TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.231

TEST REPORT

For

Broan-NuTone LLC

926 West State Street Hartford Wisconsin 53027 United States

FCC ID: 2ADLL-RGB002

Report Type:	Product Type:
Original Report	WALL CONTROL F AER110RGBL

Report Number:	RDG181221051-00
Report Date:	2019-01-31
Reviewed By:	Jerry Zhang EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	WALL CONTROL F AER110RGBL
EUT Model:	1100402
Rated Input Voltage:	DC3V from battery
External Dimension:	124mm(L)*80mm(W)*27.8mm(H)
Serial Number:	181221051
EUT Received Date:	2018.12.25

Objective

This report is prepared on behalf of ***Broan-NuTone LLC*** in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules.

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

Related Submittal(s)/Grant(s)

No related submittal(s)

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0022.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured in testing mode which was provided by manufacturer.

The device operation frequency is 433.92 MHz.

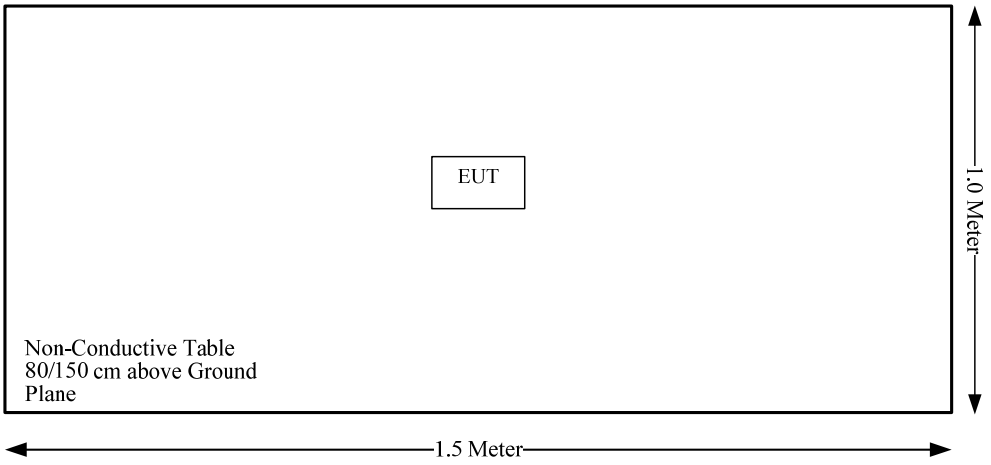
Equipment Modifications

No modifications were made to the unit tested.

EUT Exercise Software

No software was used in test.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

Not Applicable: the device was powered by battery.

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 Connector Construction

The EUT has 1 internal antenna, which was permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

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

Applicable Standard

FCC §15.205, §15.209, §15.231 (b)

(b) In addition to the provisions of §15.205, 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 emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	[1]1,250 to 3,750	[1]125 to 375
174-260	3,750	375
260-470	[1]3,750 to 12,500	[1]375 to 1,250
Above 470	12,500	1,250

[1]Linear interpolations.

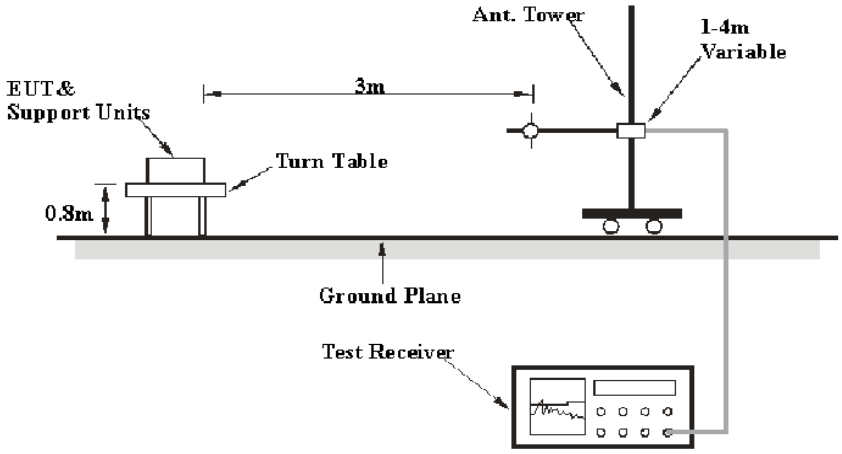
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(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.

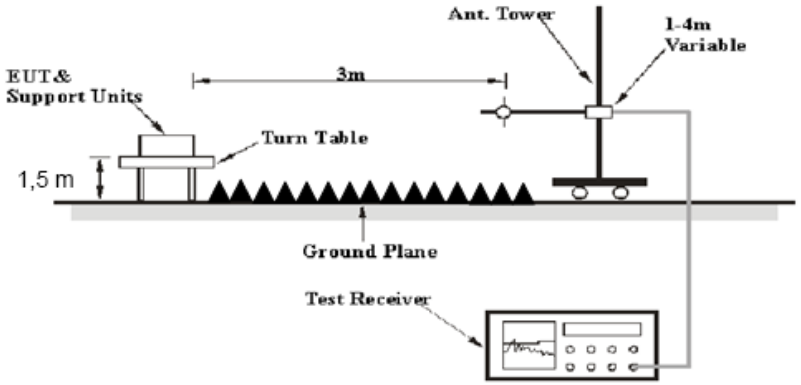
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in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

EUT Setup

Below 1 GHz:



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 test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	100 kHz	PK
1 GHz – 5 GHz	1 MHz	3 MHz	/	PK

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2018-12-10	2019-12-10
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2018-05-06	2019-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2020-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05

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

Test Procedure

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

According to §15.231, Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, 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

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Data

Environmental Conditions

Temperature:	22.5~22.9 °C
Relative Humidity:	34~45 %
ATM Pressure:	100.8kPa

The testing was performed by Vern Shen ,Tyler Pan, Tyler Pan on 2019-01-21.

Test mode: Transmitting

Field Strength (Peak)

Frequency (MHz)	Receiver Reading (dBµV)	Rx Antenna Polar (H/V)	Rx Antenna Factor (dB/m)	Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Operating Frequency: 433.92 MHz								
433.92	61.16	H	16.48	2.65	0.00	80.29	100.83	20.54
433.92	65.54	V	16.48	2.65	0.00	84.67	100.83	16.16
867.84	40.86	H	21.76	4.09	26.68	40.03	80.83	40.80
867.84	43.27	V	21.76	4.09	26.68	42.44	80.83	38.39
1301.76	74.34	H	24.53	1.57	35.95	64.49	74.00	9.51
1301.76	67.91	V	24.53	1.57	35.95	58.06	74.00	15.94
1735.68	66.12	H	26.19	1.65	36.06	57.90	80.83	22.93
1735.68	65.81	V	26.19	1.65	36.06	57.59	80.83	23.24
2169.60	70.41	H	27.64	1.74	36.18	63.61	80.83	17.22
2169.60	75.50	V	27.64	1.74	36.18	68.70	80.83	12.13
2603.52	77.19	H	28.67	1.88	36.38	71.36	80.83	9.47
2603.52	69.04	V	28.67	1.88	36.38	63.21	80.83	17.62
3037.44	70.44	H	30.19	2.18	37.04	65.77	80.83	15.06
3037.44	71.07	V	30.19	2.18	37.04	66.40	80.83	14.43

Field Strength (Average)

Frequency (MHz)	Peak Measurement@3m (dBµV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Average Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Operating Frequency: 433.92 MHz						
433.92	80.29	H	-14.02	66.27	80.83	14.56
433.92	84.67	V	-14.02	70.65	80.83	10.18
867.84	40.03	H	-14.02	26.01	60.83	34.82
867.84	42.44	V	-14.02	28.42	60.83	32.41
1301.76	64.49	H	-14.02	50.47	54	3.53
1301.76	58.06	V	-14.02	44.04	54	9.96
1735.68	57.9	H	-14.02	43.88	60.83	16.95
1735.68	57.59	V	-14.02	43.57	60.83	17.26
2169.6	63.61	H	-14.02	49.59	60.83	11.24
2169.6	68.7	V	-14.02	54.68	60.83	6.15
2603.52	71.36	H	-14.02	57.34	60.83	3.49
2603.52	63.21	V	-14.02	49.19	60.83	11.64
3037.44	65.77	H	-14.02	51.75	60.83	9.08
3037.44	66.4	V	-14.02	52.38	60.83	8.45

Note: the minimum duty cycle was the worst for calculation.
Average = peak+ Duty Cycle Correction Factor

Duty Cycle Correction Factor Calculation:

