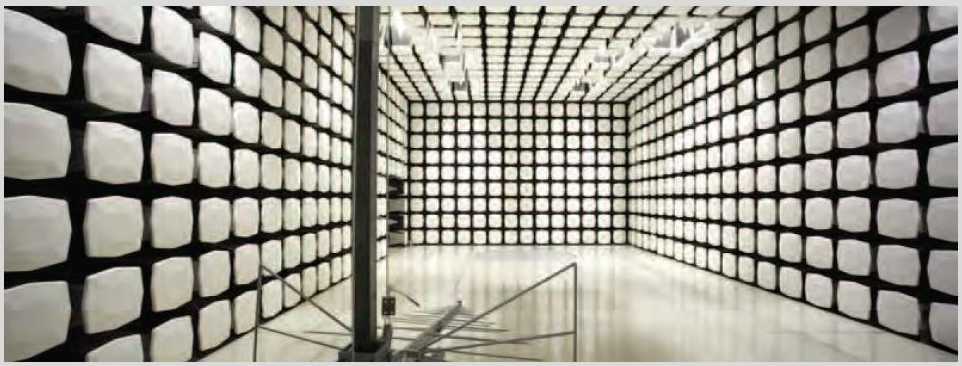
TURCK Inc.

PD67 Handheld RFID Reader

FCC 15.225:2020

13.56 MHz Radio

Report # TURC0061.3 Rev. 1



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: November 22, 2019
TURCK Inc.
EUT: PD67 Handheld RFID Reader

Radio Equipment Testing

Standards

Specification	Method
FCC 15.225:2019	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Field Strength of Spurious Emissions Less Than 30 MHz	Yes	Pass	
6.5	Field Strength of Spurious Emissions Greater Than 30 MHz	Yes	Pass	
6.8	Frequency Stability	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
01	Corrected typo on Output Power units	2020-08-19	8
	Updated configurations to PD67-UNI-NA-RSWBG model (indicates barcode included) for clarity	2020-08-19	9
	Added Power Settings table	2020-08-19	12
	Changed serial number on data module to match configuration	2020-08-19	29

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

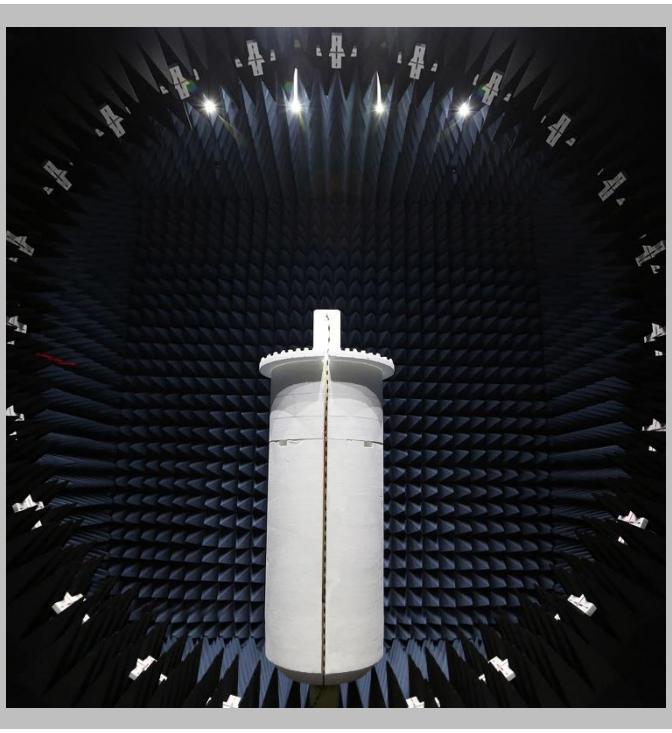
MIC – Recognized by MIC as a CAB for the acceptance of test data.

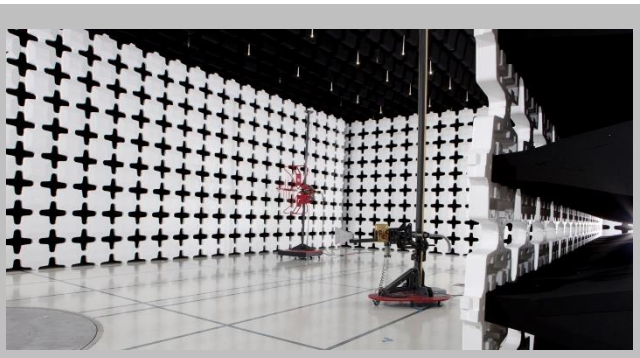
SCOPE

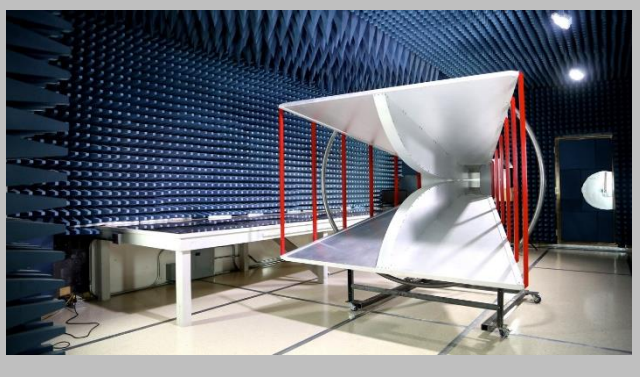
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

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







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

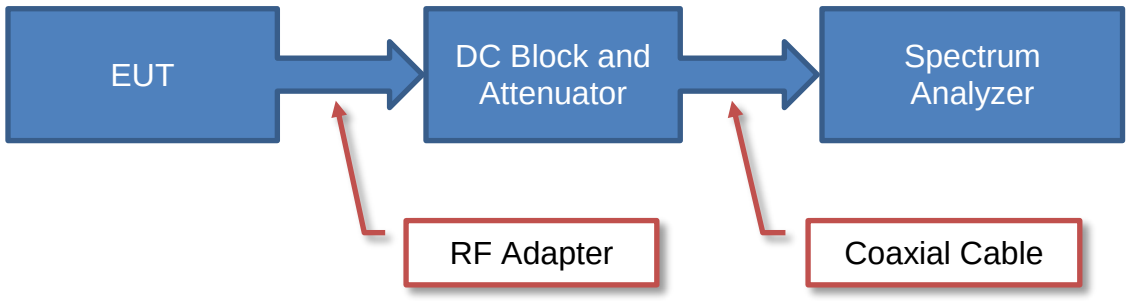
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

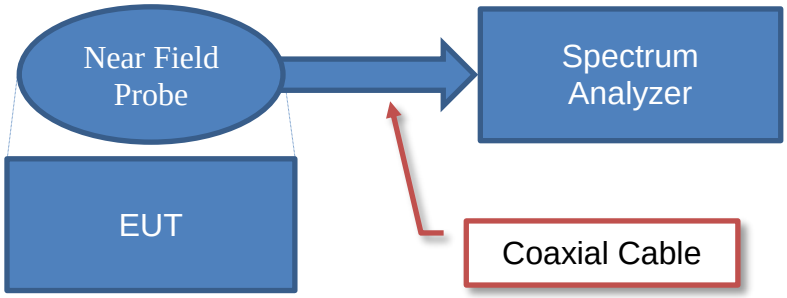
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

