		93.15		93.15	111.5 @ 2 cm	Pass



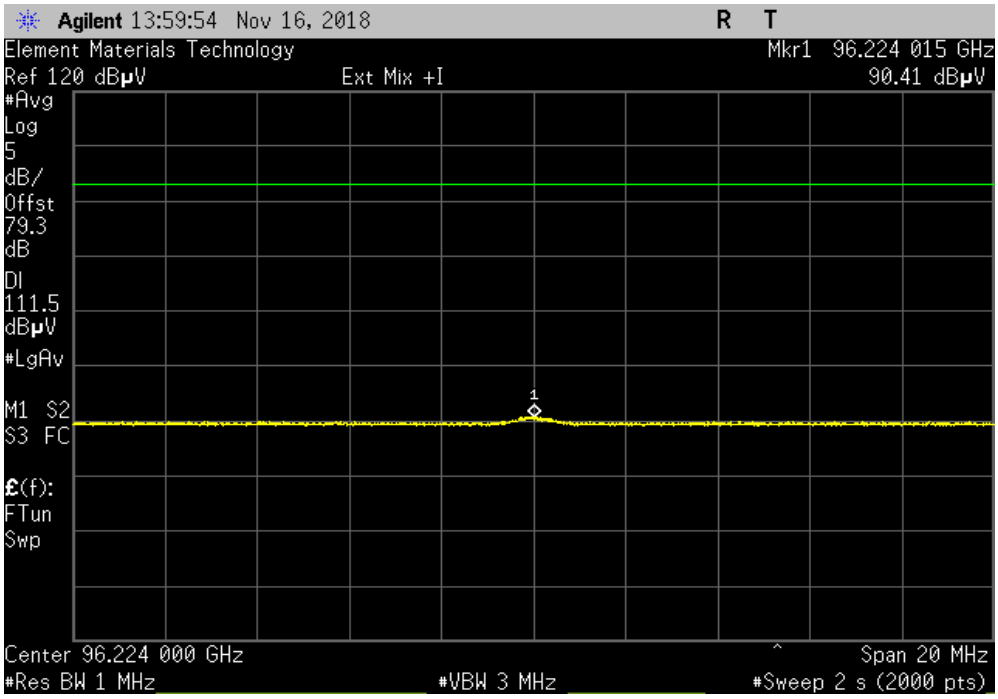
FIELD STRENGTH OF HARMONICS

XMit 2017.12.13

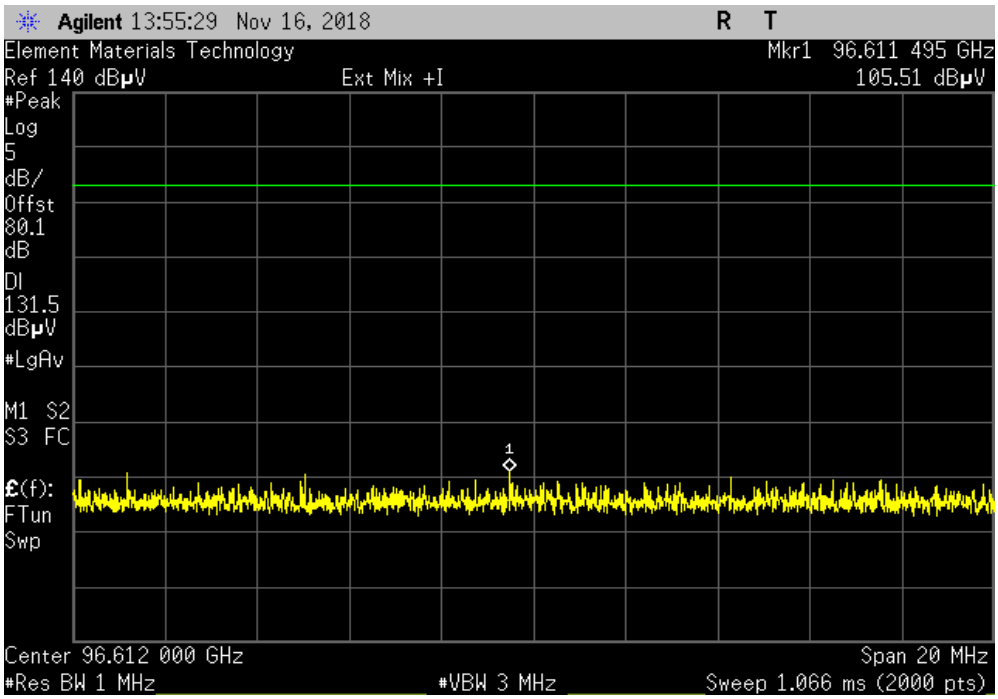
Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, Low Ch. 24056 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		104.19		104.19	131.5 @ 2 cm	Pass