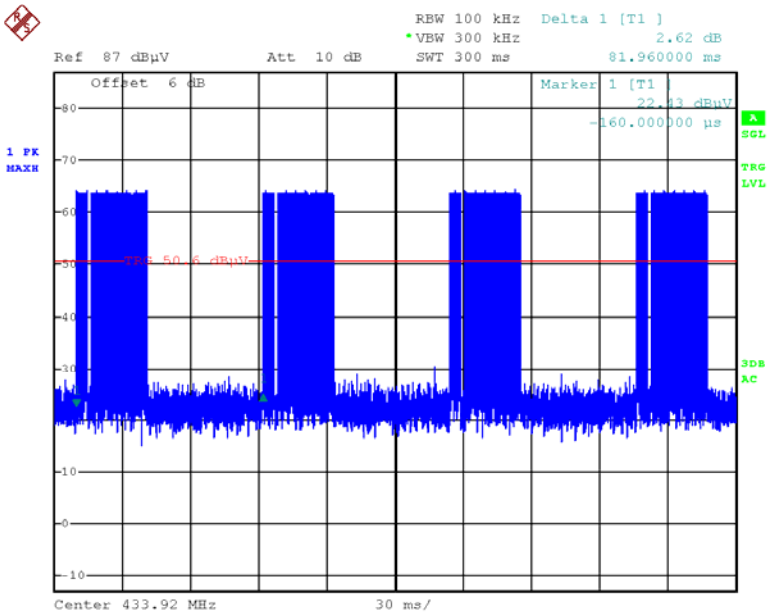
Keys	Pulse 1 width (ms)	Pulse 1 Numbers	Pulse 2 width (ms)	Pulse 2 Numbers	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1	0.24	35	0.44	18	19.91%	-14.02
2	0.24	36	0.44	17	19.69%	-14.11
3	0.24	36	0.44	17	19.69%	-14.11
4	0.24	35	0.44	18	19.79%	-14.07
5	0.24	36	0.44	17	19.46%	-14.22
6	0.24	35	0.44	18	19.90%	-14.03
7	0.24	35	0.44	18	19.90%	-14.02

Note:
Duty cycle=(Pulse 1 Width*Pulse 1 Number + Pulse 2 Width*Pulse 2 Number)/Ton+off
Duty Cycle Correction Factor= 20*log(Duty cycle)

Please refer to the following plots for duty cycle test:

Key 1:

On+Off=81.96ms



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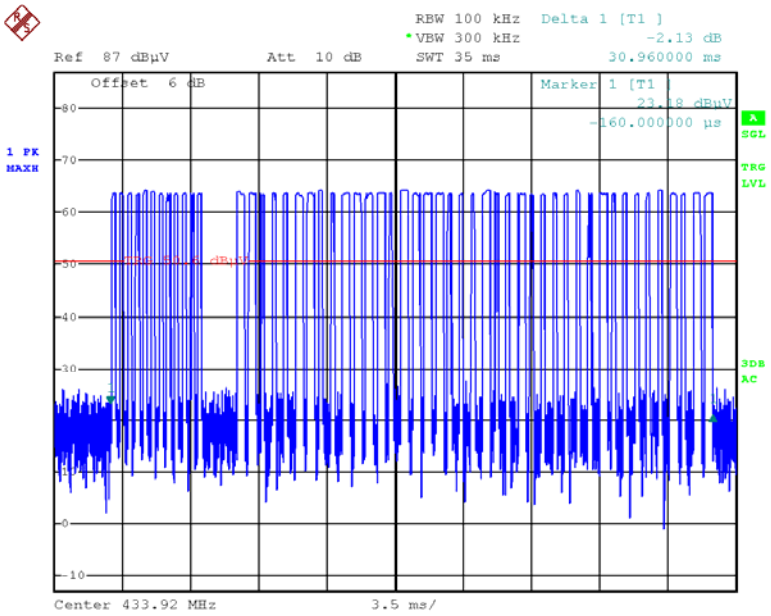
*Pulse1*35+ Pulse2 *18*



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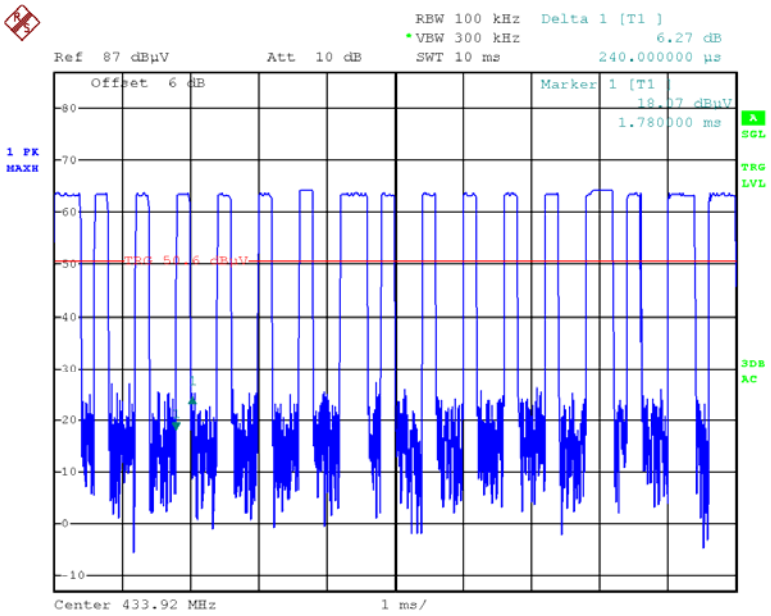
Pulse1 0.24ms



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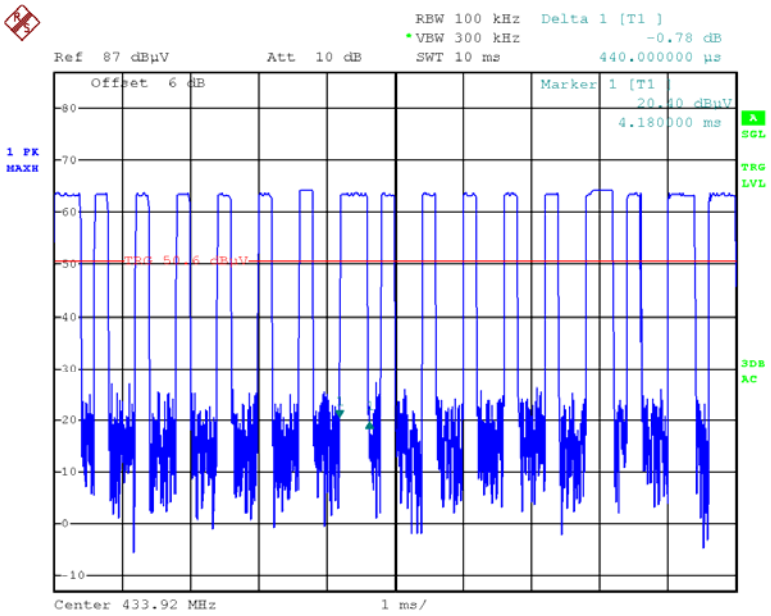
Pulse2 0.44ms



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Key 2:

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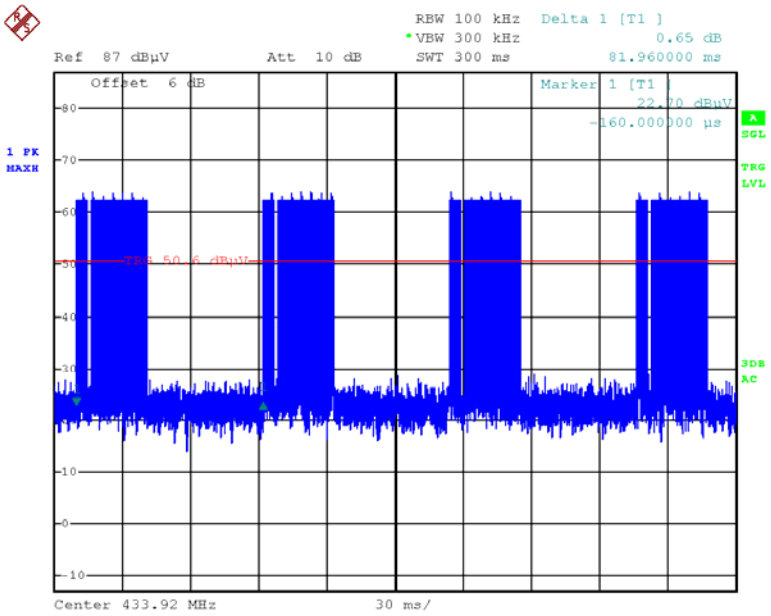

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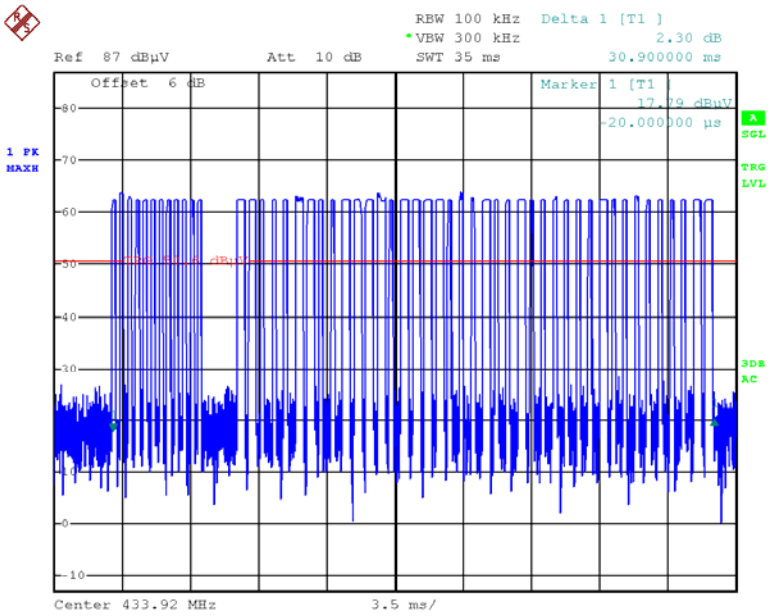
*Pulse1*36+ Pulse2 *17*