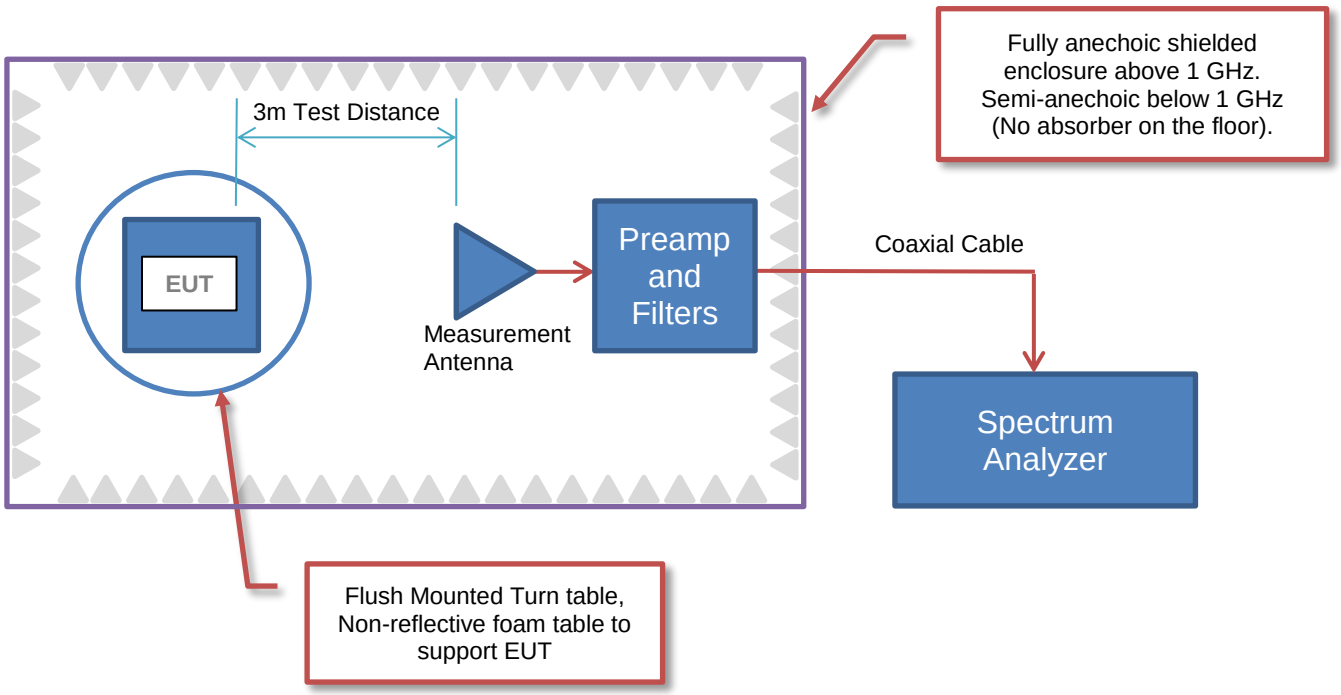
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	TURCK Inc.
Address:	3000 Campus Dr
City, State, Zip:	Plymouth, MN 55441
Test Requested By:	Gabe Selinger
EUT:	PD67 Handheld RFID Reader
First Date of Test:	November 20, 2019
Last Date of Test:	November 22, 2019
Receipt Date of Samples:	November 11, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
PD67 is a battery operated, handheld device for reading HF and UHF RFID tags, as well as barcodes. It is capable of WiFi communication, and has a USB C interface for battery charging and communication. When transmitting for RFID reading, it has a max output power of about 30dBm. Its duty cycle while transmitting is NOT constant (it is calculated and adjusted every time based on factors such as tag response and reflected power). The user interfaces with the device via 3 buttons, as well as a capacitive touch LCD. The device runs Android as its operating system. The barcode scanner contains a linear LED for aiming purposes, but there is NOT a laser. The battery is Lithium Ion. The device also has GPS capability, via an internal on-board antenna.

Testing Objective:
To demonstrate compliance to FCC Part 15.225 specifications.

CONFIGURATIONS

Configuration TURC0058- 5

Software/Firmware Running during test	
Description	**Version**
Firmware	1.19.6

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Handheld RFID Reader	TURCK Inc.	PD67-UNI-NA-RSWBG	T2

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/DC power adapter	Phihong	AQ15A-050A	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB-C to USB-C	Yes	1m	None	Handheld RFID Reader	AC/DC power adapter

Configuration TURC0058- 6

Software/Firmware Running during test	
Description	**Version**
Firmware	1.19.6

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Handheld RFID Reader	TURCK Inc.	PD67-UNI-NA-RSWBG	T2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Multimeter	Fluke	114	MMU
DC Power Supply	Agilent	U8002A	TPZ

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Cable	No	1.8 m	No	AC Mains	DC Power Supply
DC Leads (x2)	No	0.5 m	No	DC Power Supply	Multimeter
DC Leads (x2)	No	1.0 m	No	DC Power Supply	Handheld RFID Reader

CONFIGURATIONS

Configuration TURC0058- 12

Software/Firmware Running during test	
Description	**Version**
Firmware	1.19.17

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Handheld RFID Reader	TURCK Inc.	PD67-UNI-NA-RSWBG	T4

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/DC power adapter	CUI Inc	SWC15-55-NB	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB-C to USB-C	Yes	1m	None	Handheld RFID Reader	AC/DC power adapter

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-11-20	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-11-20	Field Strength of Spurious Emissions Less Than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-11-20	Field Strength of Spurious Emissions Greater Than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-11-21	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.
5	2019-11-22	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS

No adjustable power settings were provided. The EUT was tested using power settings pre-defined by the manufacturer.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

TEST DESCRIPTION

The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT.

The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.10.

In the event that the operating frequency of 13.56 MHz is causing the product to fail the FCC 15.207 limits, the following guidance can be used:

In the FCC-TCBC Conference Call Meeting Minutes from April 12, 2005, the FCC stated:

"We are willing to accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions. First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band, and then retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. For the second portion of these tests, only the fundamental emission band of the transmitter needs to be retested."

This procedure was followed for the AC powerline conducted emissions testing documented on the following pages.

Per the FCC Guidance, the FCC will accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions. (1) First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band, and then retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. (2) For the second portion of these tests, only the fundamental emission band of the transmitter needs to be retested.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15
Receiver	Rohde & Schwarz	ESR7	ARI	2019-07-08	2020-07-08

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

TURC0058-5

MODES INVESTIGATED

Transmitting at 13.56 MHz; Charging
Reading tags, Transmitting at 13.56 MHz; Charging

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

EUT:	PD67 Handheld RFID Reader	Work Order:	TURC0058
Serial Number:	T2	Date:	2019-11-21
Customer:	TURCK Inc.	Temperature:	22.1°C
Attendees:	Gabe Selinger, Matt Wickstron	Relative Humidity:	31.7%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TURC0058-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	15	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

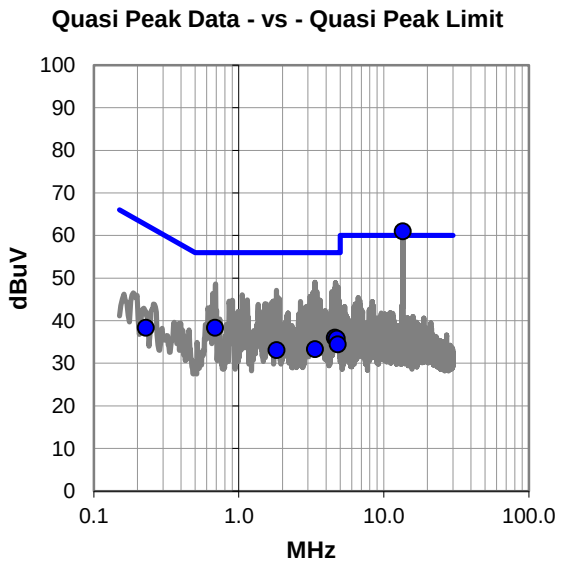
Firmware 1.19.6

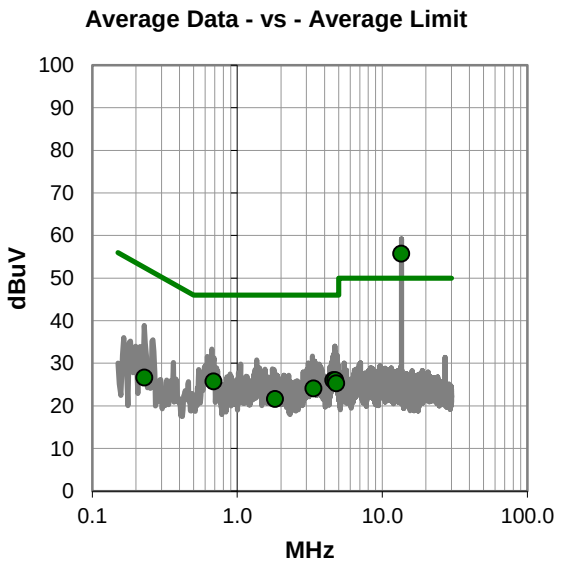
EUT OPERATING MODES

Reading tags, Transmitting at 13.56 MHz; Charging

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #15

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	40.1	20.9	61.0	60.0	1.0
0.685	17.7	20.6	38.3	56.0	-17.7
4.594	15.3	20.7	36.0	56.0	-20.0
4.735	15.1	20.7	35.8	56.0	-20.2
4.827	13.8	20.6	34.4	56.0	-21.6
3.351	12.5	20.8	33.3	56.0	-22.7
1.820	12.5	20.6	33.1	56.0	-22.9
0.228	17.6	20.7	38.3	62.5	-24.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	34.8	20.9	55.7	50.0	5.7
4.594	5.3	20.7	26.0	46.0	-20.0
4.735	5.3	20.7	26.0	46.0	-20.0
0.685	5.1	20.6	25.7	46.0	-20.3
4.827	4.7	20.6	25.3	46.0	-20.7
3.351	3.3	20.8	24.1	46.0	-21.9
1.820	1.0	20.6	21.6	46.0	-24.4
0.228	5.9	20.7	26.6	52.5	-25.9

