

**Advanced
Compliance Laboratory**

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**ELECTROMAGNETIC EMISSION COMPLIANCE
REPORT
of**

**PRODUCT NAME: WIFI TO RTS GATEWAY
MODEL/PARTS: LINK PRO
FCC ID: 2ASVG-PROLINK1**

April 2, 2019

This report concerns (check one): Original grant Class II change _____
Equipment type: Low Power Intentional Radiator

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes _____ no _____
If yes, defer until: _____ (date)
Company agrees to notify the Commission by _____ (date)
of the intended date of announcement of the product so that the grant can be
issued on that date.

Transition Rules Request per 15.37? yes _____ no _____
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR
[10-1-90 Edition] provision.

Report prepared for: US SHADE CORPORATION
Report prepared by: Advanced Compliance Lab
Report number: 0048-190320-01



The test result in this report IS supported and covered by the NVLAP
accreditation

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1. GENERAL INFORMATION

1.1 Verification of Compliance

EUT: WIFI TO RTS GATEWAY

Model/Parts #: LINK PRO

Applicant: US SHADE CORPORATION

Standards: FCC Part 15.231(e)

Result: PASS

Tested by: ADVANCED COMPLIANCE LABORATORY

Test Completion Date: April 2, 2019

Report Number: 0048-190320-01

The above equipment was tested by Compliance Laboratory, Advanced Technologies, Inc. for compliance with the requirement set forth in the FCC & IC rules and regulations. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

| | Prob. Dist. | Uncertainty(dB) | Uncertainty(dB) | Uncertainty(dB) |
|---------------------------------|-------------|-----------------|-----------------|-----------------|
| | | 30-1000MHz | 1-6.5GHz | Conducted |
| Combined Std. Uncertainty u_c | norm. | ± 2.36 | ± 2.99 | ± 1.83 |



Wei Li
Lab Manager
Advanced Compliance Lab

Date: April 2, 2019

1.2 Equipment Modifications

N/A

1.3 Product Information

System Configuration

| ITEM | DESCRIPTION | ID | CABLE |
|-----------------|------------------------------------|------------------------|-------|
| Product | WIFI TO RTS GATEWAY ⁽¹⁾ | FCC ID: 2ASVG-PROLINK1 | |
| Housing | PLASTICS | | |
| Power Supply | POE form AC 115V | | |
| Operation Freq. | 433.42 MHz | | |
| Device Type | Periodic Operation | | |
| | | | |

(1) EUT submitted for grant.

1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2014/C63.10-2013 at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey, USA. This site is accepted by FCC to perform measurements under Part 15 or 18 (Designation Number US5347) and also designated by IC as “site IC 3130A”. The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

1.6 Test Equipment

| Manufacture | Model | Serial No. | Description | Cal Due dd/mm/yy |
|------------------|------------|------------|---------------------------------------|------------------|
| Hewlett-Packard | HP8546A | 3448A00290 | EMI Receiver | 15/10/19 |
| EMCO | 3104C | 9307-4396 | 20-300MHz Biconical Antenna | 15/01/20 |
| EMCO | 3146 | 9008-2860 | 200-1000MHz Log-Periodic Antenna | 15/01/20 |
| Electro-Meterics | ALR-25M/30 | 289 | 10KHz-30MHz Active Loop Antenna | 28/05/19 |
| Fischer Custom | LISN-2 | 900-4-0008 | Line Impedance Stabilization Networks | 18/03/20 |
| Fischer Custom | LISN-2 | 900-4-0009 | Line Impedance Stabilization Networks | 24/03/20 |
| EMCO | 3115 | 4945 | Double Ridge Guide Horn Antenna | 22/01/20 |
| Agilent | E4440A | US40420700 | PSA Spectrum Analyzer | 25/08/20 |

All Test Equipment Used are Calibrated Traceable to NIST Standards.

Standard Calibration interval: 2 year.

1.7 Statement for the Document Use

This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. & Canada Governments.