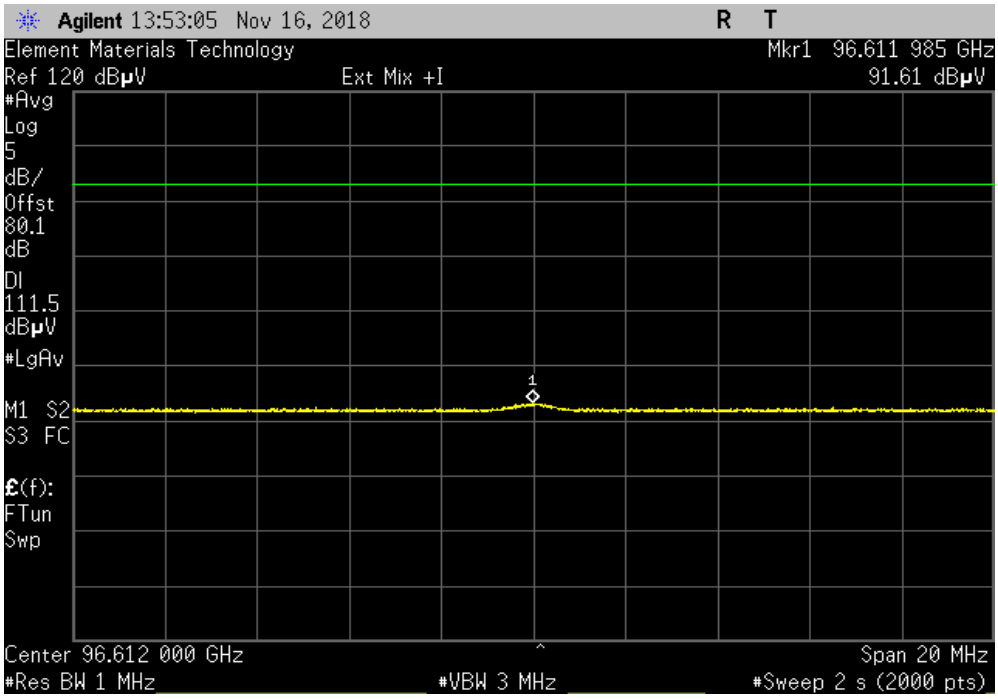
Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, Low Ch. 24056 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		90.41		90.41	111.5 @ 2 cm	Pass



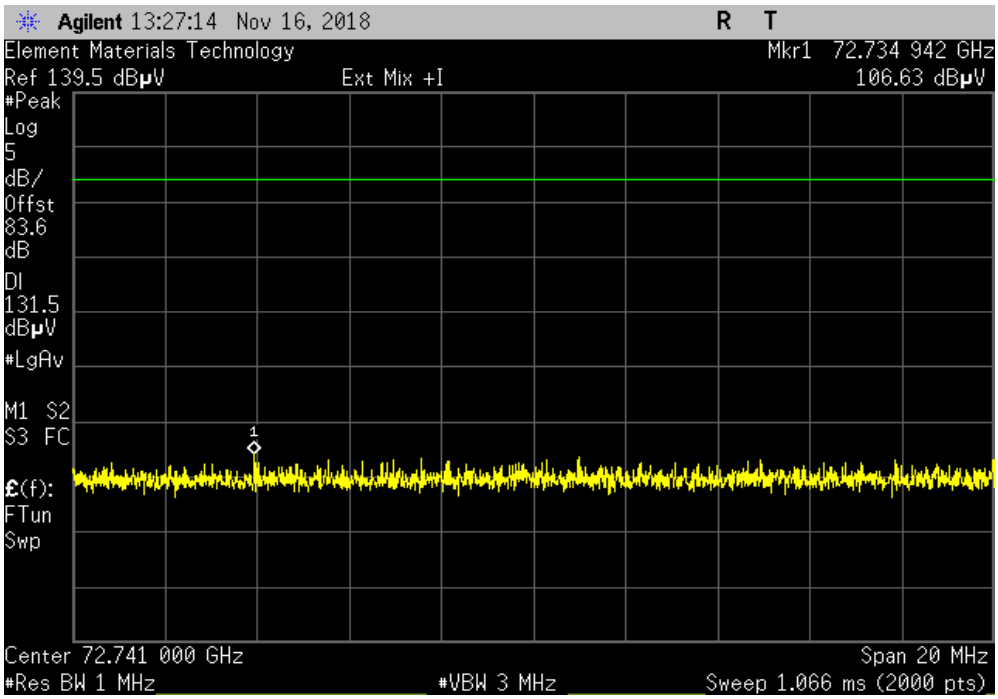
Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, Mid Ch. 24153 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		105.51		105.51	131.5 @ 2 cm	Pass