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

EUT:	PD67 Handheld RFID Reader	Work Order:	TURC0058
Serial Number:	T2	Date:	2019-11-21
Customer:	TURCK Inc.	Temperature:	22.1°C
Attendees:	Gabe Selinger, Matt Wickstron	Relative Humidity:	31.7%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TURC0058-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	18	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Firmware 1.19.6; Antenna disconnected and left as open circuit

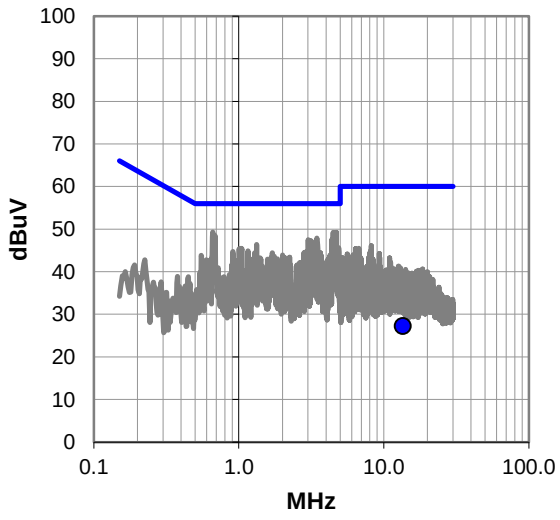
EUT OPERATING MODES

Transmitting at 13.56 MHz; Charging

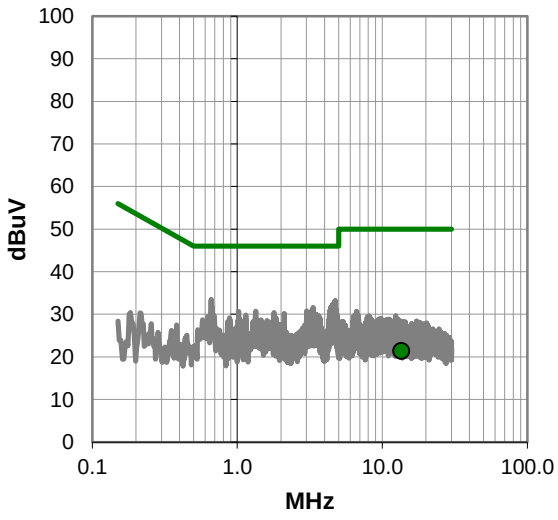
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #18

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.564	6.3	20.9	27.2	60.0	-32.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.564	0.5	20.9	21.4	50.0	-28.6

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

EUT:	PD67 Handheld RFID Reader	Work Order:	TURC0058
Serial Number:	T2	Date:	2019-11-21
Customer:	TURCK Inc.	Temperature:	22.1°C
Attendees:	Gabe Selinger, Matt Wickstron	Relative Humidity:	31.7%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TURC0058-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	16	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

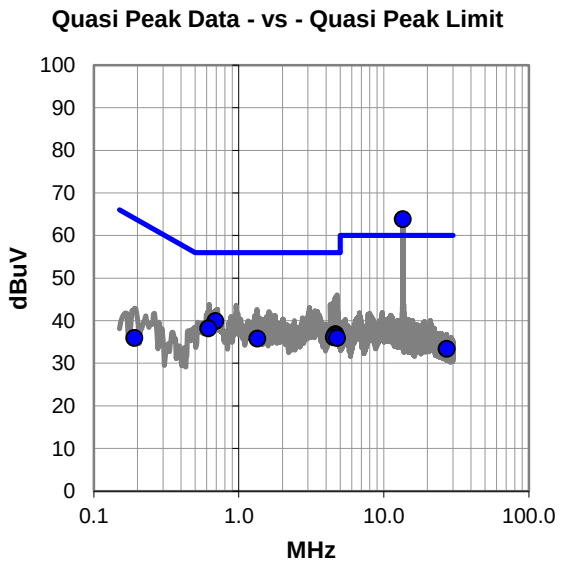
Firmware 1.19.6

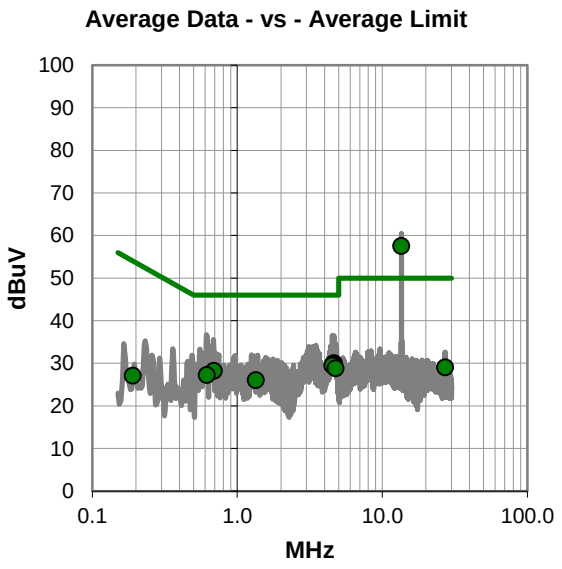
EUT OPERATING MODES

Reading tags, Transmitting at 13.56 MHz; Charging

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #16

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	42.9	20.9	63.8	60.0	3.8
0.690	19.3	20.6	39.9	56.0	-16.1
0.617	17.7	20.5	38.2	56.0	-17.8
4.639	16.1	20.7	36.8	56.0	-19.2
4.579	15.8	20.7	36.5	56.0	-19.5
4.523	15.4	20.7	36.1	56.0	-19.9
4.763	15.2	20.7	35.9	56.0	-20.1
1.346	15.2	20.6	35.8	56.0	-20.2
27.120	12.1	21.3	33.4	60.0	-26.6
0.190	15.0	20.9	35.9	64.0	-28.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	36.6	20.9	57.5	50.0	7.5
4.639	9.3	20.7	30.0	46.0	-16.0
4.579	9.0	20.7	29.7	46.0	-16.3
4.523	8.8	20.7	29.5	46.0	-16.5
4.763	8.1	20.7	28.8	46.0	-17.2
0.690	7.6	20.6	28.2	46.0	-17.8
0.617	6.7	20.5	27.2	46.0	-18.8
1.346	5.4	20.6	26.0	46.0	-20.0
27.120	7.7	21.3	29.0	50.0	-21.0
0.190	6.2	20.9	27.1	54.0	-26.9

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

EUT:	PD67 Handheld RFID Reader	Work Order:	TURC0058
Serial Number:	T2	Date:	2019-11-21
Customer:	TURCK Inc.	Temperature:	22.1°C
Attendees:	Gabe Selinger, Matt Wickstron	Relative Humidity:	31.7%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TURC0058-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	17	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Firmware 1.19.6; Antenna disconnected and left as open circuit

