

TEST REPORT

Report Number: 102971715MPK-005

Project Number: G102971715

August 27, 2017

Testing performed on the

M445-403-01-NAA-4

Model: M400 WIFI/BT

FCC ID: B32M400WIFIBT

IC: 787C-M400WIFIBT

to

FCC Part 15 Subpart C (15.225)

Industry Canada RSS-210 Issue 9

For

Verifone, Inc.

Test Performed by:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA


Test Authorized by:

Verifone, Inc.

1400 W Stanford Ranch Rd.

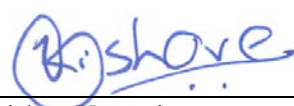
Rocklin, CA 95765 USA

Prepared by:


Anderson Soungpanya

Date: August 27, 2017

Reviewed by:


Krishna Vemuri

Date: August 27, 2017

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Report No. 102971715MPK-005

Equipment Under Test: M445-403-01-NAA-4
Trade Name: Verifone, Inc.
Model Number: M400 WIFI/BT
Serial Number: MPK1707241613-002

Applicant: Verifone, Inc.
Contact: Edwin Mandapat
Address: 1400 W Stanford Ranch Rd.
Rocklin, CA 95765
Country: USA

Tel. Number: (916) 630-0550
Email: Edwin_M1@Verifone.com

Applicable Regulation: FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 9

Test Site Location: ITS – Site 1
1365 Adams Drive
Menlo Park, CA 94025

Date of Test: June 28 to August 24, 2017

We attest to the accuracy of this report:



Anderson Soungpanya
EMC Project Engineer



Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

TEST	REFERENCE FCC 15.225	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental	15.225(a)	B.6	Complies
Radiated Emissions Outside the band	15.225(b), 15.225(c), 15.225(d), 15.209	B.6	Complies
Frequency Tolerance of the Carrier	15.225(e)	B.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Complies
Occupied Bandwidth	15.215	RSS-GEN	Complies
Antenna requirement	15.203	RSS-GEN	Complies ¹

¹ EUT utilizes an internal Antenna.

2.0 General Description

2.1 Product Description

Verifone, Inc. supplied the following description of the EUT:

The M400 WIFI/BT is an Electronic Payment/POS Terminal for Retail.

For more information, see user's manual provided by the manufacturer.

Overview of the EUT

Applicant name & address	Verifone, Inc. 1400 W Stanford Ranch Rd. Rocklin, CA 95765 USA
Contact info / Email	Edwin Mandapat / Edwin_M1@Verifone.com
Model	M400 WIFI/BT
FCC Identifier	B32M400WIFIBT
IC Identifier	787C-M400WIFIBT
Operating Frequency	13.56MHz
Number of Channels	1
Type of Modulation	ASK
Operating Temperature	-20°C to +75°C
Antenna Type	Internal PCB Antenna

EUT receive date: April 07, 2017

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: June 28, 2017

Test completion date: August 24, 2017

The test results in this report pertain only to the item tested.

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7& ANSI C63.10: 2013.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

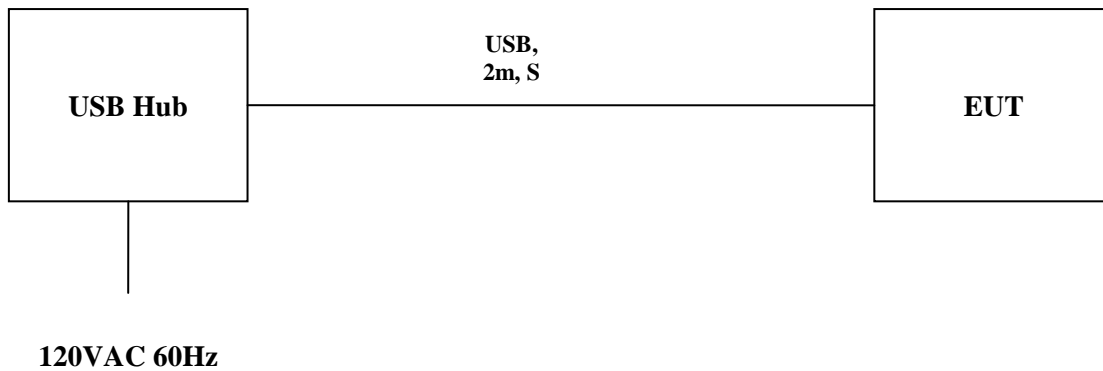
3.0 System Test Configuration

3.1 Support Equipment and description

Description	Manufacturer	Model No./ Part No.
Powered USB Hub	Cyberdata	SN# 630004156

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Electronic Payment Terminal	Verifone	M400 WIFI/BT	401-180-800



S = Shielded	F = With Ferrite
U = Unshielded	m = Length in Meters

3.3 Justification

The EUT was configured to continuously transmit. This report covers the RFID radio only.