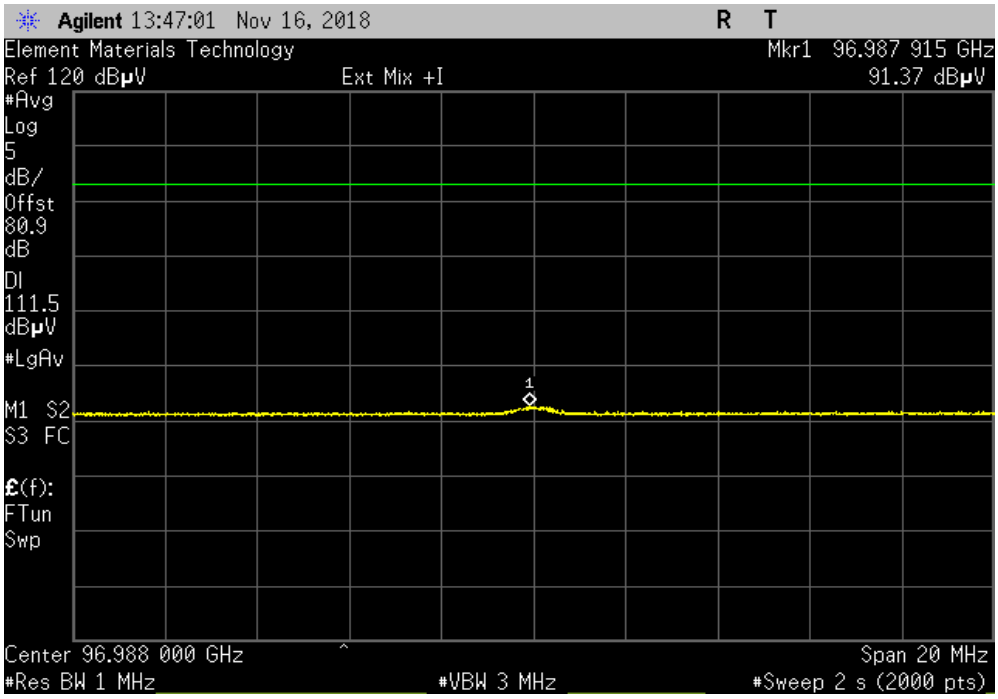
Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, Mid Ch. 24153 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		91.61		91.61	111.5 @ 2 cm	Pass



Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, High Ch. 24247 MHz, Peak						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		106.63		106.63	131.5 @ 2 cm	Pass



Continuous TX, 24056 MHz - 24247 MHz, 4th Harmonic, High Ch. 24247 MHz, Average						
		Initial Value (dBuV)	Correction (dB)	Final Value (dBuV)	Limit (dBuV)	Result
		91.37		91.37	111.5 @ 2 cm	Pass



SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2018.07.27

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

Continuous Tx, Low Ch = 24056 MHz, Mid Ch = 24153 MHz, High Ch = 24247 MHz

POWER SETTINGS INVESTIGATED

12.0 VDC

CONFIGURATIONS INVESTIGATED

PRCO0085 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	40000 MHz

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
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	28-Feb-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	30-Nov-2017	12 mo
Cable	None	Standard Gain Horns Cable	EVF	30-Nov-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	29-Nov-2017	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	29-Nov-2017	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	7-Feb-2018	24 mo
Cable	N/A	Bilog Cables	EVA	25-Jul-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	30-Nov-2017	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2-Oct-2018	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHY	NCR	0 mo
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	24-Aug-2018	12 mo
Cable	ESM Cable Corp.	KNKN-72 SMA Cable	EVZ	5-Jun-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	PAE	5-Jun-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-10	AIW	NCR	0 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-2018	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

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 and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

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

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions.

