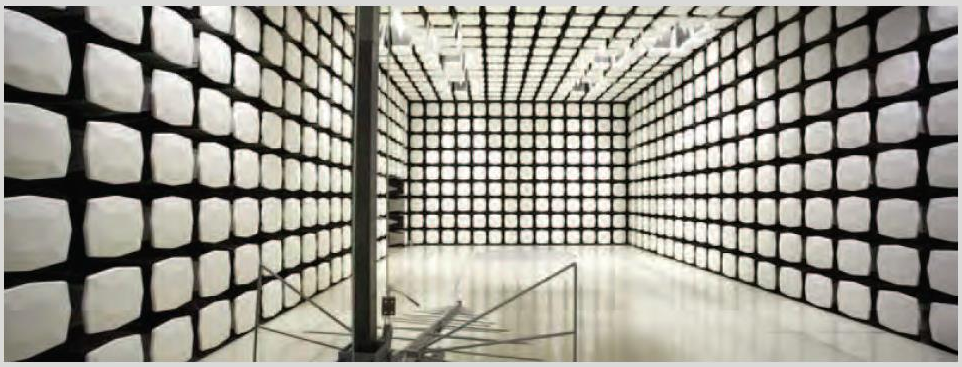
Emerson

781SA Smart Antenna

FCC 15.247:2020
Hybrid Radio

Report # EMPM0081



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: January 10, 2020
Emerson
EUT: 781SA Smart Antenna

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2020	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
7.8.2	Carrier Frequency Separation	Yes	Pass	
7.8.3	Number of Hopping Frequencies	Yes	Pass	
7.8.4	Dwell Time	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.5	Equivalent Isotropic Radiated Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	Yes	Pass	
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	Spurious Conducted Emissions	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department 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

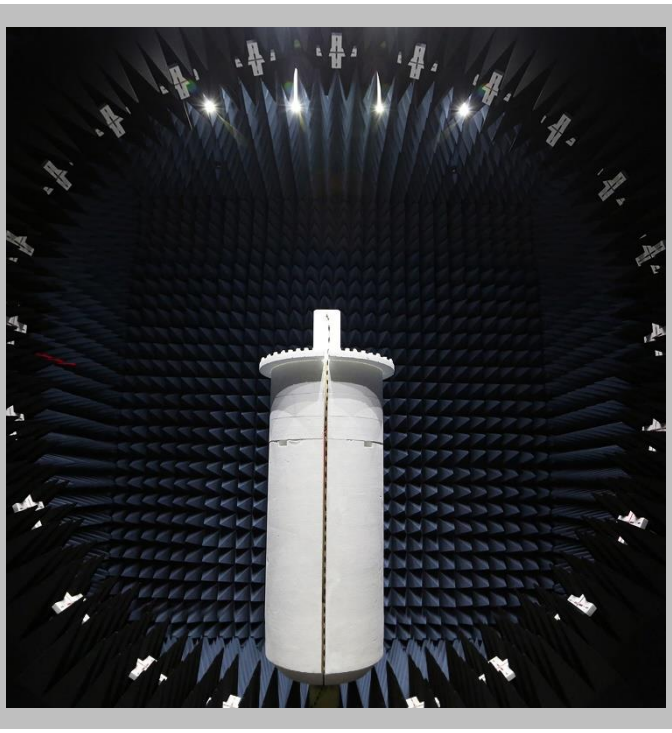
MIC – Recognized by MIC as a CAB for the acceptance of test data.

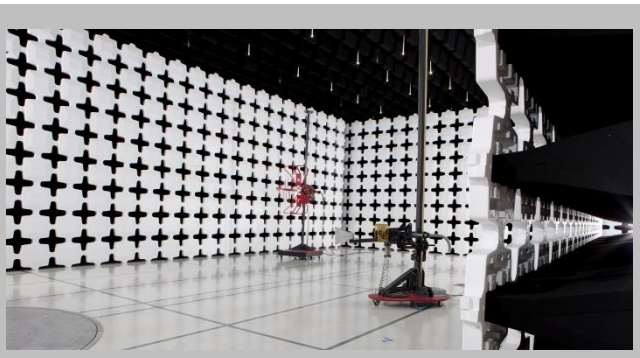
SCOPE

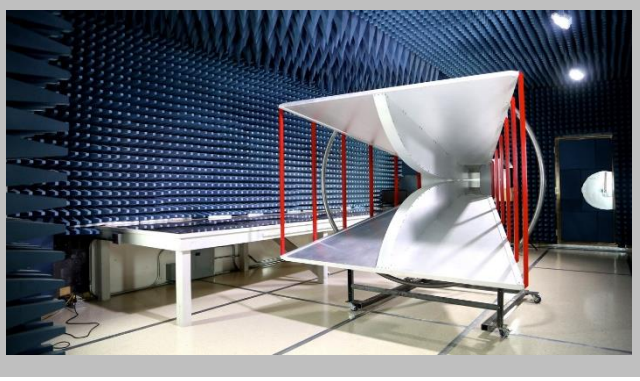
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

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







EMISSIONS MEASUREMENTS

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.

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

Sample Calculations

Radiated Emissions:

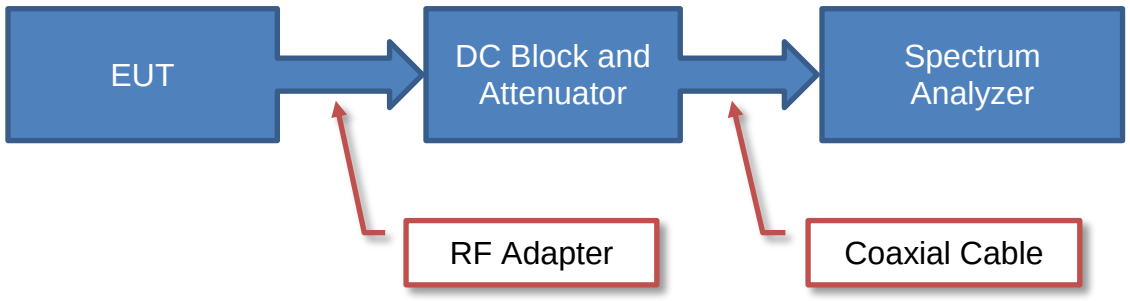
Field Strength		Measured Level		Antenna Factor		Cable Factor		Amplifier Gain		Distance Adjustment Factor		External Attenuation
33.5	=	42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0

Conducted Emissions:

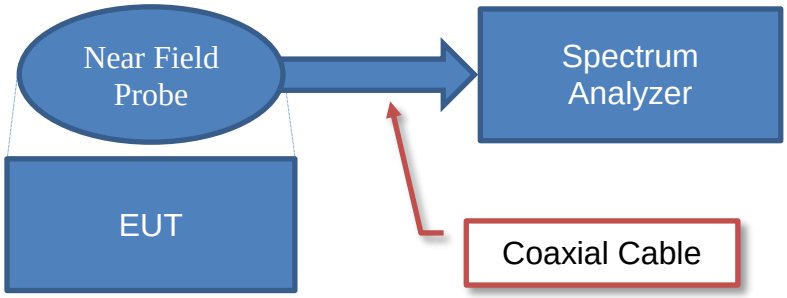
Adjusted Level		Measured Level		Transducer Factor		Cable Factor		External Attenuation
47.1	=	26.7	+	0.3	+	0.1	+	20.0

Test Setup Block Diagrams

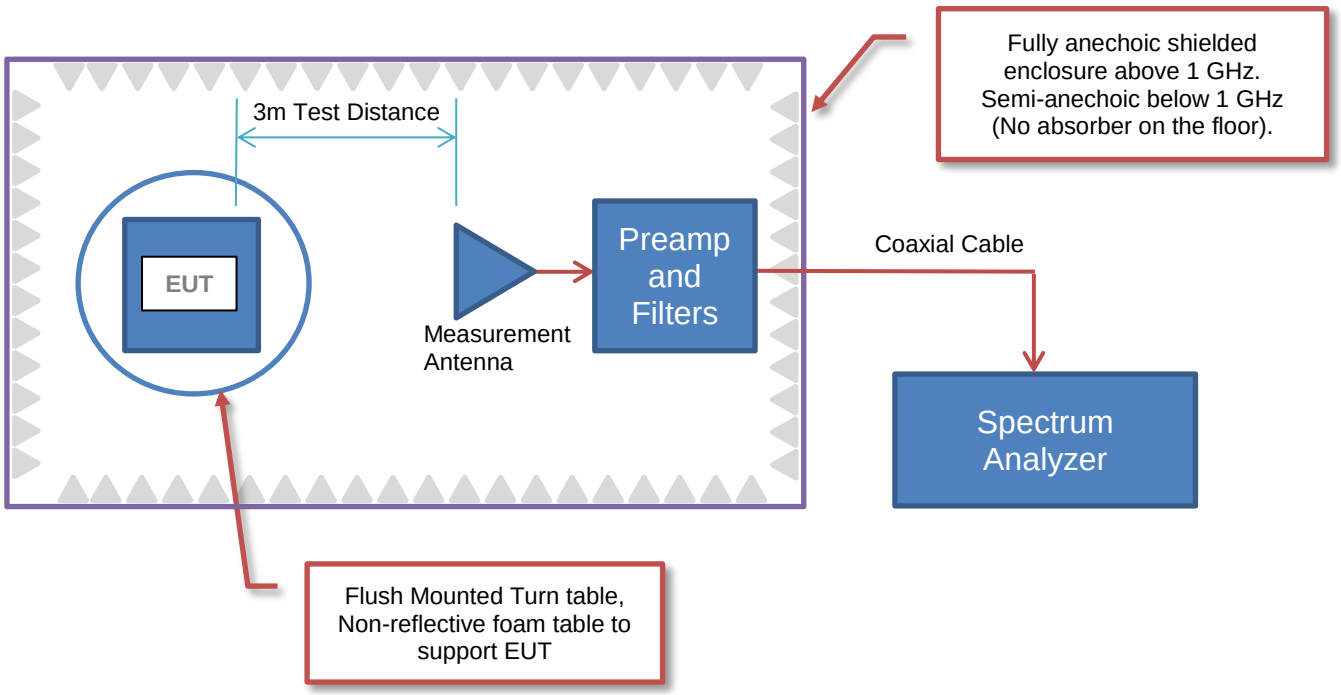
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Emerson
Address:	6021 Innovation Boulevard
City, State, Zip:	Shakopee, MN 55379
Test Requested By:	Merritt Pulkrabek
EUT:	781SA Smart Antenna
First Date of Test:	January 3, 2020
Last Date of Test:	January 10, 2020
Receipt Date of Samples:	January 3, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
WirelessHART Field Link

Testing Objective:
To demonstrate compliance of the 2.4 GHz Hybrid radio to FCC 15.247 requirements.

CONFIGURATIONS

Configuration EMPM0081- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
781SA Smart Antenna	Emerson	781SA	3007

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/DC Adapter (Smart Antenna)	CUI Inc.	KSAFE2400100W1US	R1806

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable (Smart Antenna)	No	1.8m	No	Power I/O Cable	AC/DC Adapter (Smart Antenna)
Power I/O Cable	Yes	3.1m	No	781SA Smart Antenna	DC Cable (Smart Antenna)

CONFIGURATIONS

Configuration EMPM0081- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
781SA Smart Antenna	Emerson	781SA	3004

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/DC Adapter (Smart Antenna)	CUI Inc.	KSAFE2400100W1US	R1806
Laptop 1	Lenovo	ThinkPad T510	431436U
USB HART Interface	MACTek Corporation	Viator	346802
AC Adapter (Laptop)	Lenovo	92P1160	11S92P1160Z1ZBGH87P524

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable (Smart Antenna)	No	1.8m	No	Power I/O Cable	AC/DC Adapter (Smart Antenna)
Power I/O Cable	Yes	3.1m	No	781SA Smart Antenna	DC Cable (Smart Antenna)
AC Cable (Laptop)	No	1.0m	No	AC Mains	Power Supply (Laptop 1)
DC Cable (Laptop)	No	1.8m	Yes	Power Supply (Laptop 1)	Laptop 1
HART Interface Cable	No	2.0m	No	USB HART Interface	781SA Smart Antenna
USB Cable (HART Interface)	No	0.3m	No	USB HART Interface	Laptop 1

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-01-03	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.
2	2020-01-07	Band Edge Compliance	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	2020-01-07	Duty Cycle	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	2020-01-07	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2020-01-07	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2020-01-07	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2020-01-07	Spurious 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.
8	2020-01-08	Band Edge Compliance – Hopping Mode	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2020-01-08	Carrier Frequency Separation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
10	2020-01-08	Dwell Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2020-01-08	Number of Hopping Frequencies	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
12	2020-01-10	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.
13	2020-01-10	Occupied Bandwidth	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.2019.10.29.0

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
Receiver	Rohde & Schwarz	ESR7	ARI	2019-07-08	2020-07-08
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

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

EMPM0081-1

MODES INVESTIGATED

Transmitting WirelessHART - mid channel (2440 MHz) modulated

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.10.29.0

EUT:	781SA Smart Antenna	Work Order:	EMPM0081
Serial Number:	3007	Date:	2020-01-10
Customer:	Emerson	Temperature:	22.2°C
Attendees:	Merritt Pulkrabek	Relative Humidity:	21.6%
Customer Project:	None	Bar. Pressure:	1025 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	24VDC	Configuration:	EMPM0081-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

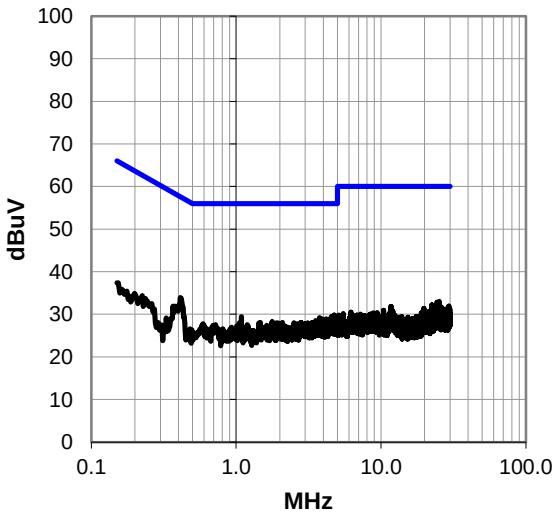
EUT OPERATING MODES

Transmitting WirelessHART - mid channel (2440 MHz) modulated

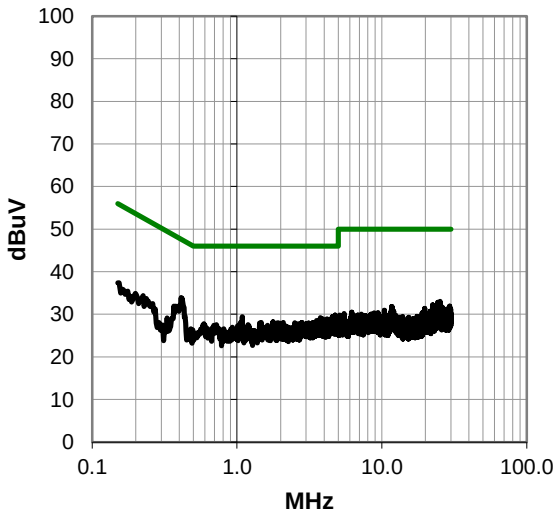
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.10.29.0

RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.4	13.300	20.6	33.9	57.6	-23.7
4.8	9.100	20.7	29.8	56.0	-26.2
1.1	8.800	20.6	29.4	56.0	-26.6
4.6	8.700	20.7	29.4	56.0	-26.6
4.7	8.700	20.7	29.4	56.0	-26.6
3.8	8.400	20.8	29.2	56.0	-26.8
25.3	11.600	21.4	33.0	60.0	-27.0
3.9	8.100	20.8	28.9	56.0	-27.1
4.2	8.200	20.7	28.9	56.0	-27.1
4.4	8.100	20.7	28.8	56.0	-27.2
4.5	8.100	20.7	28.8	56.0	-27.2
24.4	11.500	21.3	32.8	60.0	-27.2
4.3	7.900	20.7	28.6	56.0	-27.4
3.5	7.700	20.8	28.5	56.0	-27.5
4.0	7.500	20.8	28.3	56.0	-27.7
22.4	11.000	21.2	32.2	60.0	-27.8
1.8	7.600	20.6	28.2	56.0	-27.8
1.5	7.500	20.6	28.1	56.0	-27.9
2.1	7.500	20.6	28.1	56.0	-27.9
2.8	7.400	20.7	28.1	56.0	-27.9
1.9	7.400	20.6	28.0	56.0	-28.0
2.5	7.300	20.7	28.0	56.0	-28.0
3.3	7.200	20.8	28.0	56.0	-28.0
1.4	7.300	20.6	27.9	56.0	-28.1
2.0	7.300	20.6	27.9	56.0	-28.1

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.4	13.300	20.6	33.9	47.6	-13.7
4.8	9.100	20.7	29.8	46.0	-16.2
1.1	8.800	20.6	29.4	46.0	-16.6
4.6	8.700	20.7	29.4	46.0	-16.6
4.7	8.700	20.7	29.4	46.0	-16.6
3.8	8.400	20.8	29.2	46.0	-16.8
25.3	11.600	21.4	33.0	50.0	-17.0
3.9	8.100	20.8	28.9	46.0	-17.1
4.2	8.200	20.7	28.9	46.0	-17.1
4.4	8.100	20.7	28.8	46.0	-17.2
4.5	8.100	20.7	28.8	46.0	-17.2
24.4	11.500	21.3	32.8	50.0	-17.2
4.3	7.900	20.7	28.6	46.0	-17.4
3.5	7.700	20.8	28.5	46.0	-17.5
4.0	7.500	20.8	28.3	46.0	-17.7
22.4	11.000	21.2	32.2	50.0	-17.8
1.8	7.600	20.6	28.2	46.0	-17.8
1.5	7.500	20.6	28.1	46.0	-17.9
2.1	7.500	20.6	28.1	46.0	-17.9
2.8	7.400	20.7	28.1	46.0	-17.9
1.9	7.400	20.6	28.0	46.0	-18.0
2.5	7.300	20.7	28.0	46.0	-18.0
3.3	7.200	20.8	28.0	46.0	-18.0
1.4	7.300	20.6	27.9	46.0	-18.1
2.0	7.300	20.6	27.9	46.0	-18.1

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.10.29.0

EUT:	781SA Smart Antenna	Work Order:	EMPM0081
Serial Number:	3007	Date:	2020-01-10
Customer:	Emerson	Temperature:	22.2°C
Attendees:	Merritt Pulkrabek	Relative Humidity:	21.6%
Customer Project:	None	Bar. Pressure:	1025 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	24VDC	Configuration:	EMPM0081-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

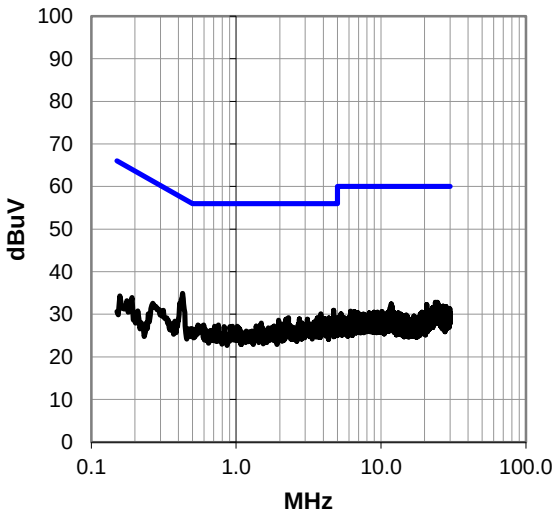
EUT OPERATING MODES

Transmitting WirelessHART - mid channel (2440 MHz) modulated

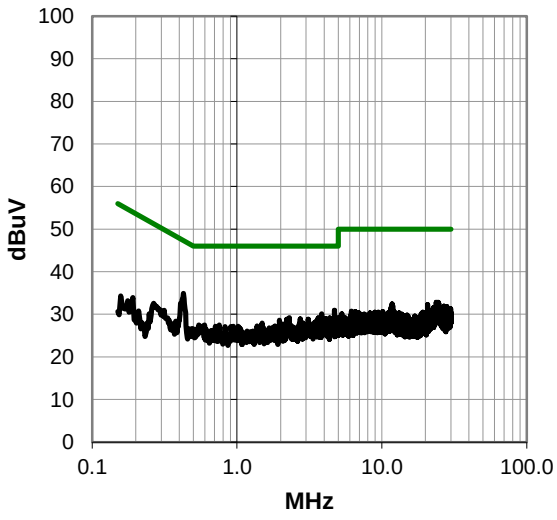
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.10.29.0

RESULTS - Run #5

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.4	14.300	20.6	34.9	57.3	-22.4
4.7	10.200	20.7	30.9	56.0	-25.1
3.8	9.300	20.8	30.1	56.0	-25.9
2.3	8.500	20.7	29.2	56.0	-26.8
3.6	8.300	20.8	29.1	56.0	-26.9
4.4	8.400	20.7	29.1	56.0	-26.9
4.9	8.500	20.6	29.1	56.0	-26.9
4.1	8.200	20.8	29.0	56.0	-27.0
2.7	8.200	20.7	28.9	56.0	-27.1
2.2	8.100	20.7	28.8	56.0	-27.2
3.1	8.100	20.7	28.8	56.0	-27.2
23.7	11.500	21.3	32.8	60.0	-27.2
24.5	11.400	21.4	32.8	60.0	-27.2
4.3	8.000	20.7	28.7	56.0	-27.3
2.0	8.000	20.6	28.6	56.0	-27.4
4.6	7.900	20.7	28.6	56.0	-27.4
4.8	7.900	20.7	28.6	56.0	-27.4
24.7	11.100	21.4	32.5	60.0	-27.5
11.7	11.500	20.9	32.4	60.0	-27.6
23.9	11.100	21.3	32.4	60.0	-27.6
20.7	11.200	21.1	32.3	60.0	-27.7
24.2	11.000	21.3	32.3	60.0	-27.7
3.5	7.400	20.8	28.2	56.0	-27.8
4.2	7.500	20.7	28.2	56.0	-27.8
3.8	7.300	20.8	28.1	56.0	-27.9

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.4	14.300	20.6	34.9	47.3	-12.4
4.7	10.200	20.7	30.9	46.0	-15.1
3.8	9.300	20.8	30.1	46.0	-15.9
2.3	8.500	20.7	29.2	46.0	-16.8
3.6	8.300	20.8	29.1	46.0	-16.9
4.4	8.400	20.7	29.1	46.0	-16.9
4.9	8.500	20.6	29.1	46.0	-16.9
4.1	8.200	20.8	29.0	46.0	-17.0
2.7	8.200	20.7	28.9	46.0	-17.1
2.2	8.100	20.7	28.8	46.0	-17.2
3.1	8.100	20.7	28.8	46.0	-17.2
23.7	11.500	21.3	32.8	50.0	-17.2
24.5	11.400	21.4	32.8	50.0	-17.2
4.3	8.000	20.7	28.7	46.0	-17.3
2.0	8.000	20.6	28.6	46.0	-17.4
4.6	7.900	20.7	28.6	46.0	-17.4
4.8	7.900	20.7	28.6	46.0	-17.4
24.7	11.100	21.4	32.5	50.0	-17.5
11.7	11.500	20.9	32.4	50.0	-17.6
23.9	11.100	21.3	32.4	50.0	-17.6
20.7	11.200	21.1	32.3	50.0	-17.7
24.2	11.000	21.3	32.3	50.0	-17.7
3.5	7.400	20.8	28.2	46.0	-17.8
4.2	7.500	20.7	28.2	46.0	-17.8
3.8	7.300	20.8	28.1	46.0	-17.9

CONCLUSION

Pass

Tested By

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

Transmitting WirelessHART - low channel (2405 MHz), mid channel (2440 MHz), and high channel (2475 MHz) modulated

POWER SETTINGS INVESTIGATED

24VDC

CONFIGURATIONS INVESTIGATED

EMPM0081 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 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	HGG	17-Sep-2019	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFM	18-Sep-2019	12 mo
Attenuator	Coaxicom	3910-20	AXY	17-Sep-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	11-Sep-2019	12 mo
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	11-Sep-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-12001800-30-10P	PAP	23-Feb-2019	12 mo
Antenna - Standard Gain	ETS-Lindgren	3160-08	AJP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	23-Feb-2019	12 mo
Cable	Element	Standard Gain Cable	MNW	23-Feb-2019	12 mo
Antenna - Standard Gain	ETS-Lindgren	3160-07	AJJ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	23-Feb-2019	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	23-Feb-2019	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	27-Aug-2018	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-2019	12 mo
Cable	Element	Biconilog Cable	MNX	23-Feb-2019	12 mo
Antenna - Biconilog	Ametek	CBL 6141B	AYS	19-Mar-2019	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-2019	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2019.05.10

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 if required, 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 as well as the restricted band requirements.