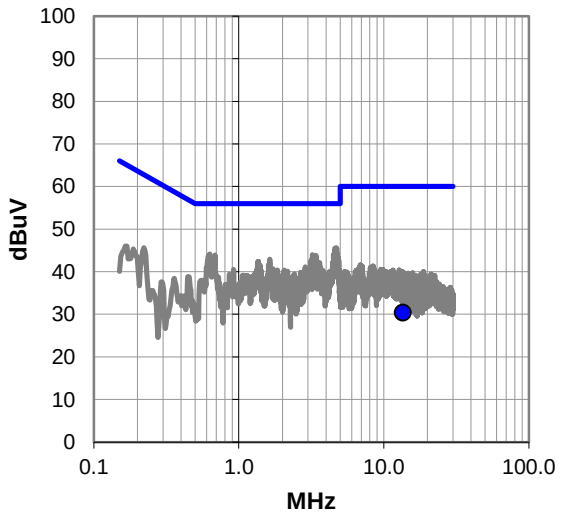
EUT OPERATING MODES

Transmitting at 13.56 MHz; Charging

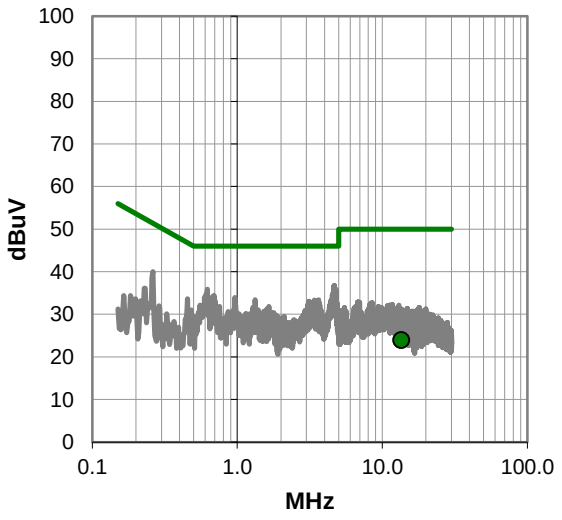
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.4.24.1

RESULTS - Run #17

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.556	9.5	20.9	30.4	60.0	-29.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.556	3.0	20.9	23.9	50.0	-26.1

CONCLUSION

Pass

Tested By

FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2019.05.10

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

MODES OF OPERATION

Reading tags, transmitting at 13.56 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

TURC0058 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	12.8 MHz	Stop Frequency	14.4 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
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	16-Feb-2019	12 mo
Antenna - Loop	ETS Lindgren	6502	AOB	21-May-2019	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-2019	12 mo

TEST DESCRIPTION

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

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

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

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

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

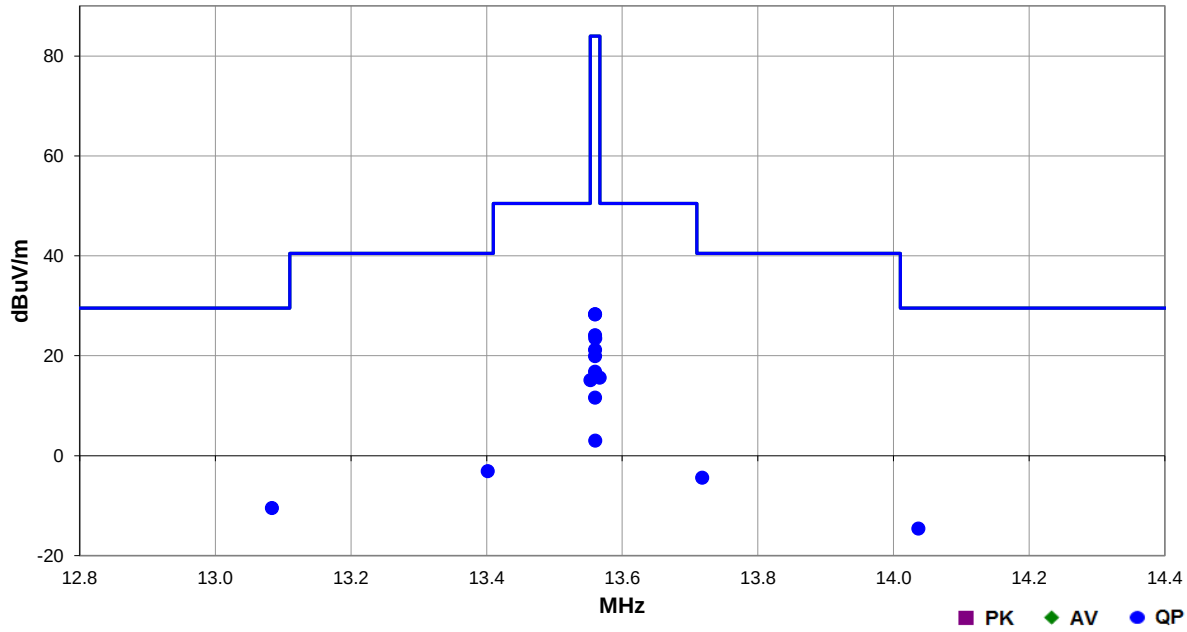
FIELD STRENGTH OF FUNDAMENTAL

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	TURC0058	**Date:**	20-Nov-2019		
Project:	None	**Temperature:**	22.2 °C		
Job Site:	MN04	**Humidity:**	33.1% RH		
Serial Number:	T2	**Barometric Pres.:**	1017 mbar	**Tested by:**	Andrew Rogstad, Glen Creuziger
EUT:	PD67 Handheld RFID Reader				
Configuration:	5				
Customer:	TURCK Inc.				
Attendees:	Gabe Selinger, Matt Wickstron				
EUT Power:	110VAC/60Hz				
Operating Mode:	Reading tags, transmitting at 13.56 MHz				
Deviations:	None				
Comments:	Firmware 1.19.6, See data comments for receive antenna orientation and EUT orientation				

Test Specifications	**Test Method**
FCC 15.225:2019	ANSI C63.10:2013

Run #	6	**Test Distance (m)**	3	**Antenna Height(s)**	1(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
13.553	44.1	11.0	1.0	68.0	3.0	0.0	Para EUT	QP	-40.0	15.1	50.5	-35.4	EUT on side
13.083	18.5	11.0	1.0	73.0	3.0	0.0	Para EUT	QP	-40.0	-10.5	29.5	-40.0	EUT on side
13.402	25.9	11.0	1.0	287.0	3.0	0.0	Para EUT	QP	-40.0	-3.1	40.5	-43.6	EUT on side
14.037	14.4	11.0	1.0	93.0	3.0	0.0	Para EUT	QP	-40.0	-14.6	29.5	-44.1	EUT on side
13.718	24.6	11.0	1.0	281.0	3.0	0.0	Para EUT	QP	-40.0	-4.4	40.5	-44.9	EUT on side
13.560	57.3	11.0	1.0	275.0	3.0	0.0	Para EUT	QP	-40.0	28.3	84.0	-55.7	EUT on side
13.560	57.3	11.0	1.0	273.0	3.0	0.0	Para EUT	QP	-40.0	28.3	84.0	-55.7	EUT vert
13.560	53.1	11.0	1.0	167.0	3.0	0.0	Perp EUT	QP	-40.0	24.1	84.0	-59.9	EUT vert
13.560	52.5	11.0	1.0	173.0	3.0	0.0	Perp EUT	QP	-40.0	23.5	84.0	-60.5	EUT on side
13.560	50.2	11.0	1.0	72.0	3.0	0.0	Para GND	QP	-40.0	21.2	84.0	-62.8	EUT vert
13.560	48.9	11.0	1.0	71.0	3.0	0.0	Para GND	QP	-40.0	19.9	84.0	-64.1	EUT on side
13.560	45.8	11.0	1.0	347.0	3.0	0.0	Para GND	QP	-40.0	16.8	84.0	-67.2	EUT horz
13.567	44.6	11.0	1.0	68.0	3.0	0.0	Para EUT	QP	-40.0	15.6	84.0	-68.4	EUT on side
13.560	40.6	11.0	1.0	269.0	3.0	0.0	Para EUT	QP	-40.0	11.6	84.0	-72.4	EUT horz
13.560	32.0	11.0	1.0	211.0	3.0	0.0	Perp EUT	QP	-40.0	3.0	84.0	-81.0	EUT horz

FIELD STRENGTH ON SPURIOUS EMISSIONS LESS THAN 30 MHz

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

Reading tags, transmitting at 13.56 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

TURC0058 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	490 kHz	Stop Frequency	30 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
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	16-Feb-2019	12 mo
Antenna - Loop	ETS Lindgren	6502	AOB	21-May-2019	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-2019	12 mo

TEST DESCRIPTION

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

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

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). An active loop antenna was 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