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

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

The average values were calculated as per FCC KDB 890966 - Measurement Procedure for Level Probing Radars, Section 9. The steps for the calculation are as follows:

1. Calculate the dwell time, T_D, of the sweep frequency signal per MHz of the sweep frequency span:

   T_D = Ts/ΔF, where:

   Ts is the signal sweep frequency time in seconds
   ΔF is the signal sweep frequency span in MHz

2. Calculate the Average Factor:

   Average factor = (T_D) / cycle time, where:

   cycle time is the total time for a complete cycle of the signal including retrace and any other latency times.

3. Calculate the Duty Cycle Correctoin Factor (DCCF):

   DCCF = 10*log(Average Factor)

4. Apply the DCCF to the PK measurements to determine the AVG value

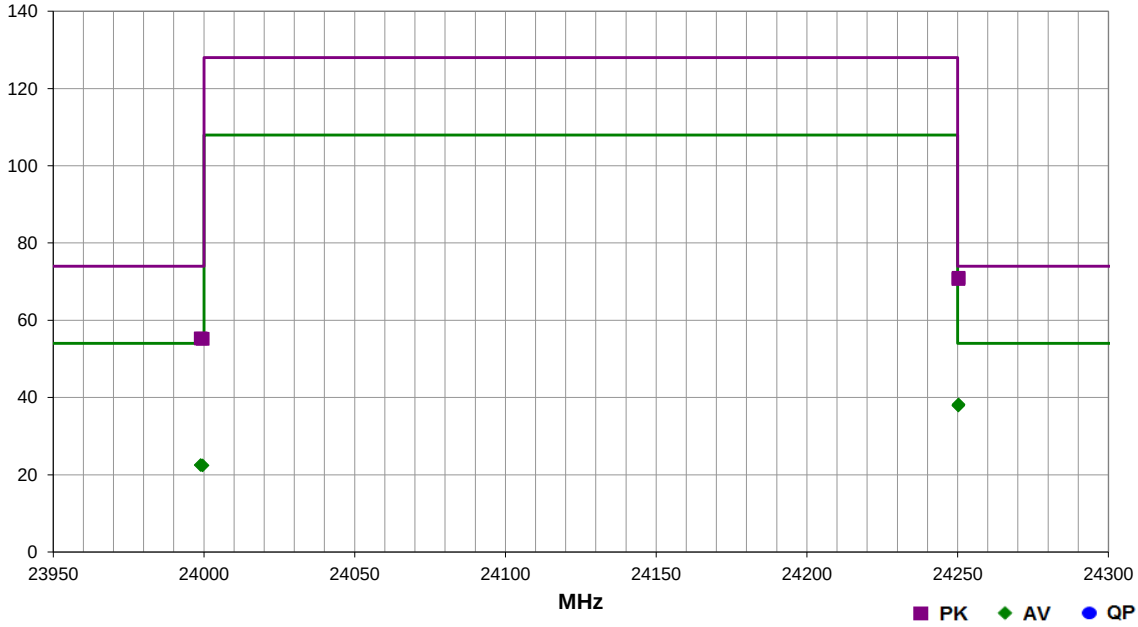
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	PRCO0085	**Date:**	15-Nov-2018		
Project:	None	**Temperature:**	21 °C		
Job Site:	EV01	**Humidity:**	36.5% RH		
Serial Number:	1	**Barometric Pres.:**	1032 mbar	**Tested by:**	Jeff Alcoke
EUT:	Sentry® ST97and Side Defender® II SDII97				
Configuration:	1				
Customer:	Preco, Inc.				
Attendees:	None				
EUT Power:	12.0 VDC				
Operating Mode:	Continuous Tx, Low Ch = 24056 MHz, Mid Ch = 24153 MHz, High Ch = 24247 MHz				
Deviations:	None				
Comments:	See comments below for Channel, Modulation type and EUT orientation. The radio employs FMCW modulation, the AVG value was calculated from the PK measurement as per FCC KDB 890966 Section F. The radio has a dwell time (T_D) of 5.86*10^-6 s/MHz, and a Cycle Time of 11.1 ms. The Average Factor = T_D/Cycle Time = 5.27*10^-4. The DCCF used to calculate the AVG value is 10*log(Average Factor) = -32.8 dB				