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.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*LOG(dc).

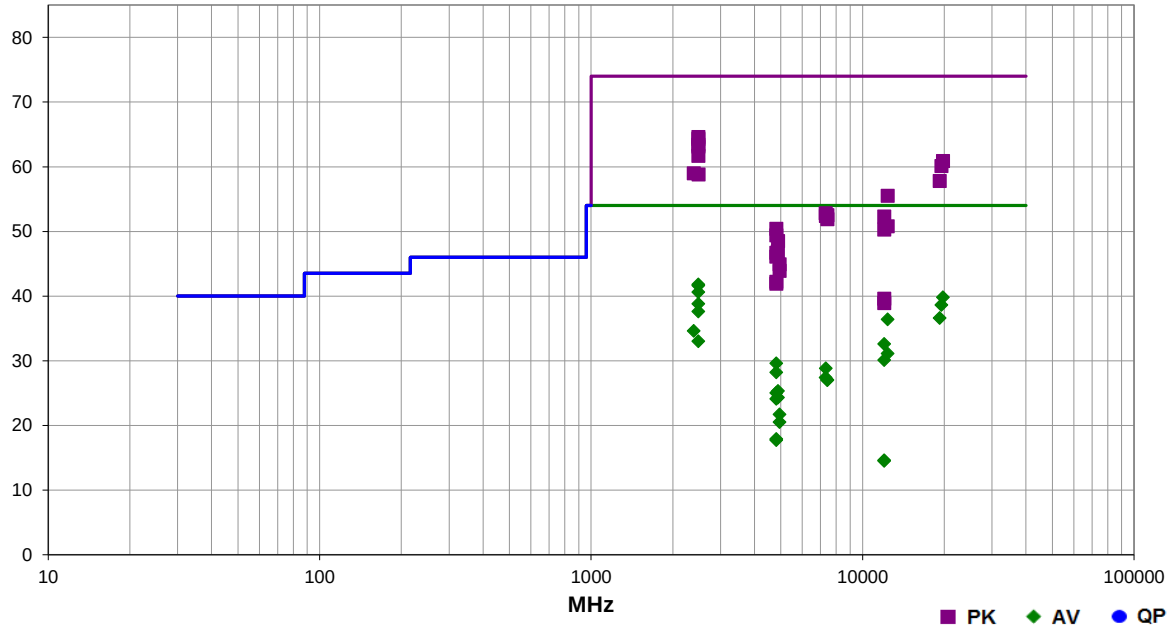
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	EMPM0081	**Date:**	3-Jan-2020		
Project:	None	**Temperature:**	22.1 °C		
Job Site:	MN09	**Humidity:**	27.6% RH		
Serial Number:	3007	**Barometric Pres.:**	1012 mbar	**Tested by:**	Dustin Sparks
EUT:	781SA Smart Antenna				
Configuration:	1				
Customer:	Emerson				
Attendees:	Merritt Pulkrabek				
EUT Power:	24VDC				
Operating Mode:	Transmitting WirelessHART - low channel (2405 MHz), mid channel (2440 MHz), and high channel (2475 MHz) modulated				
Deviations:	None				
Comments:	Duty cycle correction factor (DCCF) of 0.9 dB added to RMS average points based on the formula 10 * log(1/0.805), where 0.805 is the duty cycle during test. A DCCF of 15.3 dB was then subtracted from the RMS average points based on the formula 20 * log(0.172), where 0.172 is the overall worst-case duty cycle observed during a 100 ms observation period when the EUT was placed in frequency hopping mode.				

Test Specifications	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

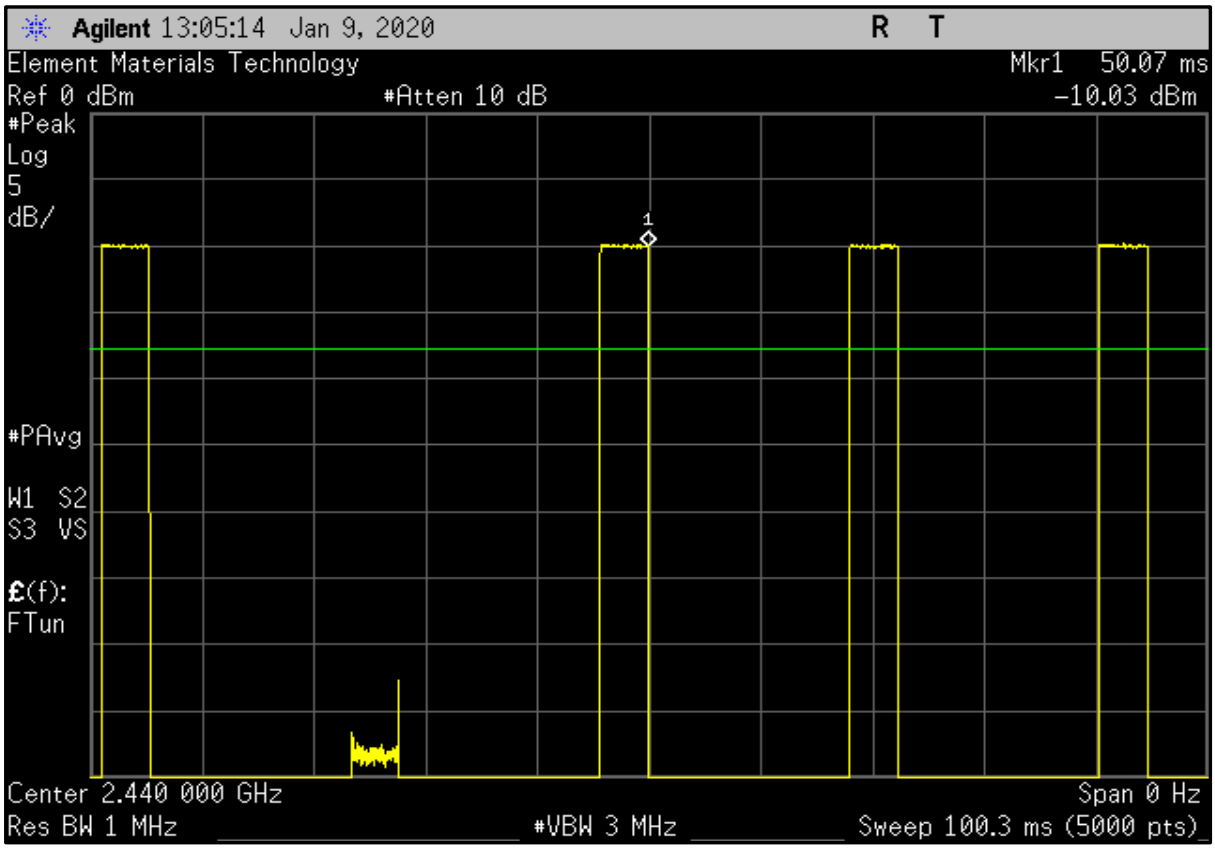
Run #	19	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass

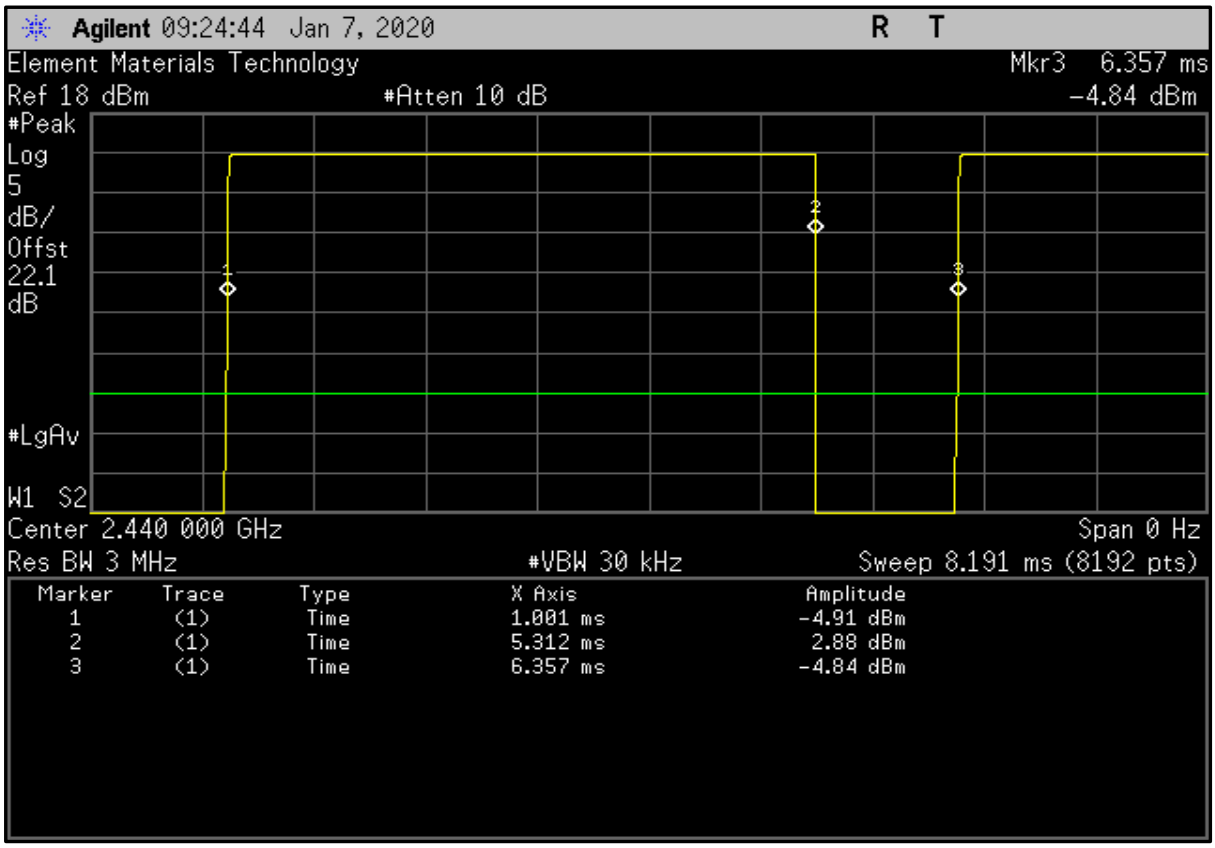


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.517	48.7	-4.1	3.8	326.0	0.0	20.0	Vert	PK	0.0	64.6	74.0	-9.4	High ch, EUT vertical
2483.583	48.4	-4.1	1.0	333.0	0.0	20.0	Horz	PK	0.0	64.3	74.0	-9.7	High ch, EUT horizontal
2483.508	47.5	-4.1	1.0	73.0	0.0	20.0	Horz	PK	0.0	63.4	74.0	-10.6	High ch, EUT on side
2483.633	47.2	-4.1	4.0	40.0	0.0	20.0	Vert	PK	0.0	63.1	74.0	-10.9	High ch, EUT horizontal
2483.508	40.3	-4.1	3.8	326.0	-14.4	20.0	Vert	AV	0.0	41.8	54.0	-12.2	High ch, EUT vertical
2483.508	45.8	-4.1	3.7	185.0	0.0	20.0	Vert	PK	0.0	61.7	74.0	-12.3	High ch, EUT on side
2483.508	40.1	-4.1	1.0	333.0	-14.4	20.0	Horz	AV	0.0	41.6	54.0	-12.4	High ch, EUT horizontal
19795.700	46.2	14.7	1.7	35.0	0.0	0.0	Horz	PK	0.0	60.9	74.0	-13.1	High ch, EUT horizontal
2483.500	39.1	-4.1	1.0	73.0	-14.4	20.0	Horz	AV	0.0	40.6	54.0	-13.4	High ch, EUT on side
19515.740	45.6	14.5	1.7	37.0	0.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	Mid ch, EUT horizontal
19795.790	39.5	14.7	1.7	35.0	-14.4	0.0	Horz	AV	0.0	39.8	54.0	-14.2	High ch, EUT horizontal
2388.550	43.2	-4.2	3.1	319.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	Low ch, EUT vertical
2483.525	37.3	-4.1	4.0	40.0	-14.4	20.0	Vert	AV	0.0	38.8	54.0	-15.2	High ch, EUT horizontal
2486.567	42.9	-4.1	1.5	17.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	High ch, EUT vertical
19515.860	38.5	14.5	1.7	37.0	-14.4	0.0	Horz	AV	0.0	38.6	54.0	-15.4	Mid ch, EUT horizontal
19244.240	43.5	14.3	1.7	47.0	0.0	0.0	Horz	PK	0.0	57.8	74.0	-16.2	Low ch, EUT horizontal
2483.517	36.1	-4.1	3.7	185.0	-14.4	20.0	Vert	AV	0.0	37.6	54.0	-16.4	High ch, EUT on side

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
19244.070	36.7	14.3	1.7	47.0	-14.4	0.0	Horz	AV	0.0	36.6	54.0	-17.4	Low ch, EUT horizontal
12377.480	51.3	-0.5	1.7	325.0	-14.4	0.0	Horz	AV	0.0	36.4	54.0	-17.6	High ch, EUT horizontal
12372.580	56.0	-0.5	1.7	325.0	0.0	0.0	Horz	PK	0.0	55.5	74.0	-18.5	High ch, EUT horizontal
2389.950	33.2	-4.2	3.1	319.0	-14.4	20.0	Vert	AV	0.0	34.6	54.0	-19.4	Low ch, EUT vertical
2483.608	31.5	-4.1	1.5	17.0	-14.4	20.0	Horz	AV	0.0	33.0	54.0	-21.0	High ch, EUT vertical
7318.400	40.1	12.7	3.8	64.0	0.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Mid ch, EUT vertical
12027.500	48.2	-1.2	1.9	43.0	-14.4	0.0	Horz	AV	0.0	32.6	54.0	-21.4	Low ch, EUT horizontal
7424.467	39.7	12.8	1.5	265.0	0.0	0.0	Vert	PK	0.0	52.5	74.0	-21.5	High ch, EUT vertical
7321.275	39.7	12.7	2.8	308.0	0.0	0.0	Horz	PK	0.0	52.4	74.0	-21.6	Mid ch, EUT horizontal
12027.360	53.5	-1.2	1.9	43.0	0.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	Low ch, EUT horizontal
7424.575	39.1	12.8	1.5	360.0	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	High ch, EUT horizontal
12377.480	46.0	-0.5	3.4	316.0	-14.4	0.0	Vert	AV	0.0	31.1	54.0	-22.9	High ch, EUT vertical
12372.520	51.3	-0.5	3.4	316.0	0.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	High ch, EUT vertical
4811.083	47.0	3.4	3.0	321.0	0.0	0.0	Horz	PK	0.0	50.4	74.0	-23.6	Low ch, EUT horizontal
12022.550	51.5	-1.2	2.4	346.0	0.0	0.0	Vert	PK	0.0	50.3	74.0	-23.7	Low ch, EUT vertical
12027.480	45.7	-1.2	2.4	346.0	-14.4	0.0	Vert	AV	0.0	30.1	54.0	-23.9	Low ch, EUT vertical
4810.992	40.6	3.4	3.0	321.0	-14.4	0.0	Horz	AV	0.0	29.6	54.0	-24.4	Low ch, EUT horizontal
4810.900	46.0	3.4	3.1	90.0	0.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	Low ch, EUT on Side
7321.492	30.5	12.7	3.8	64.0	-14.4	0.0	Vert	AV	0.0	28.8	54.0	-25.2	Mid ch, EUT vertical
4881.100	45.0	3.5	2.9	85.0	0.0	0.0	Horz	PK	0.0	48.5	74.0	-25.5	Mid ch, EUT horizontal
4810.967	39.2	3.4	3.1	90.0	-14.4	0.0	Horz	AV	0.0	28.2	54.0	-25.8	Low ch, EUT on Side
7318.333	29.1	12.7	2.8	308.0	-14.4	0.0	Horz	AV	0.0	27.4	54.0	-26.6	Mid ch, EUT horizontal
7422.825	28.6	12.8	1.5	265.0	-14.4	0.0	Vert	AV	0.0	27.0	54.0	-27.0	High ch, EUT vertical
7422.992	28.6	12.8	1.5	360.0	-14.4	0.0	Horz	AV	0.0	27.0	54.0	-27.0	High ch, EUT horizontal
4878.867	43.3	3.6	3.1	128.0	0.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Mid ch, EUT vertical
4808.883	43.3	3.4	2.5	235.0	0.0	0.0	Vert	PK	0.0	46.7	74.0	-27.3	Low ch, EUT vertical
4810.750	42.7	3.4	3.9	18.0	0.0	0.0	Vert	PK	0.0	46.1	74.0	-27.9	Low ch, EUT on Side
4881.000	36.2	3.5	2.9	85.0	-14.4	0.0	Horz	AV	0.0	25.3	54.0	-28.7	Mid ch, EUT horizontal
4810.958	36.0	3.4	2.5	235.0	-14.4	0.0	Vert	AV	0.0	25.0	54.0	-29.0	Low ch, EUT vertical
4950.967	41.3	3.6	2.3	79.0	0.0	0.0	Horz	PK	0.0	44.9	74.0	-29.1	High ch, EUT horizontal
4880.975	35.2	3.5	3.1	128.0	-14.4	0.0	Vert	AV	0.0	24.3	54.0	-29.7	Mid ch, EUT vertical
4810.950	35.1	3.4	3.9	18.0	-14.4	0.0	Vert	AV	0.0	24.1	54.0	-29.9	Low ch, EUT on Side
4951.208	40.3	3.6	3.9	102.0	0.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	High ch, EUT vertical
4809.692	38.8	3.4	1.5	52.0	0.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	Low ch, EUT vertical
4811.958	38.5	3.4	1.5	105.0	0.0	0.0	Vert	PK	0.0	41.9	74.0	-32.1	Low ch, EUT horizontal
4950.967	32.5	3.6	2.3	79.0	-14.4	0.0	Horz	AV	0.0	21.7	54.0	-32.3	High ch, EUT horizontal
4951.008	31.3	3.6	3.9	102.0	-14.4	0.0	Vert	AV	0.0	20.5	54.0	-33.5	High ch, EUT vertical
12024.620	40.8	-1.2	1.5	223.0	0.0	0.0	Horz	PK	0.0	39.6	74.0	-34.4	Mid ch, EUT horizontal
12024.130	40.1	-1.2	1.5	11.0	0.0	0.0	Vert	PK	0.0	38.9	74.0	-35.1	Mid ch, EUT vertical
4811.017	28.9	3.4	1.5	105.0	-14.4	0.0	Vert	AV	0.0	17.9	54.0	-36.1	Low ch, EUT horizontal
4810.942	28.7	3.4	1.5	52.0	-14.4	0.0	Horz	AV	0.0	17.7	54.0	-36.3	Low ch, EUT vertical
12022.980	30.2	-1.2	1.5	11.0	-14.4	0.0	Vert	AV	0.0	14.6	54.0	-39.4	Mid ch, EUT vertical
12025.250	30.1	-1.2	1.5	223.0	-14.4	0.0	Horz	AV	0.0	14.5	54.0	-39.5	Mid ch, EUT horizontal

SPURIOUS RADIATED EMISSIONS





DUTY CYCLE

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	23.3% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