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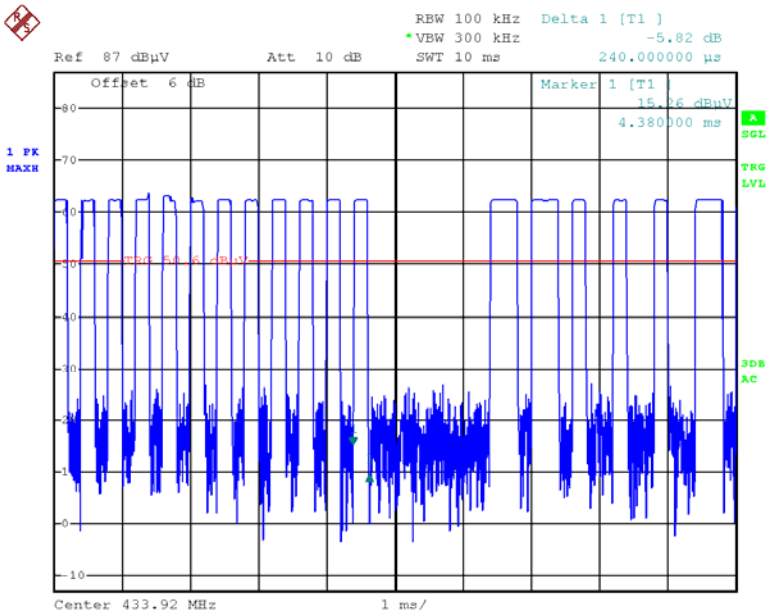
Pulse1 0.24ms



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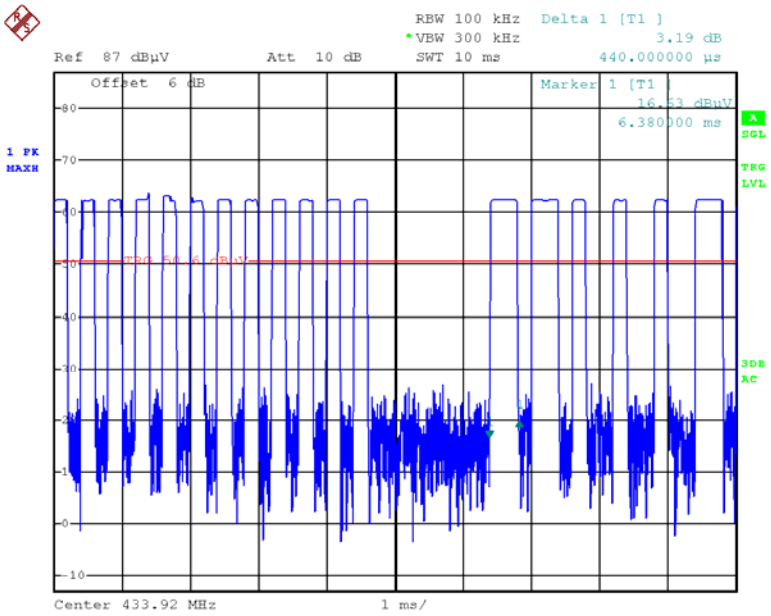
Pulse2 0.44ms



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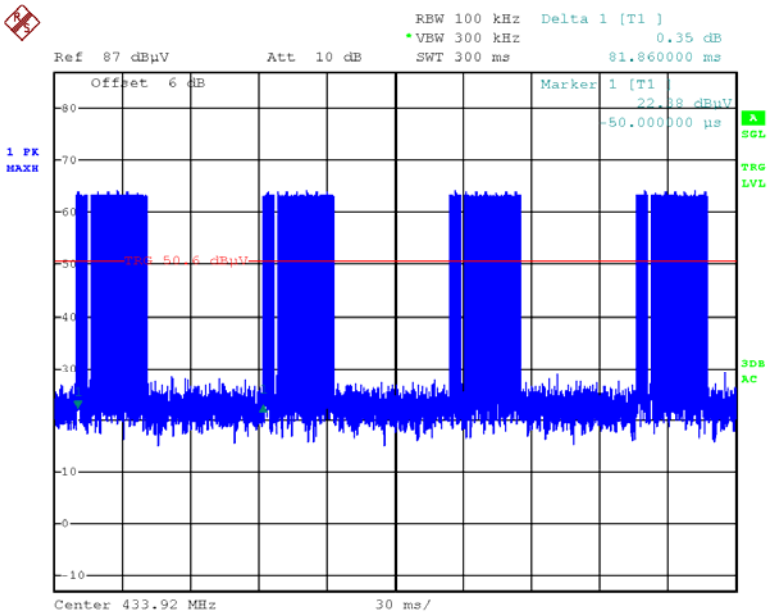
Key 3:

On+Off=81.86ms



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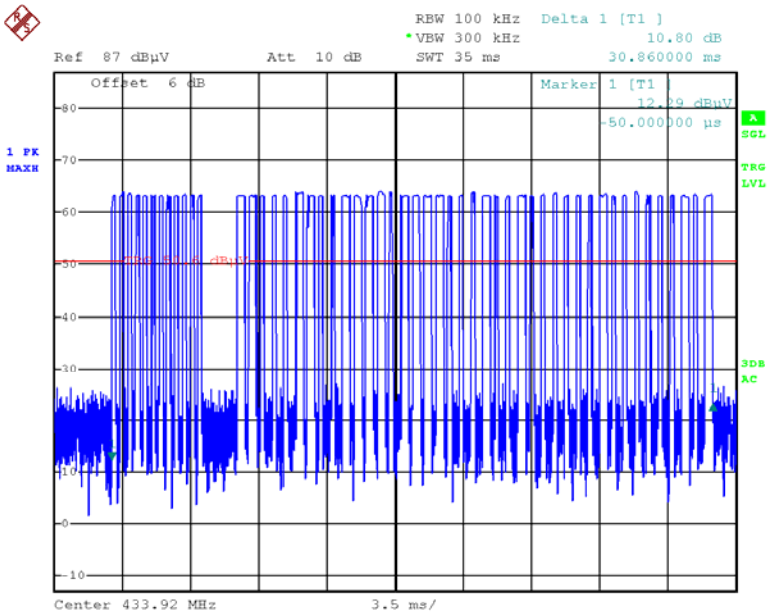
*Pulse1*36+ Pulse2 *17*



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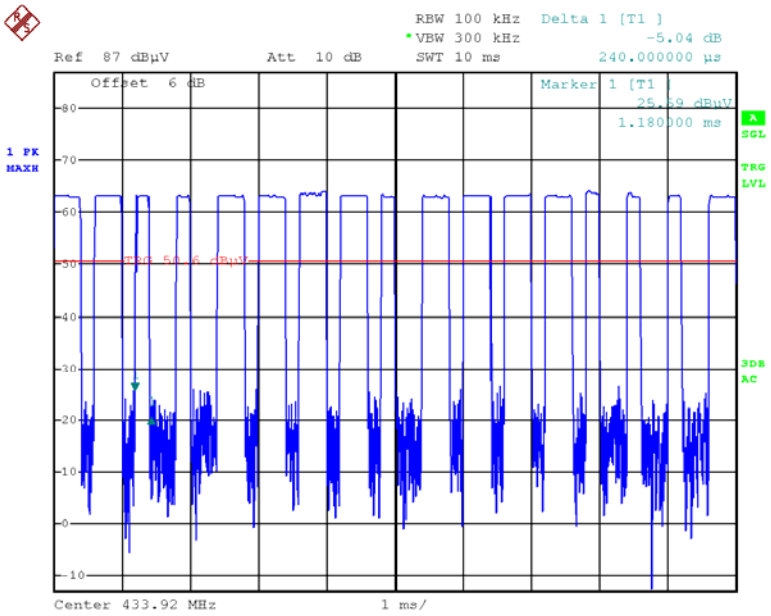
Pulse1 0.24ms



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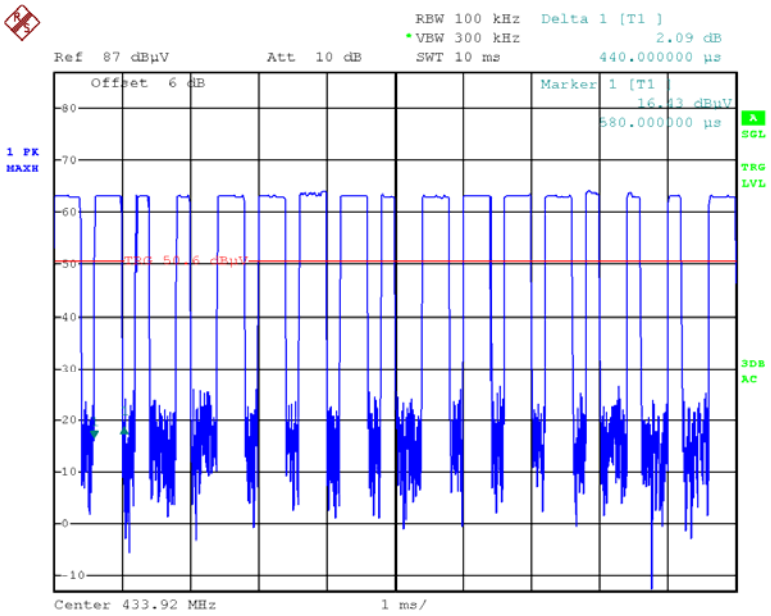
Pulse2 0.44ms