3.4 Software Exercise Program

For testing purposes, the EUT was configured by the manufacturer to continuously transmit.

3.5 Mode of Operation during test

EUT was continuously transmitting during the tests.

3.6 Modifications required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

- a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.
- b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG - DCF$$

Where FS = Field Strength in dB (μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB (μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

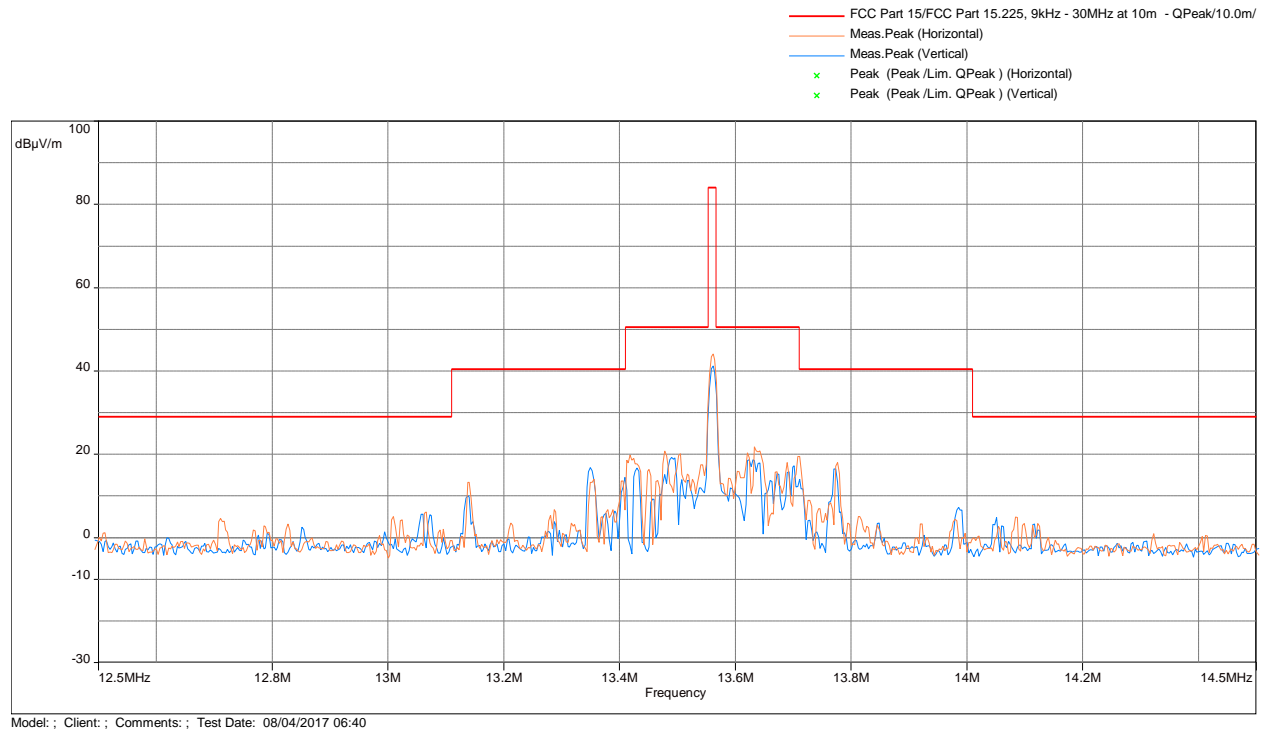
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result 15.225 (a)(b)(c)

The data below shows the significant emission frequencies, the limit and the margin of compliance.