DEVIATIONS FROM TEST STANDARD

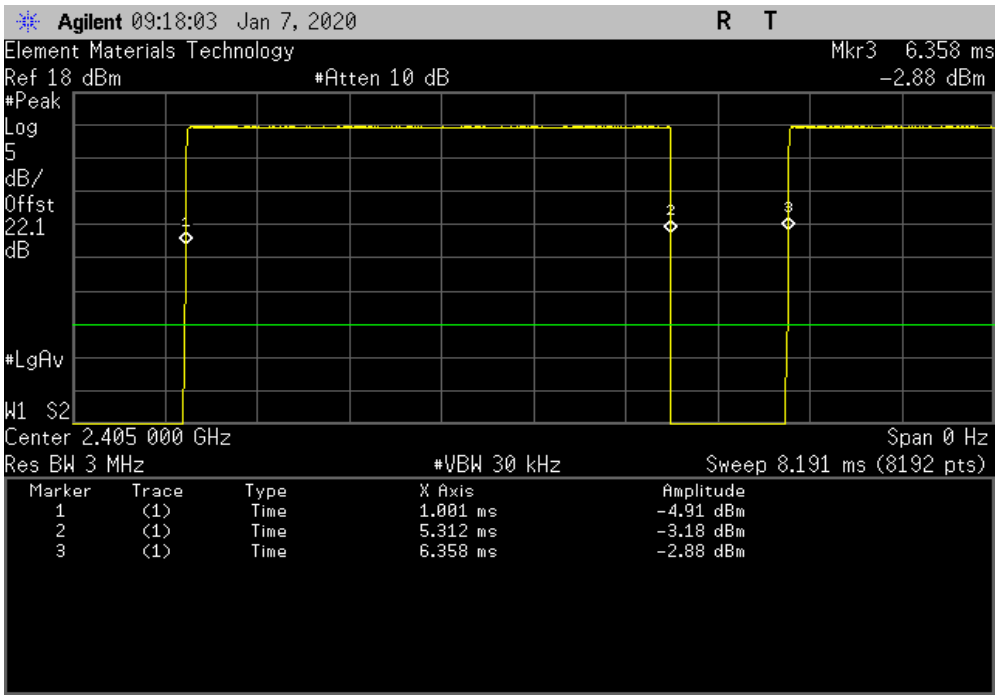
None

Configuration #	2	Signature Dustin Sparks

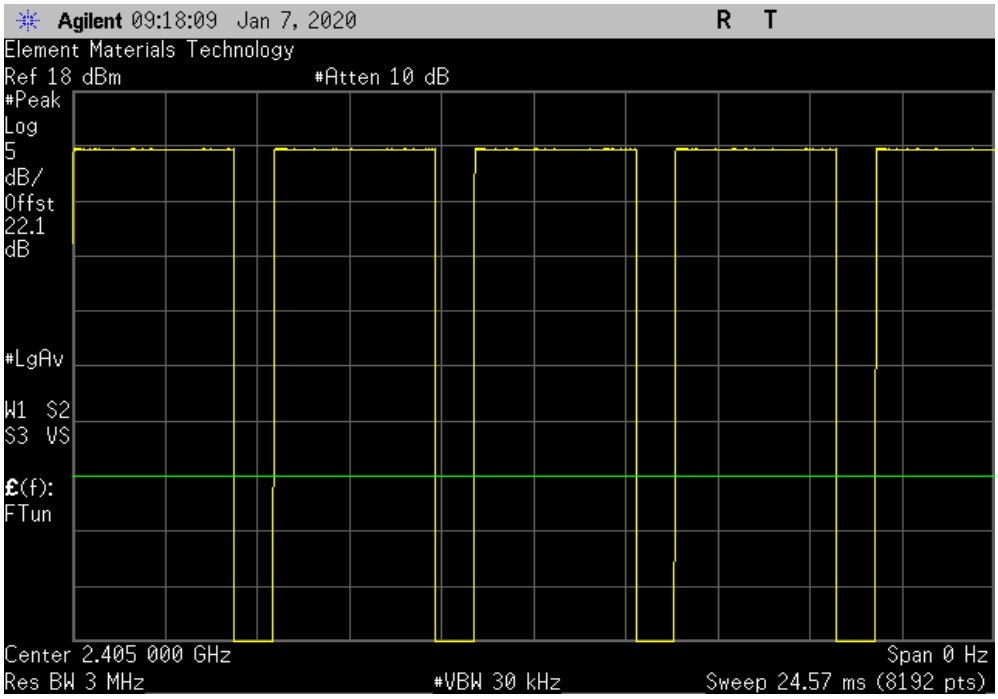
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
WirelessHART						
Low Channel, 2405 MHz	4.311 ms	5.357 ms	1	80.5	N/A	N/A
Low Channel, 2405 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2440 MHz	4.311 ms	5.356 ms	1	80.5	N/A	N/A
Mid Channel, 2440 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2475 MHz	4.31 ms	5.355 ms	1	80.5	N/A	N/A
High Channel, 2475 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

WirelessHART, Low Channel, 2405 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.311 ms	5.357 ms	1	80.5	N/A	N/A

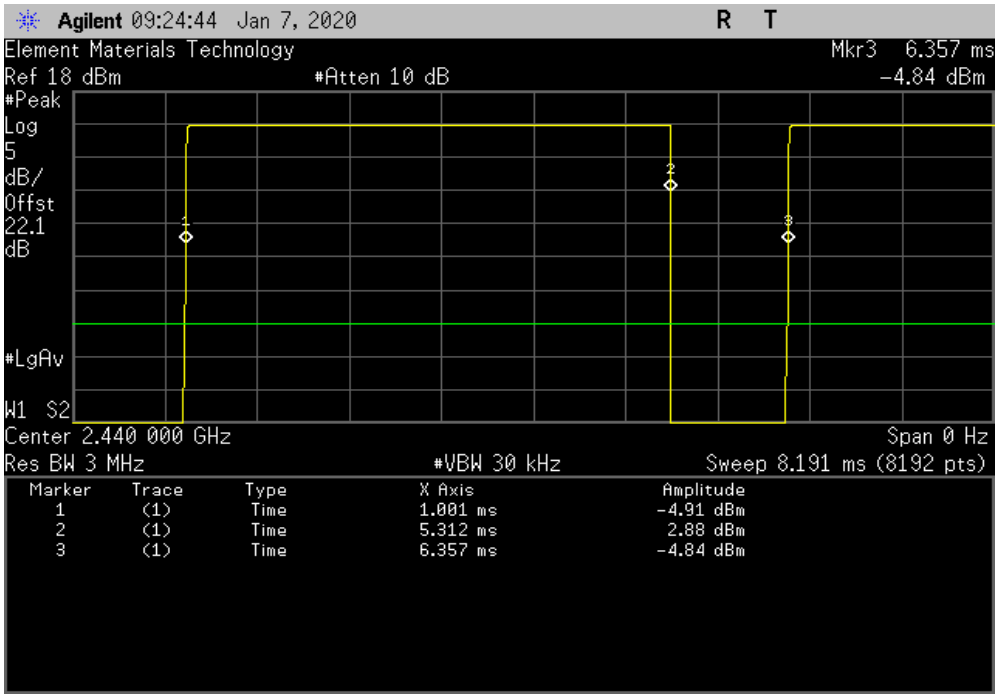


WirelessHART, Low Channel, 2405 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

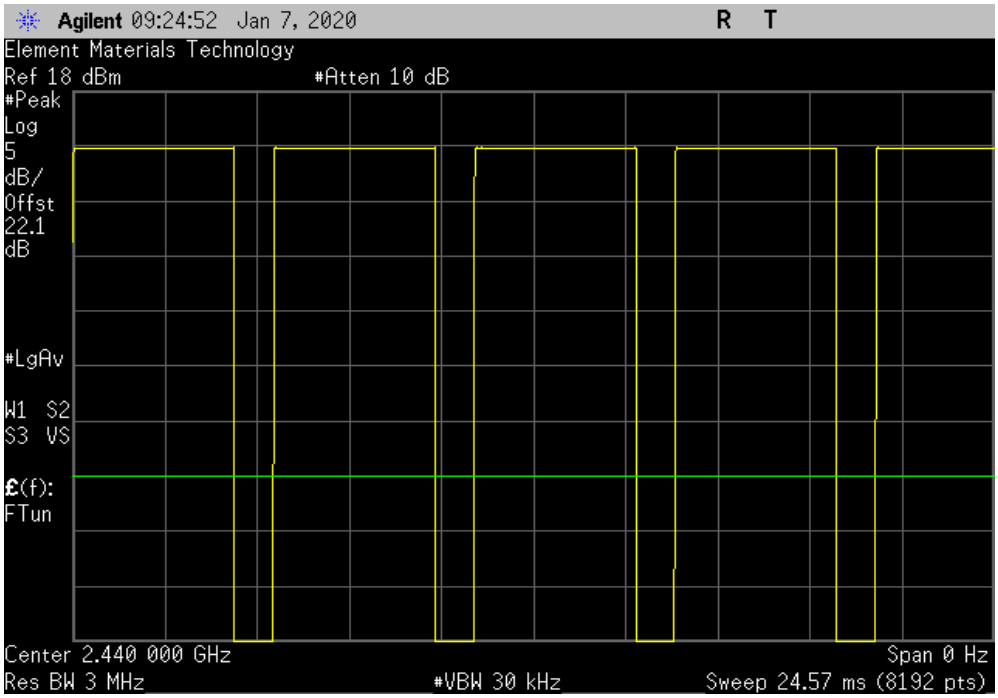


DUTY CYCLE

WirelessHART, Mid Channel, 2440 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.311 ms	5.356 ms	1	80.5	N/A	N/A

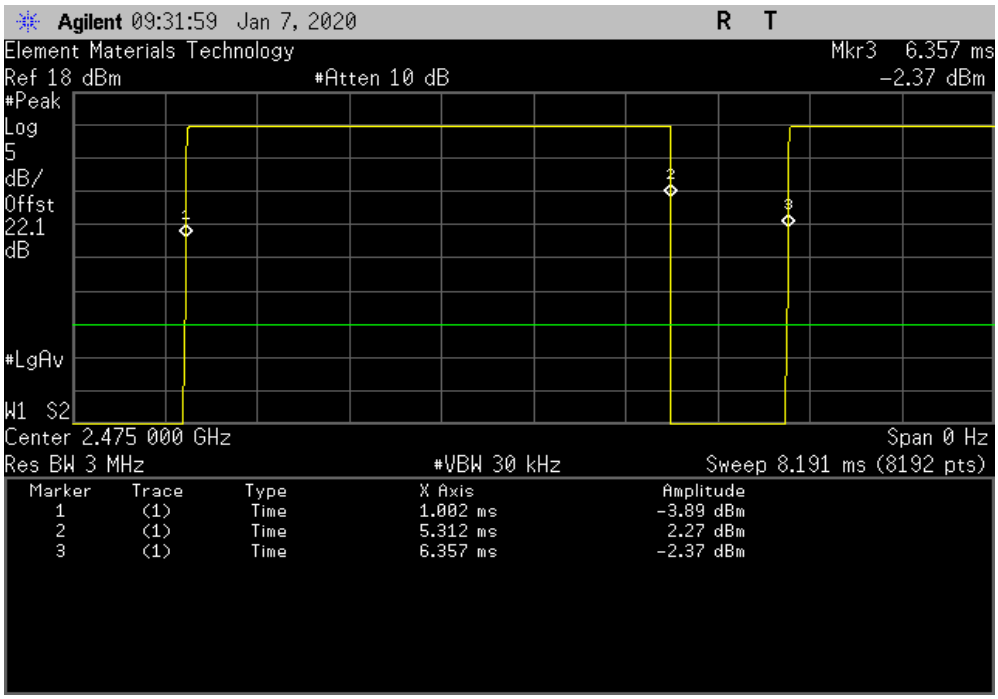


WirelessHART, Mid Channel, 2440 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

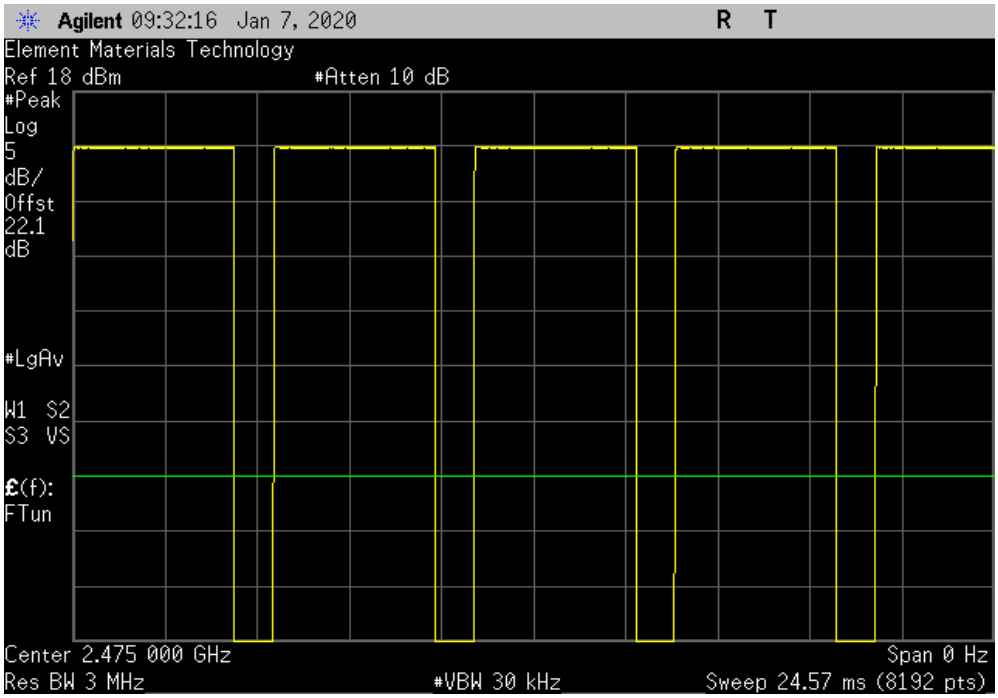


DUTY CYCLE

WirelessHART, High Channel, 2475 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.31 ms	5.355 ms	1	80.5	N/A	N/A



WirelessHART, High Channel, 2475 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



CARRIER FREQUENCY SEPARATION

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The channel carrier frequencies in the 2400-2483.5MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CARRIER FREQUENCY SEPARATION

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	8-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	18.1% RH
Project:	None			**Barometric Pres.:**	1032 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection. Limit is equal to the 20 dB bandwidth of the fundamental emission.

DEVIATIONS FROM TEST STANDARD

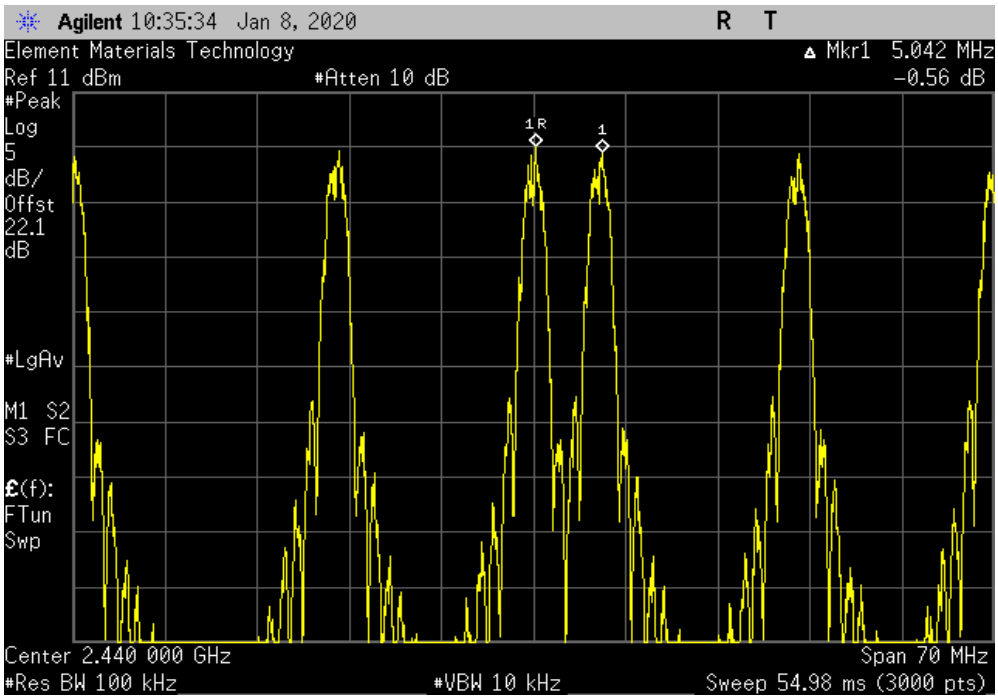
None

Configuration #	2	Signature Dustin Sparks

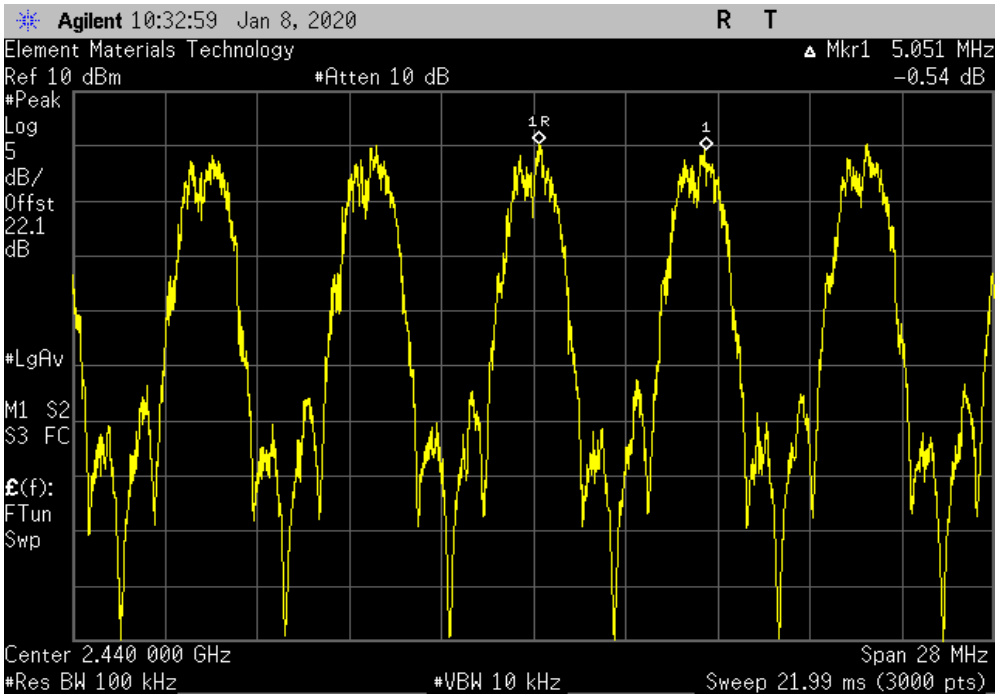
	Value	Limit (≥)	Results
WirelessHART, 6-Channel Hopping Mode	5.0 MHz	2.6 MHz	Pass
WirelessHART, 15-Channel Hopping Mode	5.1 MHz	2.6 MHz	Pass

CARRIER FREQUENCY SEPARATION

WirelessHART, 6-Channel Hopping Mode						
				Value	Limit (≥)	Results
				5.0 MHz	2.6 MHz	Pass



WirelessHART, 15-Channel Hopping Mode						
				Value	Limit (≥)	Results
				5.1 MHz	2.6 MHz	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled. Per FCC KDB 558047 section 10, there is no minimum requirement for number of hopping channels for a hybrid device.

NUMBER OF HOPPING FREQUENCIES

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	8-Jan-20
Customer:	Emerson			**Temperature:**	22.5 °C
Attendees:	None			**Humidity:**	18.2% RH
Project:	None			**Barometric Pres.:**	1032 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

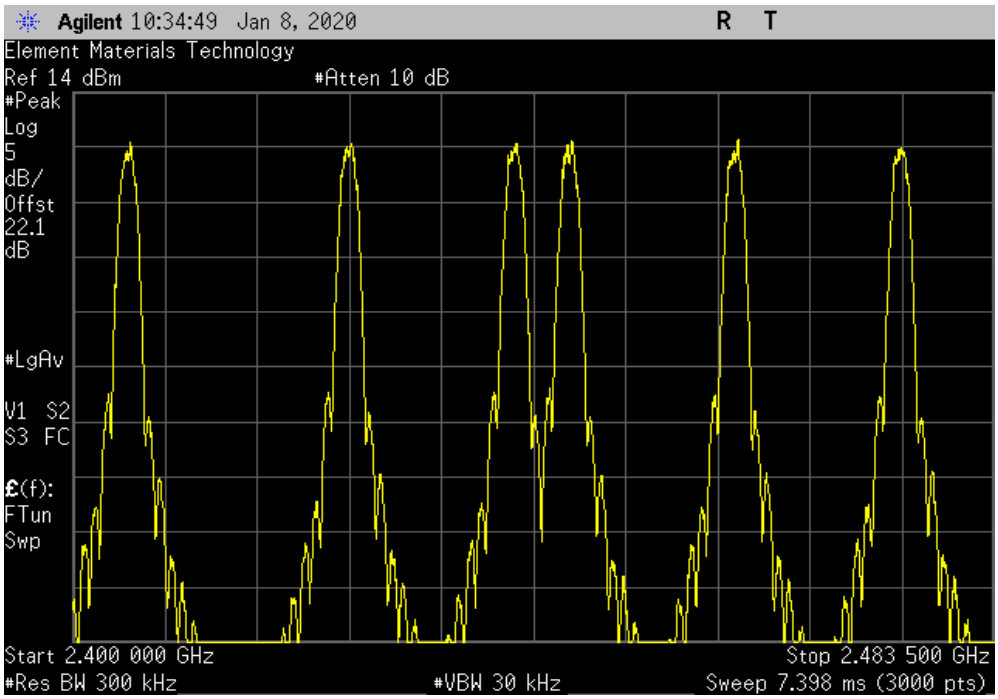
DEVIATIONS FROM TEST STANDARD

None

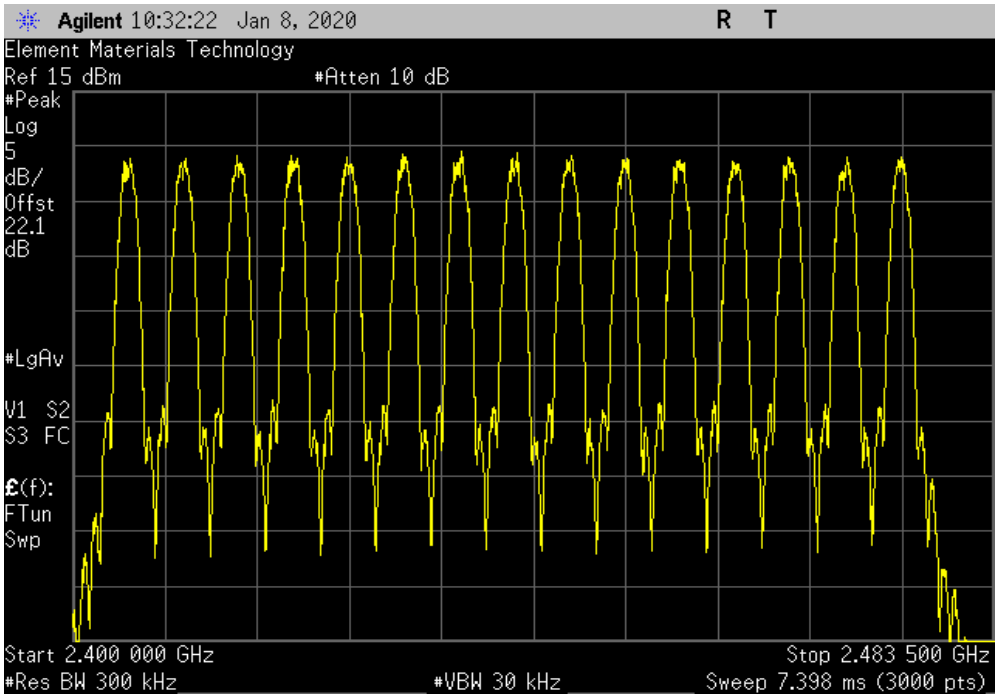
Configuration #	2	Signature Dustin Sparks

	Number of Channels	Limit (≥)	Results
WirelessHART, 6-Channel Hopping Mode	6	N/A	N/A
WirelessHART, 15-Channel Hopping Mode	15	N/A	N/A

WirelessHART, 6-Channel Hopping Mode						
				Number of Channels	Limit (≥)	Results
				6	N/A	N/A



WirelessHART, 15-Channel Hopping Mode						
				Number of Channels	Limit (≥)	Results
				15	N/A	N/A



DWELL TIME

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The hopping function of the EUT was enabled.