2. PRODUCT LABELING

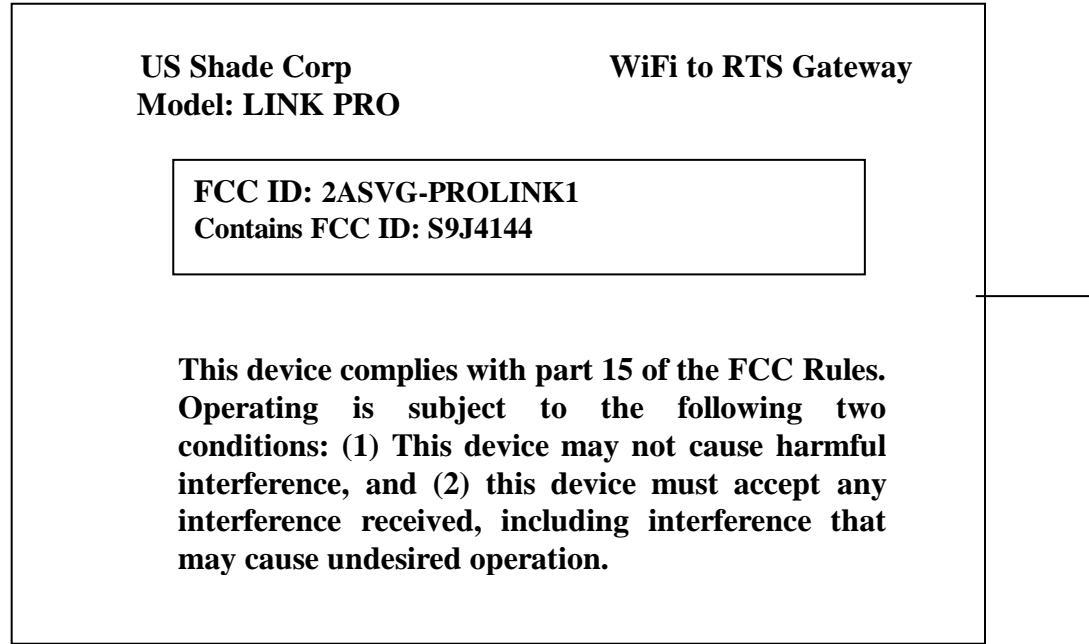


Figure 2.1 ID Label (statement shown in the manual)

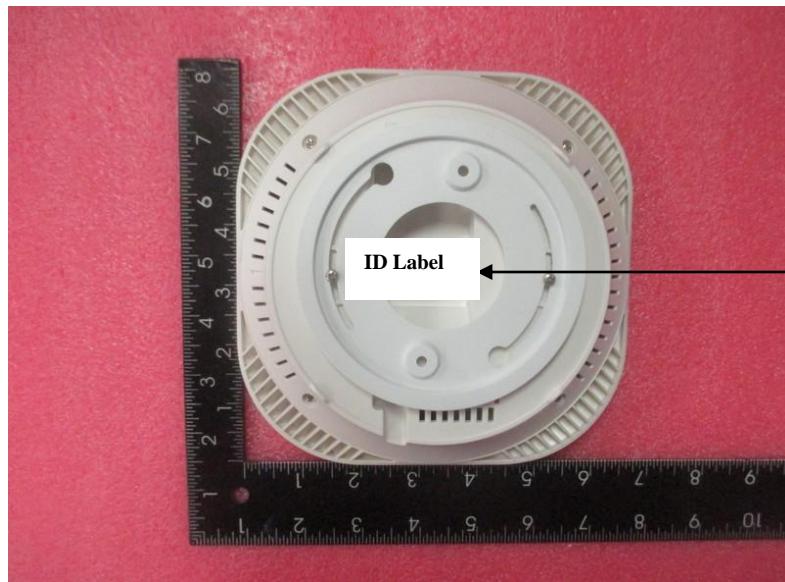


Figure 2.2 ID Label Location

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The product was configured for testing in a typical fashion (as a customer would normally use it). EUT was properly orientated for being tested in the correct plane. Its antenna is permanently connected to PCB.

For this certification, the RTX module drives an external RF circuit whose carrier frequency is 433.42 MHz +/- 100 KHz. The power level of the RF circuit has been set to operate at the level described in FCC 15.231(e). It does not send data.

In normal operation mode, the transmission does stop within 5 seconds after the transmission is deactivated.

Emission test was performed as 433.42MHz Tx was operated continuously (where applicable, fresh batteries shall be used during the test).

3.2 Special Accessories

N/A

3.3 Configuration of Tested System

Figure 3.x illustrate this system, which is tested standing along.



Standard Orientation (X)





Figure 3.1 Radiated Test Setup



Figure 3.2 Conducted Test Setup

4. SYSTEM SCHEMATICS

See Attachment.

Figure 4.1 System Schematics

5. CONDUCTED EMISSION DATA

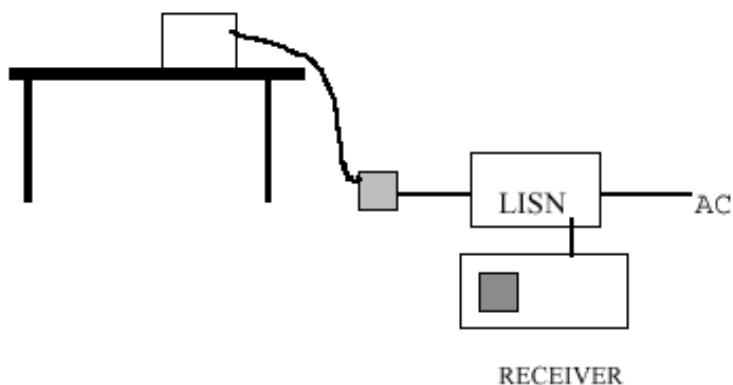
5.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHZ to 30MHZ. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the CISPR 22 Class B limit in Figure 5.1 through Figure 5.2.

| Conducted Emission Technical Requirements | | | | |
|---|--------------------|-----------------|--------------------|-----------------|
| | Class A | | Class B | |
| Frequency Range | Quasi-Peak dBuV | Average dBuV | Quasi-Peak dBuV | Average dBuV |
| 150kHz -0.5MHz | 79 (8912uV) | 66 (1995uV) | 66-56 | 56-46 |
| 0.5MHz-30MHz | 73 (4467uV) | 60 (1000uV) | --- | --- |
| 0.5MHz- 5MHz | --- | --- | 56 | 46 (250uV) |
| 5MHz-30MHz | --- | --- | 60 | 50 |

Emissions that have peak values close to the specification limit (if any) are also measured in the quasi-peak mode to determine compliance.