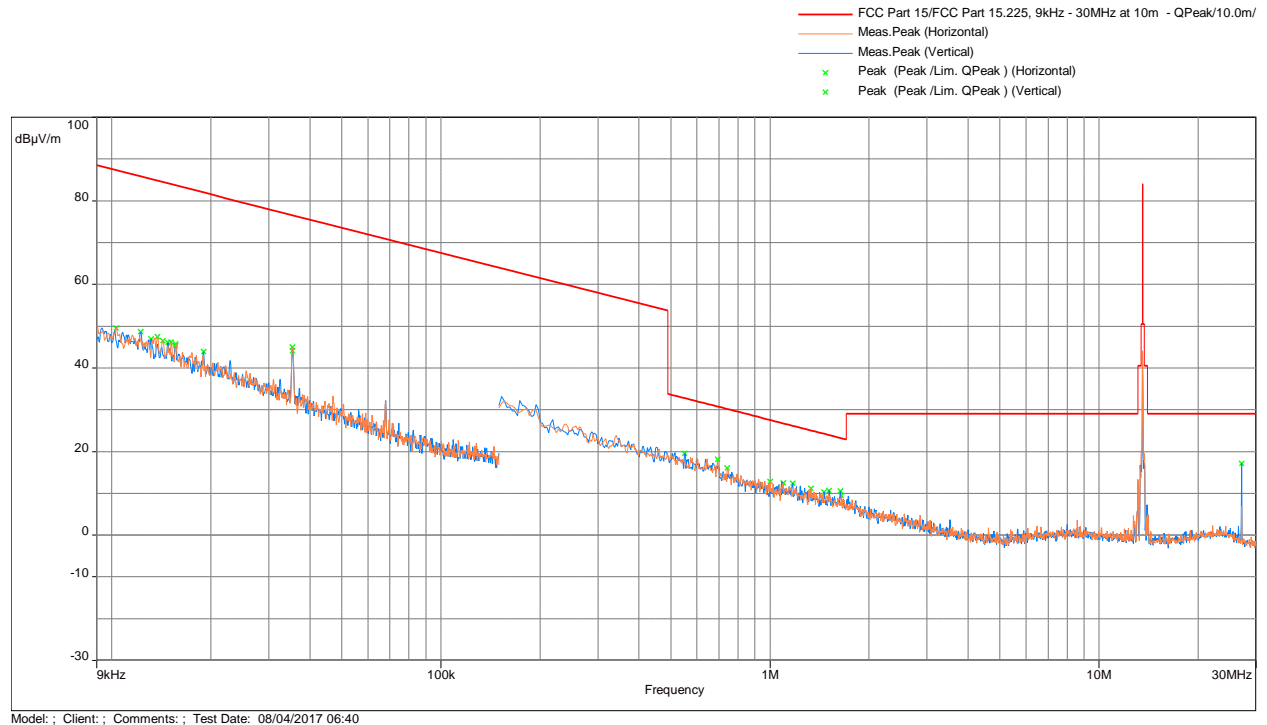
Note: Measurements were performed at parallel and perpendicular orientation of loop antenna, and vertical and horizontal orientations of EUT. The worst case data was presented below.



Frequency (MHz)	Peak FS@30m dB(uV/m)	Limit@30m dB(uV/m)	Margin dB	RA@10m dB(uV)	Correction dB
13.56	44.2	84	-39.8	60.3	-16.1

