

FCC PART 15.231

TEST REPORT

For

Changxing Potek Electronics & Technology Co., Ltd.

No. 289 Nanzhuang Road, Economic Development Zone, Changxing County, Huzhou City,
Zhejiang, China

FCC ID: 2AMV5-TX221

Report Type: Original Report	Product Type: Transmitter
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Changxing Potek Electronics & Technology Co., Ltd.
Tested Model	TX-221
Series Model	TX221-1, TX221-2, TX221-4, TX221-6
Model Difference	The number of buttons and levers (Refer to the following table)
Product Type	Transmitter
Dimension	76 mm(L) × 41.5 mm(W) × 17 mm(H)
Power Supply	DC 3.0V from CR2032 battery

Sample Model	Number of Buttons	Number of Levers
TX-221	2	0
TX221-1	2	1
TX221-2	4	1
TX221-4	4	0
TX221-6	6	0

**All measurement and test data in this report was gathered from production sample serial number: 20171120001.
(Assigned by the BACL. The EUT supplied by the applicant was received on 2017-11-20)*

Objective

This test report is prepared on behalf of Changxing Potek Electronics & Technology Co., Ltd. All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s)

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10 - 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz ~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).
The EUT has 2 buttons. All the buttons triggered the same RF parameters (Including bandwidth, power level, duty cycle).

EUT Exercise Software

No exercise software.

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

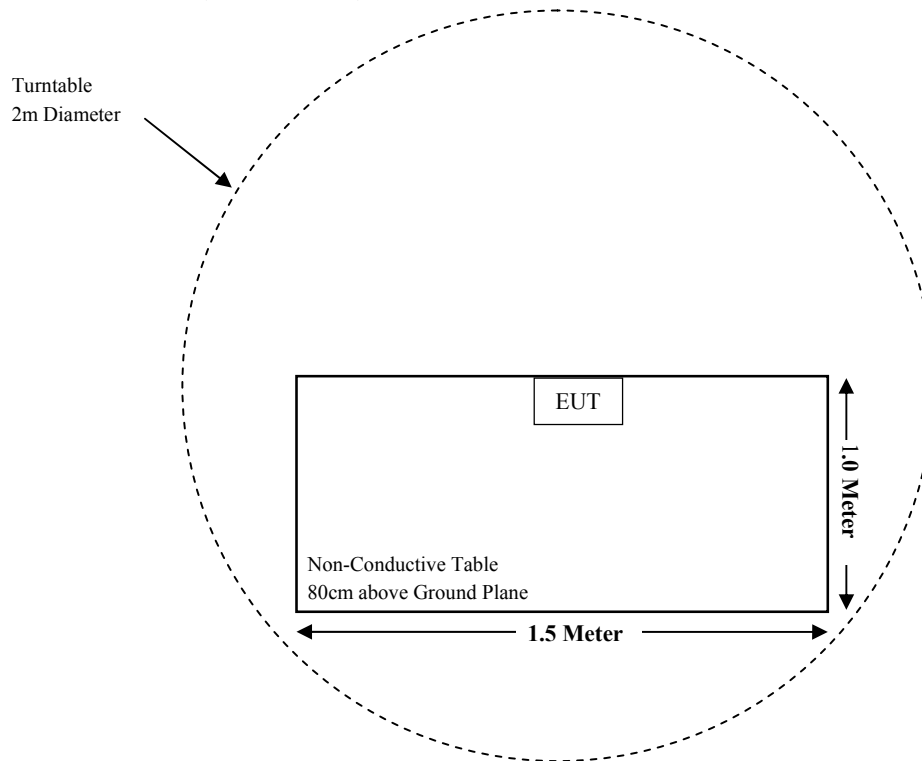
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