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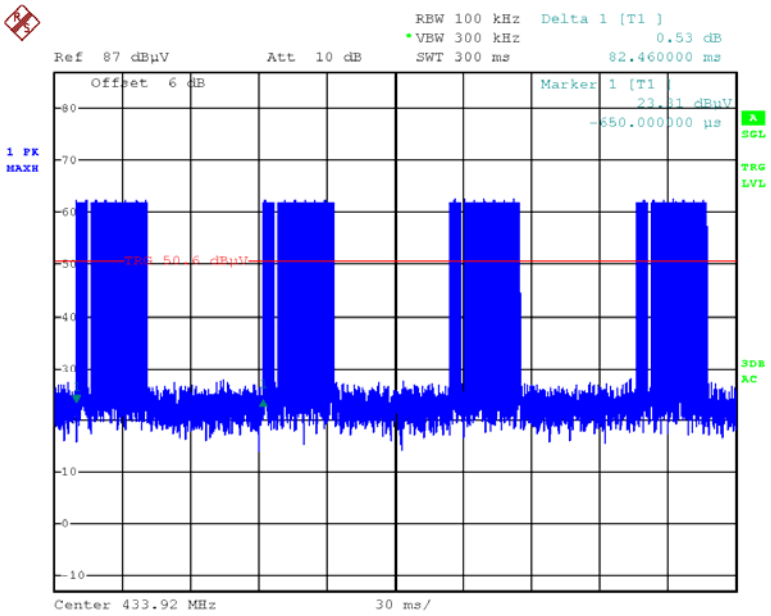

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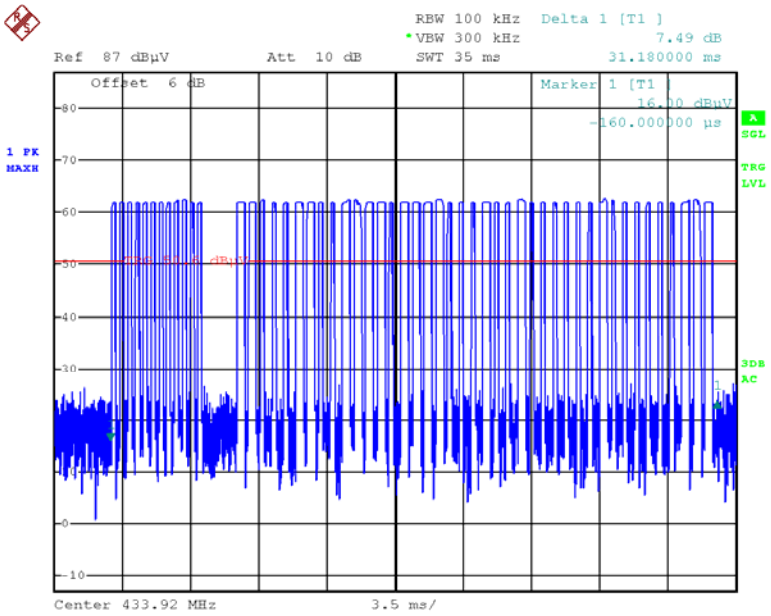
*Pulse1*35+ Pulse2 *18*



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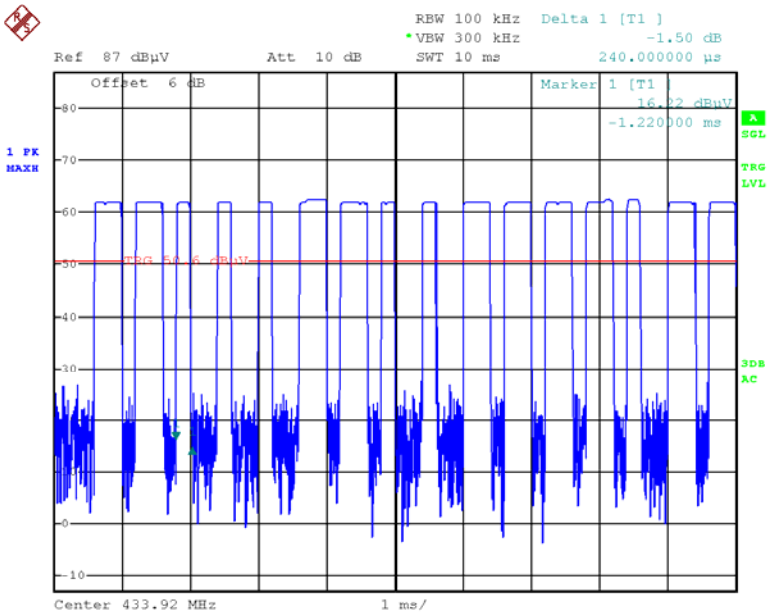
Pulse1 0.24ms



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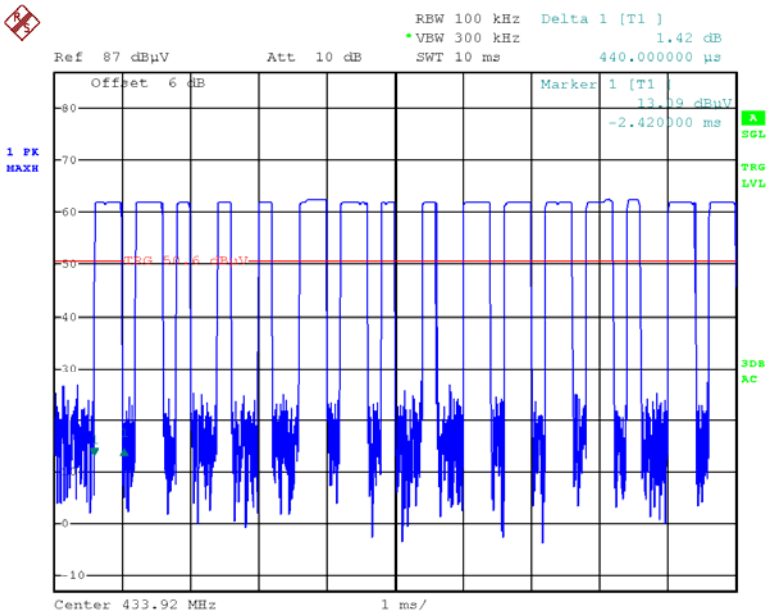
Pulse2 0.44ms



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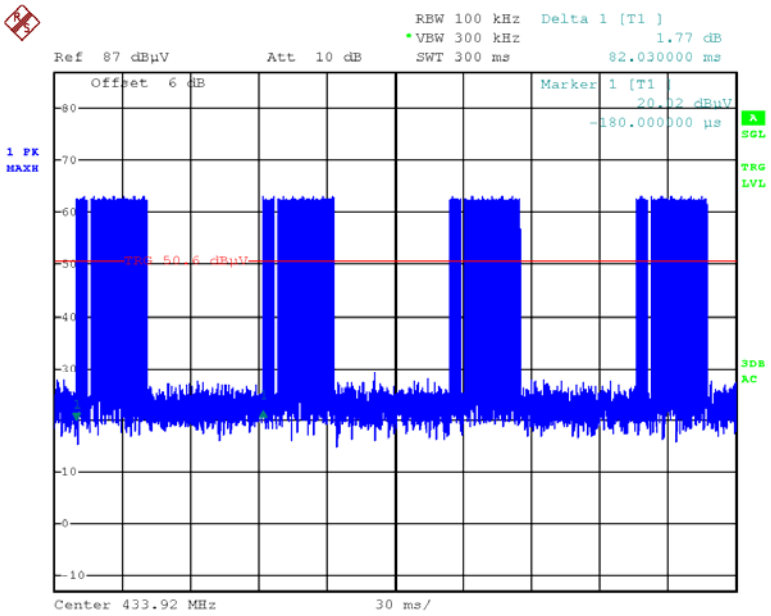

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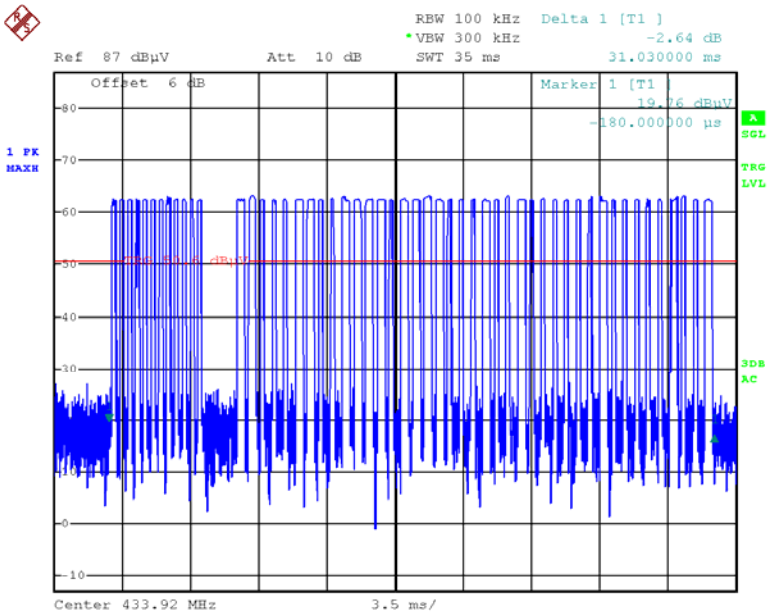
*Pulse1*36+ Pulse2 *17*