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

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

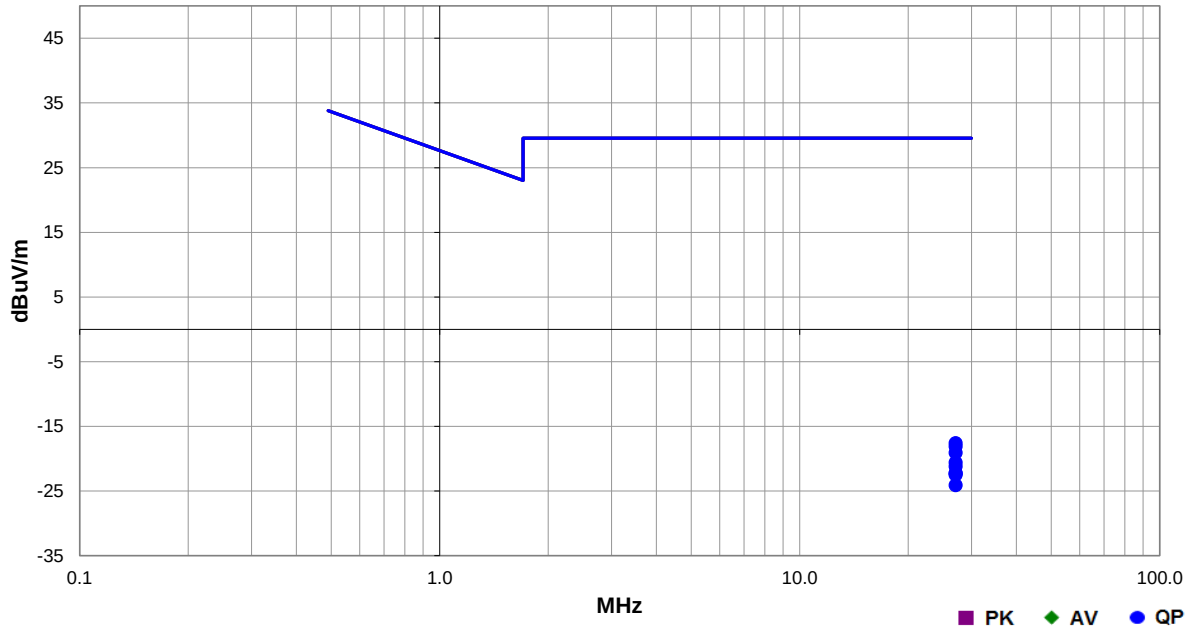
FIELD STRENGTH ON SPURIOUS EMISSIONS LESS THAN 30 MHz

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	TURC0058	**Date:**	20-Nov-2019		
Project:	None	**Temperature:**	22.2 °C		
Job Site:	MN04	**Humidity:**	33.6% RH		
Serial Number:	T2	**Barometric Pres.:**	1016 mbar	**Tested by:**	Andrew Rogstad, Glen Creuziger
EUT:	PD67 Handheld RFID Reader				
Configuration:	5				
Customer:	TURCK Inc.				
Attendees:	Gabe Selinger, Matt Wickstron				
EUT Power:	110VAC/60Hz				
Operating Mode:	Reading tags, transmitting at 13.56 MHz				
Deviations:	None				
Comments:	Firmware 1.19.6, See data comments for receive antenna orientation and EUT orientation.				

Test Specifications	**Test Method**
FCC 15.225:2019	ANSI C63.10:2013

Run #	10	**Test Distance (m)**	3	**Antenna Height(s)**	1(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
27.120	12.8	9.6	1.0	224.0	3.0	0.0	Perp EUT	QP	-40.0	-17.6	29.5	-47.1	EUT on side
27.120	12.3	9.6	1.0	213.0	3.0	0.0	Perp EUT	QP	-40.0	-18.1	29.5	-47.6	EUT horz
27.120	11.3	9.6	1.0	65.0	3.0	0.0	Perp EUT	QP	-40.0	-19.1	29.5	-48.6	EUT vert
27.120	9.8	9.6	1.0	118.0	3.0	0.0	Para EUT	QP	-40.0	-20.6	29.5	-50.1	EUT on side
27.119	9.2	9.6	1.0	140.0	3.0	0.0	Para EUT	QP	-40.0	-21.2	29.5	-50.7	EUT horz
27.120	8.2	9.6	1.0	64.0	3.0	0.0	Para GND	QP	-40.0	-22.2	29.5	-51.7	EUT on side
27.120	8.1	9.6	1.0	128.0	3.0	0.0	Para EUT	QP	-40.0	-22.3	29.5	-51.8	EUT vert
27.120	7.9	9.6	1.0	117.0	3.0	0.0	Para GND	QP	-40.0	-22.5	29.5	-52.0	EUT horz
27.122	6.3	9.6	1.0	314.0	3.0	0.0	Para GND	QP	-40.0	-24.1	29.5	-53.6	EUT vert

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

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 at 13.56 MHz

POWER SETTINGS INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

TURC0058 - 12

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	18-Oct-2019	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	5-Apr-2019	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	18-Oct-2019	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo

TEST DESCRIPTION

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

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 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.

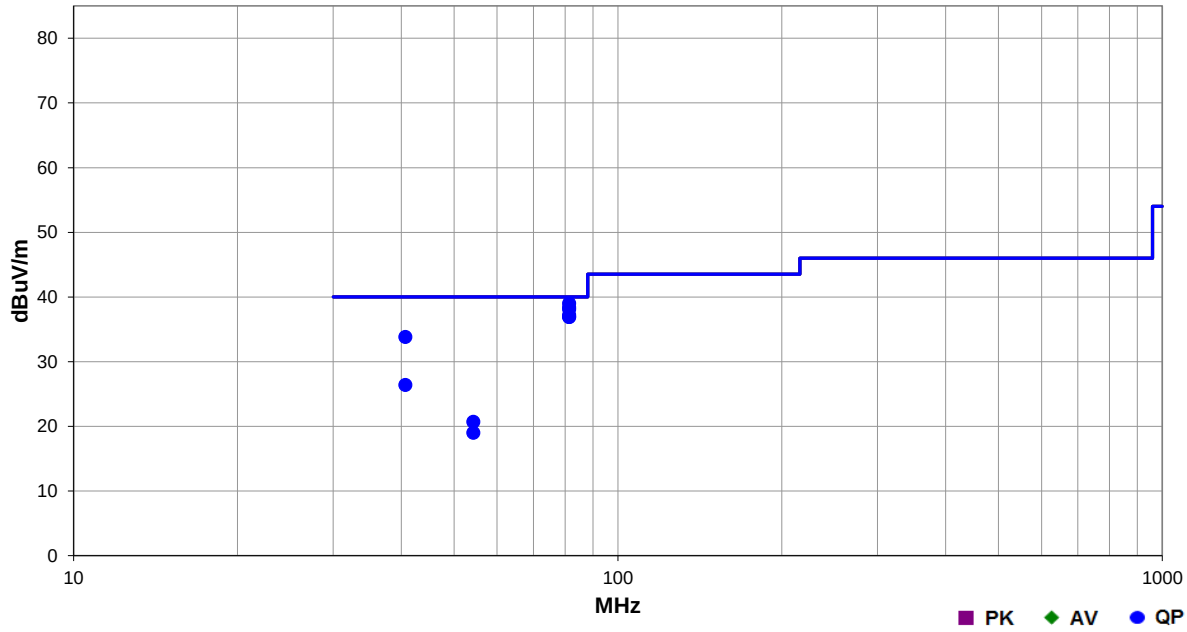
FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	TURC0058	**Date:**	20-Dec-2019		
Project:	None	**Temperature:**	22.7 °C		
Job Site:	MN05	**Humidity:**	20.3% RH		
Serial Number:	T04	**Barometric Pres.:**	1023 mbar	**Tested by:**	Andrew Rogstad
EUT:	PD67 Handheld RFID Reader				
Configuration:	12				
Customer:	TURCK Inc.				
Attendees:	Gabe Selinger, Matt Wickstrom				
EUT Power:	120VAC/60Hz				
Operating Mode:	Transmitting at 13.56 MHz				
Deviations:	None				
Comments:	Rev C baseboard, FW 1.19.17 (2.2.1).				