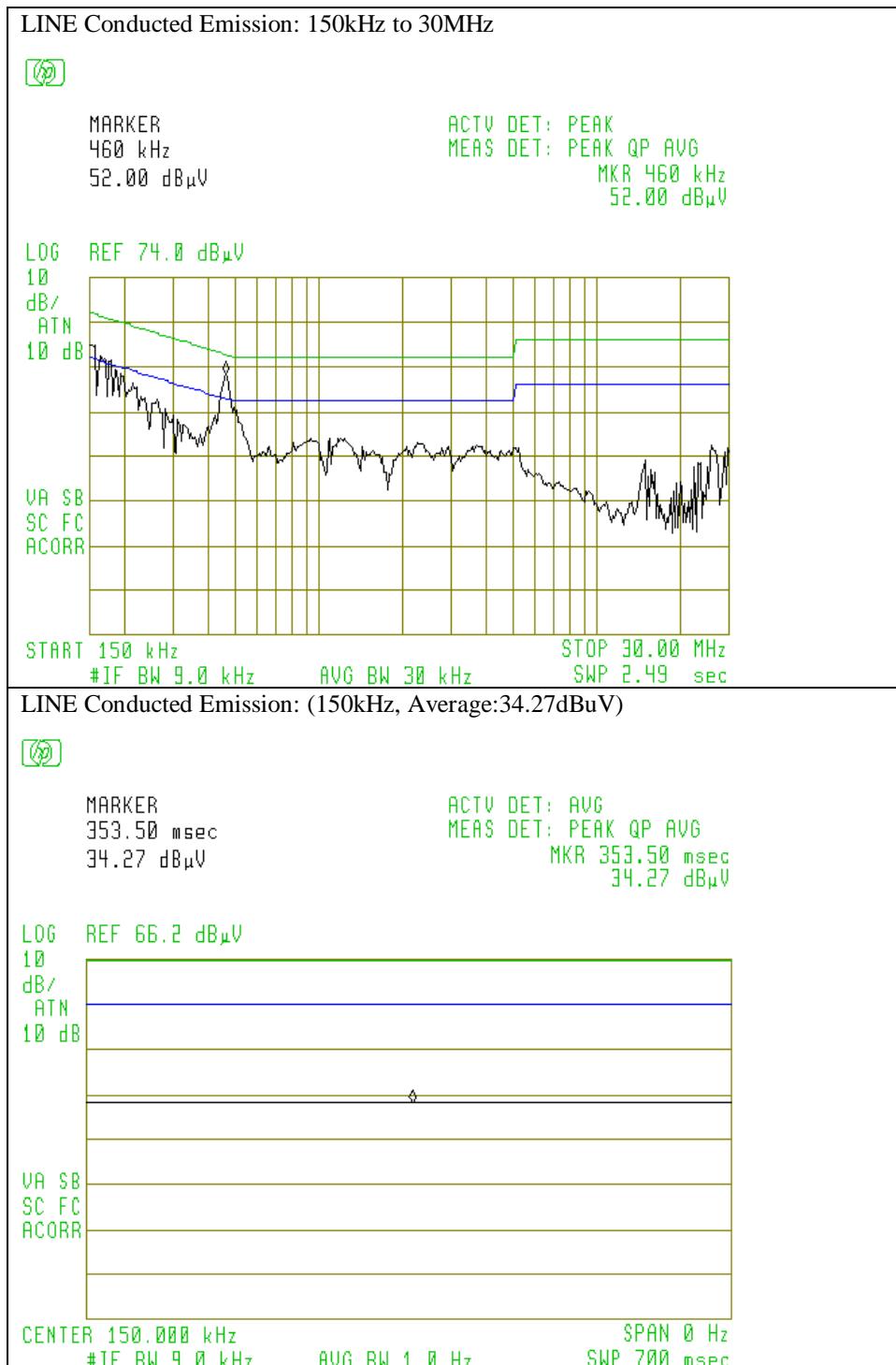
5.2 Measurement Instrument Configuration for Conducted Emission



5.3 Testing Data

The following plots show the neutral and line conducted emissions for the typical operation condition (Transmitting and receiving). The conducted test data shows the worst case emissions still below the FCC Part 15/CISPR22 Class B limits.