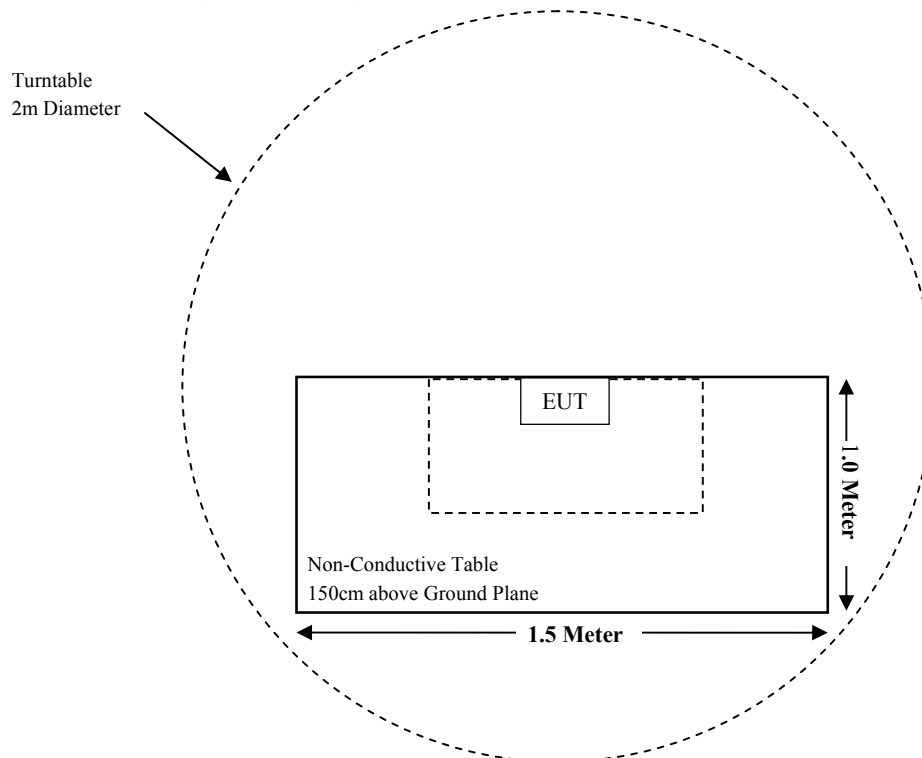
Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conducted Emissions	Not applicable (See Note)
§15.205, §15.209, §15.231(b)	Radiated Emissions	Compliance
§15.231 (a)(1)	Deactivation	Compliance
§15.231 (c)	20dB Emission Bandwidth	Compliance

Note: The EUT is powered by battery .

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-25	2018-11-24
ETS-LINDGREN	PASSIVE LOOP	6512	108100	2016-01-09	2019-01-08
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sonoma Instrunent	Pre-amplifier	310N	185700	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2017-09-21	2018-09-20
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Rohde & Schwarz	Auto test Software	EMC32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Antenna Connected Construction

The EUT has a PCB antenna arrangement which was permanently attached and the antenna gain is 3.0 dBi; fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS**Applicable Standard**

FCC §15.205, §15.209, §15.231 (b)

According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750 **	125 to 375 **
174-260	3750	375
260-470	3750 to 12500 **	375 to 1250**
Above 470	12500	1250

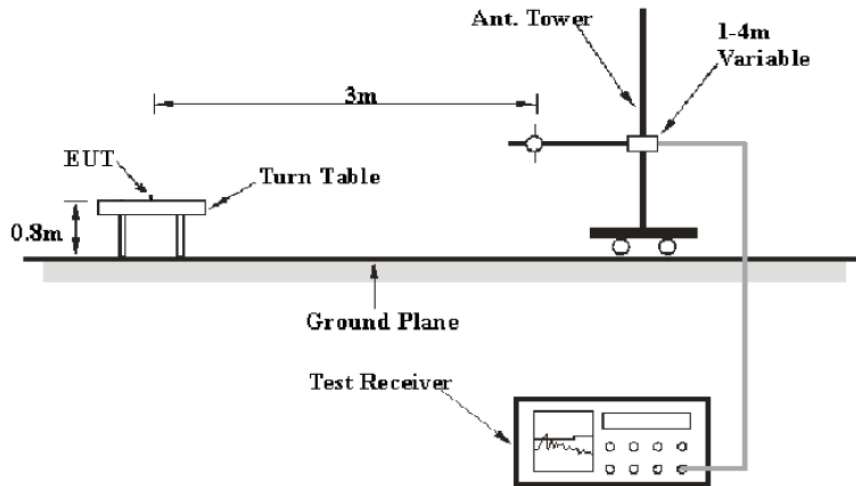
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

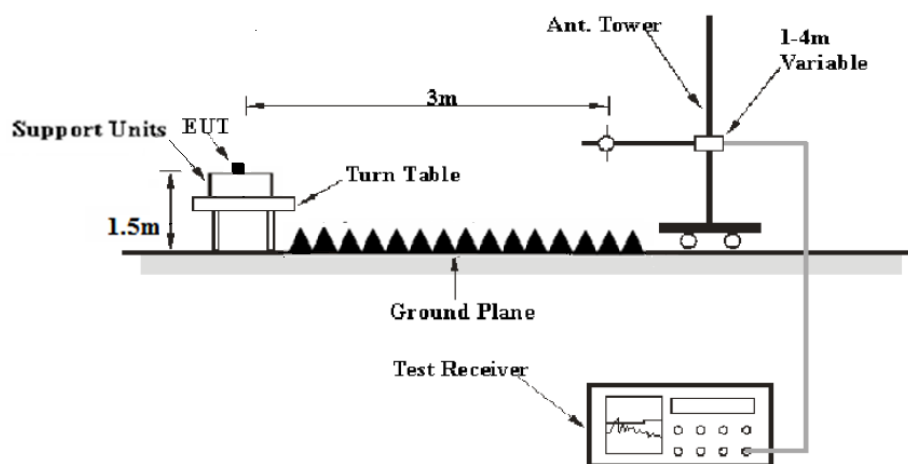
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