Test Specifications	**Test Method**
FCC 15.249:2018	ANSI C63.10:2013

Run #	8	**Test Distance (m)**	0.1	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
24250.310	57.4	43.1	1.6	0.0		0.0	Vert	PK	-29.5	71.0	74.0	-3.0	High Ch, CW, EUT on Side
24250.240	57.1	43.1	1.5	330.0		0.0	Horz	PK	-29.5	70.7	74.0	-3.3	High Ch, CW, EUT Horz
24250.310	57.4	43.1	1.6	0.0	-32.8	0.0	Vert	AV	-29.5	38.2	54.0	-15.8	High Ch, CW, EUT on Side
24250.240	57.1	43.1	1.5	330.0	-32.8	0.0	Horz	AV	-29.5	37.9	54.0	-16.1	High Ch, CW, EUT Horz
23998.950	41.5	43.3	1.6	0.0		0.0	Vert	PK	-29.5	55.3	74.0	-18.7	Low Ch, CW, EUT on Side
23999.570	41.4	43.3	1.5	330.0		0.0	Horz	PK	-29.5	55.2	74.0	-18.8	Low Ch, CW, EUT Horz
23998.950	41.5	43.3	1.6	0.0	-32.8	0.0	Vert	AV	-29.5	22.5	54.0	-31.5	Low Ch, CW, EUT on Side
23999.570	41.4	43.3	1.5	330.0	-32.8	0.0	Horz	AV	-29.5	22.4	54.0	-31.6	Low Ch, CW, EUT Horz

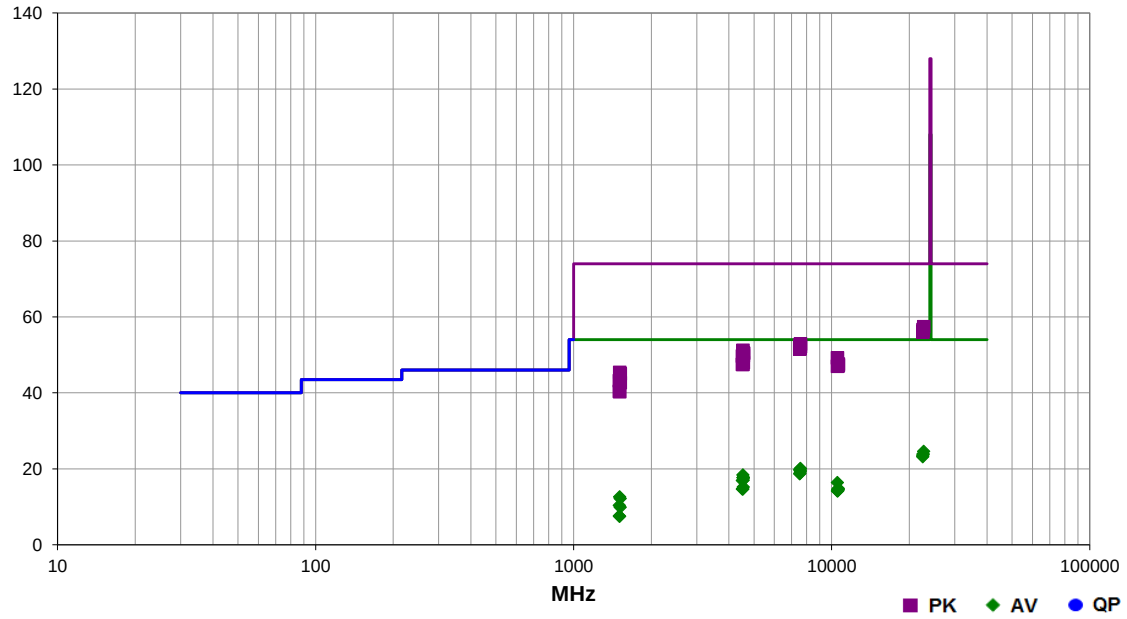
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	PRCO0085	**Date:**	15-Nov-2018		
Project:	None	**Temperature:**	21 °C		
Job Site:	EV01	**Humidity:**	40.9% RH		
Serial Number:	1	**Barometric Pres.:**	1030 mbar	**Tested by:**	Jeff Alcoke
EUT:	Sentry® ST97and Side Defender® II SDII97				
Configuration:	1				
Customer:	Preco, Inc.				
Attendees:	None				
EUT Power:	12.0 VDC				
Operating Mode:	Continuous Tx, Low Ch = 24056 MHz, Mid Ch = 24153 MHz, High Ch = 24247 MHz				
Deviations:	None				
Comments:	See comments below for Channel, Modulation type and EUT orientation. The radio employs FMCW modulation, the AVG value was calculated from the PK measurement as per FCC KDB 890966 Section F. The radio has a dwell time (T_D) of 5.86*10^-6 s/MHz, and a Cycle Time of 11.1 ms. The Average Factor = T_D/Cycle Time = 5.27*10^-4. The DCCF used to calculate the AVG value is 10*log(Average Factor) = -32.8 dB				