The dwell time limit is 400 ms within a time span of 400 ms multiplied by the minimum number of hopping frequencies.
On Time During 2.4 s (6-channel mode) = Pulse Width * Average Number of Pulses
On Time During 6 s (15-channel mode) = Pulse Width * Average Number of Pulses

➢Average Number of Pulses is based on 4 samples. A scale factor was used for the 15-channel mode.

➢Scale Factor = 6 Sec / Screen Capture Sweep Time = 6 Sec / 3 Sec = 2

DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	8-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	18% RH
Project:	None			**Barometric Pres.:**	1032 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

DEVIATIONS FROM TEST STANDARD

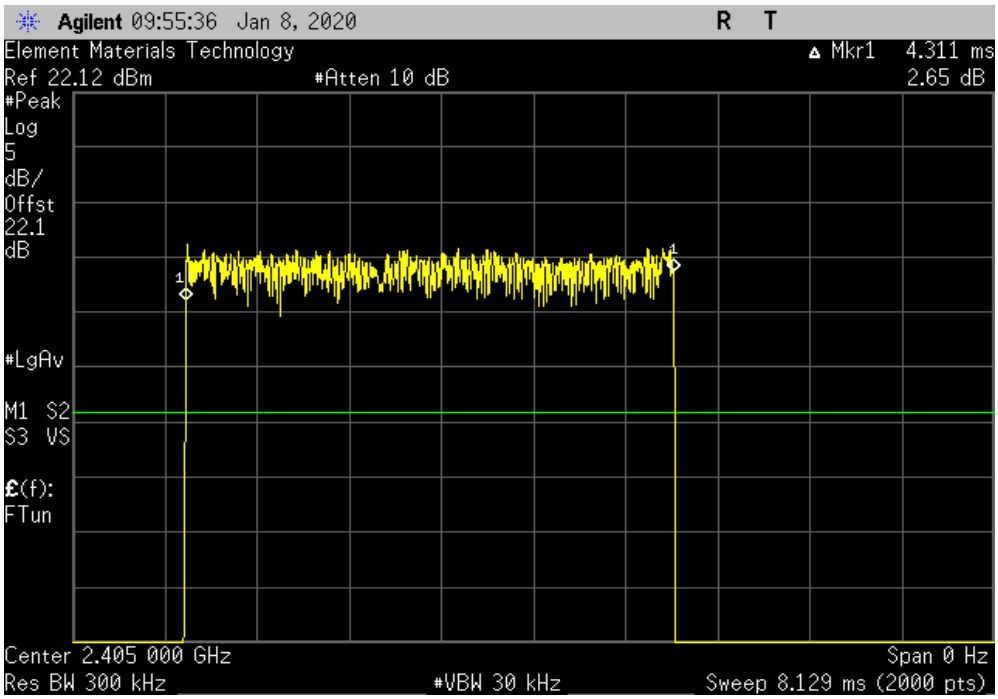
None

Configuration #	2	Signature

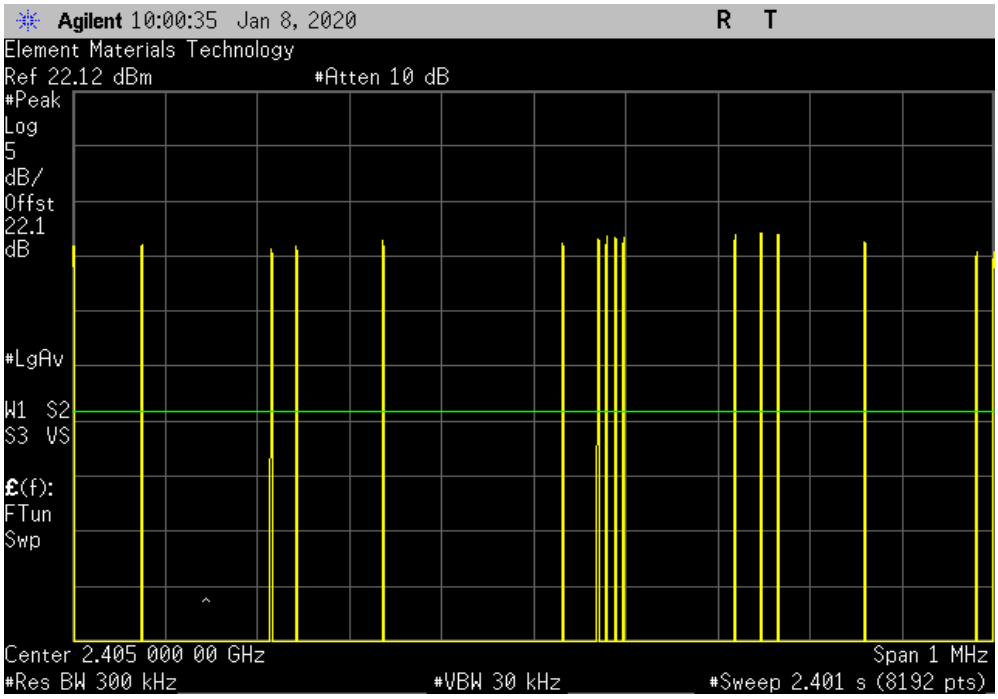
	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
WirelessHART, 6-Channel Hopping Mode							
Low Channel, 2405 MHz	4.311	N/A	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	15	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	17	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	24	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	17	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	4.311	N/A	18.25	N/A	78.68	400	Pass
High Channel, 2475 MHz	4.311	N/A	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	17	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	11	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	24	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	19	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	4.311	N/A	17.75	N/A	76.52	400	Pass
WirelessHART, 15-Channel Hopping Mode							
Low Channel, 2405 MHz	4.311	N/A	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	15	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	6	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	10	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	N/A	6	N/A	N/A	N/A	N/A	N/A
Low Channel, 2405 MHz	4.311	N/A	9.25	2	79.75	400	Pass
High Channel, 2475 MHz	4.311	N/A	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	9	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	13	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	8	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	N/A	12	N/A	N/A	N/A	N/A	N/A
High Channel, 2475 MHz	4.311	N/A	10.5	2	90.53	400	Pass

DWELL TIME

WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	N/A	N/A	N/A	N/A	N/A

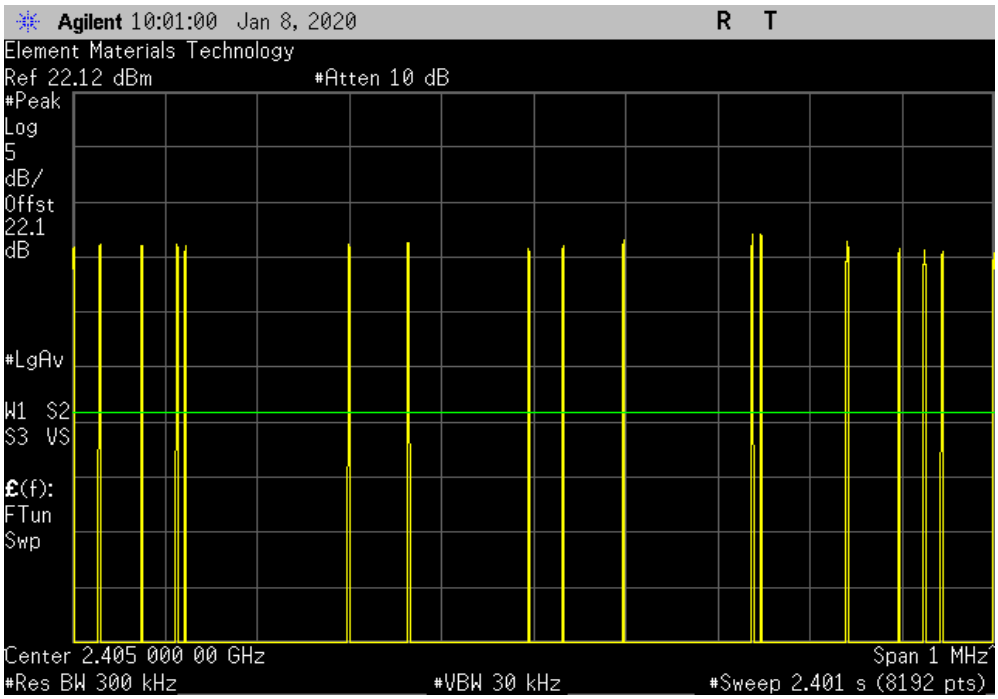


WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	15	N/A	N/A	N/A	N/A	N/A

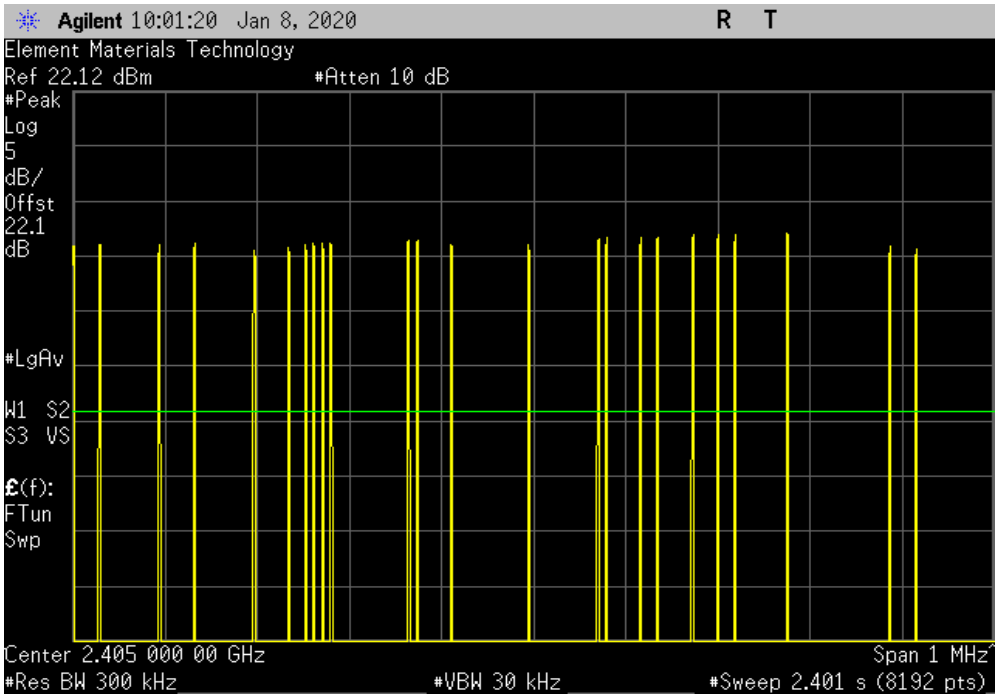


DWELL TIME

WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	17	N/A	N/A	N/A	N/A	N/A



WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	24	N/A	N/A	N/A	N/A	N/A



DWELL TIME

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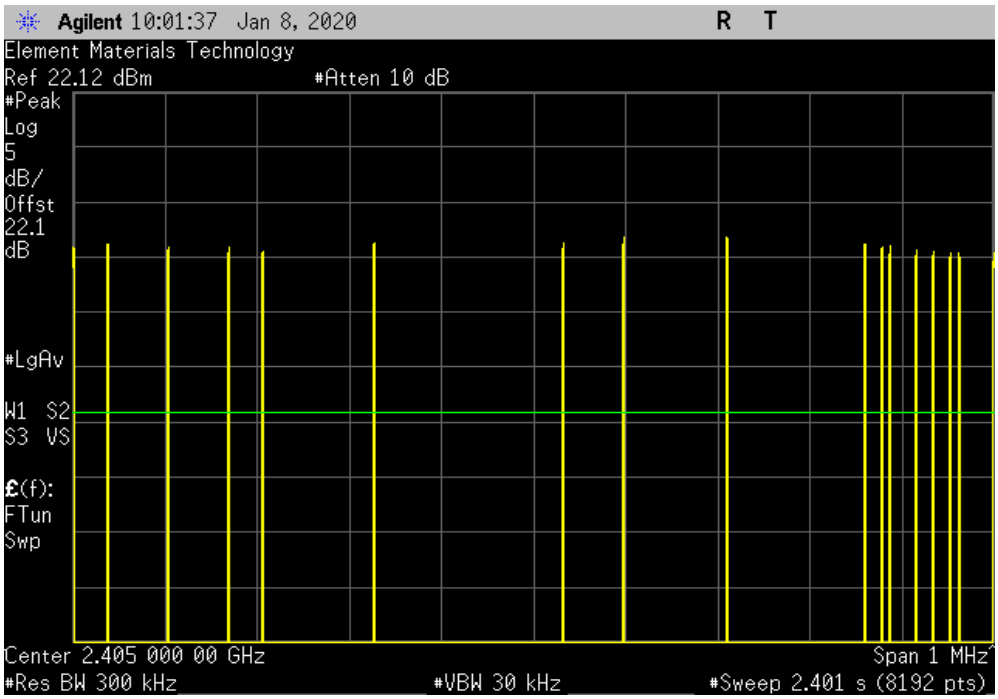
WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	17	N/A	N/A	N/A	N/A	N/A



WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	18.25	N/A	78.68	400	Pass

Calculation Only

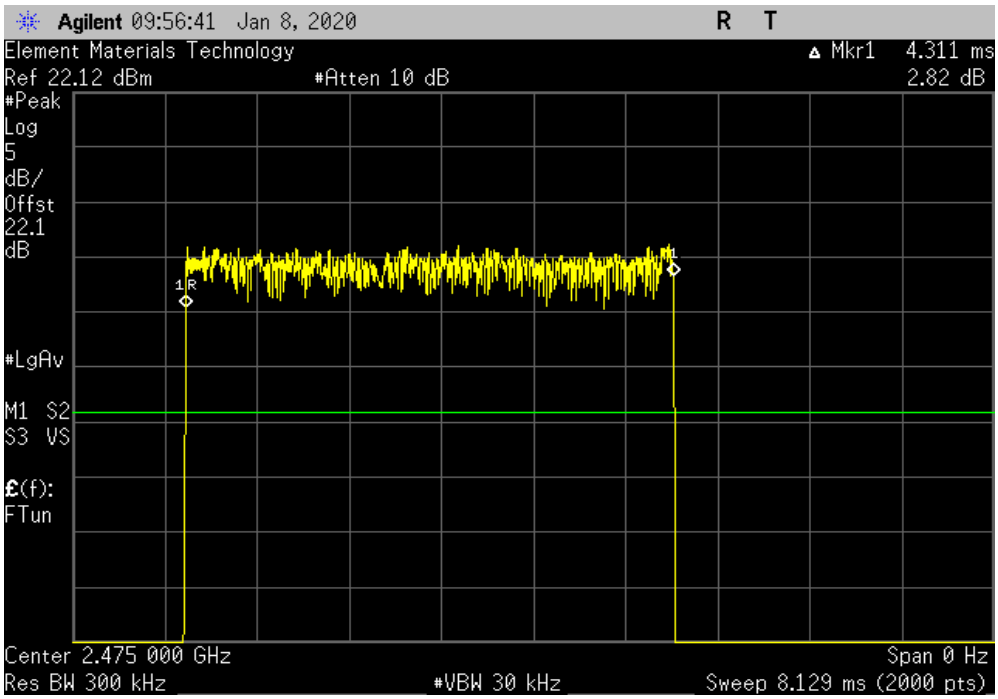
No Screen Capture Required

DWELL TIME

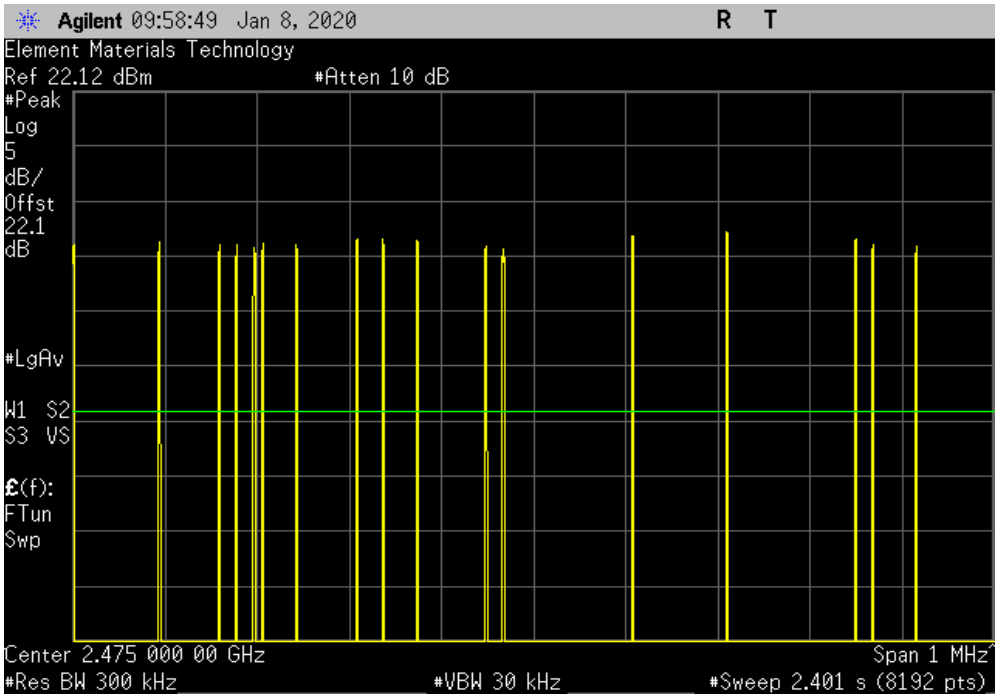
element

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	N/A	N/A	N/A	N/A	N/A



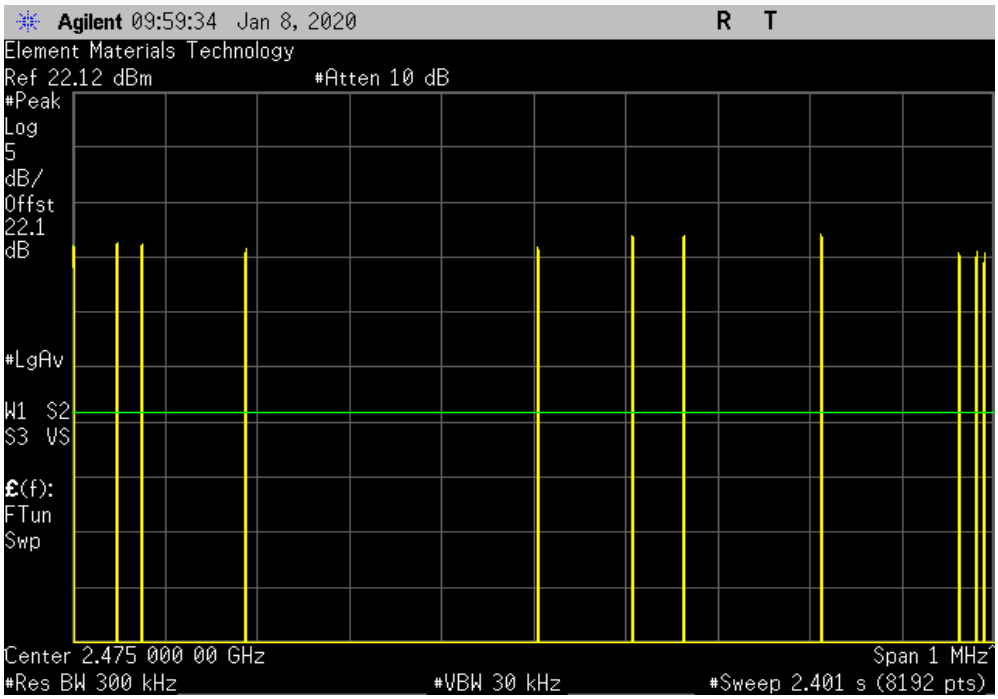
WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	17	N/A	N/A	N/A	N/A	N/A



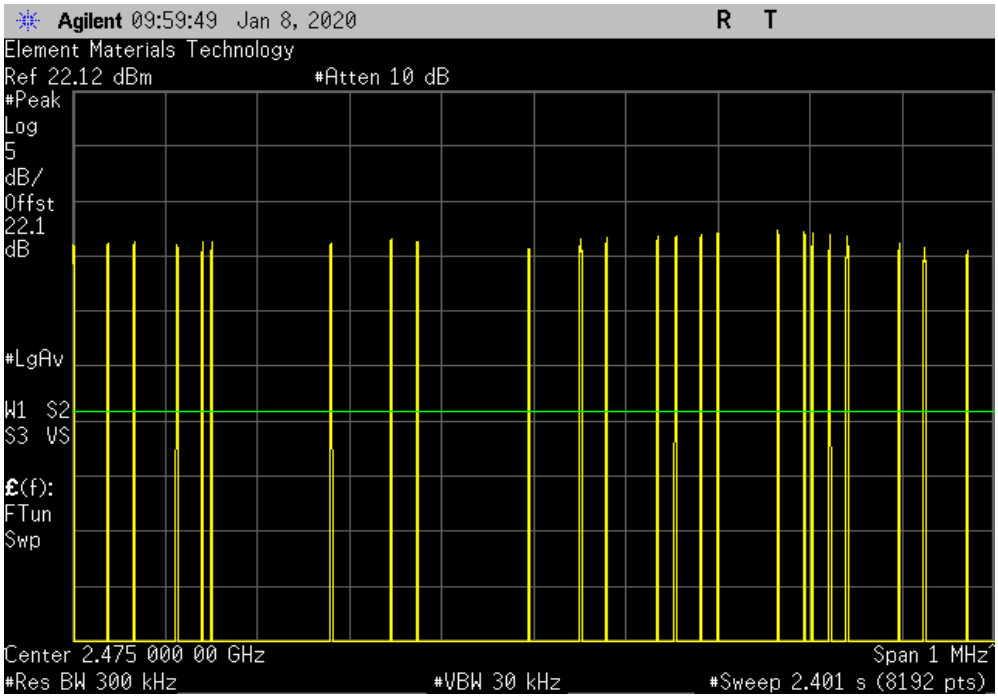
DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	11	N/A	N/A	N/A	N/A	N/A