EUT Setup

Below 1GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
1000MHz – 5000MHz	1MHz	3MHz	/	PK

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (b).

Test Data

Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Chris Wang on 2017-12-06.

Test mode: Transmitting (Scan with X-Axis, Y-Axis and Z-Axis position, the worst case was recorded)

30MHz-5GHz (ASK modulation)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.231(b)/205/209	
	Reading (dBμV)	Detector		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
315.00	88.94	PK	213	164	H	-10.66	78.28	95.62	17.34
315.00	90.23	PK	37	180	V	-10.66	79.57	95.62	16.05
630.00	63.66	PK	166	181	H	-4.72	58.94	75.62	16.68
630.00	64.83	PK	306	143	V	-4.72	60.11	75.62	15.51
945.00	55.73	PK	156	235	H	1.11	56.84	75.62	18.78
945.00	57.79	PK	233	102	V	1.11	58.90	75.62	16.72
1260.00	68.06	PK	282	134	H	-9.55	58.51	75.62	17.11
1260.00	68.99	PK	71	213	V	-9.55	59.44	75.62	16.18
1575.00	66.19	PK	260	157	H	-7.34	58.85	74.00	15.15
1575.00	64.50	PK	267	158	V	-7.34	57.16	74.00	16.84
1890.00	65.56	PK	289	121	H	-5.77	59.79	75.62	15.83
1890.00	64.29	PK	279	150	V	-5.77	58.52	75.62	17.10
3150.00	49.63	PK	343	159	H	-0.65	48.98	75.62	26.64
3150.00	47.90	PK	323	140	V	-0.65	47.25	75.62	28.37

Field Strength of Average Emission

Frequency (MHz)	Peak Measurement@3m (dBμV/m)	Polar (H/V)	Duty Cycle Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.231(b)/205/209	
					Limit (dBμV/m)	Margin (dB)
315.00	78.28	H	-8.05	70.23	75.62	5.39
315.00	79.57	V	-8.05	71.52	75.62	4.10
630.00	58.94	H	-8.05	50.89	55.62	4.73
630.00	60.11	V	-8.05	52.06	55.62	3.56
945.00	56.84	H	-8.05	48.79	55.62	6.83
945.00	58.90	V	-8.05	50.85	55.62	4.77
1260.00	58.51	H	-8.05	50.46	55.62	5.16
1260.00	59.44	V	-8.05	51.39	55.62	4.23
1575.00	58.85	H	-8.05	50.80	54.00	3.20
1575.00	57.16	V	-8.05	49.11	54.00	4.89
1890.00	59.79	H	-8.05	51.74	55.62	3.88
1890.00	58.52	V	-8.05	50.47	55.62	5.15
3150.00	48.98	H	-8.05	40.93	55.62	14.69
3150.00	47.25	V	-8.05	39.20	55.62	16.42

Note 1:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor

Margin = Limit - Corr. Amplitude

Note 2:

Calculate Average value based on Duty Cycle correction factor:

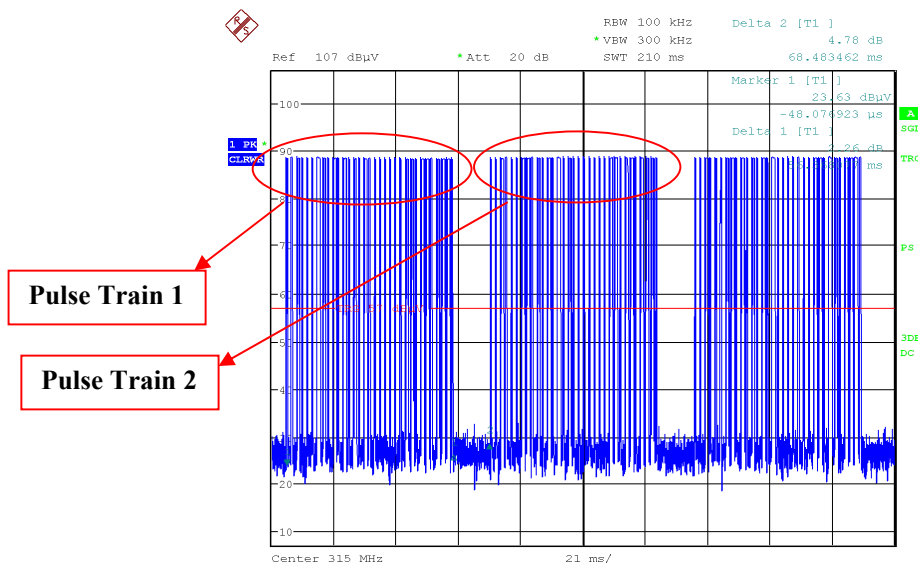
$T_p = 68.483\text{ms}$

$T_{on} = \text{Burst1} * N_1 + \text{Burst2} * N_2 = 1.250\text{ms} * 14 + 0.505\text{ms} * 19 = 27.095\text{ms}$

Duty Cycle Corrected Factor $= 20 * \log(T_{on}/T_p) = 20 * \log(27.095\text{ms}/68.483\text{ms}) = -8.05\text{dB}$

Average = Peak + Duty Cycle Corrected Factor

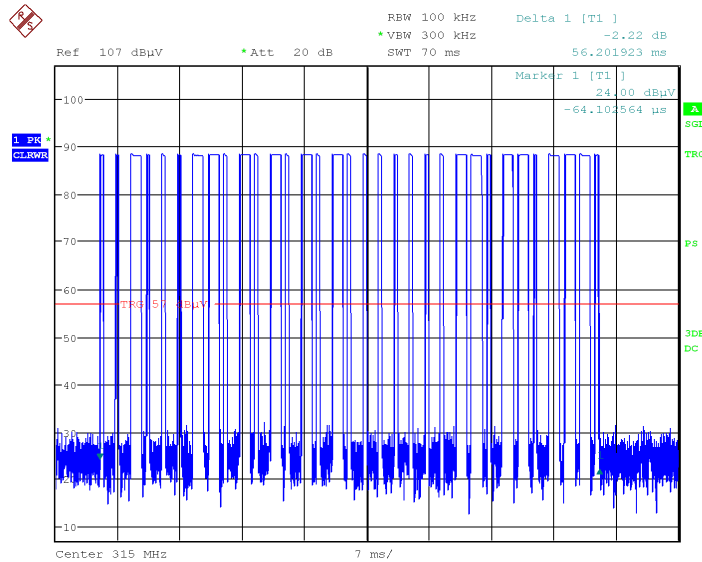
Duty Cycle $T_p = 68.483\text{ms}$



Date: 6.DEC.2017 10:28:26

Zoom in Pulse Train 1

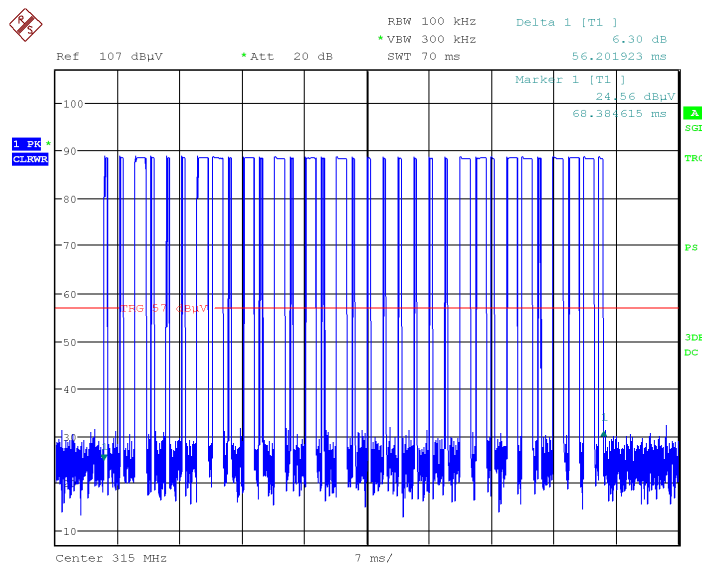
N1=14, N2=19



Date: 6.DEC.2017 10:35:16

Zoom in Pulse Train 2

N1=14, N2=19



Date: 6.DEC.2017 10:36:31

Ref 107 dBμV Att 20 dB RBW 100 kHz VBW 300 kHz SWT 5 ms Delta 1 [T1] 8.49 dB 1.250000 ms