Test Specifications	**Test Method**
FCC 15.225:2019	ANSI C63.10:2013

Run #	133	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
81.367	48.7	-9.7	1.0	119.0	3.0	0.0	Vert	QP	0.0	39.0	40.0	-1.0	EUT horz
81.363	48.1	-9.7	1.0	74.9	3.0	0.0	Vert	QP	0.0	38.4	40.0	-1.6	EUT vert
81.362	47.8	-9.7	1.0	72.1	3.0	0.0	Vert	QP	0.0	38.1	40.0	-1.9	EUT on side
81.363	46.9	-9.7	2.33	161.0	3.0	0.0	Horz	QP	0.0	37.2	40.0	-2.8	EUT on side
81.365	46.6	-9.7	4.0	333.0	3.0	0.0	Horz	QP	0.0	36.9	40.0	-3.1	EUT horz
81.363	46.6	-9.7	3.95	357.0	3.0	0.0	Horz	QP	0.0	36.9	40.0	-3.1	EUT vert
40.685	33.4	0.4	2.84	55.1	3.0	0.0	Horz	QP	0.0	33.8	40.0	-6.2	EUT on side
40.692	26.0	0.4	1.0	124.0	3.0	0.0	Vert	QP	0.0	26.4	40.0	-13.6	EUT horz
54.245	26.4	-5.7	1.0	207.0	3.0	0.0	Vert	QP	0.0	20.7	40.0	-19.3	EUT horz
54.238	24.7	-5.7	3.39	232.0	3.0	0.0	Horz	QP	0.0	19.0	40.0	-21.0	EUT on side

FREQUENCY STABILITY

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
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20

TEST DESCRIPTION

A near-field probe was placed near the transmitter. A low-loss coaxial cable was used to connect the near-field probe to the spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made on the single transmit frequency as called out on the data sheets. Testing was done while the EUT was continuously polling.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage while at ambient temperature. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range of -20 ° to +50° C and at 10°C intervals.

The requirement of a frequency tolerance of ±0.01% is equivalent to 100 ppm
The formula to check for compliance is:

ppm = (Measured Frequency / Measured Nominal Frequency - 1) * 1,000,000

FREQUENCY STABILITY

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**PD67 Handheld RFID Reader**			**Work Order:**	**TURC0058**
Serial Number:	**T2**			**Date:**	**22-Nov-19**
Customer:	**TURCK Inc.**			**Temperature:**	**22.7 °C**
Attendees:	**Gabe Selinger, Matt Wickstrom**			**Humidity:**	**20.3% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Andrew Rogstad**	**Power:**	**120VAC/60Hz**	**Job Site:**	**MN09**
TEST SPECIFICATIONS			**Test Method**		
FCC 15.225:2019			ANSI C63.10:2013		

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

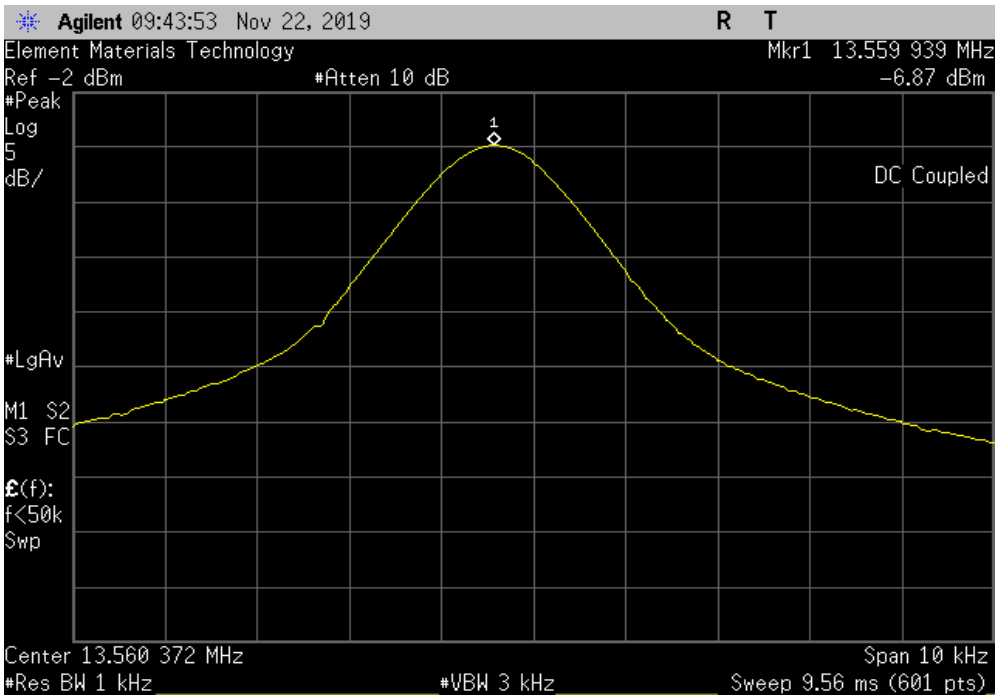
None

Configuration #	**6**	*Signature*

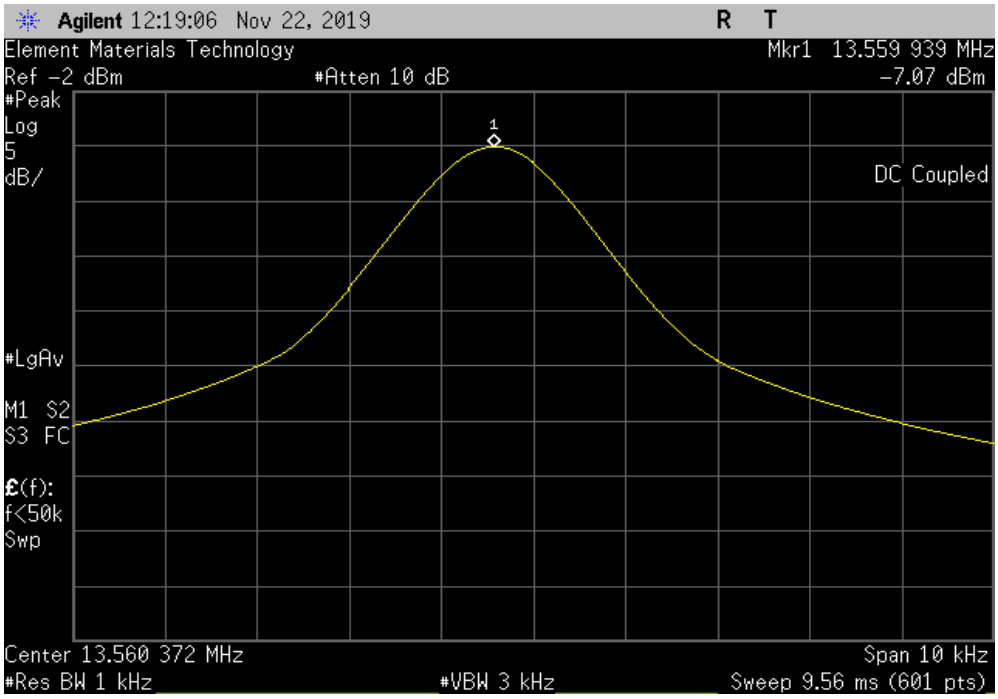
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
13.56 MHz, Modulated						
	Ambient (20 C)					
	Nominal (7.4 VDC)	13.559939	13.56	4.5	100	Pass
	Battery operating end point (6.2 VDC)	13.559939	13.56	4.5	100	Pass
	+50 C					
	Nominal (7.4 VDC)	13.559955	13.56	3.3	100	Pass
	+40 C					
	Nominal (7.4 VDC)	13.559938	13.56	4.6	100	Pass
	+30 C					
	Nominal (7.4 VDC)	13.559939	13.56	4.5	100	Pass
	+20 C					
	Nominal (7.4 VDC)	13.559955	13.56	3.3	100	Pass
	+10 C					
	Nominal (7.4 VDC)	13.559972	13.56	2.1	100	Pass
	0 C					
	Nominal (7.4 VDC)	13.560005	13.56	0.4	100	Pass
	-10 C					
	Nominal (7.4 VDC)	13.560022	13.56	1.6	100	Pass
	-20 C					
	Nominal (7.4 VDC)	13.559989	13.56	0.8	100	Pass