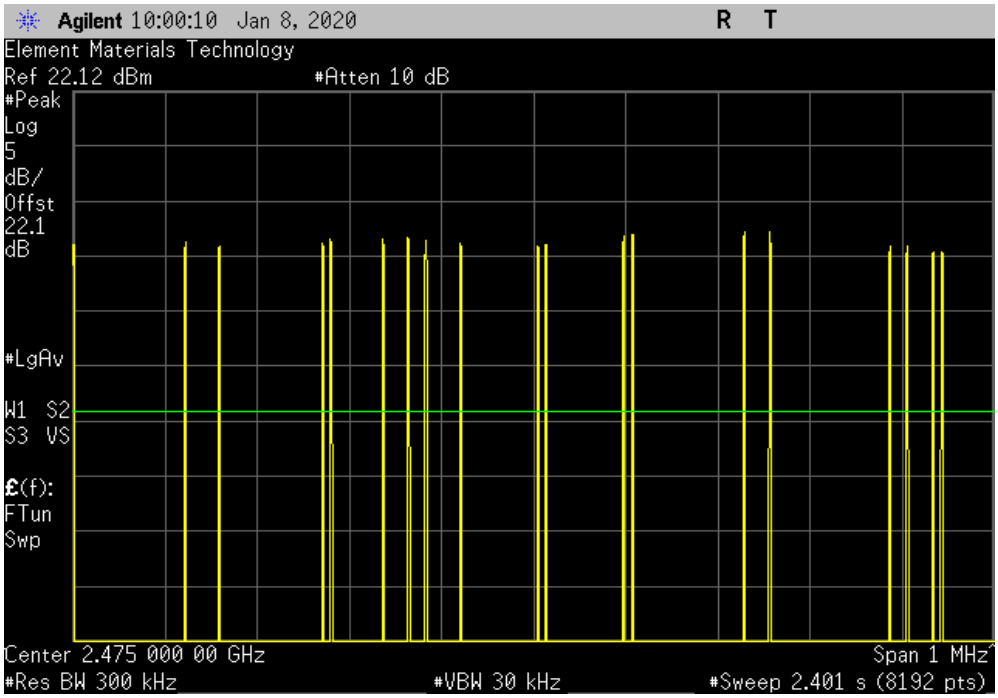


WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	24	N/A	N/A	N/A	N/A	N/A



DWELL TIME

WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	19	N/A	N/A	N/A	N/A	N/A



WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	17.75	N/A	76.52	400	Pass

Calculation Only

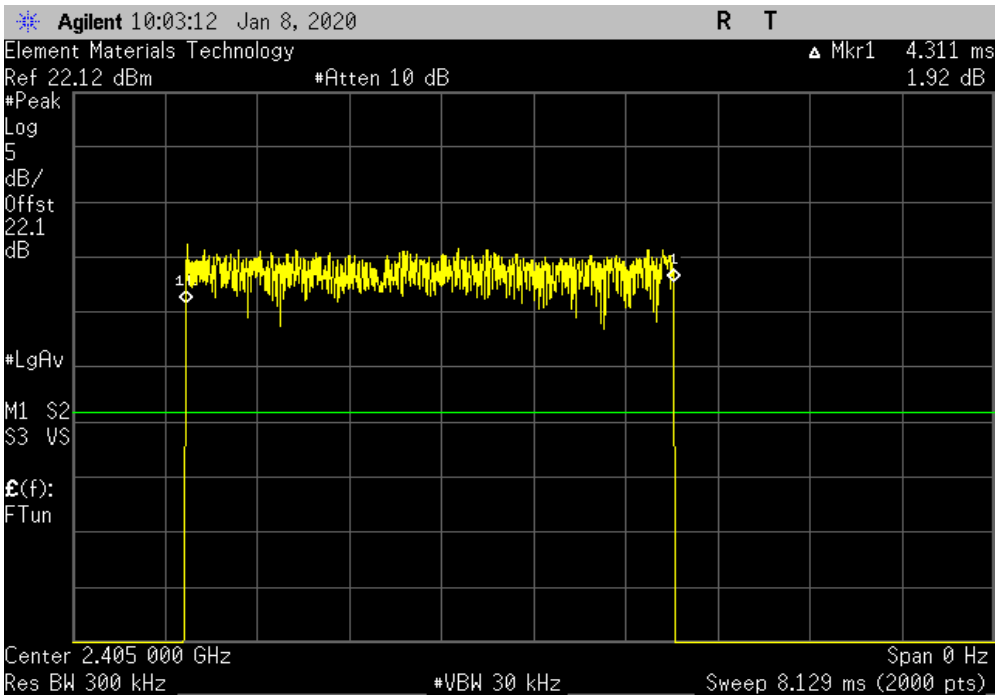
No Screen Capture Required

DWELL TIME

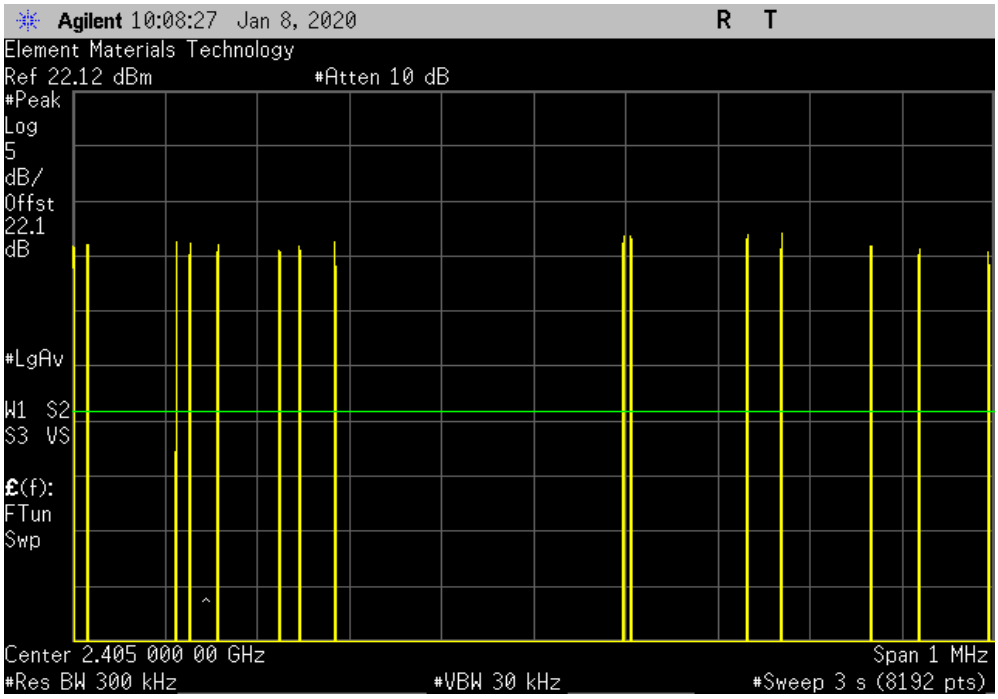
element

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	N/A	N/A	N/A	N/A	N/A

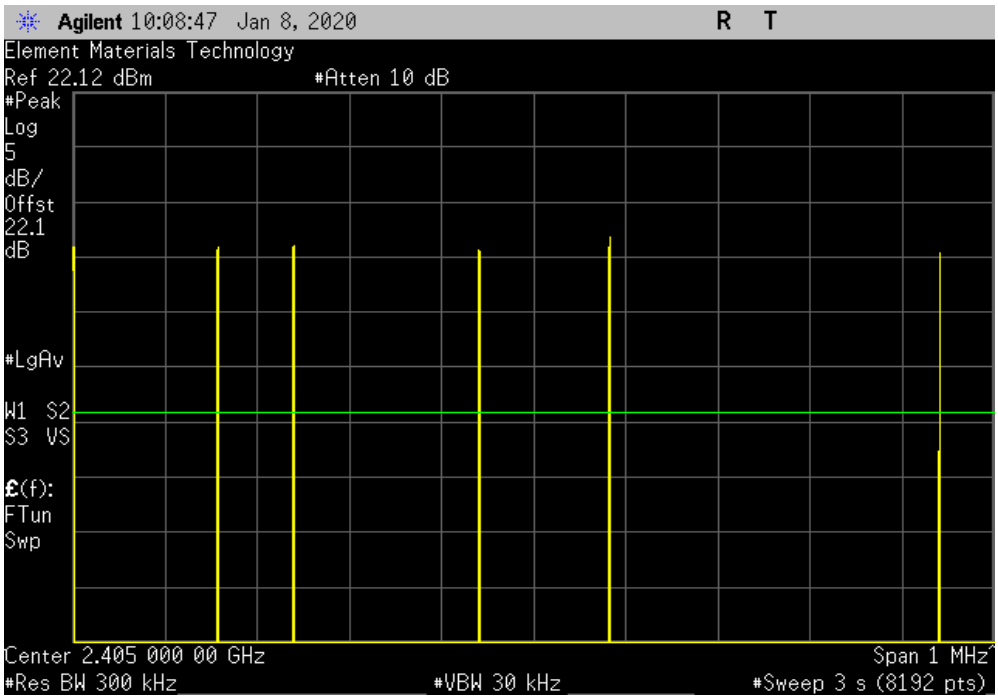


WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	15	N/A	N/A	N/A	N/A	N/A

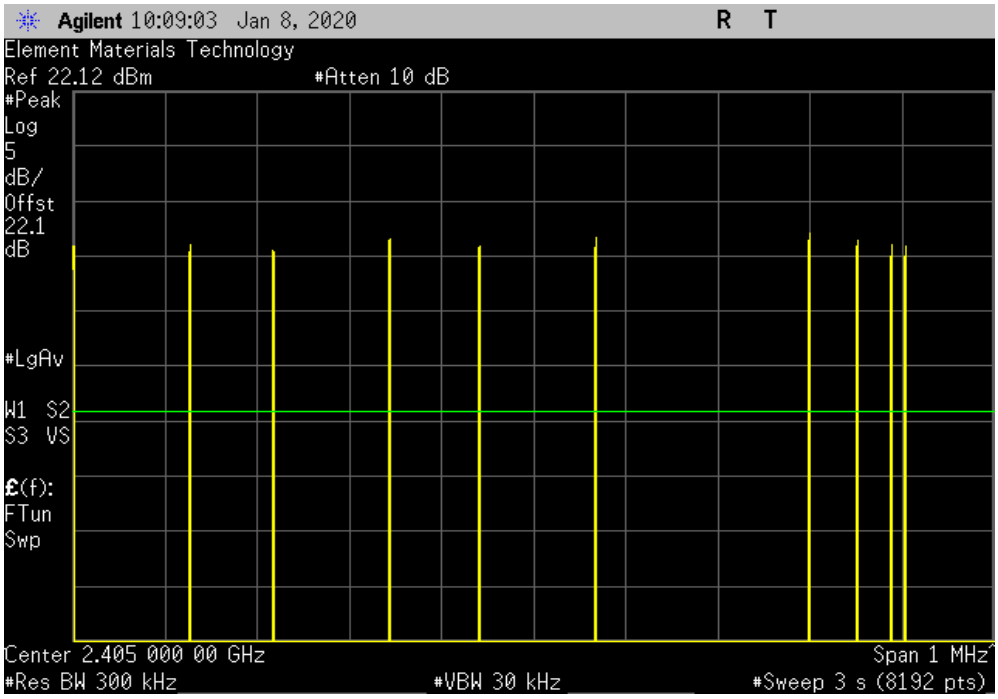


DWELL TIME

WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	6	N/A	N/A	N/A	N/A	N/A



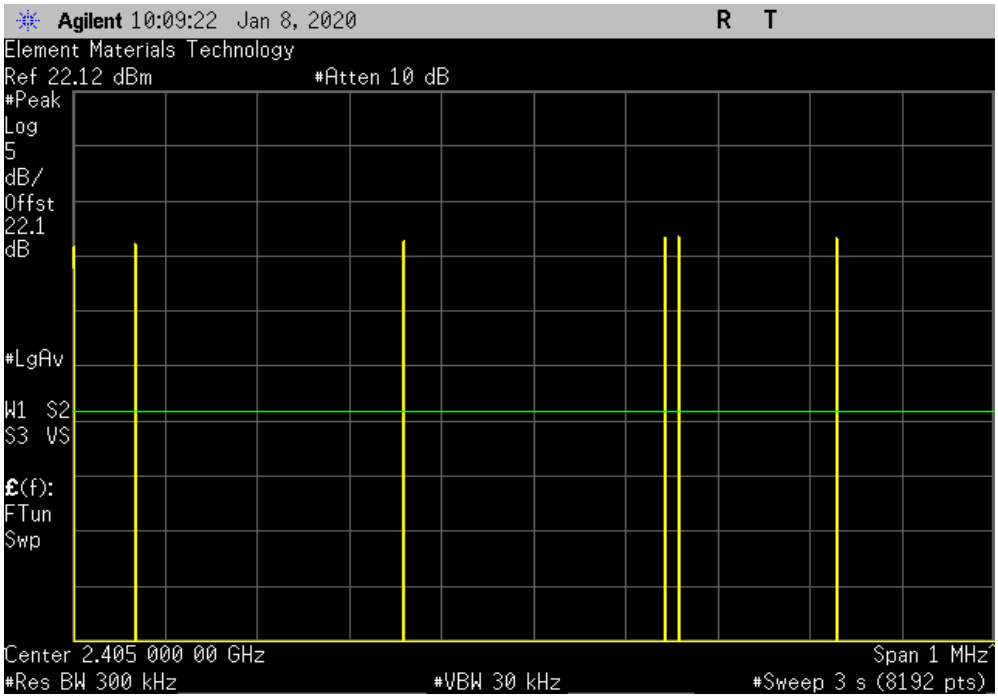
WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	10	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	6	N/A	N/A	N/A	N/A	N/A



WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	9.25	2	79.75	400	Pass

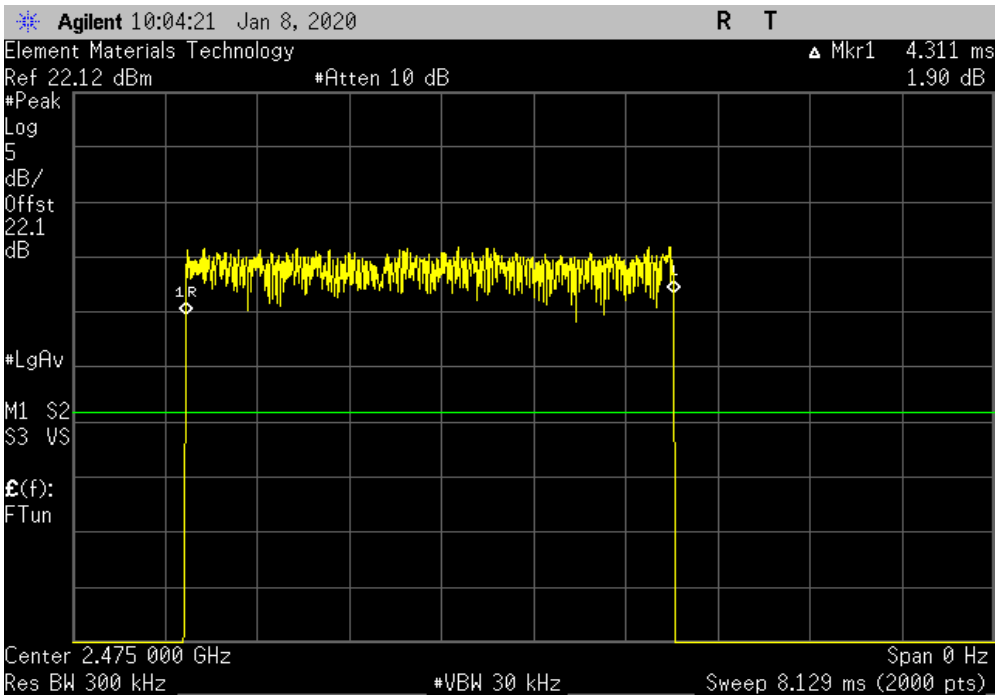
Calculation Only

No Screen Capture Required

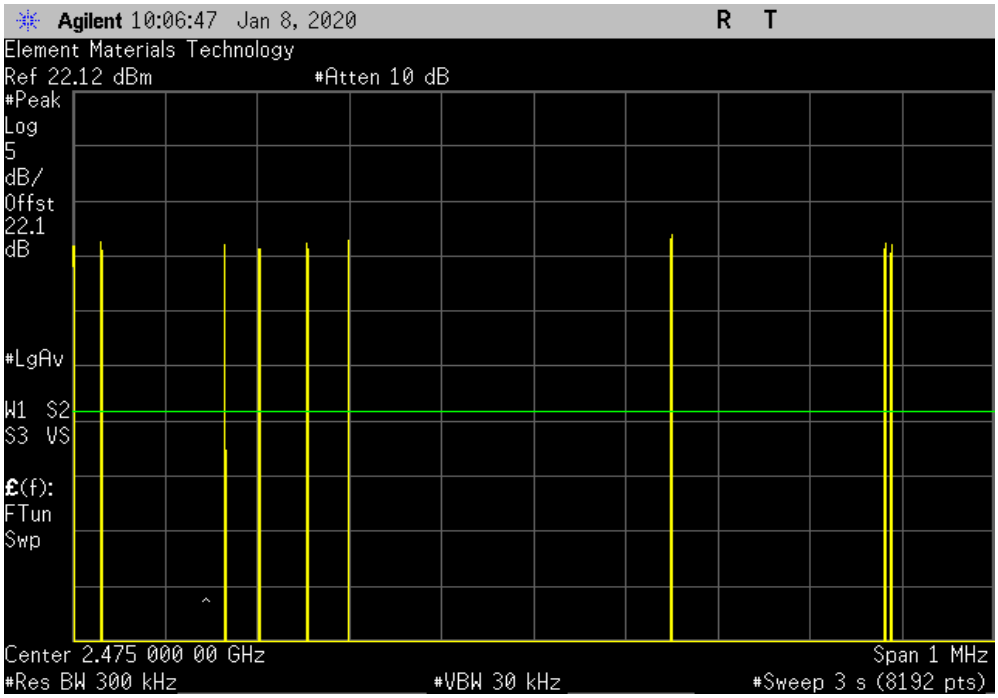
DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	N/A	N/A	N/A	N/A	N/A



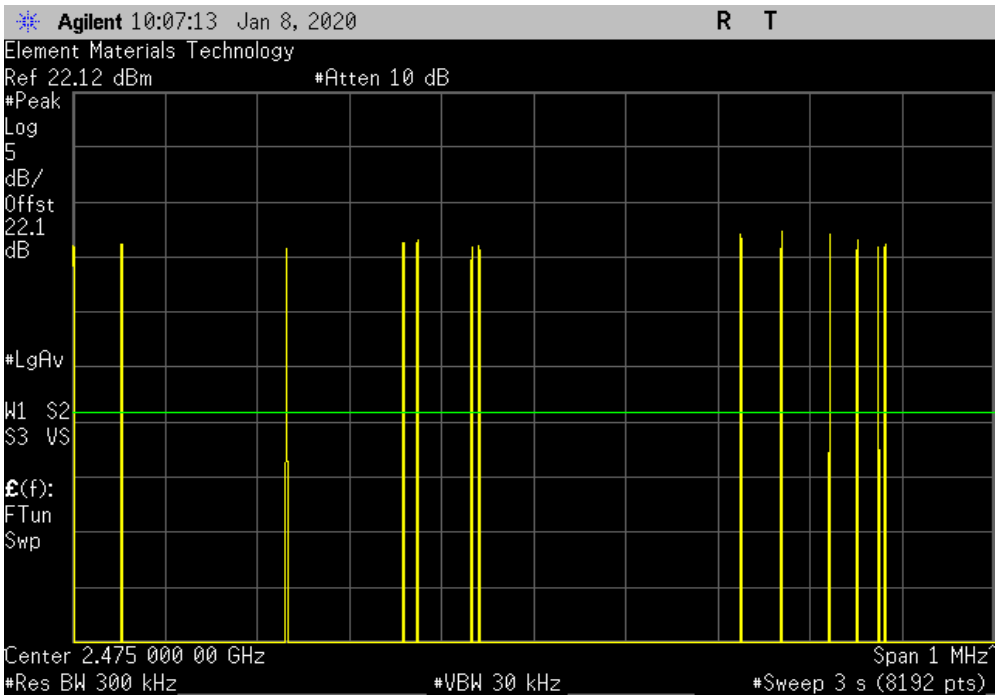
WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	9	N/A	N/A	N/A	N/A	N/A