Test Specifications	**Test Method**
FCC 15.249:2018	ANSI C63.10:2013

Run #	20	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
22731.750	43.4	43.5	1.6	0.0		0.0	Vert	PK	-29.5	57.4	74.0	-16.6	High Ch, CW, EUT on Side
22643.580	42.9	43.3	1.6	0.0		0.0	Vert	PK	-29.5	56.7	74.0	-17.3	Mid Ch, CW, EUT on Side
22643.520	42.8	43.3	1.5	330.0		0.0	Horz	PK	-29.5	56.6	74.0	-17.4	Mid Ch, CW, EUT Horz
22552.450	42.6	43.1	1.6	0.0		0.0	Vert	PK	-29.5	56.2	74.0	-17.8	Low Ch, CW, EUT on Side
22552.330	42.4	43.1	1.5	330.0		0.0	Horz	PK	-29.5	56.0	74.0	-18.0	Low Ch, CW, EUT Horz
7577.433	40.4	12.5	2.1	355.0		0.0	Horz	PK	0.0	52.9	74.0	-21.1	High Ch, CW, EUT on Side
7548.063	40.1	12.6	3.2	168.0		0.0	Vert	PK	0.0	52.7	74.0	-21.3	Mid Ch, CW, EUT on Side
7517.545	39.8	12.7	4.0	87.0		0.0	Horz	PK	0.0	52.5	74.0	-21.5	Low Ch, CW, EUT on Side
7575.683	39.7	12.5	1.0	250.0		0.0	Vert	PK	0.0	52.2	74.0	-21.8	High Ch, CW, EUT on Side
7546.388	39.1	12.6	1.0	296.0		0.0	Horz	PK	0.0	51.7	74.0	-22.3	Mid Ch, CW, EUT on Side
7517.345	38.8	12.7	1.0	10.0		0.0	Vert	PK	0.0	51.5	74.0	-22.5	Low Ch, CW, EUT on Side
4528.775	47.0	4.2	1.2	16.0		0.0	Horz	PK	0.0	51.2	74.0	-22.8	Mid Ch, CW, EUT on Side
4546.285	46.3	4.2	1.0	344.0		0.0	Vert	PK	0.0	50.5	74.0	-23.5	High Ch, CW, EUT on Side
4546.547	46.3	4.2	1.1	353.0		0.0	Horz	PK	0.0	50.5	74.0	-23.5	High Ch, CW, EUT on Side
4546.155	46.3	4.2	1.0	244.0		0.0	Vert	PK	0.0	50.5	74.0	-23.5	High Ch, CW, EUT Vert
4546.347	46.2	4.2	1.2	355.0		0.0	Vert	PK	0.0	50.4	74.0	-23.6	High Ch, CW, EUT Horz
4546.297	45.6	4.2	1.0	357.0		0.0	Horz	PK	0.0	49.8	74.0	-24.2	High Ch, CW, EUT Horz
4510.448	45.6	4.1	1.3	17.0		0.0	Horz	PK	0.0	49.7	74.0	-24.3	Low Ch, CW, EUT on Side
10524.590	50.1	-0.9	1.8	39.0		0.0	Vert	PK	0.0	49.2	74.0	-24.8	Low Ch, CW, EUT on Side
4546.440	43.8	4.2	1.0	146.0		0.0	Horz	PK	0.0	48.0	74.0	-26.0	High Ch, CW, EUT Vert