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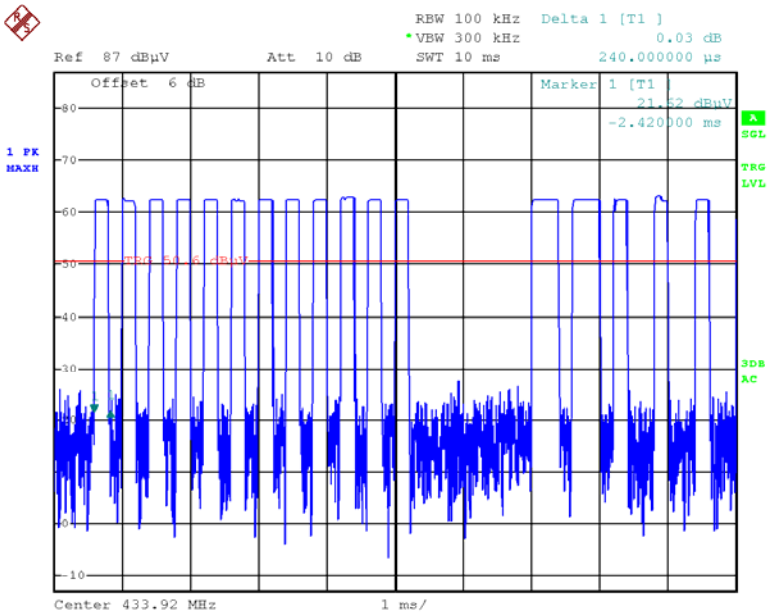

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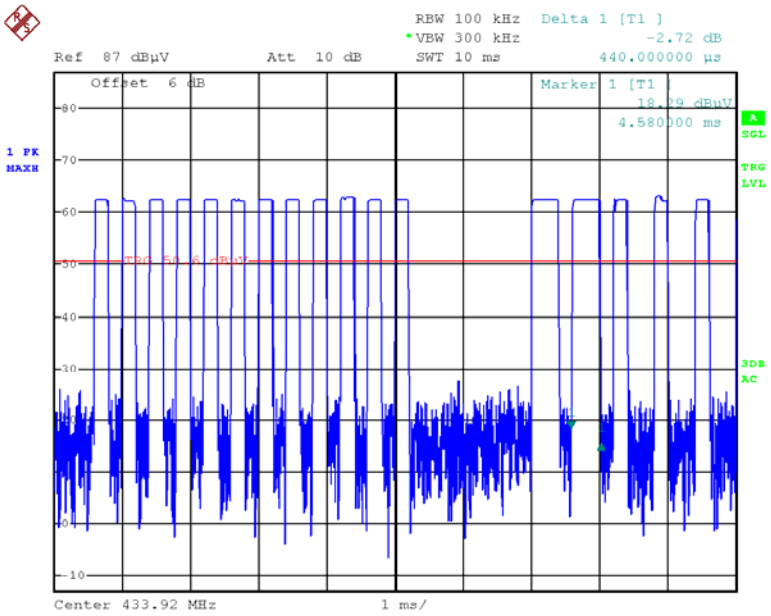

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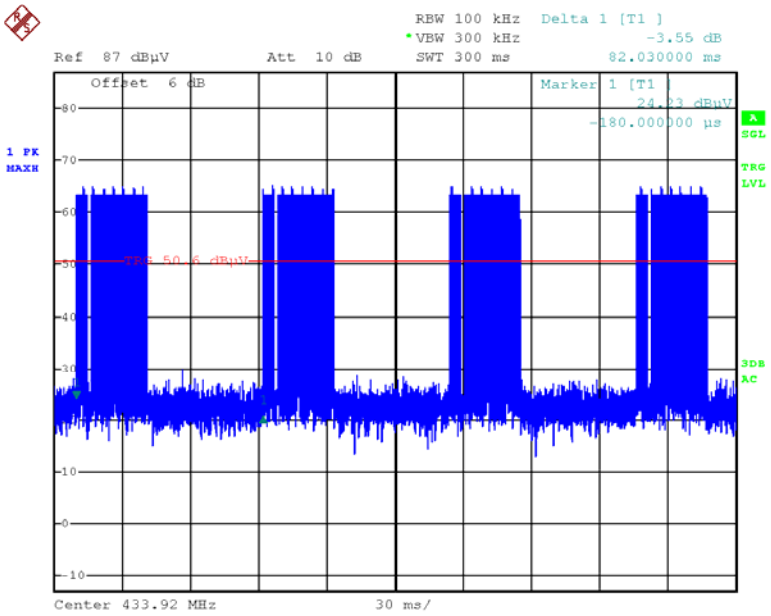

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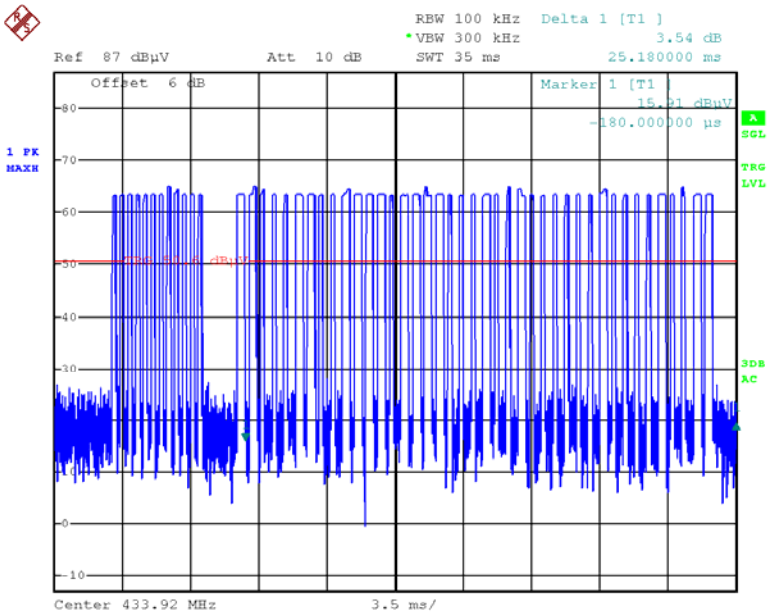

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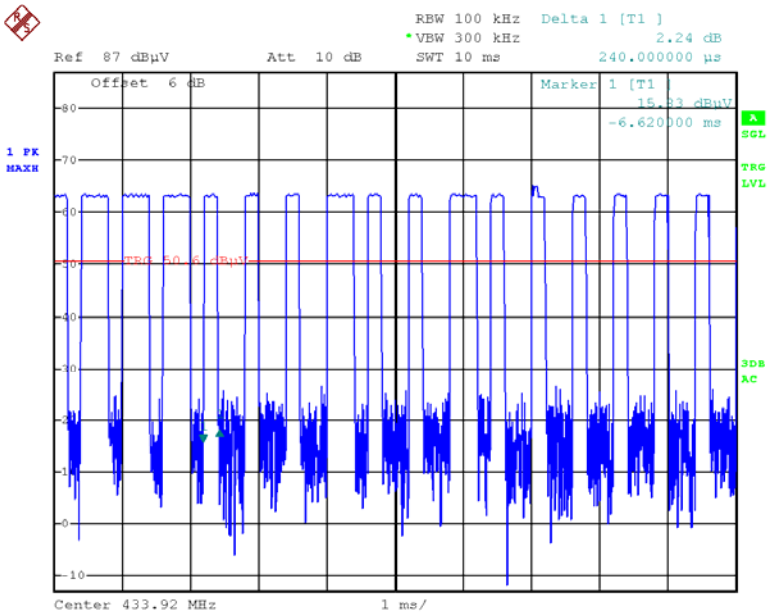

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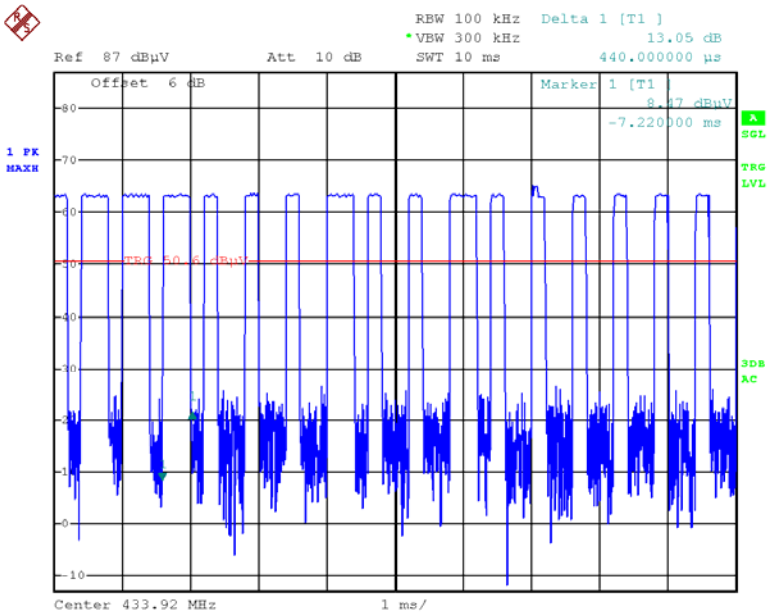