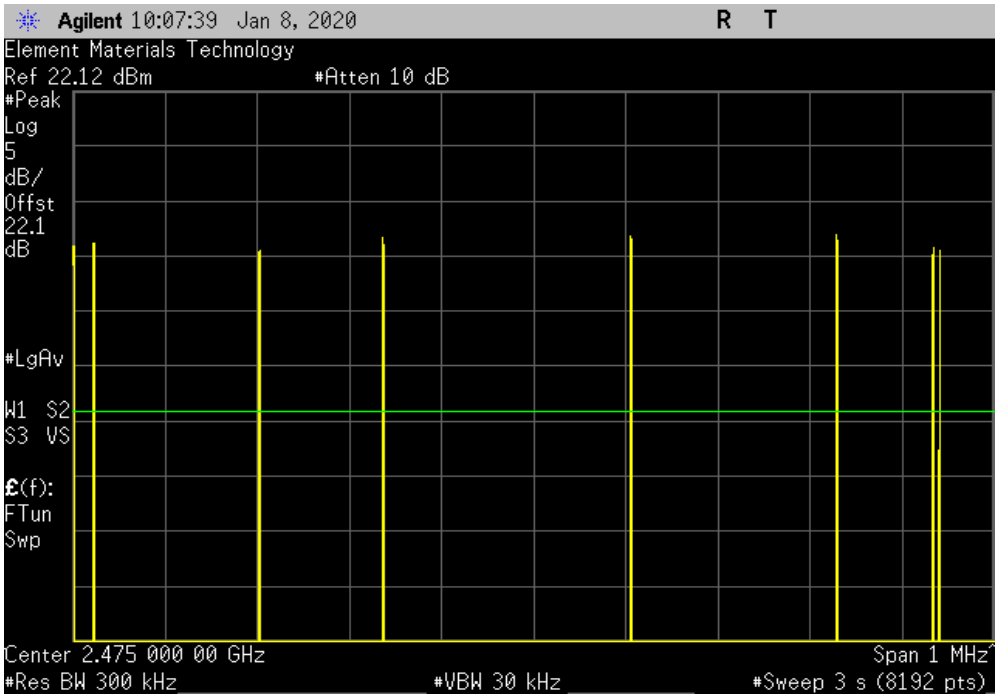
DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	13	N/A	N/A	N/A	N/A	N/A



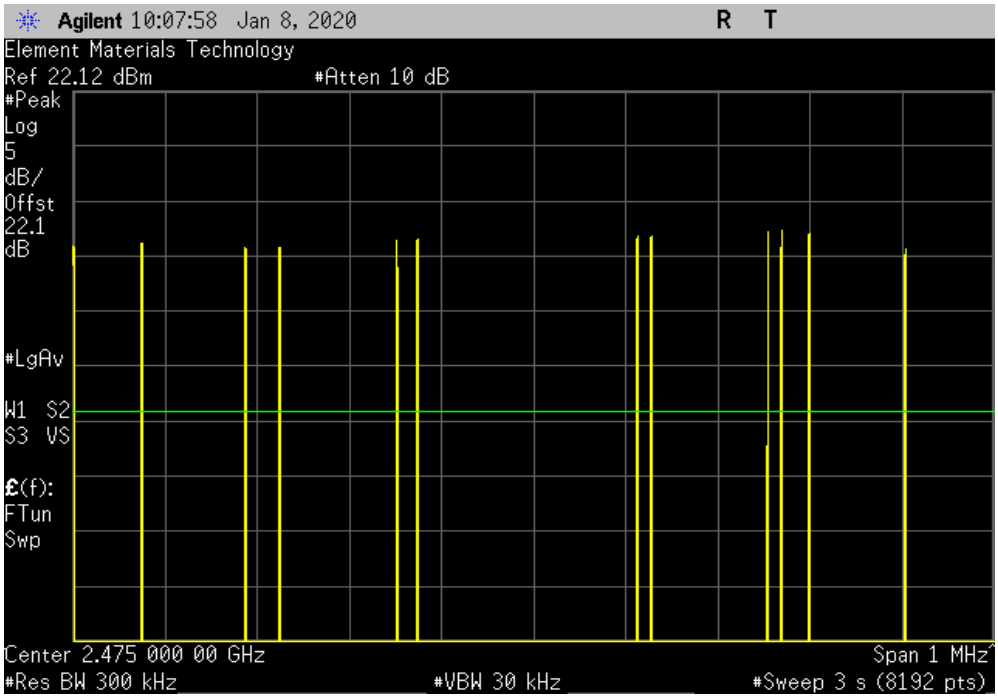
WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	8	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
N/A	12	N/A	N/A	N/A	N/A	N/A



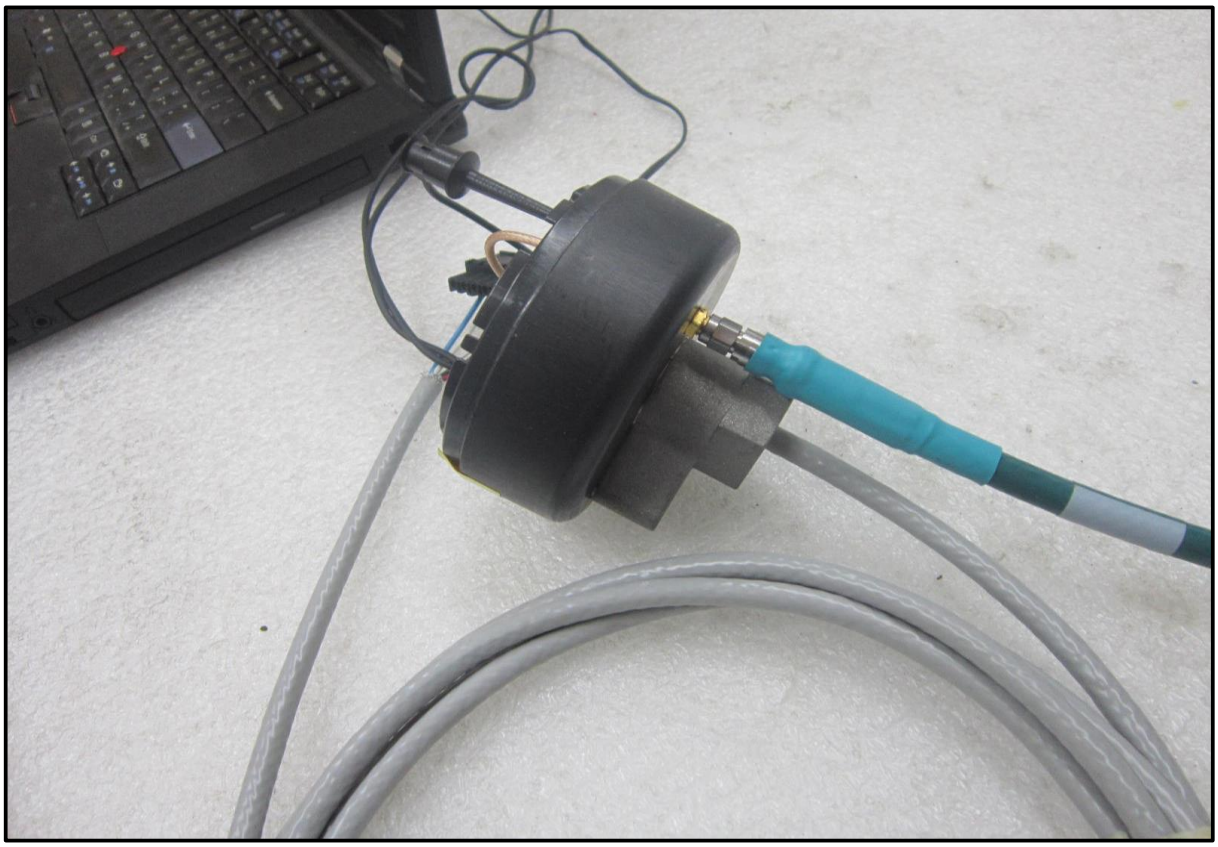
WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms)	Limit (ms)	Results
4.311	N/A	10.5	2	90.53	400	Pass

Calculation Only

No Screen Capture Required

DWELL TIME

XMit 2019.09.05



OUTPUT POWER

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

OUTPUT POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	23.1% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

DEVIATIONS FROM TEST STANDARD

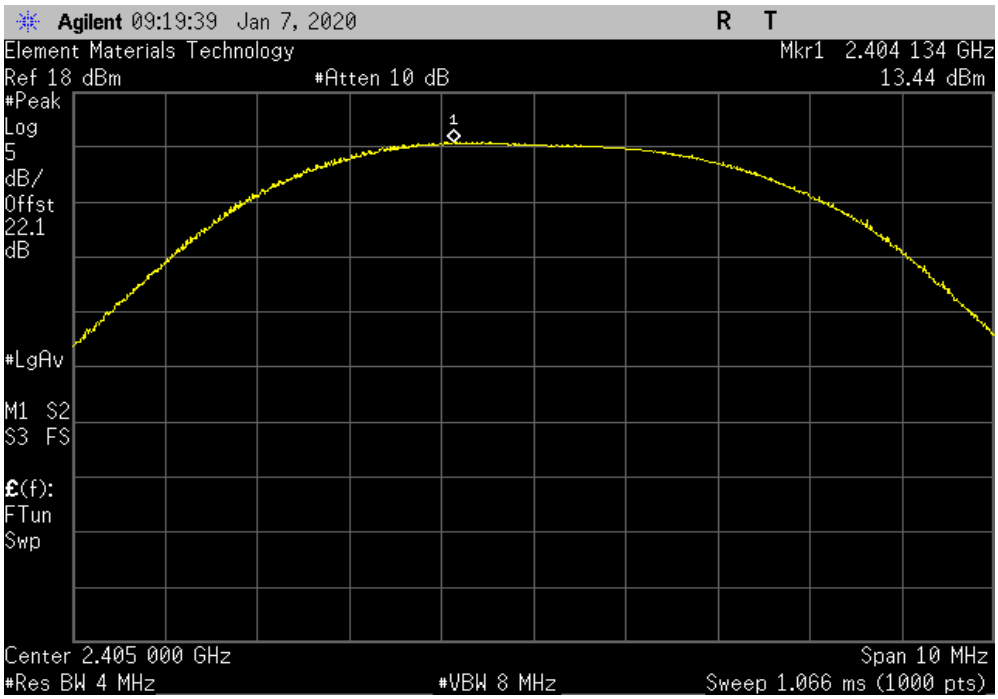
None

Configuration #	2	Signature

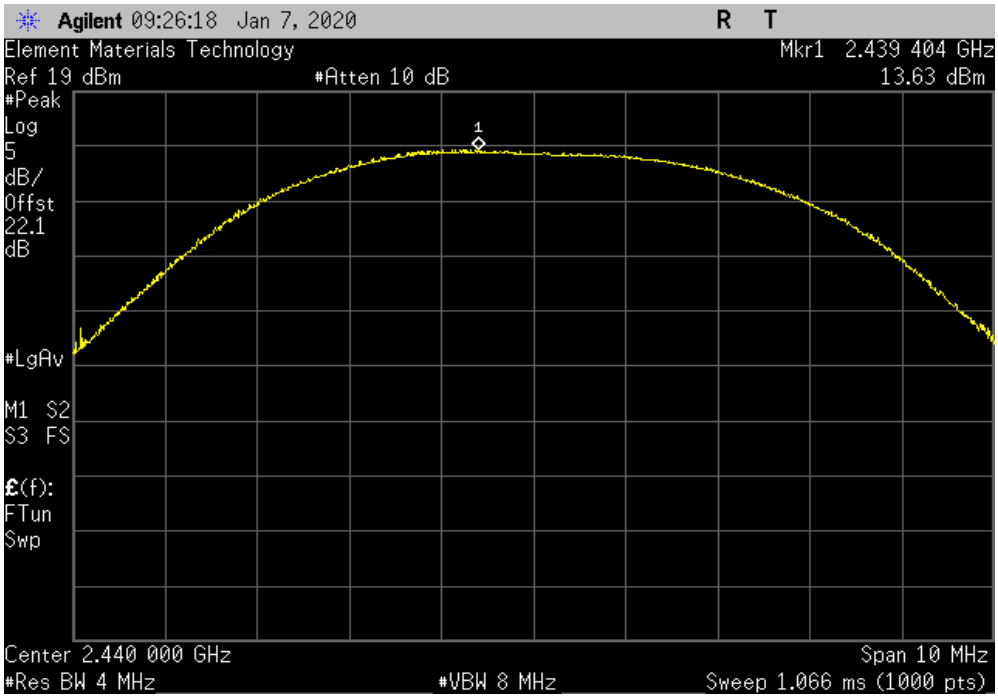
	Out Pwr (dBm)	Limit (dBm)	Result
WirelessHART			
Low Channel, 2405 MHz	13.435	30	Pass
Mid Channel, 2440 MHz	13.629	30	Pass
High Channel, 2475 MHz	13.636	30	Pass

OUTPUT POWER

WirelessHART, Low Channel, 2405 MHz							
					Out Pwr (dBm)	Limit (dBm)	Result
					13.435	30	Pass

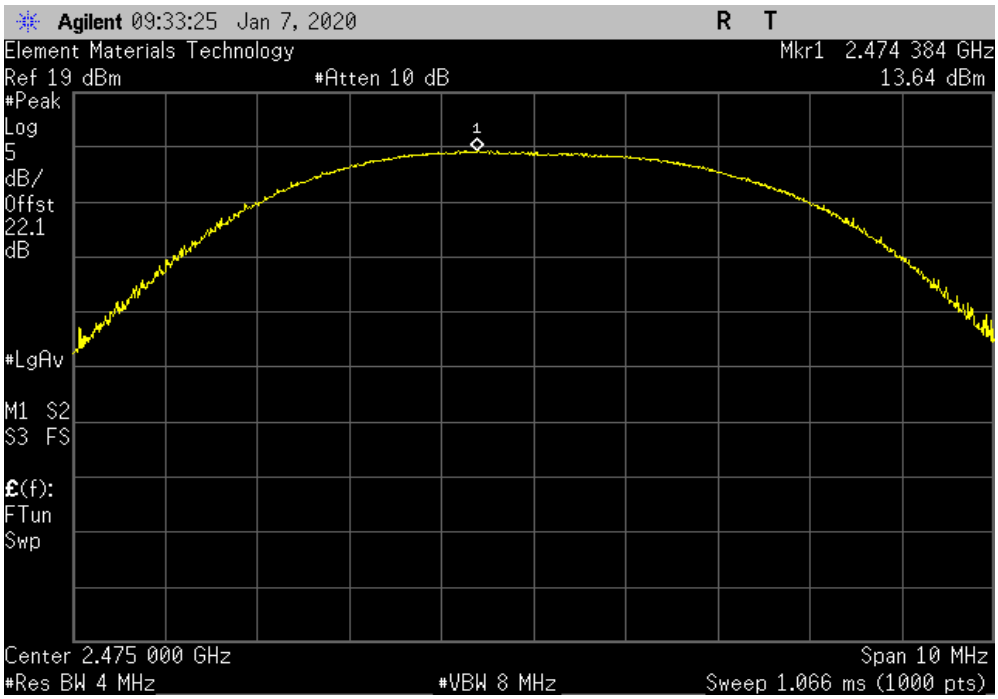


WirelessHART, Mid Channel, 2440 MHz							
					Out Pwr (dBm)	Limit (dBm)	Result
					13.629	30	Pass



OUTPUT POWER

WirelessHART, High Channel, 2475 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				13.636	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

The antenna gain in dBi was added to the output power in order to calculate the EIRP.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	22.6 °C
Attendees:	None			**Humidity:**	22.9% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

DEVIATIONS FROM TEST STANDARD

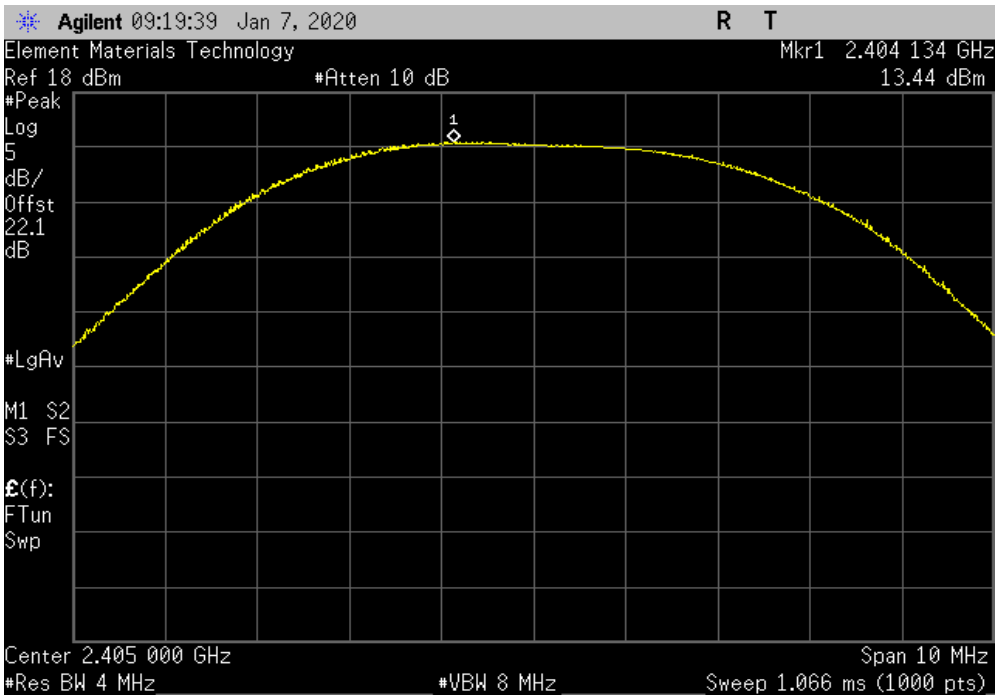
None

Configuration #	2	Signature Dustin Sparks

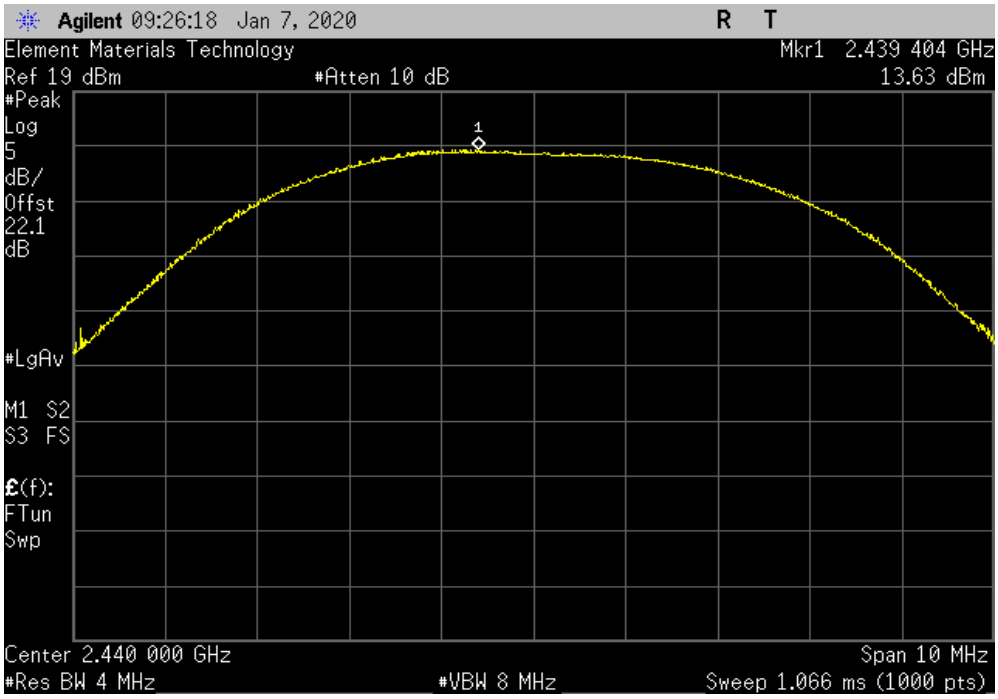
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
WirelessHART					
Low Channel, 2405 MHz	13.435	2	15.435	36	Pass
Mid Channel, 2440 MHz	13.629	2	15.629	36	Pass
High Channel, 2475 MHz	13.636	2	15.636	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

WirelessHART, Low Channel, 2405 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		13.435	2	15.435	36	Pass



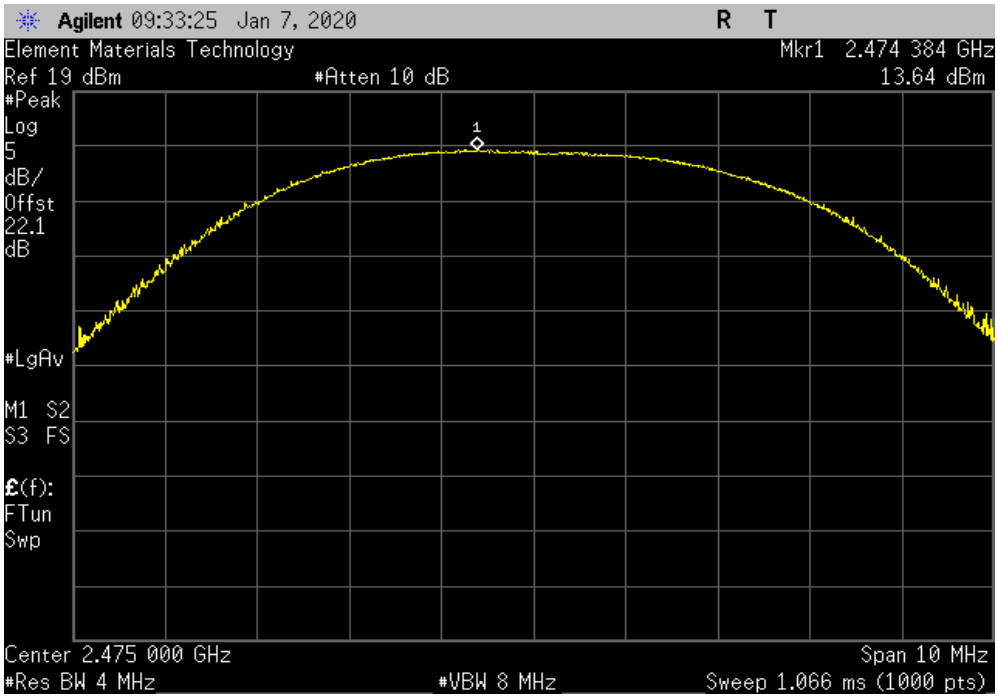
WirelessHART, Mid Channel, 2440 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		13.629	2	15.629	36	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2019.08.30.0 XMit 2019.09.05

WirelessHART, High Channel, 2475 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		13.636	2	15.636	36	Pass



BAND EDGE COMPLIANCE

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	23 °C
Attendees:	None			**Humidity:**	22.9% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