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
10607.970	48.3	-0.7	1.7	45.0		0.0	Vert	PK	0.0	47.6	74.0	-26.4	High Ch, CW, EUT on Side
4528.818	43.3	4.2	1.0	9.0		0.0	Vert	PK	0.0	47.5	74.0	-26.5	Mid Ch, CW, EUT on Side
4510.482	43.4	4.1	1.0	9.0		0.0	Vert	PK	0.0	47.5	74.0	-26.5	Low Ch, CW, EUT on Side
10566.940	48.3	-0.9	1.7	39.0		0.0	Vert	PK	0.0	47.4	74.0	-26.6	Mid Ch, CW, EUT on Side
10608.190	48.0	-0.7	3.2	262.0		0.0	Horz	PK	0.0	47.3	74.0	-26.7	High Ch, CW, EUT on Side
10524.430	47.9	-0.9	1.1	236.0		0.0	Horz	PK	0.0	47.0	74.0	-27.0	Low Ch, CW, EUT on Side
10566.890	47.9	-0.9	2.9	164.0		0.0	Horz	PK	0.0	47.0	74.0	-27.0	Mid Ch, CW, EUT on Side
1509.425	52.3	-6.9	1.2	231.0		0.0	Horz	PK	0.0	45.4	74.0	-28.6	Mid Ch, CW, EUT on Side
1515.587	51.9	-6.9	1.3	229.0		0.0	Horz	PK	0.0	45.0	74.0	-29.0	High Ch, CW, EUT on Side
22731.750	43.4	43.5	1.6	0.0	-32.8	0.0	Vert	AV	-29.5	24.6	54.0	-29.4	High Ch, CW, EUT on Side
22643.580	42.9	43.3	1.6	0.0	-32.8	0.0	Vert	AV	-29.5	23.9	54.0	-30.1	Mid Ch, CW, EUT on Side
22643.520	42.8	43.3	1.5	330.0	-32.8	0.0	Horz	AV	-29.5	23.8	54.0	-30.2	Mid Ch, CW, EUT Horz
22552.450	42.6	43.1	1.6	0.0	-32.8	0.0	Vert	AV	-29.5	23.4	54.0	-30.6	Low Ch, CW, EUT on Side
22552.330	42.4	43.1	1.5	330.0	-32.8	0.0	Horz	AV	-29.5	23.2	54.0	-30.8	Low Ch, CW, EUT Horz
1503.387	50.1	-6.9	1.0	112.0		0.0	Vert	PK	0.0	43.2	74.0	-30.8	Low Ch, CW, EUT on Side
1515.378	49.6	-6.9	1.0	191.0		0.0	Vert	PK	0.0	42.7	74.0	-31.3	High Ch, CW, EUT on Side
1503.453	47.3	-6.9	1.7	184.0		0.0	Horz	PK	0.0	40.4	74.0	-33.6	Low Ch, CW, EUT on Side
1509.650	47.2	-6.9	3.1	188.0		0.0	Vert	PK	0.0	40.3	74.0	-33.7	Mid Ch, CW, EUT on Side
7577.433	40.4	12.5	2.1	355.0	-32.8	0.0	Horz	AV	0.0	20.1	54.0	-33.9	High Ch, CW, EUT on Side
7548.063	40.1	12.6	3.2	168.0	-32.8	0.0	Vert	AV	0.0	19.9	54.0	-34.1	Mid Ch, CW, EUT on Side
7517.545	39.8	12.7	4.0	87.0	-32.8	0.0	Horz	AV	0.0	19.7	54.0	-34.3	Low Ch, CW, EUT on Side
7575.683	39.7	12.5	1.0	250.0	-32.8	0.0	Vert	AV	0.0	19.4	54.0	-34.6	High Ch, CW, EUT on Side
7546.388	39.1	12.6	1.0	296.0	-32.8	0.0	Horz	AV	0.0	18.9	54.0	-35.1	Mid Ch, CW, EUT on Side