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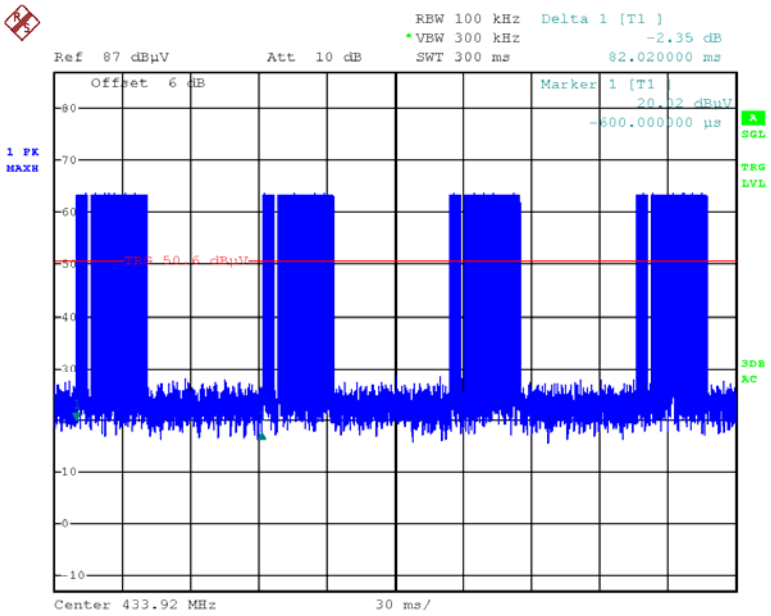
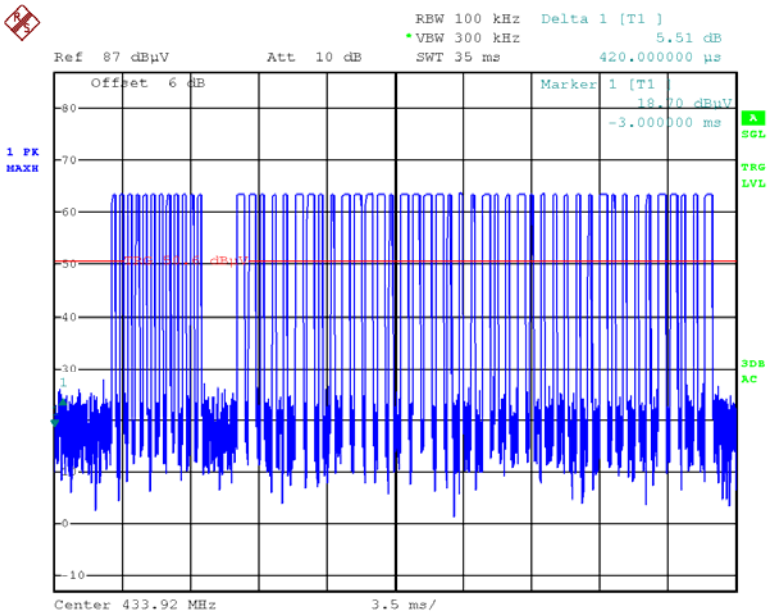
On+Off=82.02ms



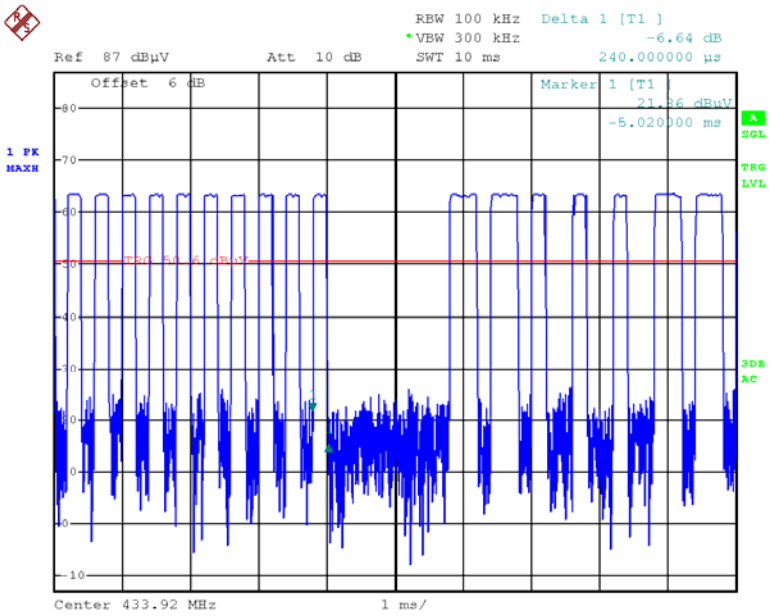
Date: 21.JAN.2019 15:33:41

*Pulse1*35+ Pulse2 *18*



Date: 21.JAN.2019 15:32:51

Pulse1 0.24ms



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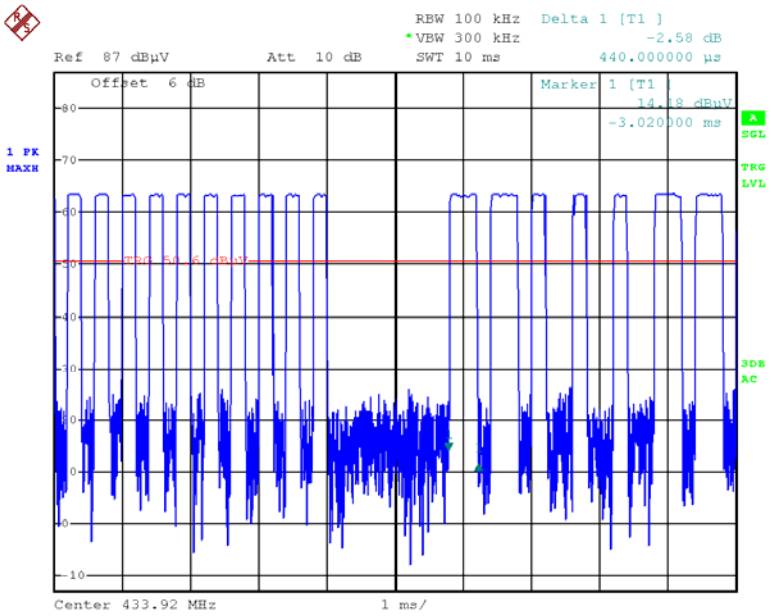
Pulse2 0.44ms



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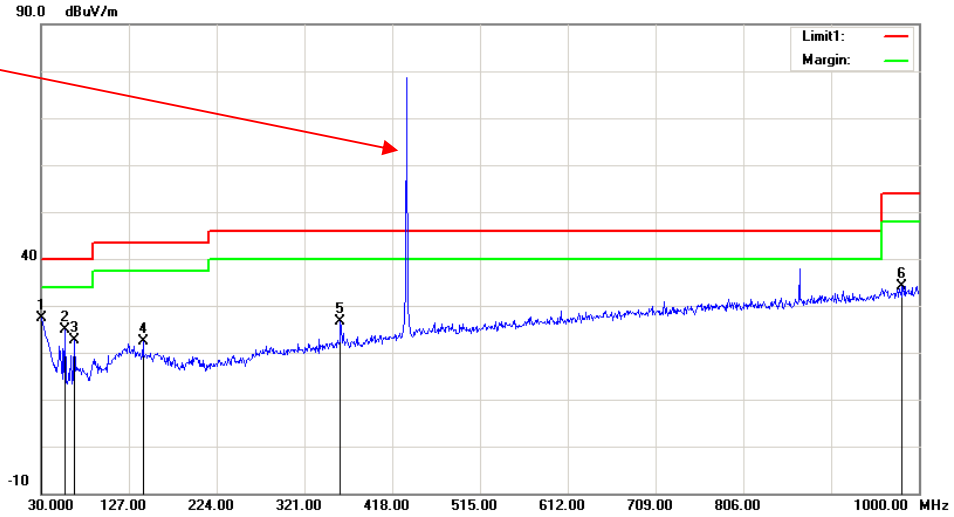
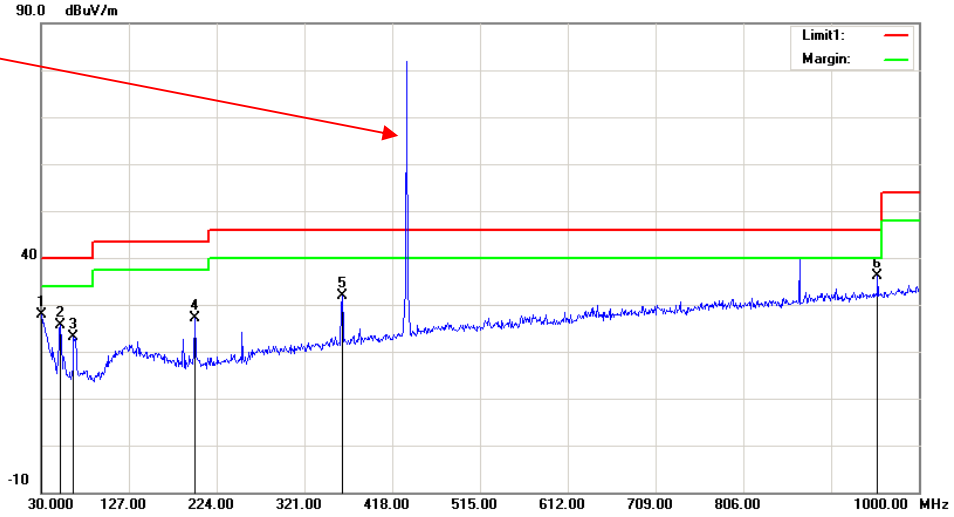
Horizontal:

Fundamental

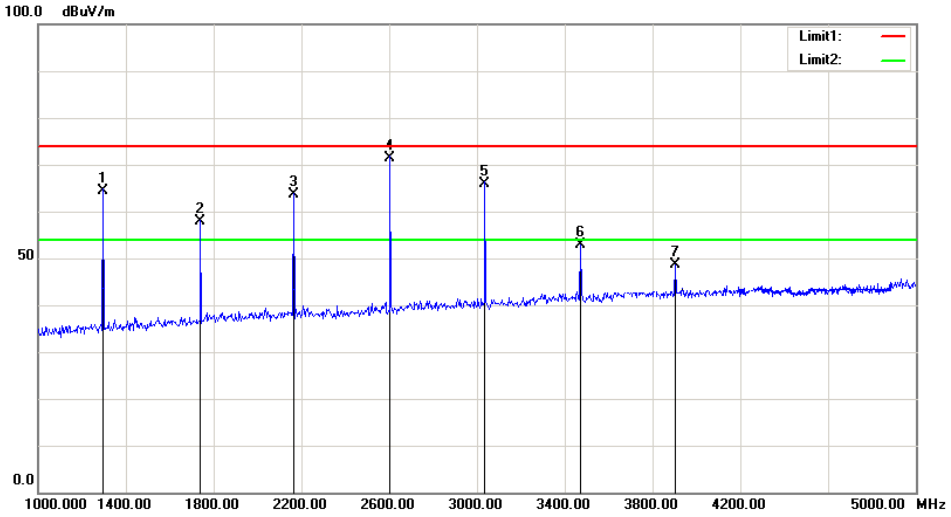


Vertical:

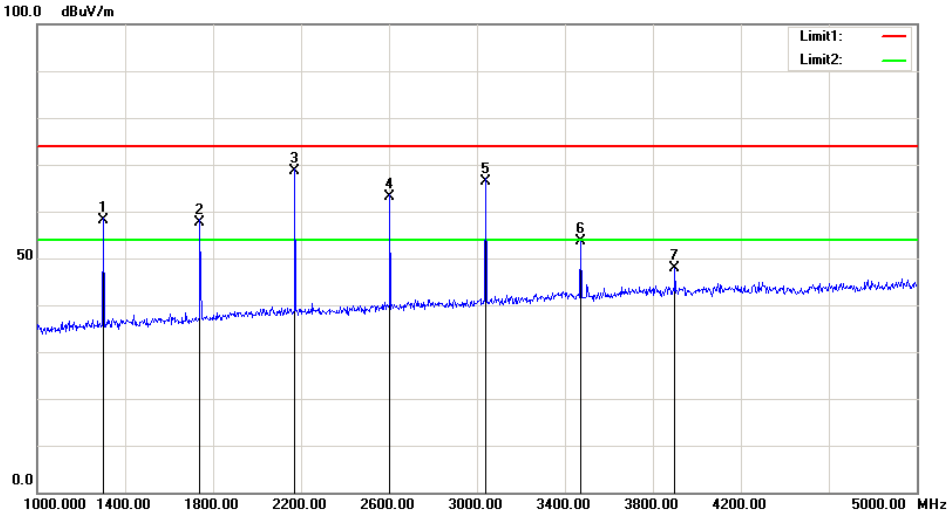
Fundamental



Horizontal:



Vertical:



FCC §15.231(c) – 20 dB BANDWIDTH TESTING

Requirement

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2018-12-10	2019-12-10
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2018-05-06	2019-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05

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

Test Procedure

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:	19.6°C
Relative Humidity:	29 %
ATM Pressure:	102.3 kPa

The testing was performed by Vern Shen on 2019-01-01.

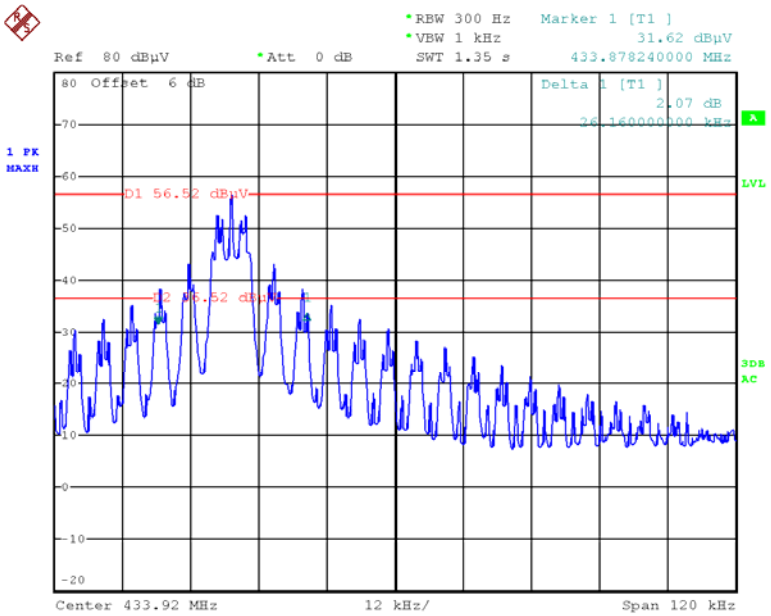
Test Mode: Transmitting

Please refer to following table and plot.

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	26.16	1084.8	Pass

Note: Limit = 0.25% * Center Frequency = 0.25%*433.92MHz = 1084.8kHz

20 dB Bandwidth



Date: 1.JAN.2019 14:58:32

FCC §15.231(a) - DEACTIVATION TESTING

Applicable Standard

Per 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2018-12-10	2019-12-10
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2018-05-06	2019-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05

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

Test Data

Environmental Conditions

Temperature:	22.9~23.8°C
Relative Humidity:	34~50 %
ATM Pressure:	100.6~100.8 kPa

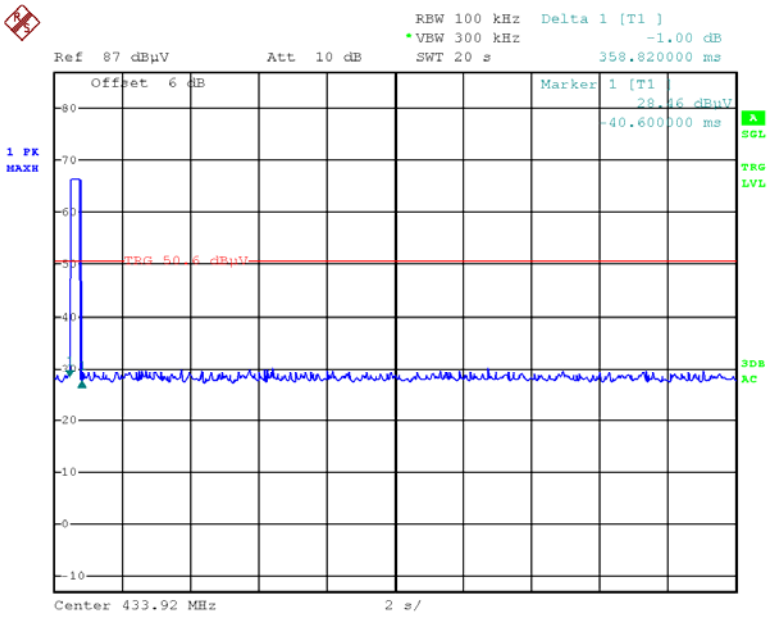
The testing was performed by Vern Shen on 2019-01-21~2019-02-13.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following plot.