FREQUENCY STABILITY

13.56 MHz, Modulated, Ambient (20 C), Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559939	13.56	4.5	100	Pass

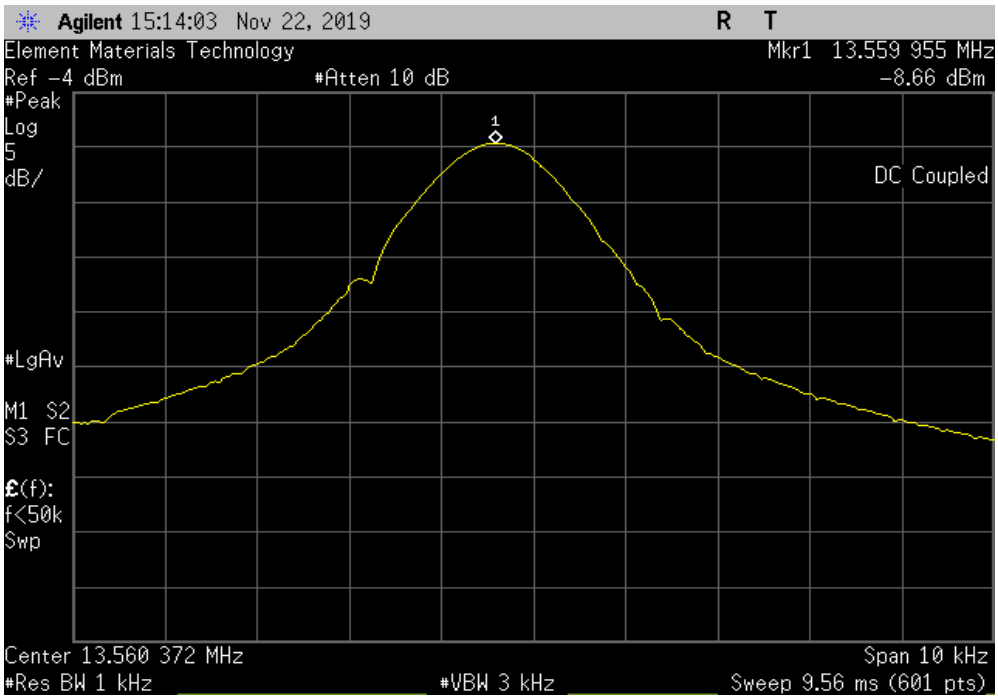


13.56 MHz, Modulated, Ambient (20 C), Battery operating end point (6.0 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559939	13.56	4.5	100	Pass

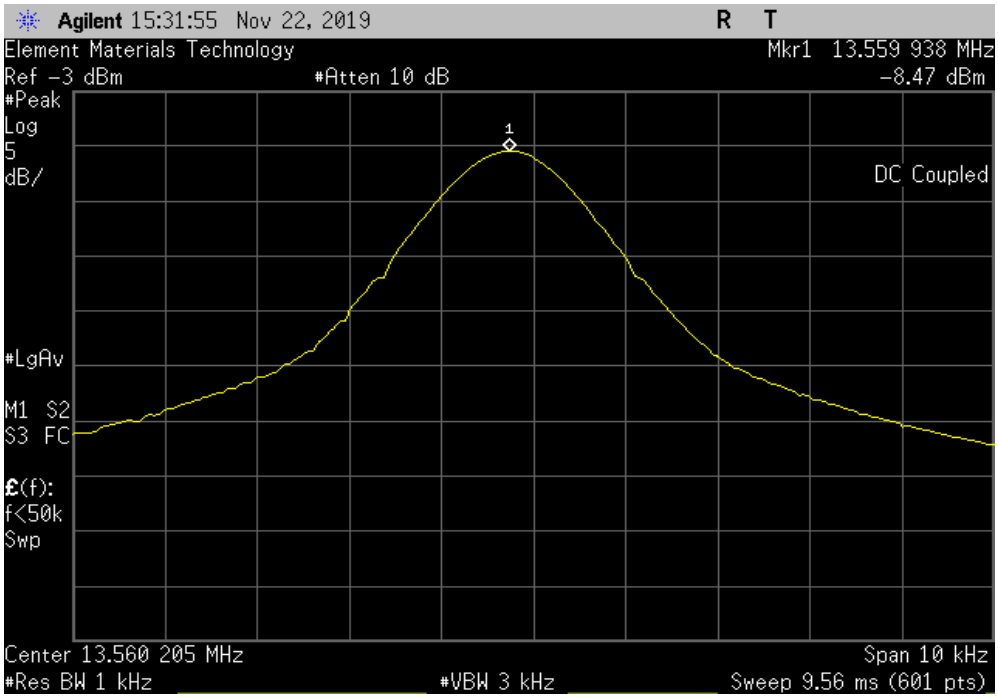


FREQUENCY STABILITY

13.56 MHz, Modulated, +50 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559955	13.56	3.3	100	Pass



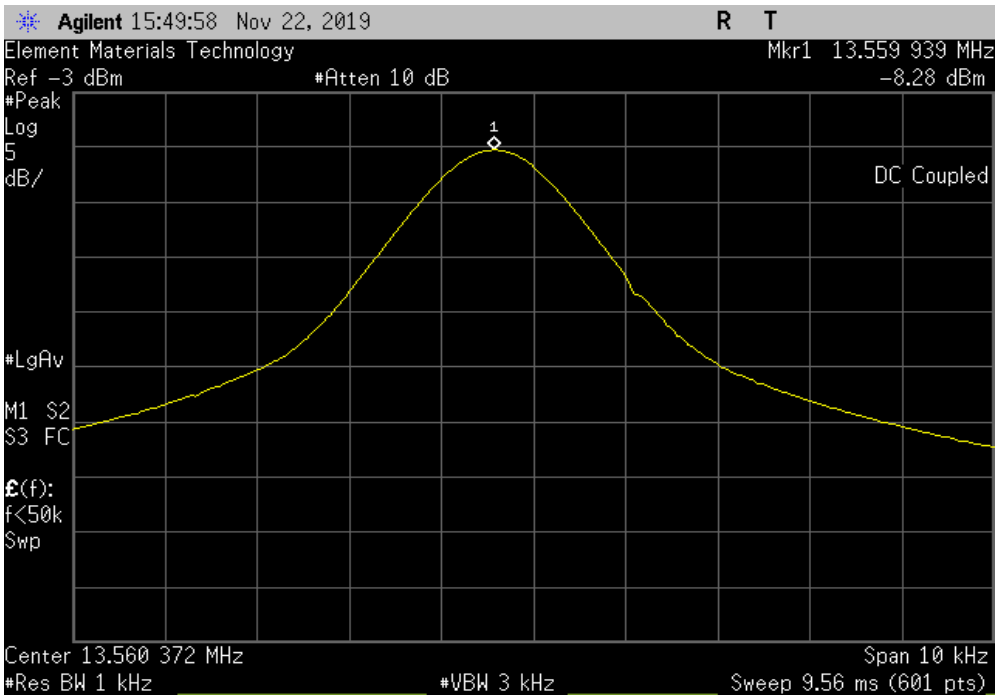
13.56 MHz, Modulated, +40 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559938	13.56	4.6	100	Pass