| Highest Data for AC Main Conducted Emissions 115Vac | | | | | |
|---|-------|-------|-------|-------|--|
| Frequency (KHz) | 150 | 170 | 220 | 460 | |
| Peak Reading (dBuV) from Line* | 58.95 | 55.33 | 50.33 | 52.0 | |
| Averagr Reading (dBuV) from Line* | 34.27 | | | 44.42 | |
| Frequency (KHz) | 150 | 170 | 220 | 460 | |
| Peak Reading(dBuV) from Neutral * | 60.2 | 56.19 | 49.81 | 36.82 | |
| Averagr Reading (dBuV) from Neutral* | 32.78 | | | 41.48 | |

Operation Mode: Normal

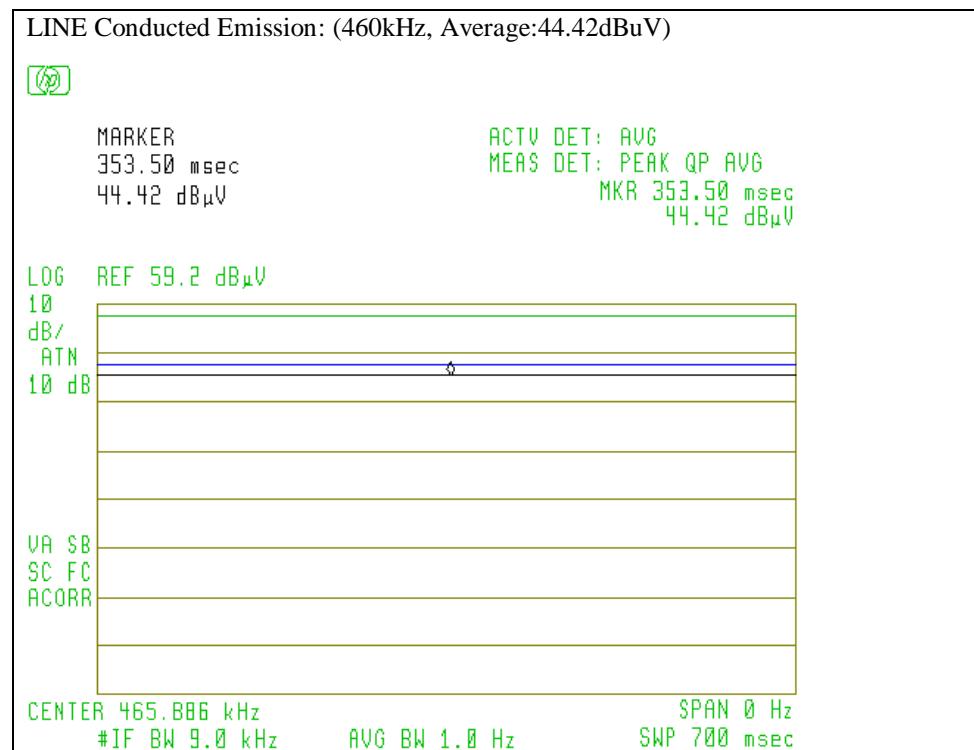


Figure 5.1 LINE Conducted Emission

NEUTRAL Conducted Emission



MARKER
150 kHz
60.20 dB μ V

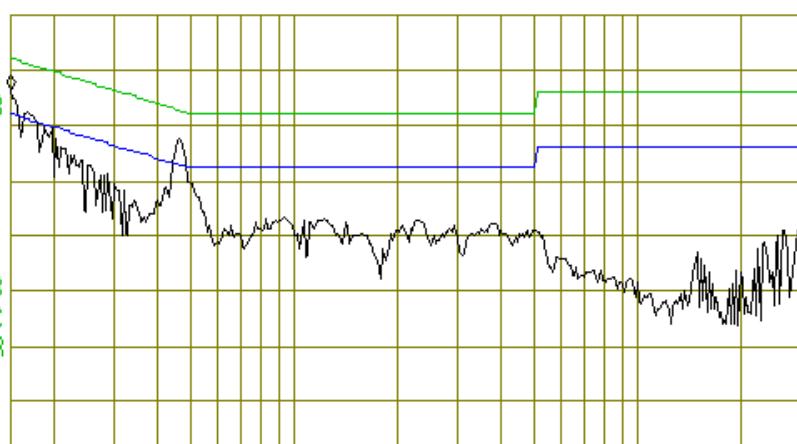
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 150 kHz
60.20 dB μ V

LOG REF 74.0 dB μ V

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

START 150 kHz
#IF BW 9.0 kHz AVG BW 30 kHz STOP 30.00 MHz
SWP 2.49 sec



NEUTRAL Conducted Emission: (150kHz, Average:32.78dBuV)