Mode	Deactivate Time (s)	Limit (s)	Result
Key 1	0.359	<5	Pass
Key 2	0.350	<5	Pass
Key 3	0.310	<5	Pass
Key 4	0.350	<5	Pass
Key 5	0.350	<5	Pass
Key 6	0.430	<5	Pass
Key 7	0.350	<5	Pass

Key 1



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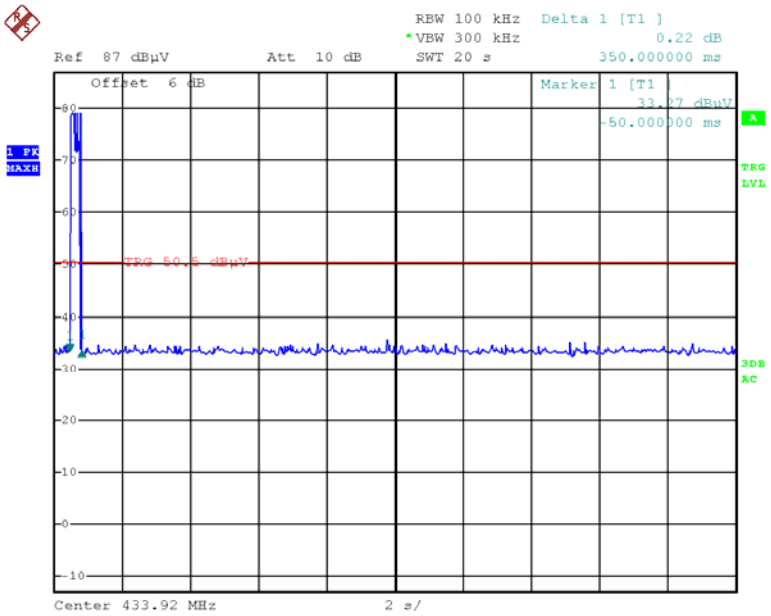
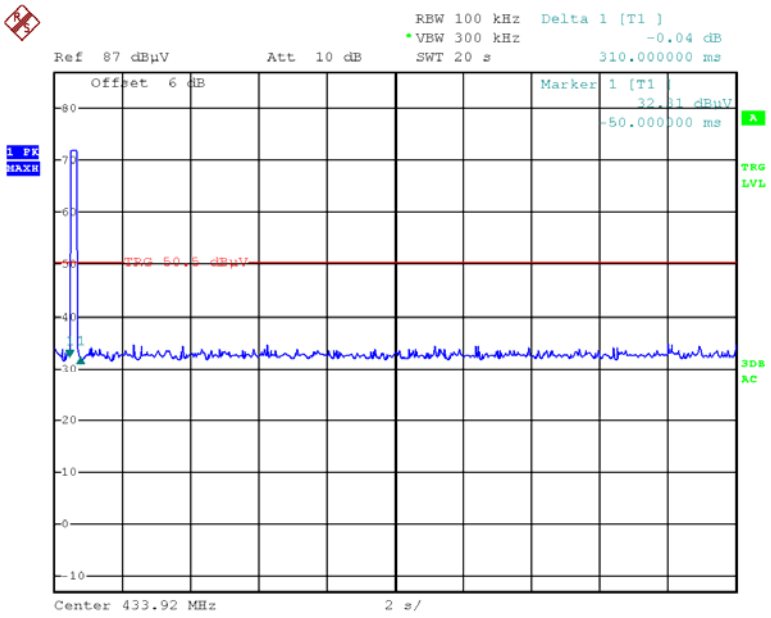
Key 2



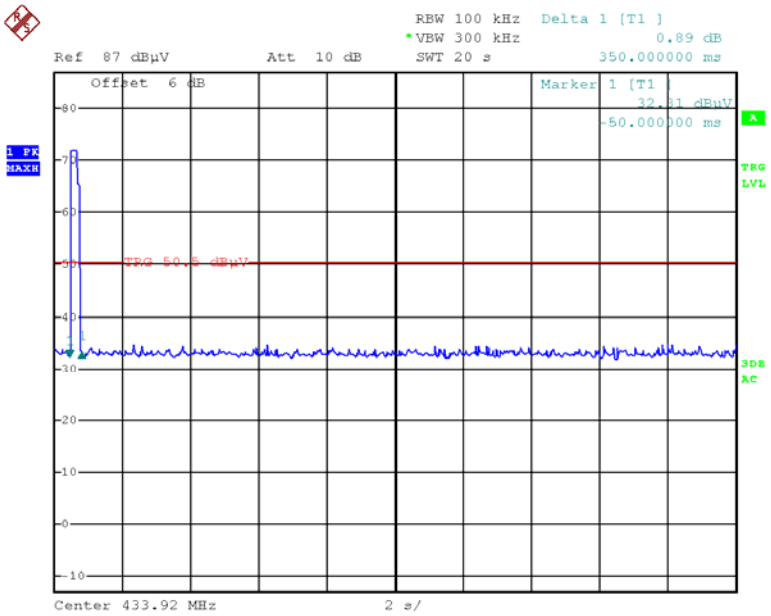
Date: 13.FEB.2019 10:30:06

Key 3



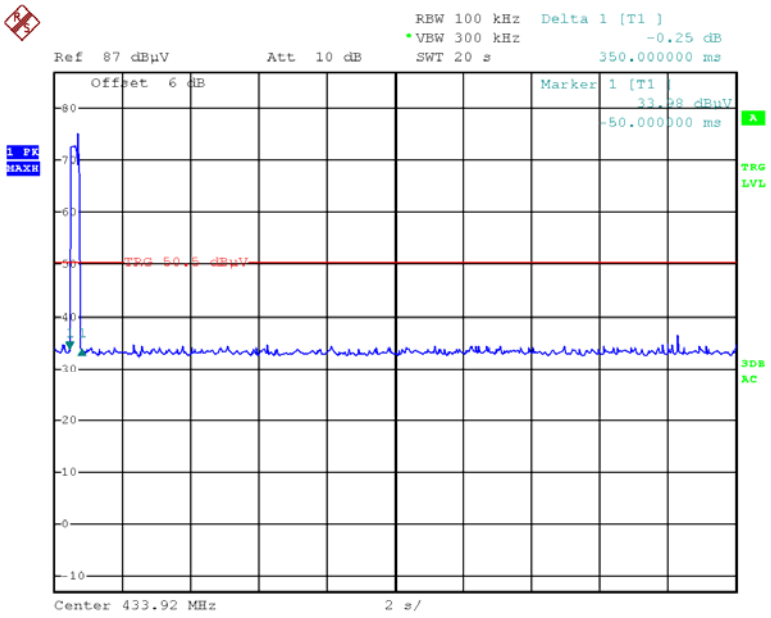
Date: 13.FEB.2019 10:31:33

Key 4



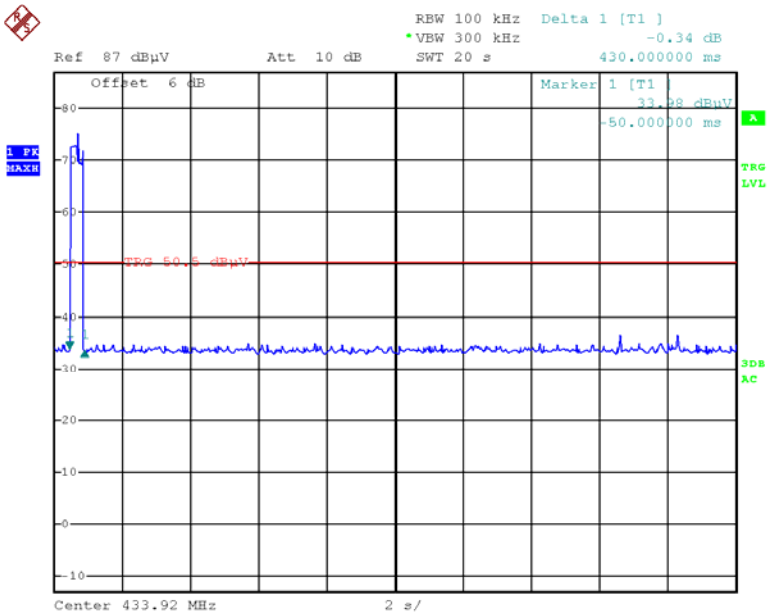
Date: 13.FEB.2019 10:32:37

Key 5



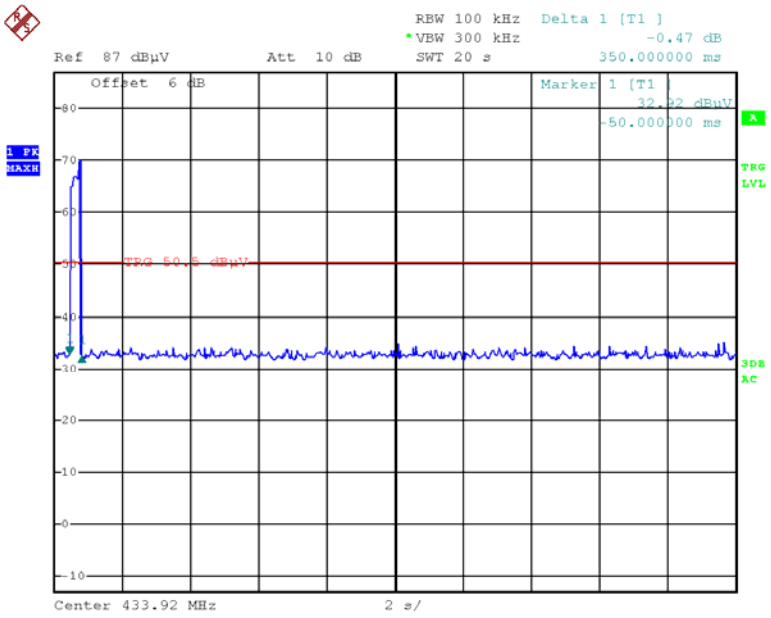
Date: 13.FEB.2019 10:34:00

Key 6



Date: 13.FEB.2019 10:38:41

Key 7



Date: 13.FEB.2019 10:42:51

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