7517.345	38.8	12.7	1.0	10.0	-32.8	0.0	Vert	AV	0.0	18.7	54.0	-35.3	Low Ch, CW, EUT on Side
4528.775	47.0	4.2	1.2	16.0	-32.8	0.0	Horz	AV	0.0	18.4	54.0	-35.6	Mid Ch, CW, EUT on Side
4546.285	46.3	4.2	1.0	344.0	-32.8	0.0	Vert	AV	0.0	17.7	54.0	-36.3	High Ch, CW, EUT on Side
4546.547	46.3	4.2	1.1	353.0	-32.8	0.0	Horz	AV	0.0	17.7	54.0	-36.3	High Ch, CW, EUT on Side
4546.155	46.3	4.2	1.0	244.0	-32.8	0.0	Vert	AV	0.0	17.7	54.0	-36.3	High Ch, CW, EUT Vert
4546.347	46.2	4.2	1.2	355.0	-32.8	0.0	Vert	AV	0.0	17.6	54.0	-36.4	High Ch, CW, EUT Horz
4546.297	45.6	4.2	1.0	357.0	-32.8	0.0	Horz	AV	0.0	17.0	54.0	-37.0	High Ch, CW, EUT Horz
4510.448	45.6	4.1	1.3	17.0	-32.8	0.0	Horz	AV	0.0	16.9	54.0	-37.1	Low Ch, CW, EUT on Side
10524.590	50.1	-0.9	1.8	39.0	-32.8	0.0	Vert	AV	0.0	16.4	54.0	-37.6	Low Ch, CW, EUT on Side
4546.440	43.8	4.2	1.0	146.0	-32.8	0.0	Horz	AV	0.0	15.2	54.0	-38.8	High Ch, CW, EUT Vert
10607.970	48.3	-0.7	1.7	45.0	-32.8	0.0	Vert	AV	0.0	14.8	54.0	-39.2	High Ch, CW, EUT on Side
4528.818	43.3	4.2	1.0	9.0	-32.8	0.0	Vert	AV	0.0	14.7	54.0	-39.3	Mid Ch, CW, EUT on Side
4510.482	43.4	4.1	1.0	9.0	-32.8	0.0	Vert	AV	0.0	14.7	54.0	-39.3	Low Ch, CW, EUT on Side
10566.940	48.3	-0.9	1.7	39.0	-32.8	0.0	Vert	AV	0.0	14.6	54.0	-39.4	Mid Ch, CW, EUT on Side
10608.190	48.0	-0.7	3.2	262.0	-32.8	0.0	Horz	AV	0.0	14.5	54.0	-39.5	High Ch, CW, EUT on Side
10524.430	47.9	-0.9	1.1	236.0	-32.8	0.0	Horz	AV	0.0	14.2	54.0	-39.8	Low Ch, CW, EUT on Side
10566.890	47.9	-0.9	2.9	164.0	-32.8	0.0	Horz	AV	0.0	14.2	54.0	-39.8	Mid Ch, CW, EUT on Side
1509.425	52.3	-6.9	1.2	231.0	-32.8	0.0	Horz	AV	0.0	12.6	54.0	-41.4	Mid Ch, CW, EUT on Side
1515.587	51.9	-6.9	1.3	229.0	-32.8	0.0	Horz	AV	0.0	12.2	54.0	-41.8	High Ch, CW, EUT on Side
1503.387	50.1	-6.9	1.0	112.0	-32.8	0.0	Vert	AV	0.0	10.4	54.0	-43.6	Low Ch, CW, EUT on Side
1515.378	49.6	-6.9	1.0	191.0	-32.8	0.0	Vert	AV	0.0	9.9	54.0	-44.1	High Ch, CW, EUT on Side
1503.453	47.3	-6.9	1.7	184.0	-32.8	0.0	Horz	AV	0.0	7.6	54.0	-46.4	Low Ch, CW, EUT on Side
1509.650	47.2	-6.9	3.1	188.0	-32.8	0.0	Vert	AV	0.0	7.5	54.0	-46.5	Mid Ch, CW, EUT on Side