MARKER
355.25 msec
32.78 dB μ V

ACTV DET: AVG
MEAS DET: PEAK QP AVG
MKR 355.25 msec
32.78 dB μ V

LOG REF 66.2 dB μ V

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

CENTER 150.086 kHz
#IF BW 9.0 kHz AVG BW 1.0 Hz SPAN 0 Hz
SWP 700 msec



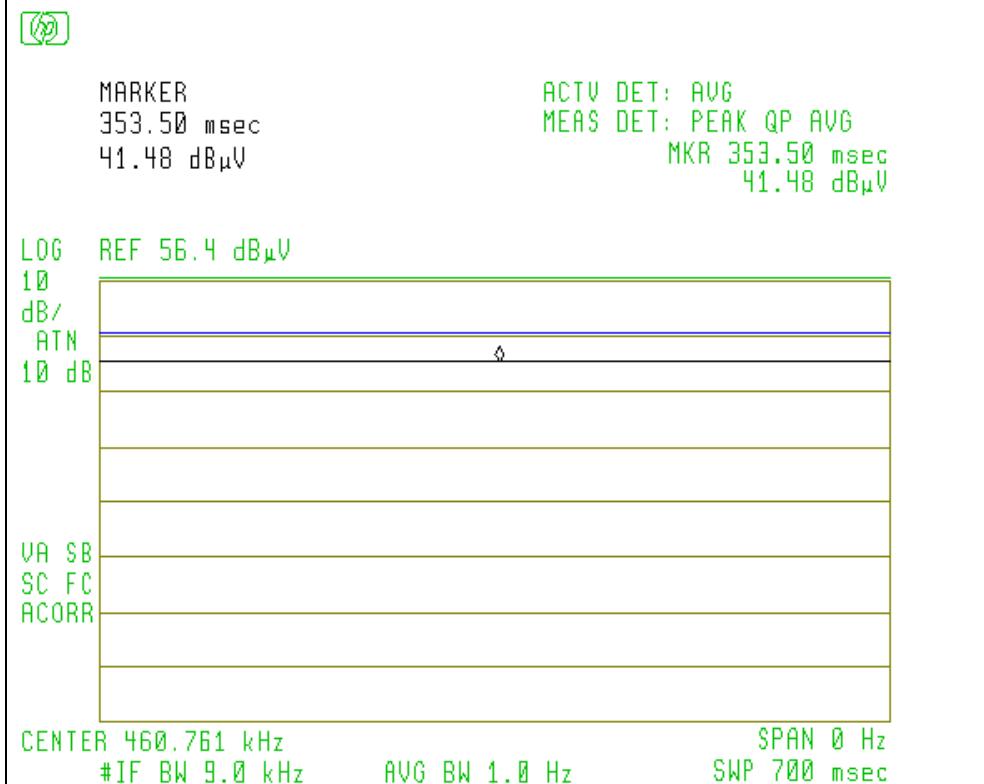
NEUTRAL Conducted Emission: (460kHz, Average:41.48dB μ V)

Figure 5.2 NEUTRAL Conducted Emission

6. RADIATED EMISSION DATA

6.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

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

where FS: Corrected Field Strength in $\text{dB}\mu\text{V}/\text{m}$

RA: Amplitude of EMI Receiver before correction in $\text{dB}\mu\text{V}$

AF: Antenna Factor in dB/m

CF: Cable Attenuation Factor in dB

AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

The pulse train timing plots are showed in Figure 6.2.

The pulse train timing plots as follows:

The total time for each pulse train is 139.62 ms, The short pulse is 0.640ms, The middle pulse is 2.5 ms, The long pulse is 4.8ms.

Coeff. $=(55 \times 0.640 + 1 \times 4.8 + 5 \times 2.5) / 100 = 0.525$

The maximum average field strength should be 0.525 of the peak field strength measured. So we use peak value minus 5.6dB as calculated maximum average field strength.

6.2 Test Methods and Conditions

The initial step in collecting radiated data is a EMI Receiver scan of the measurement range below 30MHz using peak detector and 9KHz IF bandwidth / 30KHz video bandwidth. For the range under 1GHz, 120KHz IF bandwidth / 120KHz video bandwidth are used. Both bandwidths are 1MHz for above 1GHz measurement. The frequency range from the lowest clock frequency in EUT circuitry to 10th harmonics were investigated.

6.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 6.1.

Test Personnel:



Typed/Printed Name: Edward Lee

Date: March 15th, 2017

Radiated Test Data

X- Polarization

| Freq. (MHz) | Worst H/V | Height. (m) | Azimuth | Peak* @3m (dBuV/m) | QP/Avg @3m (dBuV/m) | | QP /Avg. Limit (dBuV/m) | | QP /Avg. Margin (dBuV/m) |
|-------------|-----------|-------------|---------|--------------------|---------------------|--|-------------------------|--|--------------------------|
| 433.42 | HX(1) | 1.1 | 190 | 74.6 | 69.0 | | 72.9(3) | | -3.9 |
| 866.84 | HX | 1.2 | 230 | 40.8 | 35.2 | | 52.9(4) | | -17.7 |
| 1300.3 | HX | 1.1 | 260 | 39.4 | 33.8 | | 52.9(2) | | -19.1 |
| 1733.7 | HX | 1.1 | 250 | 41.4 | 35.8 | | 52.9 | | -17.1 |
| 433.42 | VX | 1.1 | 180 | 67.6 | 62.0 | | 72.9 | | -10.9 |
| 866.84 | VX | 1.0 | 190 | 39.8 | 34.2 | | 52.9 | | -18.7 |
| 1300.3 | VX | 1.1 | 000 | 38.5 | 32.9 | | 52.9 | | -20 |
| 1733.7 | VX | 1.0 | 020 | 41.5 | 35.9 | | 52.9 | | -17 |

(1) See Figure 3.1, 3.2 and 3.3 for definition of position.