Marker 1 [T1] 16.19 dBμV 53.774038 ms

TRG 57 dBμV

Center 315 MHz 500 μs/

REW 100 kHz Marker 1 [T1] 17.10 dBuV
 *VBW 300 kHz
 *Att 20 dB
 SWT 5 ms
 55.440705 ms

Ref 107 dBuV

Delta 1 [T1] 17.10 dB
 504.807692 μs

1 [T1]
 57 dBuV

Center 315 MHz 500 μs/

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FCC §15.231(a) (1) - DEACTIVATION TESTING**Applicable Standard**

Per FCC §15.231(a) (1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=1MHz VBW=3MHz Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

Test Data**Environmental Conditions**

Temperature:	24.1 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

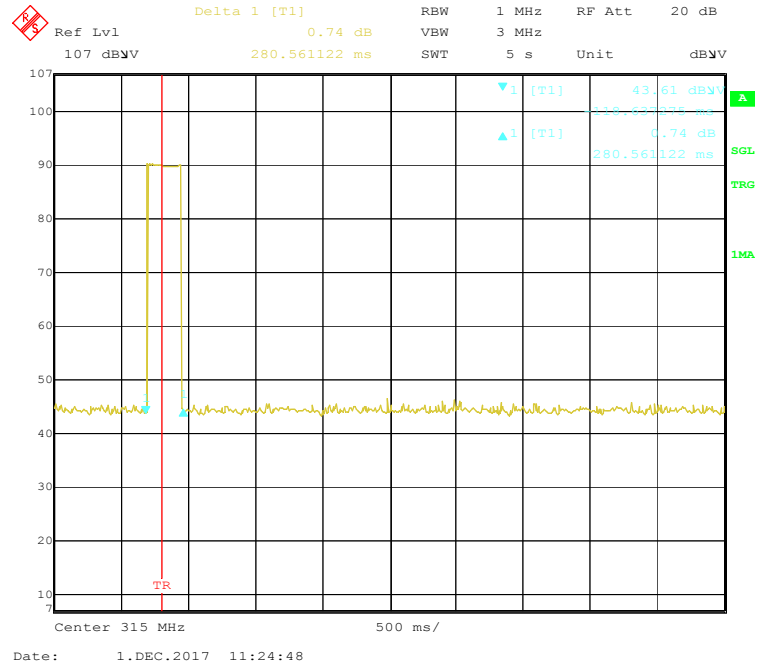
The testing was performed by Chris Wang on 2017-12-01.

Test mode: Transmitting

Channel Frequency (MHz)	Transmission Time (s)	Limit (s)	Result
315.00	0.28	<5	Pass

ASK Modulation

5s



FCC §15.231(c) - 20dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data**Environmental Conditions**

Temperature:	24.1 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

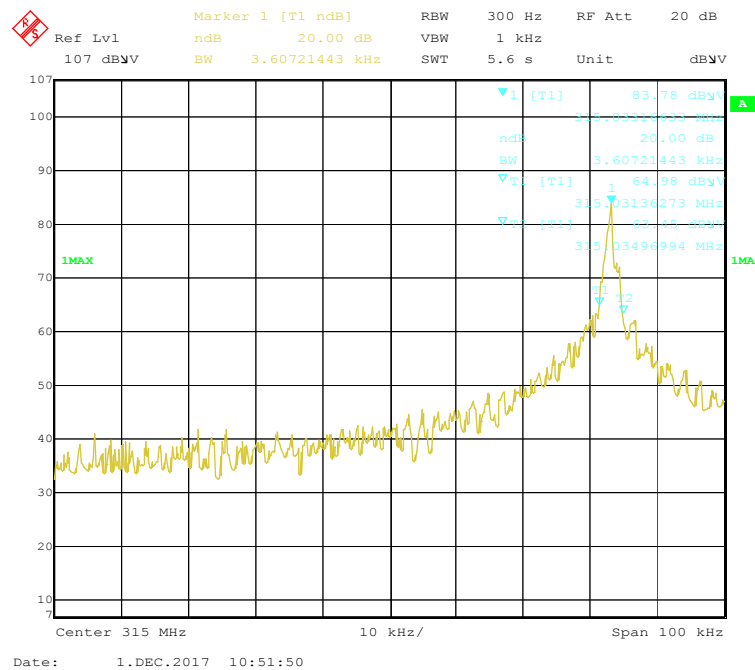
The testing was performed by Chris Wang on 2017-12-01.

Test Mode: Transmitting

ASK modulation:

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
315.00	3.61	787.50	Pass

Note: Limit = 0.25% * Center Frequency = 0.25% * 315.00 MHz = 787.50 kHz

20 dB Emission Bandwidth

******* END OF REPORT *******