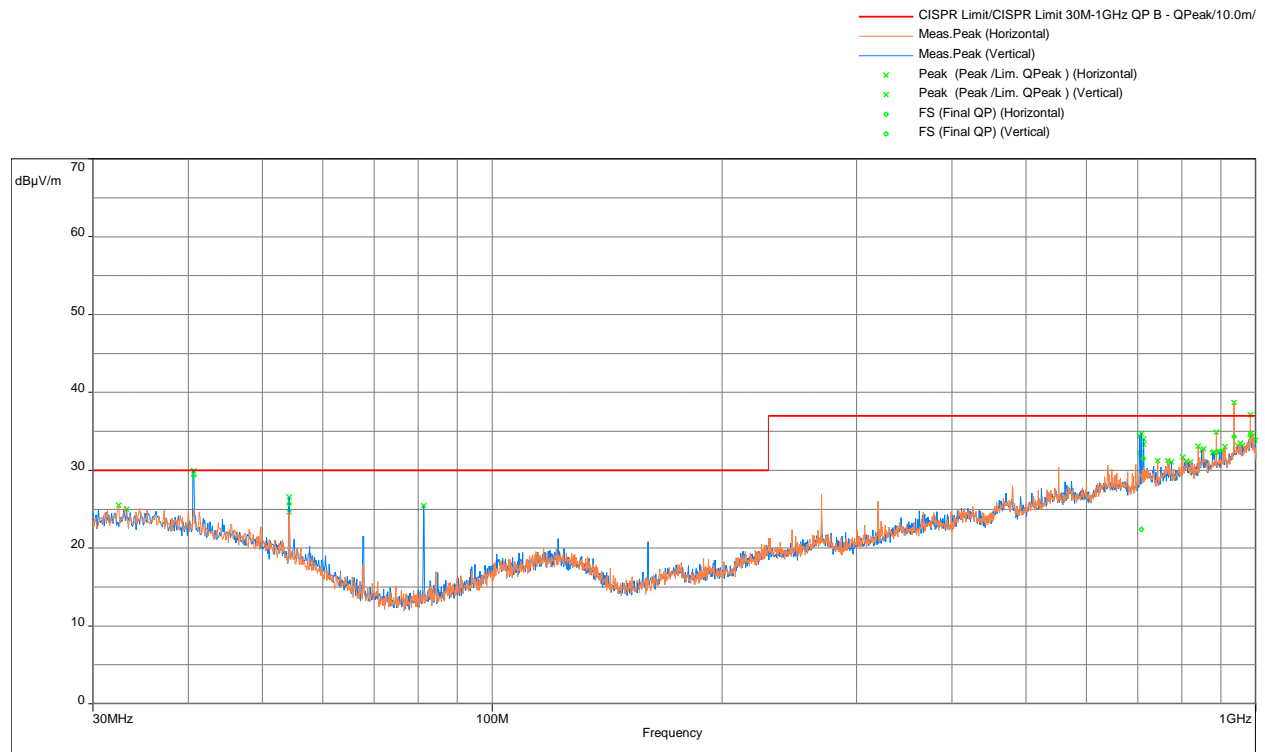
4.1.4 Test Result 15.225 (d)

Radiated Spurious Emissions from 9 kHz to 30MHz



Frequency (MHz)	Peak FS dB(uV/m)	Limit@30m dB(uV/m)	Margin dB	RA@10m dB(uV)	Correction dB
27.122	17.0	29	-12	33.3	-16.3

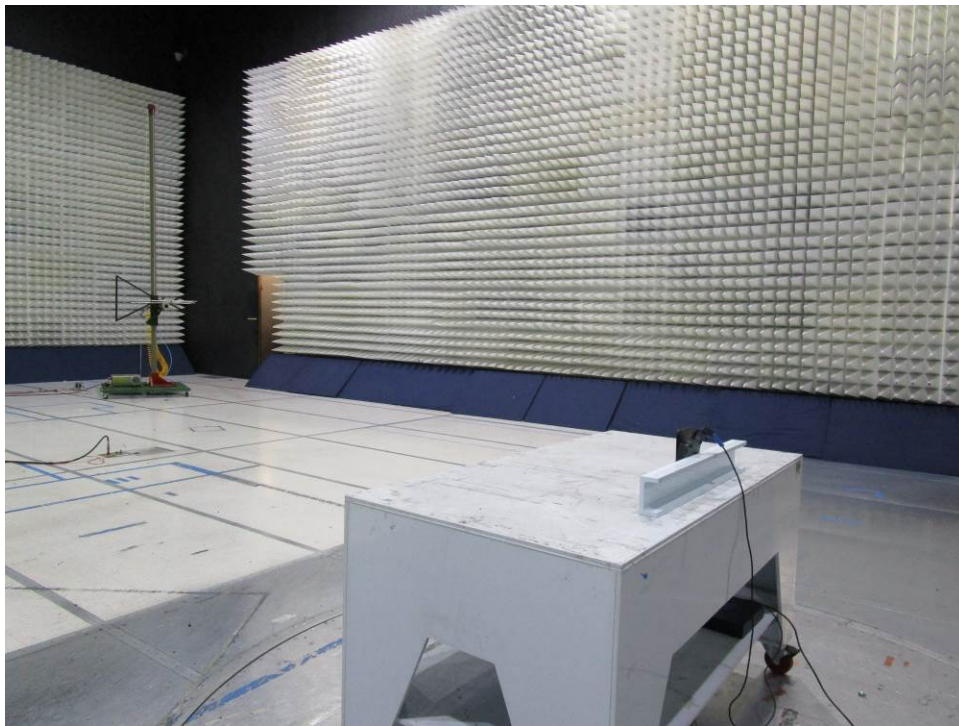
Radiated Spurious Emissions from 30 MHz to 1000 MHz