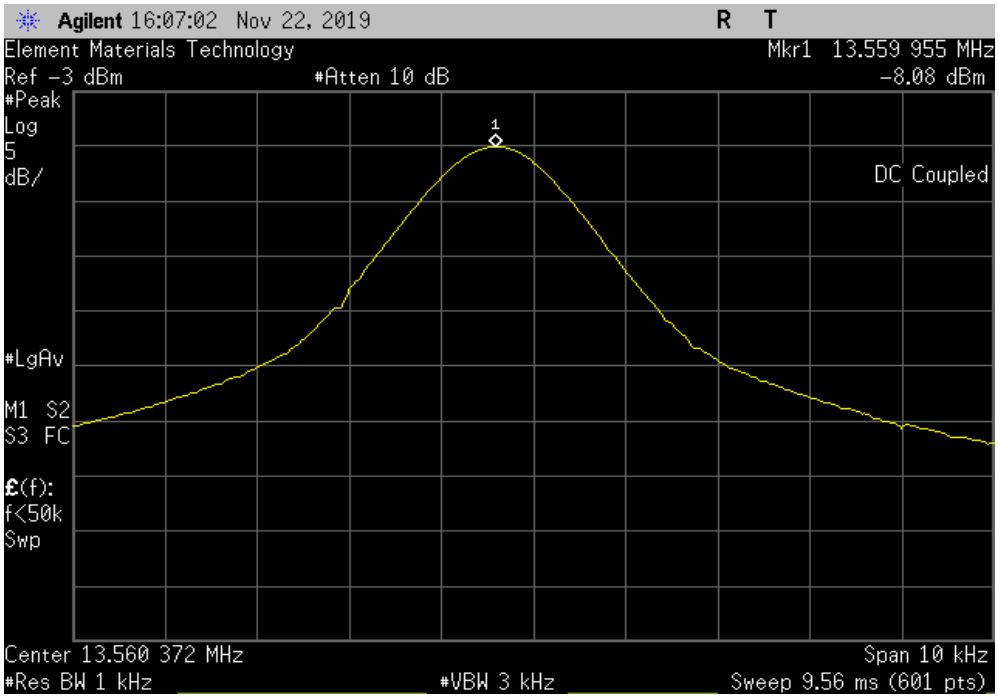
FREQUENCY STABILITY

TbtTx 2019.08.30.0 XMit 2019.09.05

13.56 MHz, Modulated, +30 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559939	13.56	4.5	100	Pass

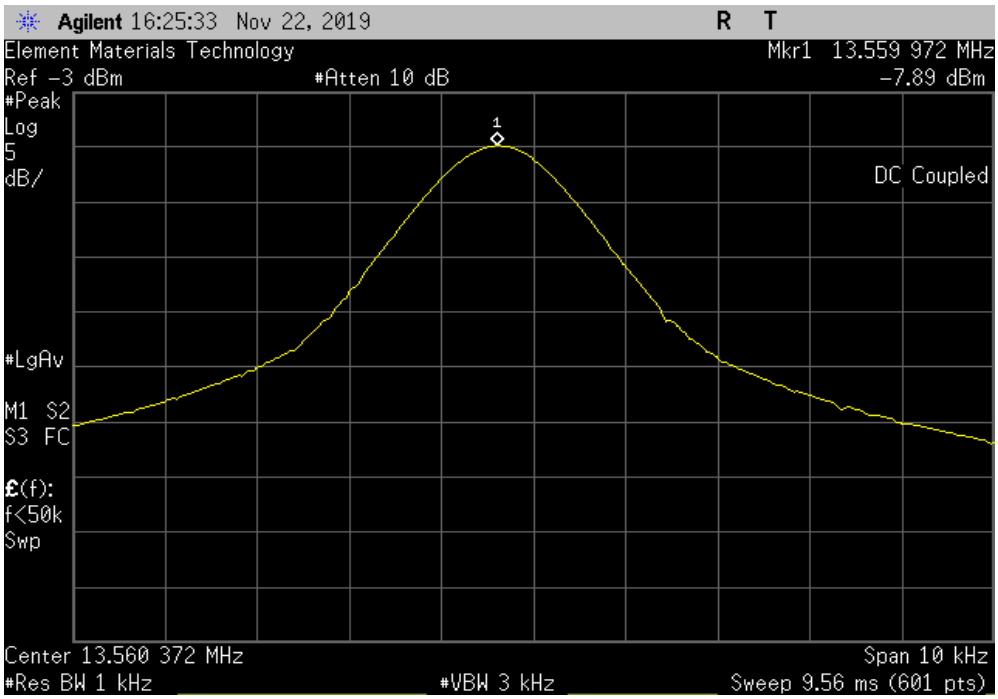


13.56 MHz, Modulated, +20 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559955	13.56	3.3	100	Pass

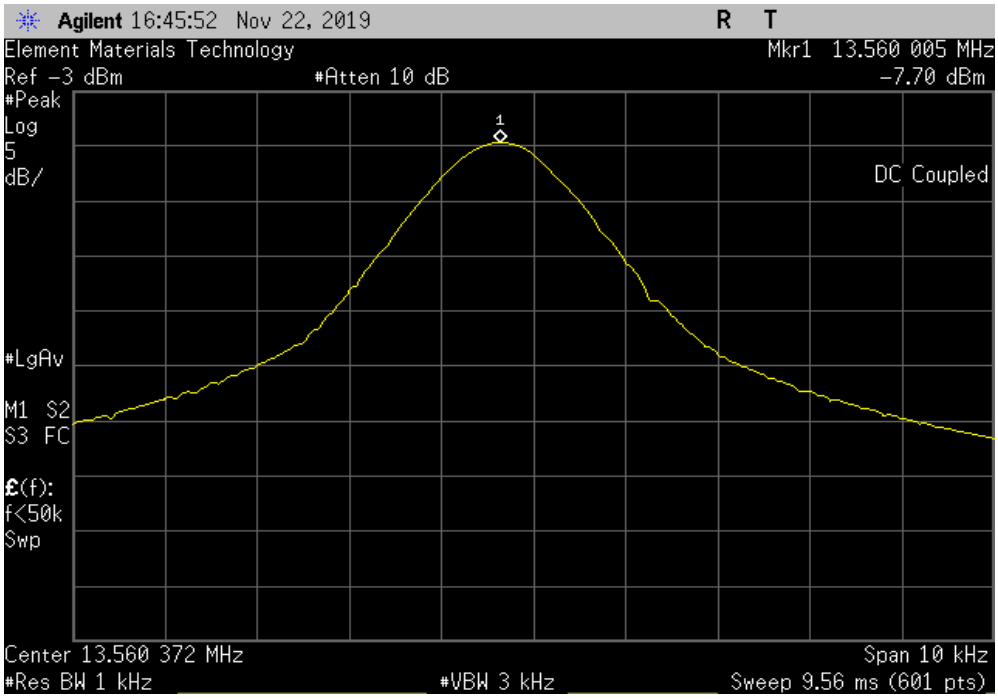


FREQUENCY STABILITY

13.56 MHz, Modulated, +10 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559972	13.56	2.1	100	Pass



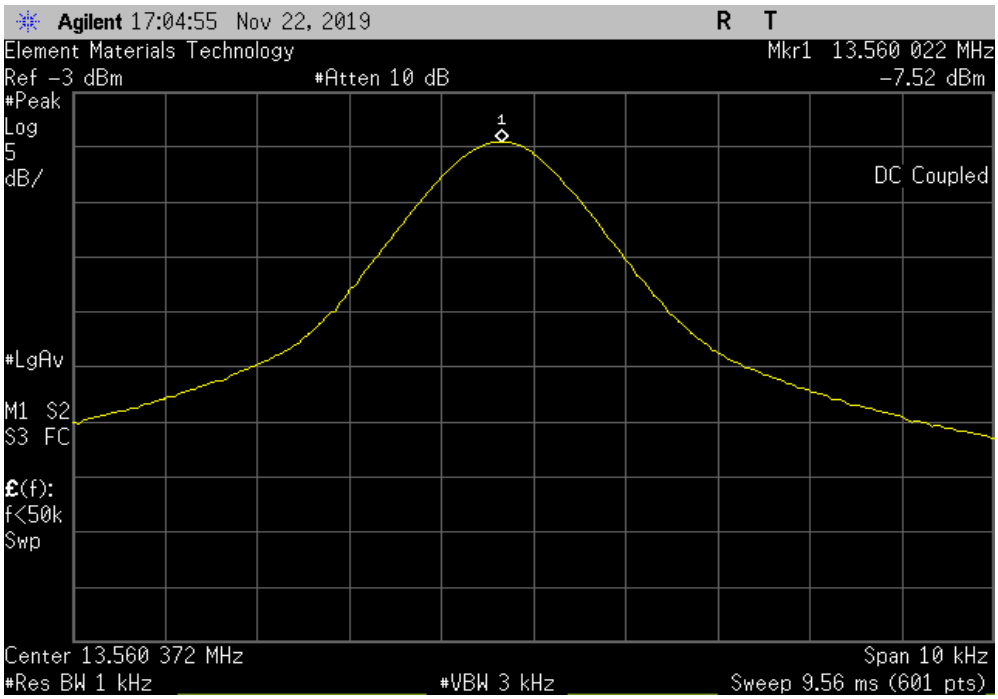
13.56 MHz, Modulated, 0 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560005	13.56	0.4	100	Pass



FREQUENCY STABILITY

TbtTx 2019.08.30.0 XMit 2019.09.05

13.56 MHz, Modulated, -10 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560022	13.56	1.6	100	Pass



13.56 MHz, Modulated, -20 C, Nominal (7.4 VDC)						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.559989	13.56	0.8	100	Pass