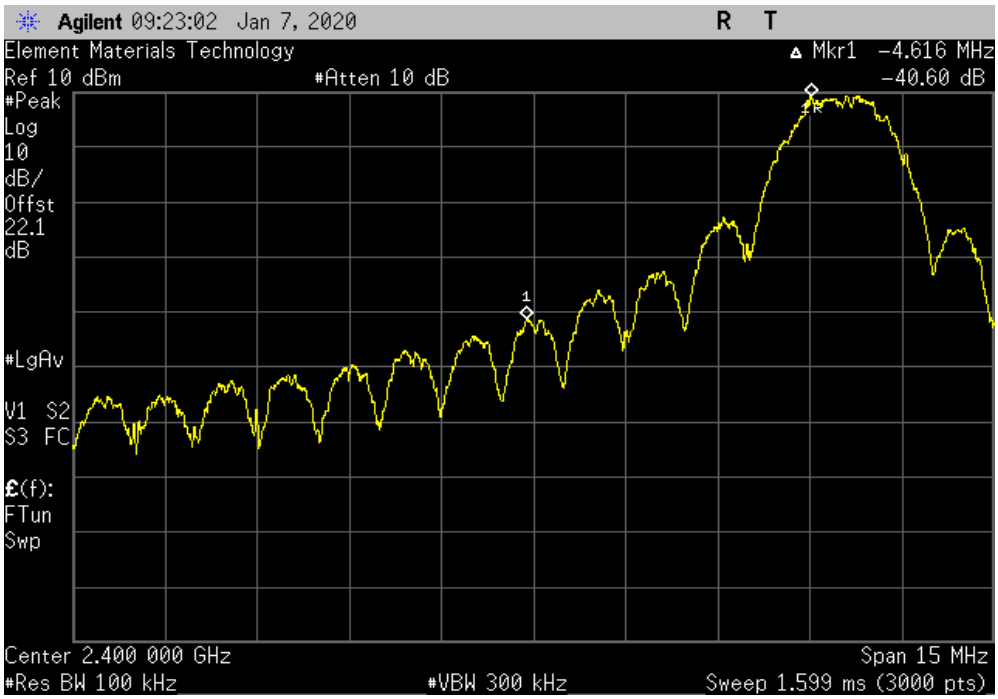
DEVIATIONS FROM TEST STANDARD

None

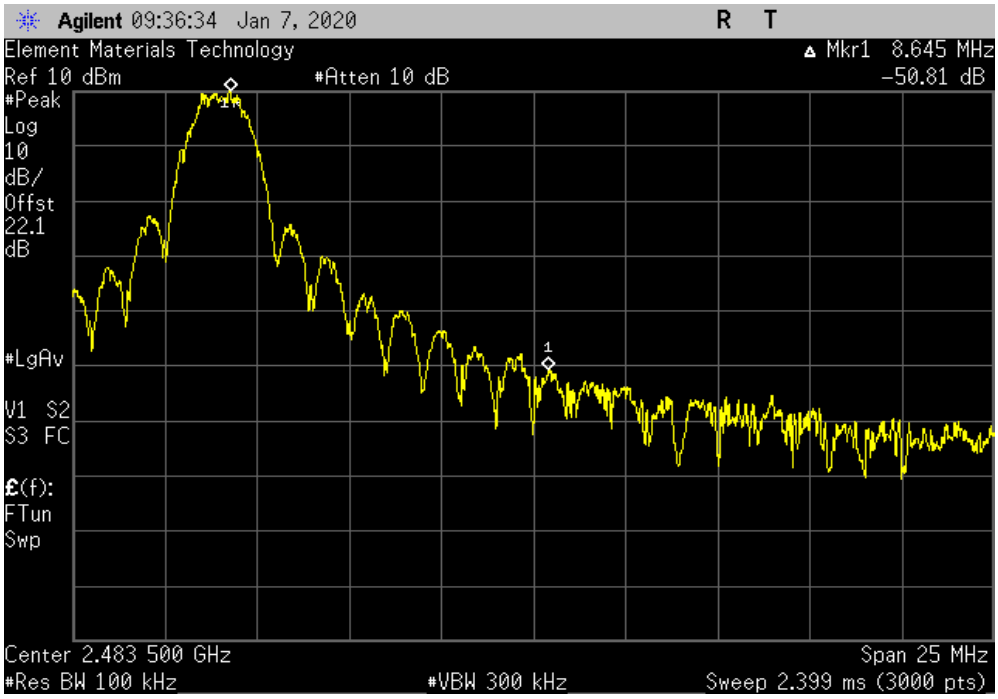
Configuration #	2	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
WirelessHART			
Low Channel, 2405 MHz	-40.6	-20	Pass
High Channel, 2475 MHz	-50.81	-20	Pass

WirelessHART, Low Channel, 2405 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-40.6	-20	Pass



WirelessHART, High Channel, 2475 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-50.81	-20	Pass



BAND EDGE COMPLIANCE -HOPPING MODE

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE -HOPPING MODE

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	8-Jan-20
Customer:	Emerson			**Temperature:**	22.5 °C
Attendees:	None			**Humidity:**	18.2% RH
Project:	None			**Barometric Pres.:**	1032 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

DEVIATIONS FROM TEST STANDARD

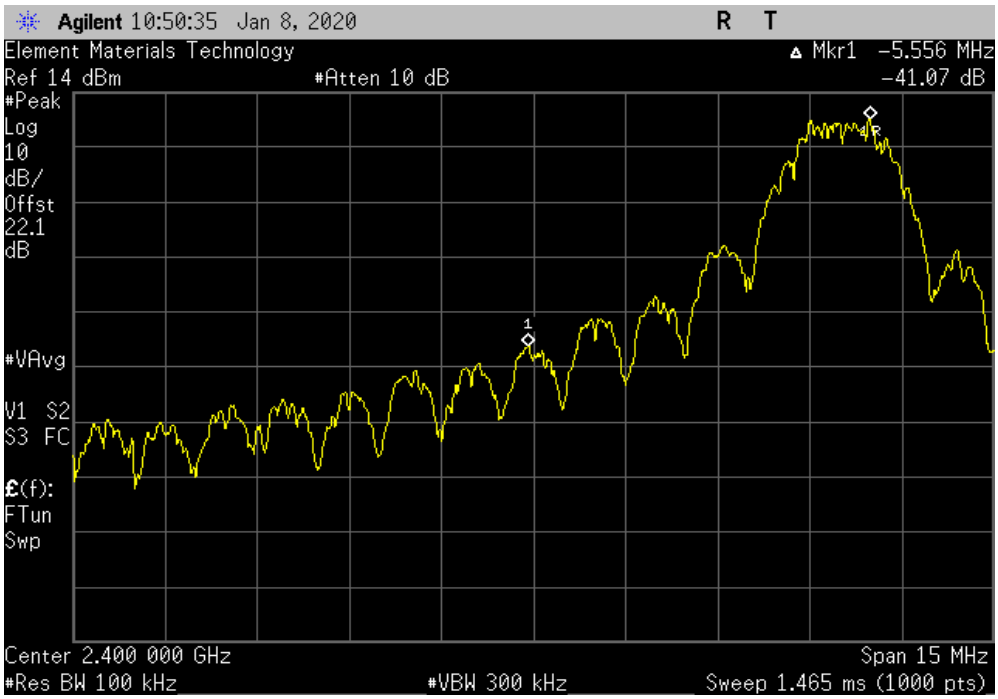
None

Configuration #	2	Signature Dustin Sparks

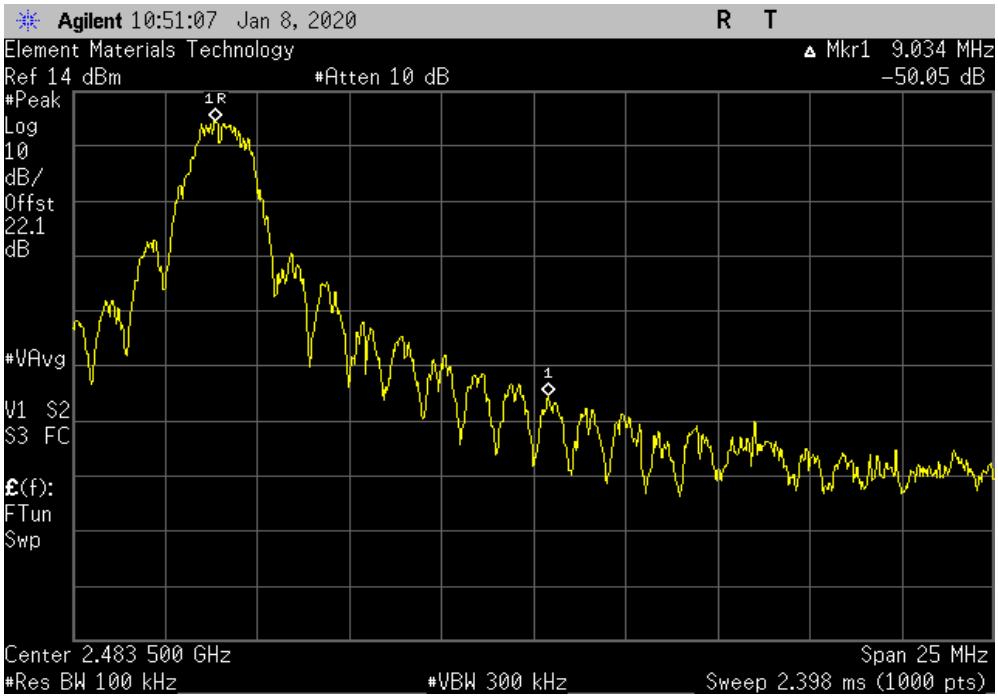
	Value (dBc)	Limit ≤ (dBc)	Result
WirelessHART, 6-Channel Hopping Mode			
Low Channel, 2405 MHz	-41.07	-20	Pass
High Channel, 2475 MHz	-50.05	-20	Pass
WirelessHART, 15-Channel Hopping Mode			
Low Channel, 2405 MHz	-40.68	-20	Pass
High Channel, 2475 MHz	-51.07	-20	Pass

BAND EDGE COMPLIANCE -HOPPING MODE

WirelessHART, 6-Channel Hopping Mode, Low Channel, 2405 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-41.07	-20	Pass

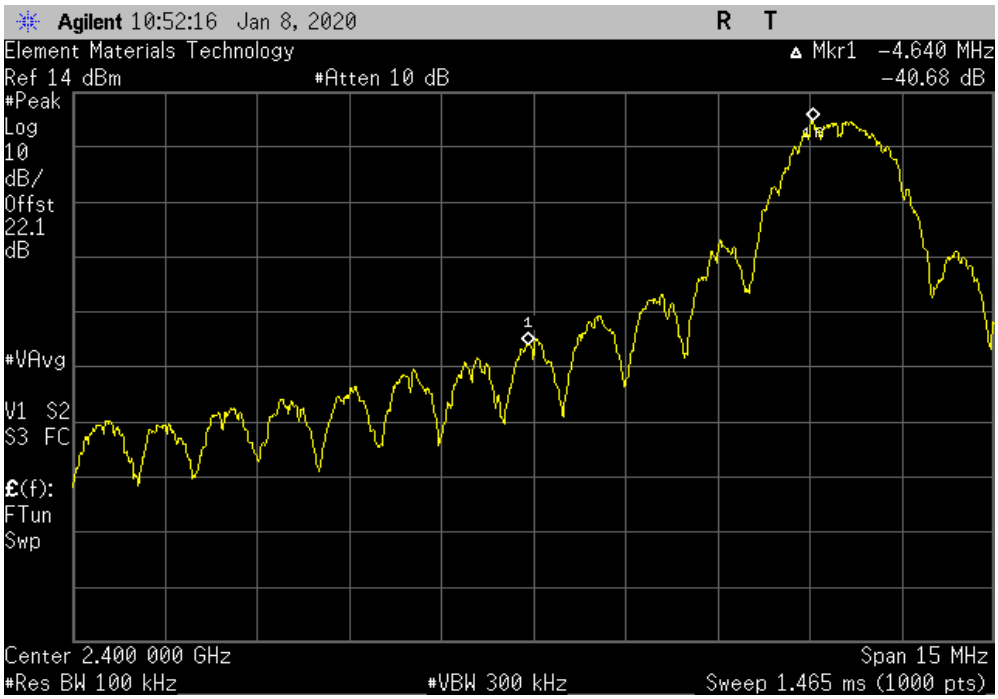


WirelessHART, 6-Channel Hopping Mode, High Channel, 2475 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-50.05	-20	Pass

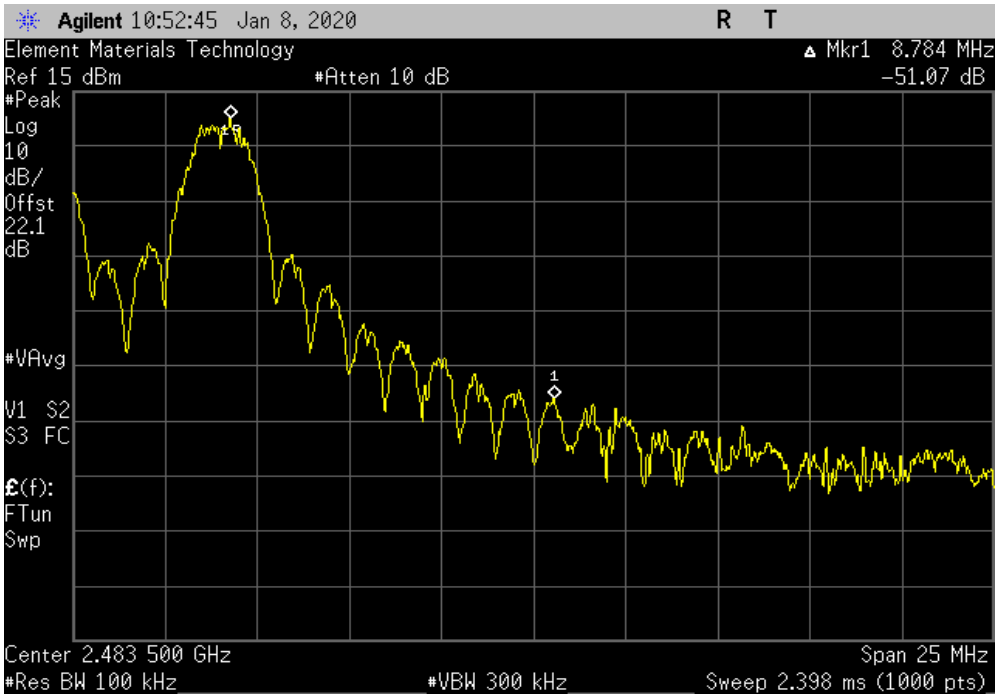


BAND EDGE COMPLIANCE -HOPPING MODE

WirelessHART, 15-Channel Hopping Mode, Low Channel, 2405 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-40.68	-20	Pass



WirelessHART, 15-Channel Hopping Mode, High Channel, 2475 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-51.07	-20	Pass



OCCUPIED BANDWIDTH

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

Per FCC KDB 558074 Section 10(b)(3), there is no requirement for hybrid systems to comply with the 500 kHz minimum 6dB bandwidth for DTS devices. The 20 dB bandwidth was taken for reference purposes.

OCCUPIED BANDWIDTH

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	10-Jan-20
Customer:	Emerson			**Temperature:**	22.1 °C
Attendees:	None			**Humidity:**	20.8% RH
Project:	None			**Barometric Pres.:**	1025 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

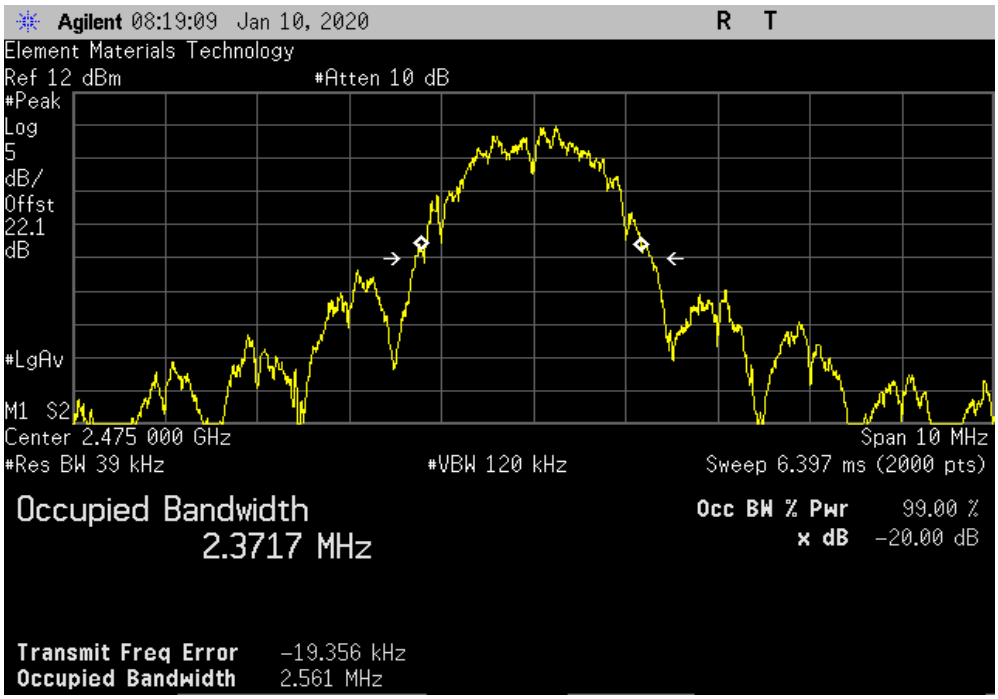
Configuration #	2	Signature

	Value	Limit (<)	Result
WirelessHART			
Low Channel, 2405 MHz	2.495 MHz	N/A	N/A
Mid Channel, 2440 MHz	2.512 MHz	N/A	N/A
High Channel, 2475 MHz	2.561 MHz	N/A	N/A

WirelessHART, Low Channel, 2405 MHz						
				Value	Limit (<)	Result
				2.495 MHz	N/A	N/A

WirelessHART, Mid Channel, 2440 MHz						
				Value	Limit (<)	Result
				2.512 MHz	N/A	N/A

WirelessHART, High Channel, 2475 MHz						
				Value	Limit (<)	Result
				2.561 MHz	N/A	N/A



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	23.3% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

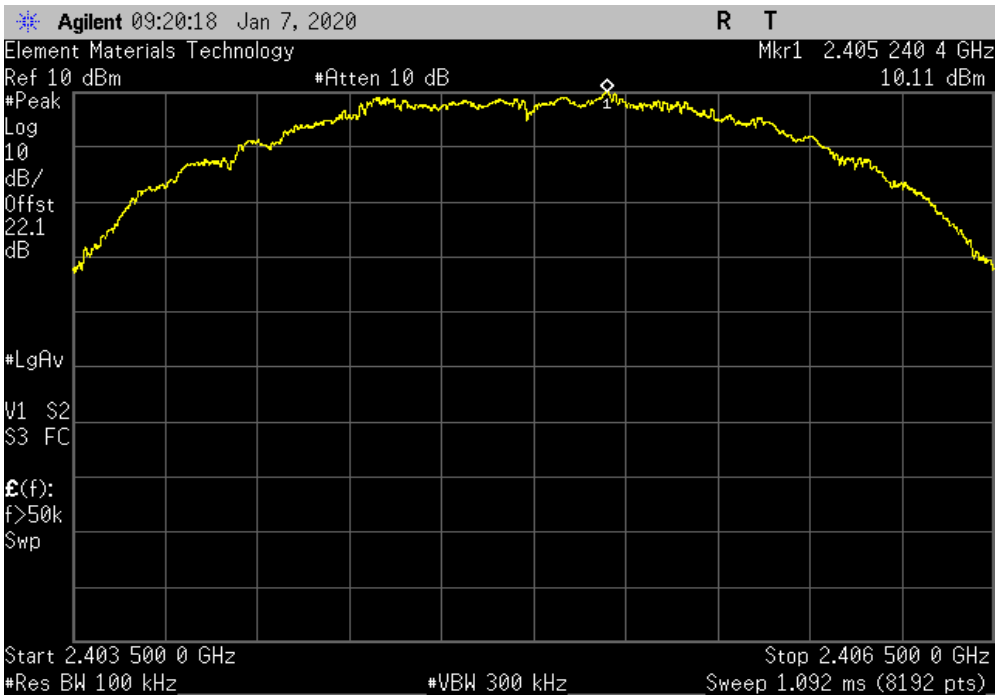
DEVIATIONS FROM TEST STANDARD

None

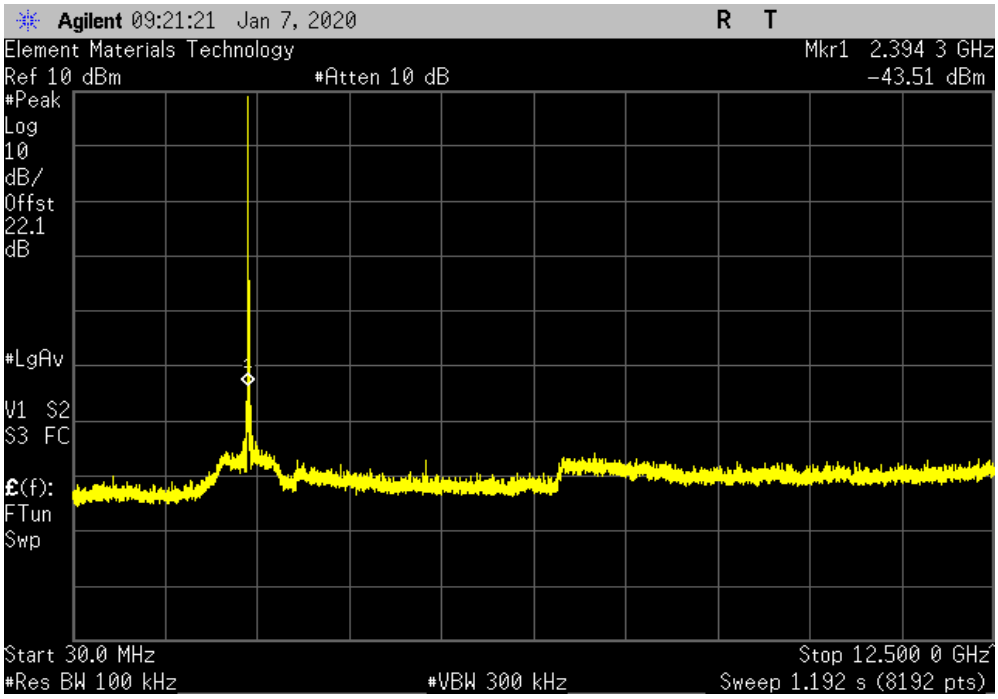
Configuration #	2	Signature

	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
WirelessHART					
Low Channel, 2405 MHz	Fundamental	2405.24	N/A	N/A	N/A
Low Channel, 2405 MHz	30 MHz - 12.5 GHz	2394.3	-53.62	-20	Pass
Low Channel, 2405 MHz	12.5 GHz - 25 GHz	14250.4	-63.37	-20	Pass
Mid Channel, 2440 MHz	Fundamental	2440.25	N/A	N/A	N/A
Mid Channel, 2440 MHz	30 MHz - 12.5 GHz	2558.7	-65.08	-20	Pass
Mid Channel, 2440 MHz	12.5 GHz - 25 GHz	14187.8	-62.5	-20	Pass
High Channel, 2475 MHz	Fundamental	2475.24	N/A	N/A	N/A
High Channel, 2475 MHz	30 MHz - 12.5 GHz	2505.4	-58.45	-20	Pass
High Channel, 2475 MHz	12.5 GHz - 25 GHz	13798.7	-62.74	-20	Pass