(2) Limit in Restricted band per FCC 15.209 or 15.231(e), whichever is lower.

(3) Fundamental limit is 1500-5000 microvolts/meter linear interpolations (average reading) for 260-470 MHz fundamental frequency range; 4383uV/m for 433.4MHz Fundamental per FCC 15.231(e).

(4) Spurious limit is 150-500 microvolts/meter linear interpolations (average reading) per 15.231(e).

* In this case, since duty cycle factor is much lower than 20dB, therefore peak value of each emission shall meet Peak Value limit, which is equal to average limit +20dB.

6.4 Occupied Bandwidth

The bandwidth of the emission shall be no wider than 0.25% of the center frequency, in this case, 1.0835Hz(433.42x0.25%). Bandwidth is determined at the points 20dB down from the modulated carrier or by containing 99% of the total power of the signal. The occupied bandwidth plots are given as following.

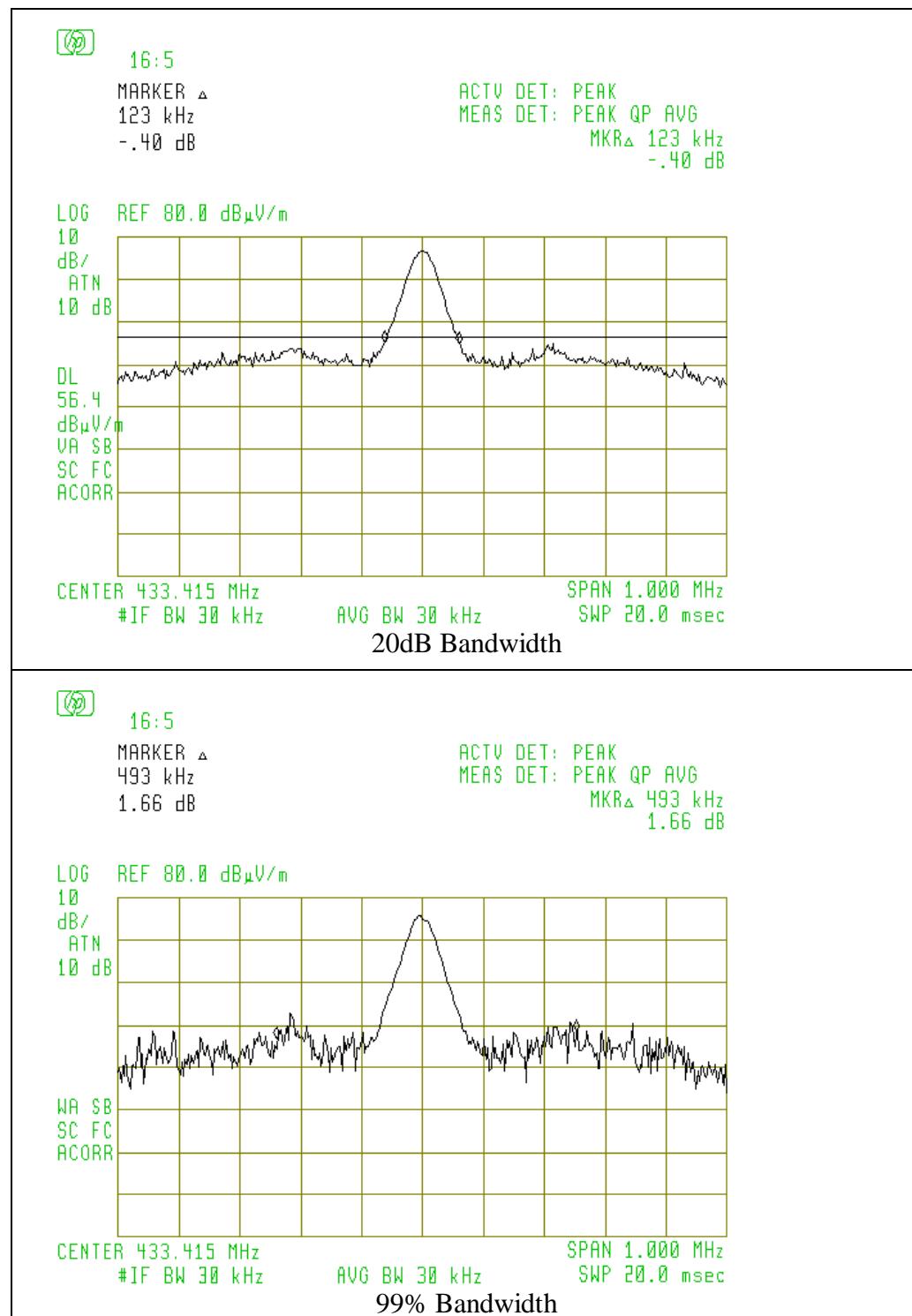


Figure 6.1 Occupied Bandwidth

6.5 Transmission and Silent Period Per 15.231(e)

Devices operated under this provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