Freq (MHz)	FS (dB(uV/m))	Limit (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
32.145	17.4	29.5	-12.1	97.8	3.9	Horizontal	21.5	-4.2
933.806	23.5	35.5	-12.0	88.3	3.4	Horizontal	19.0	4.5
953.712	23.6	35.5	-11.9	153.3	3.5	Horizontal	18.7	4.9
30.561	17.3	29.5	-12.2	237.0	1.2	Vertical	21.3	-4.1
41.714	16.2	29.5	-13.3	162.3	3.8	Vertical	21.4	-5.2
941.446	23.6	35.5	-11.9	107.3	1.7	Vertical	18.7	4.9

Result Complies by 11.9dB

4.1.5 Test Configuration Photographs



4.2 Frequency Tolerance

4.2.1 Requirement FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+75$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded. In addition, the carrier frequency was recorded when the power was set to 13.8 V DC (115% of 12V DC) and to 8.5 V DC (85% of 12V DC).

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13560000 Hz

Voltage (DC)	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
12	-20	13559889	111	0.00082
12	-10	13559887	113	0.00083
12	0	13559882	118	0.00087
12	10	13559883	117	0.00086
12	20	13559883	117	0.00086
12	30	13559915	85	0.00063
12	40	13559923	77	0.00057
12	50	13559907	93	0.00069
12	60	13559925	75	0.00055
12	70	13559948	52	0.00038
12	75	13559950	50	0.00037
8.5	20	13559878	122	0.00090
13.8	20	13559891	109	0.00080