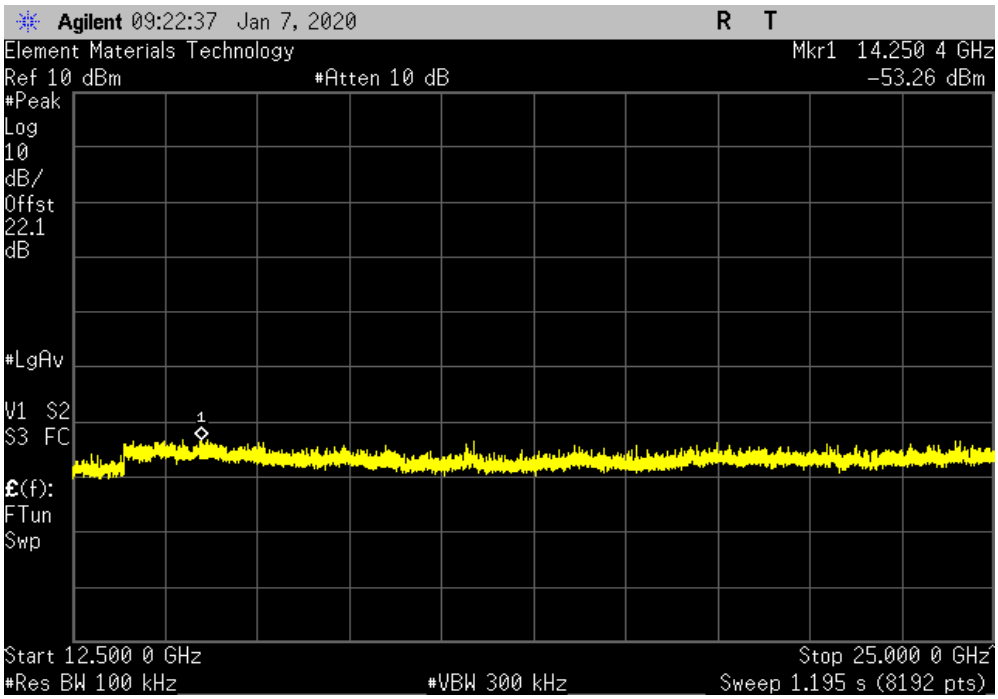
WirelessHART, Low Channel, 2405 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2405.24	N/A	N/A	N/A



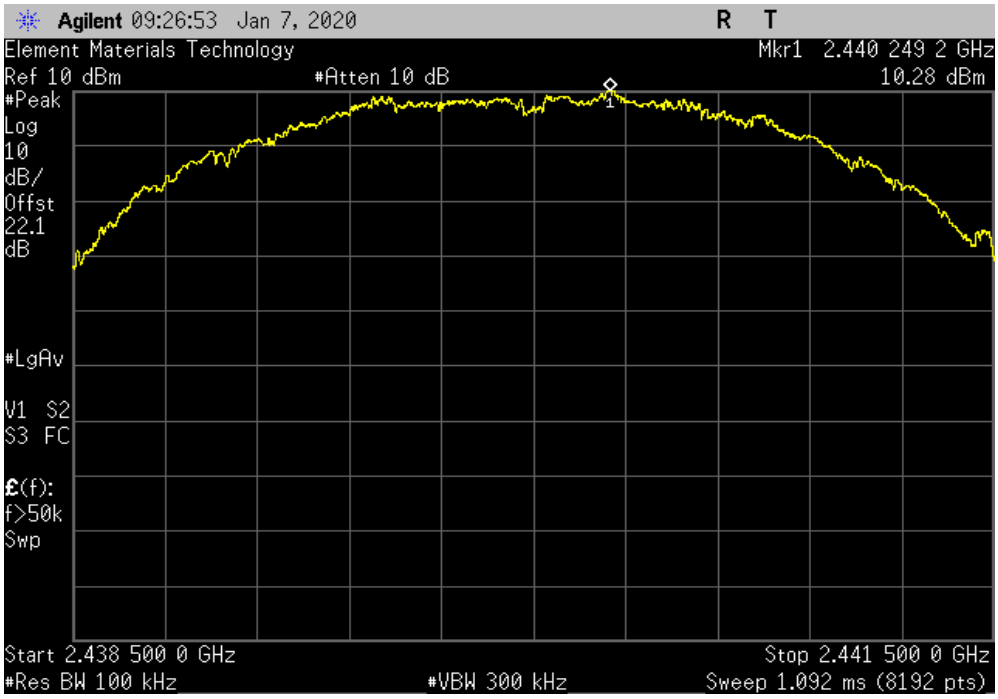
WirelessHART, Low Channel, 2405 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2394.3	-53.62	-20	Pass



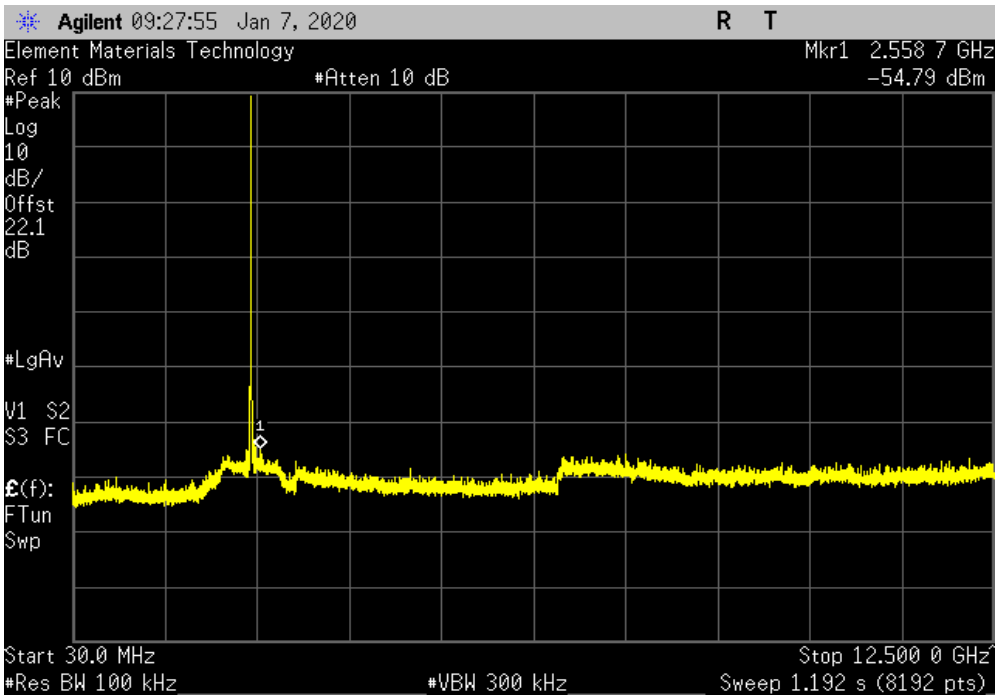
WirelessHART, Low Channel, 2405 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	14250.4	-63.37	-20	Pass



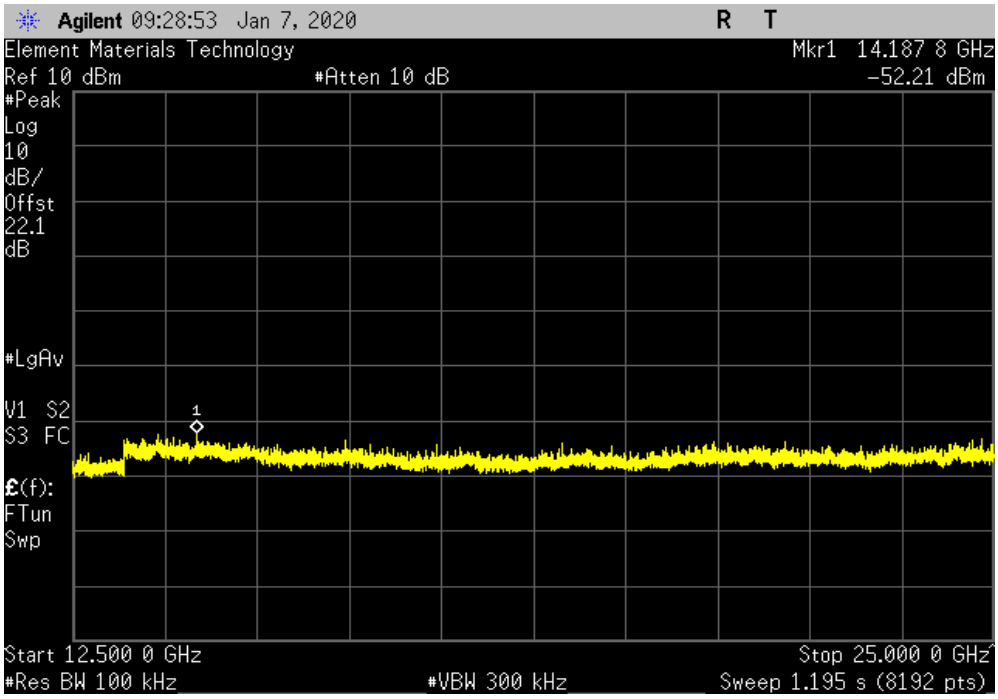
WirelessHART, Mid Channel, 2440 MHz					
Frequency Range		**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental	2440.25	N/A	N/A	N/A



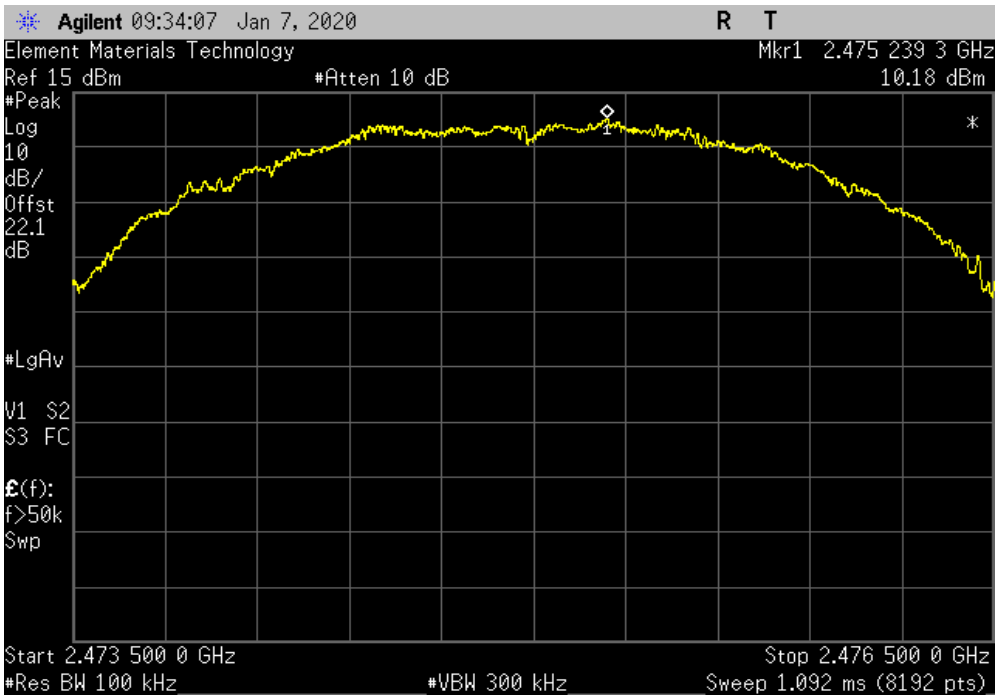
WirelessHART, Mid Channel, 2440 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	2558.7	-65.08	-20	Pass



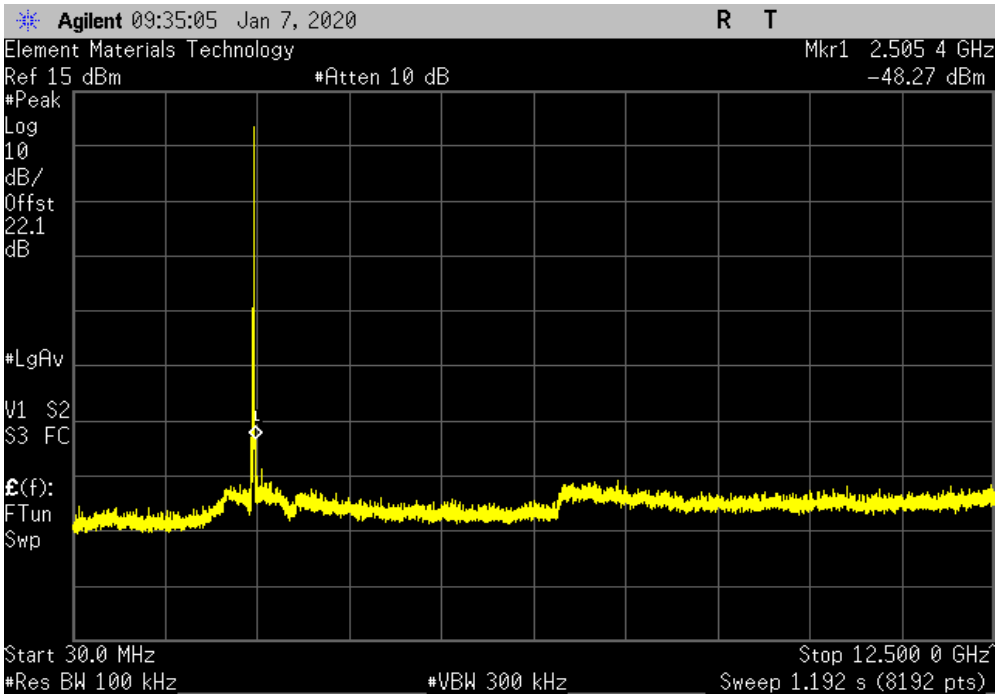
WirelessHART, Mid Channel, 2440 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	14187.8	-62.5	-20	Pass



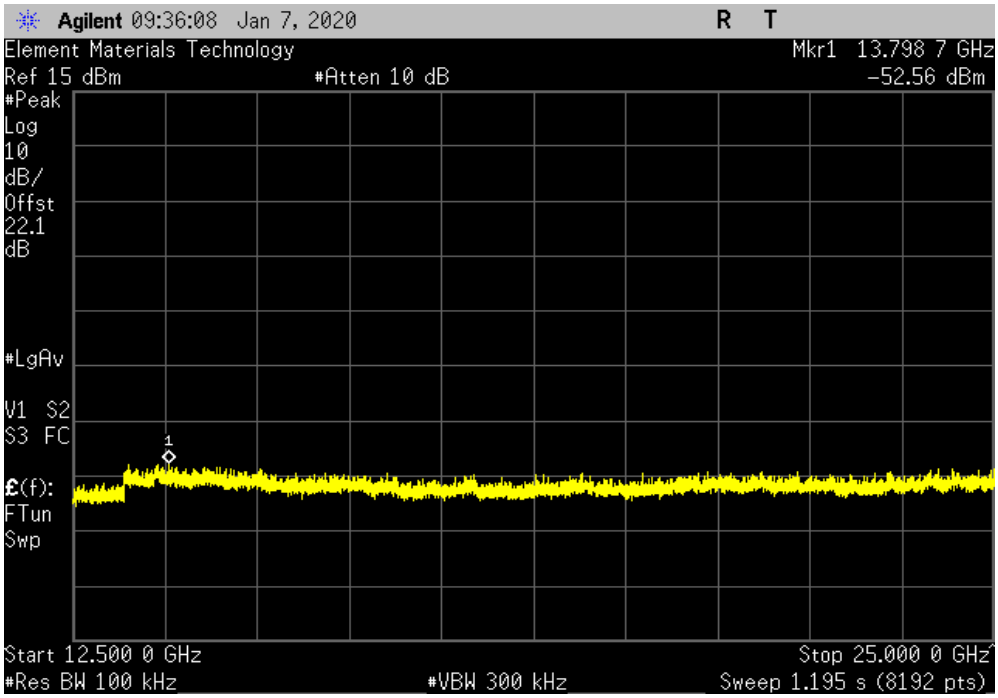
WirelessHART, High Channel, 2475 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2475.24	N/A	N/A	N/A



WirelessHART, High Channel, 2475 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2505.4	-58.45	-20	Pass



WirelessHART, High Channel, 2475 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	13798.7	-62.74	-20	Pass



POWER SPECTRAL DENSITY

XMit 2019.09.05

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
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	781SA Smart Antenna			**Work Order:**	EMPM0081
Serial Number:	3004			**Date:**	7-Jan-20
Customer:	Emerson			**Temperature:**	22.3 °C
Attendees:	None			**Humidity:**	23.2% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Dustin Sparks	**Power:**	24VDC	**Job Site:**	MN09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, DC block, 20 dB attenuator, and the EUT's SMA connection.

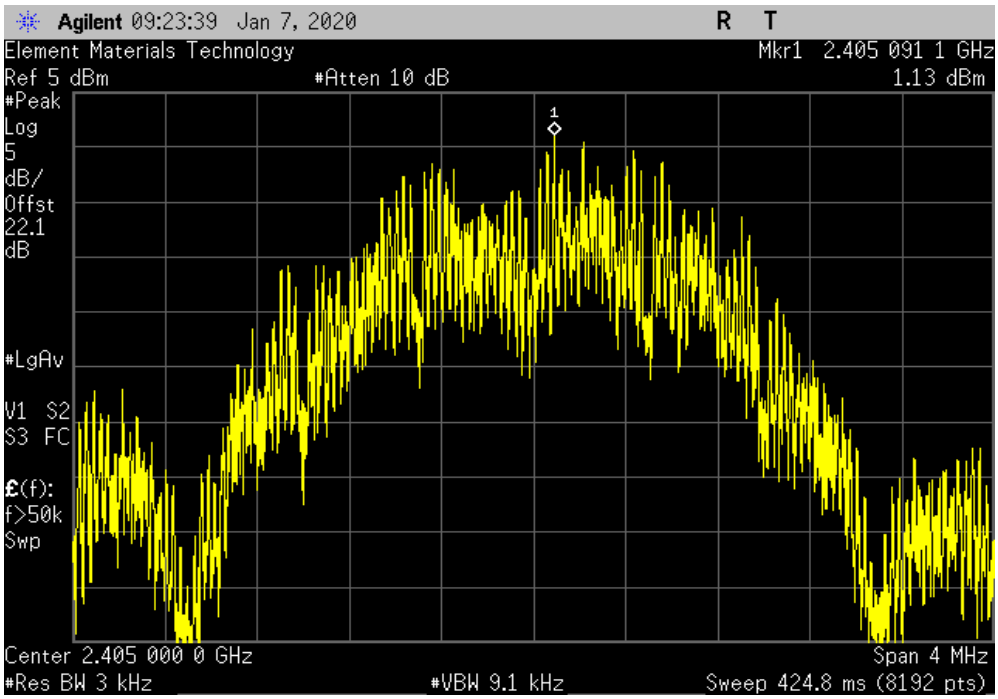
DEVIATIONS FROM TEST STANDARD

None

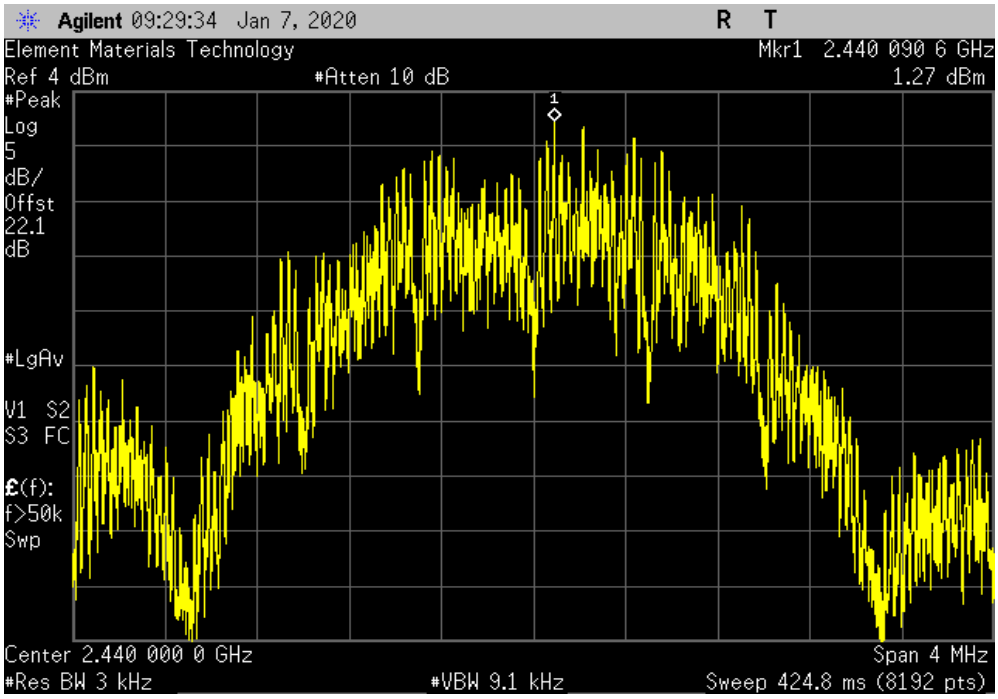
Configuration #	2	Signature Dustin Sparks

	Value dBm/3kHz	Limit < dBm/3kHz	Results
WirelessHART			
Low Channel, 2405 MHz	1.129	8	Pass
Mid Channel, 2440 MHz	1.271	8	Pass
High Channel, 2475 MHz	1.409	8	Pass

WirelessHART, Low Channel, 2405 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				1.129	8	Pass



WirelessHART, Mid Channel, 2440 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				1.271	8	Pass



POWER SPECTRAL DENSITY

WirelessHART, High Channel, 2475 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				1.409	8	Pass