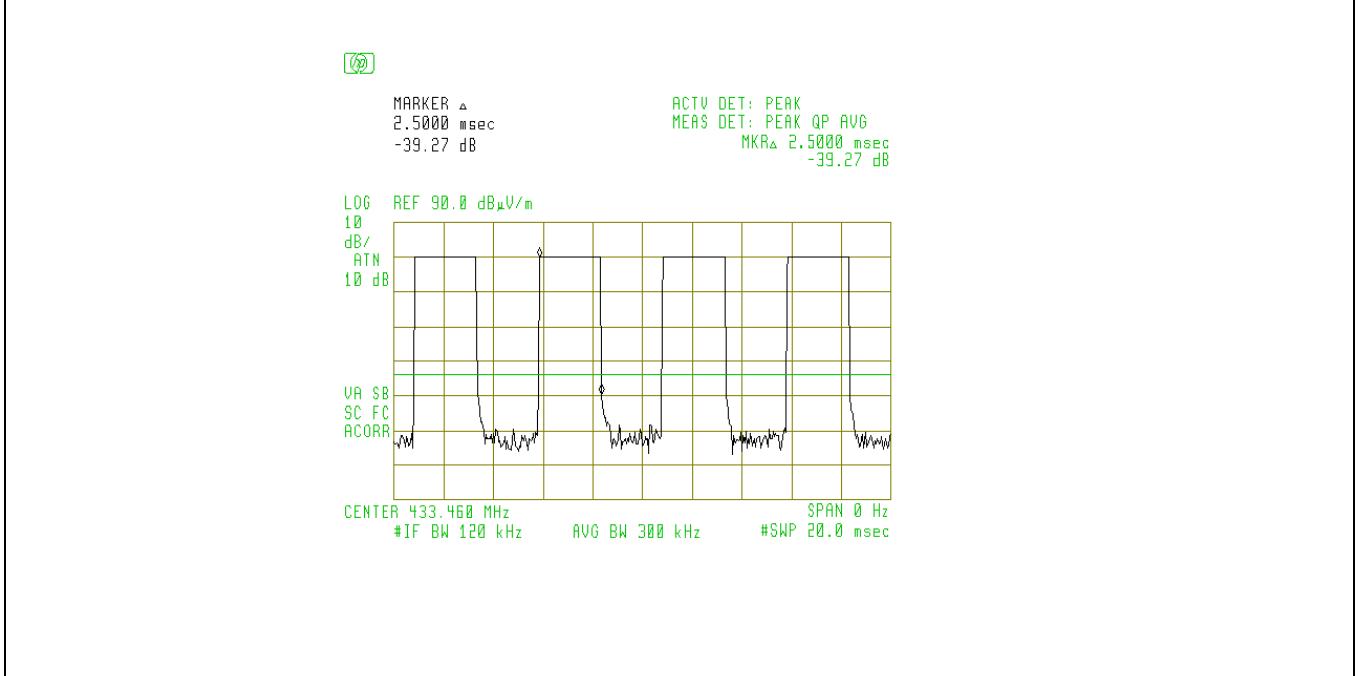
Deactivation

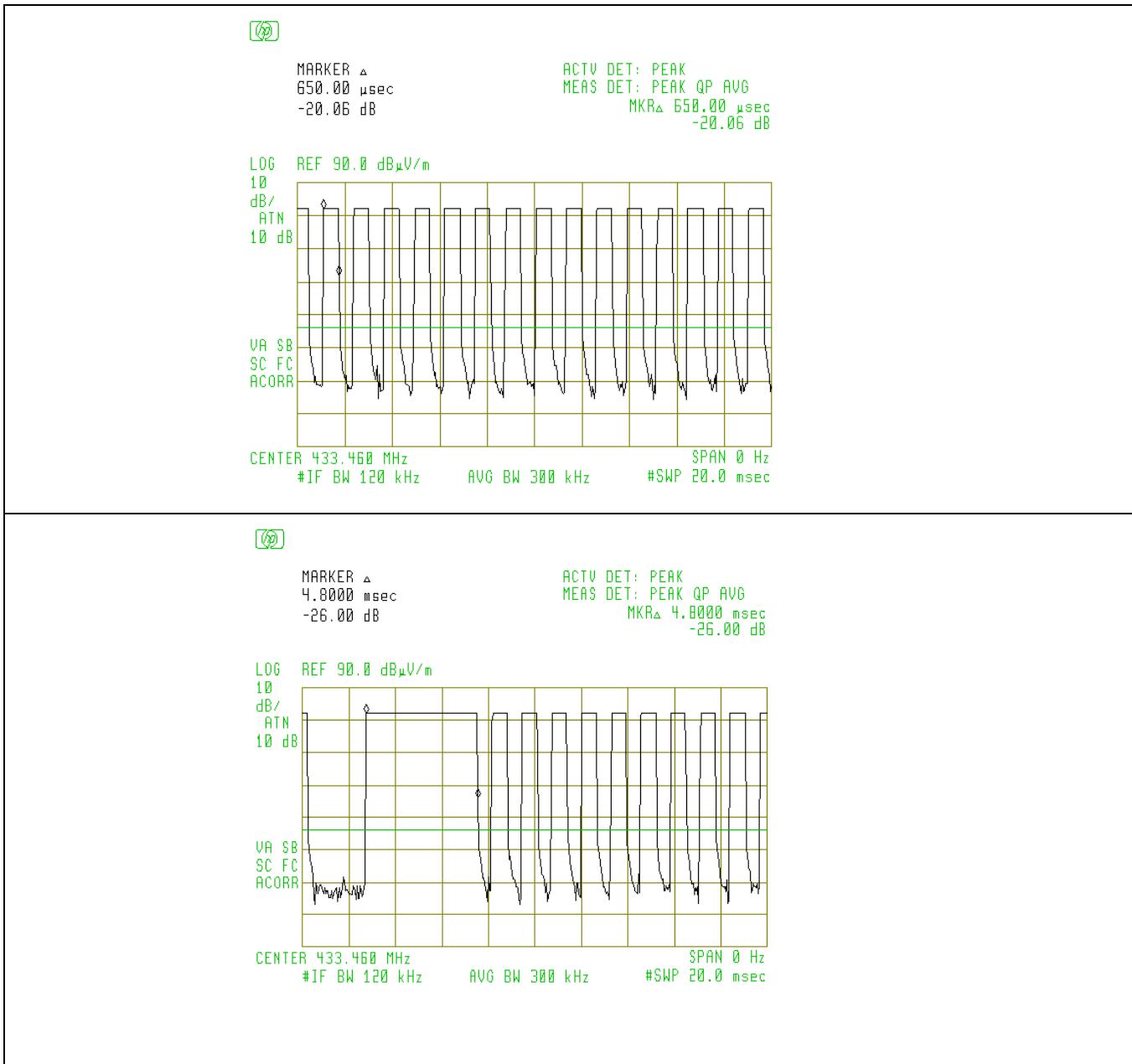
| Transmission Period (s) | Limit (s) | Result |
|-------------------------|-----------|--------|
| 0.573 | <1 | Pass |

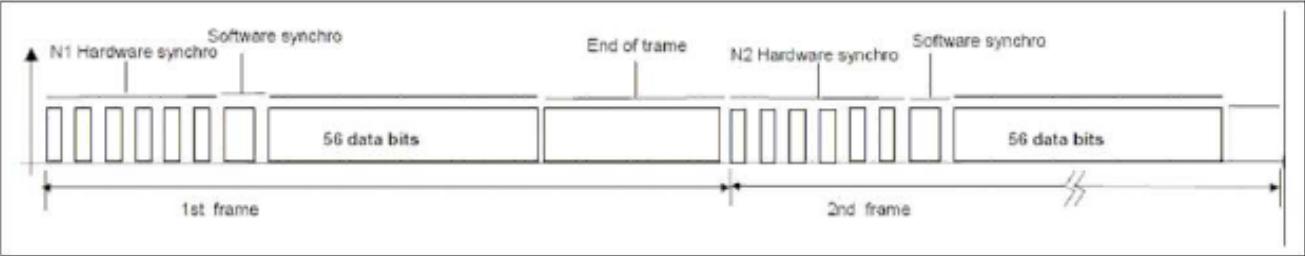
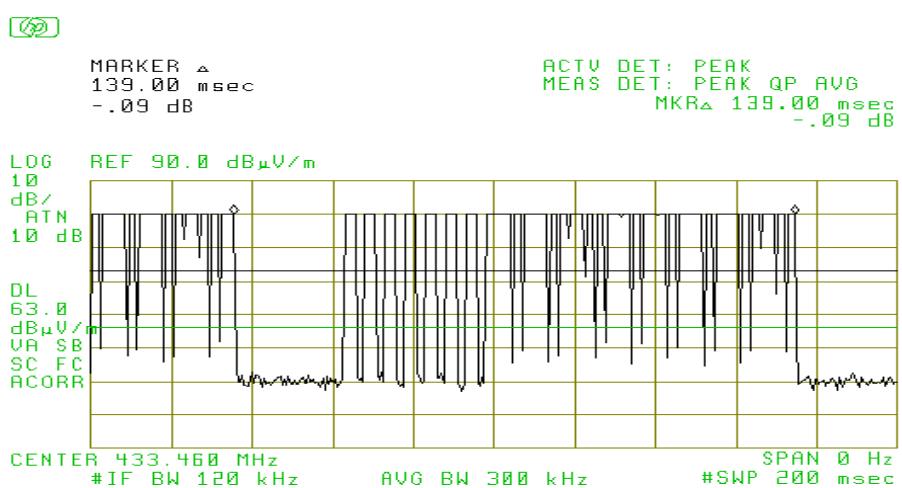
Silent Period

| Silent Period (s) | Limit (s) | Result |
|-------------------|-----------|--------|
| 17.194 | >10 | Pass |

The duration time is 0.573s, so $0.573 \times 30 = 17.19$ s.







Details and calculations are provided in Operational Description File.

Figure 6.2 Pulse Train Timing