4.3 Occupied Bandwidth FCC 15.215

4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

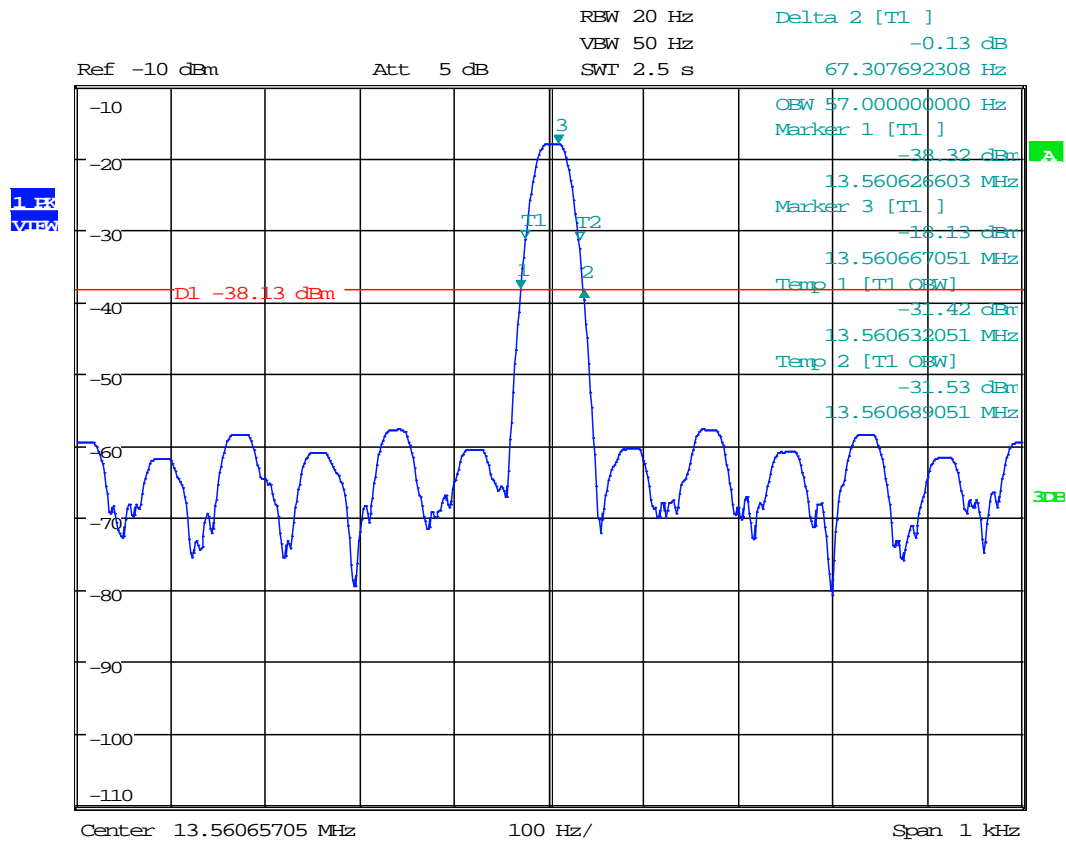
4.3.2 Procedure

The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

Frequency (MHz)	20-dB Channel Bandwidth (Hz)	99% Channel Bandwidth (Hz)
13.56	67.31	57.0



Date: 18.AUG.2017 11:50:42

4.4 AC Line Conducted Emission FCC Rule 15.207

4.4.1 Requirement

Frequency Band MHz	Class B Limit dB(μ V)		Class A Limit dB(μ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.

4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

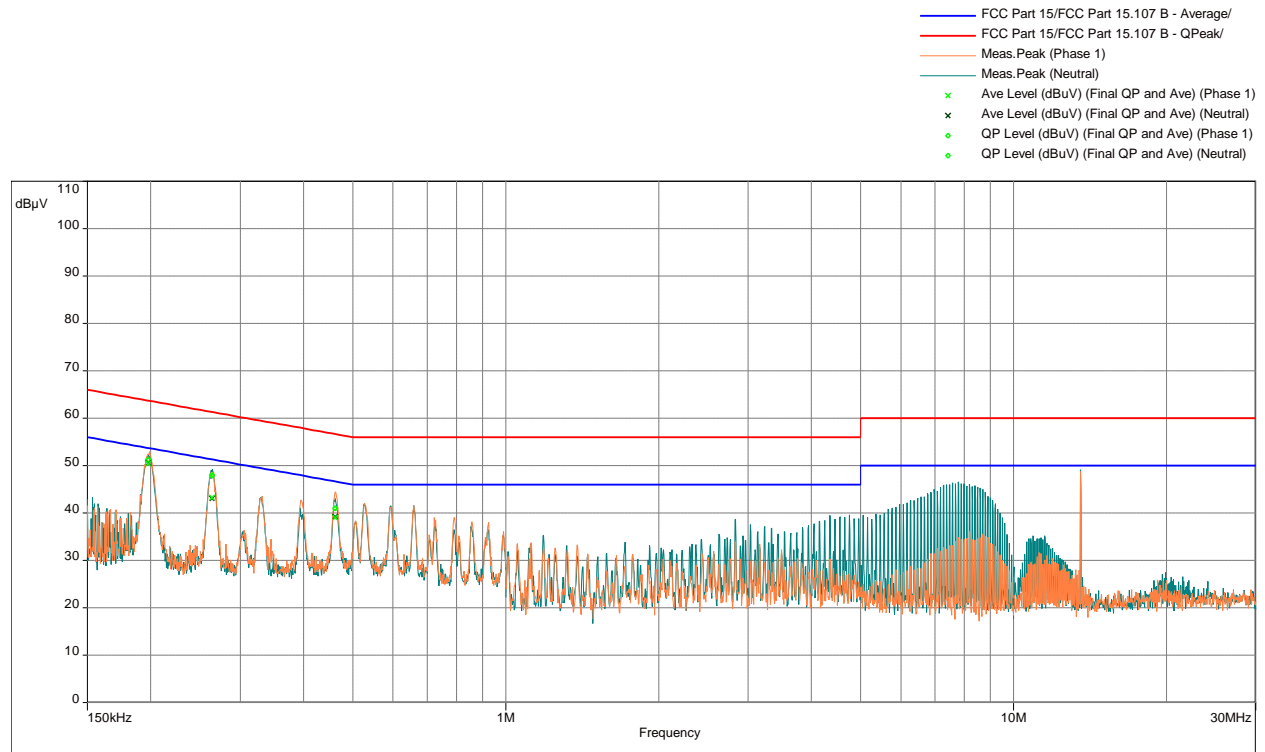
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207 outside the transmitter fundamental emissions band. After, the EUT antenna is removed from the EUT and only the fundamental emission band was measured to show that the fundamental emission band is in compliance with the 15.207 limits.

Equipment setup for conducted disturbance tests followed.

4.4.3 Test Result

AC Line Conducted Emission on Model Number: M400 WIFI/BT



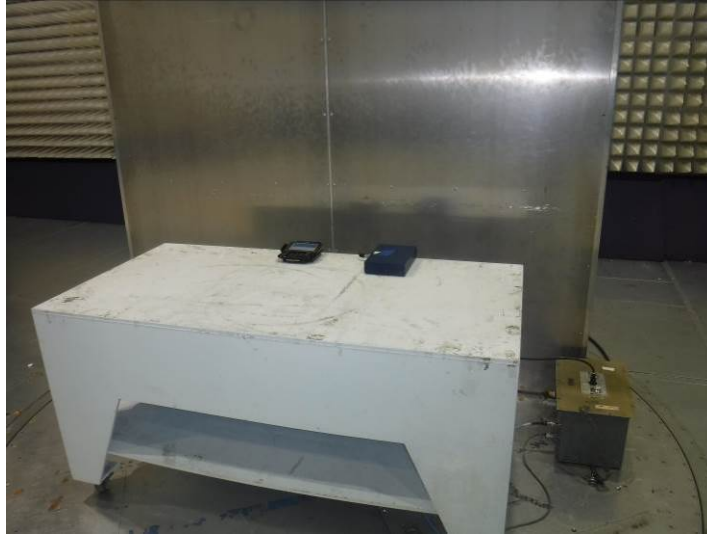
Model: ; Client: ; Comments: ; Test Date: 08/24/2017 09:44

Frequency (MHz)	Ave Level (dBuV)	QP Level (dBuV)	Ave Limit (dBuV)	QP Limit (dBuV)	Ave Margin (dB)	QP Margin (dB)	Line	Correction (dB)
0.197	50.42	51.20	53.70	63.70	-3.28	-12.50	Phase 1	11.05
0.263	43.29	47.87	51.31	61.31	-8.02	-13.44	Phase 1	11.07
0.461	39.06	41.00	46.66	56.66	-7.60	-15.66	Phase 1	11.09
13.559	48.35	49.05	50.00	60.00	-1.65	-10.95	Phase 1	11.70
0.197	50.48	51.24	53.70	63.70	-3.22	-12.46	Neutral	11.05
0.263	43.01	48.04	51.31	61.31	-8.30	-13.27	Neutral	11.07
0.461	39.19	40.95	46.66	56.66	-7.47	-15.71	Neutral	11.09
13.559	48.51	49.01	50.00	60.00	-1.49	-10.99	Neutral	11.70

Result Complies by 1.49 dB

4.4.4 Test Configuration Photographs

The following photographs show the testing configurations used.



5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
Spectrum Analyzer	Rohde & Schwarz	FSP	ITS 01200	12	10/10/17
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	07/10/18
Pre-Amplifier	Sonoma Instrument	310	ITS 01493	12	09/28/17
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	08/19/18
RF Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	08/19/18
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/19/18
Transient Limiter	COM-POWER	LIT-153A	ITS 01452	12	06/19/18
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	08/24/17
RF Cable	Megaphase	TM40-K1K1-59 RF	ITS 01156	12	01/26/18
LISN	FCC	FCC-LISN-PA-NEMA-5-	ITS 00551	12	09/14/17
BI-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	09/09/17
Passive Loop Antenna	EMCO	6512	ITS 01598	12	09/13/17
Passive Loop Antenna	Solar Electronics	7334-1	ITS 01608	12	09/12/17
Environmental Chamber	Espec	BTX-475	ITS 01436	12	09/06/17

* Calibration performed by ITS prior to the test. # Calibration not required

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G102971715	AS	KV	August 27, 2017	Original document