TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.231

TEST REPORT

For

Changzhou Kaidi Electrical Inc.

Jiangcun, Henglin Town, Changzhou, China

FCC ID: 2AOTUKDH139

Report Type:	Product Type:
Original Report	Handset

Test Engineer:	Chao Gao
Report Number:	RSHA191231001-00A
Report Date:	2020-03-12
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Changzhou Kaidi Electrical Inc.
Tested Model	KDH139
Product Type	Handset
Power Supply	DC 4.5V from battery
RF Function	SRD
Operating Band/Frequency	433.92MHz
Channel Number	1
Modulation Type	OOK
Antenna Type	PCB antenna
Maximum Antenna Gain	1.0dBi

**All measurement and test data in this report was gathered from production sample serial number: 20191231001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-12-31)*

Objective

This test report is prepared on behalf of *Changzhou Kaidi Electrical Inc.* 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)

FCC Part 15B CYY Submittals with FCC ID: 2AOTUKDDY036

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%

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

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 and CAB identifier CN0004 under the ISED requirement. 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

Channel List:

Channel	Frequency (MHz)
1	433.92

All buttons triggered the same RF parameters (Contain bandwidth, power level).

EUT Exercise Software

For radiated emission testing:

Engineering mode which can continue transmit.

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

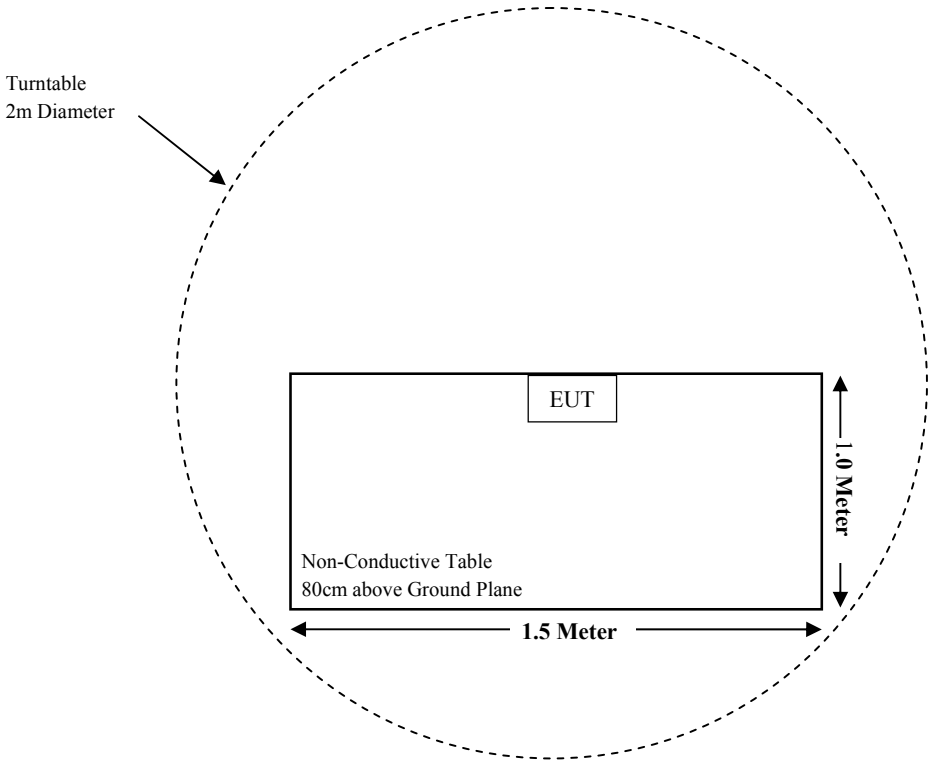
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

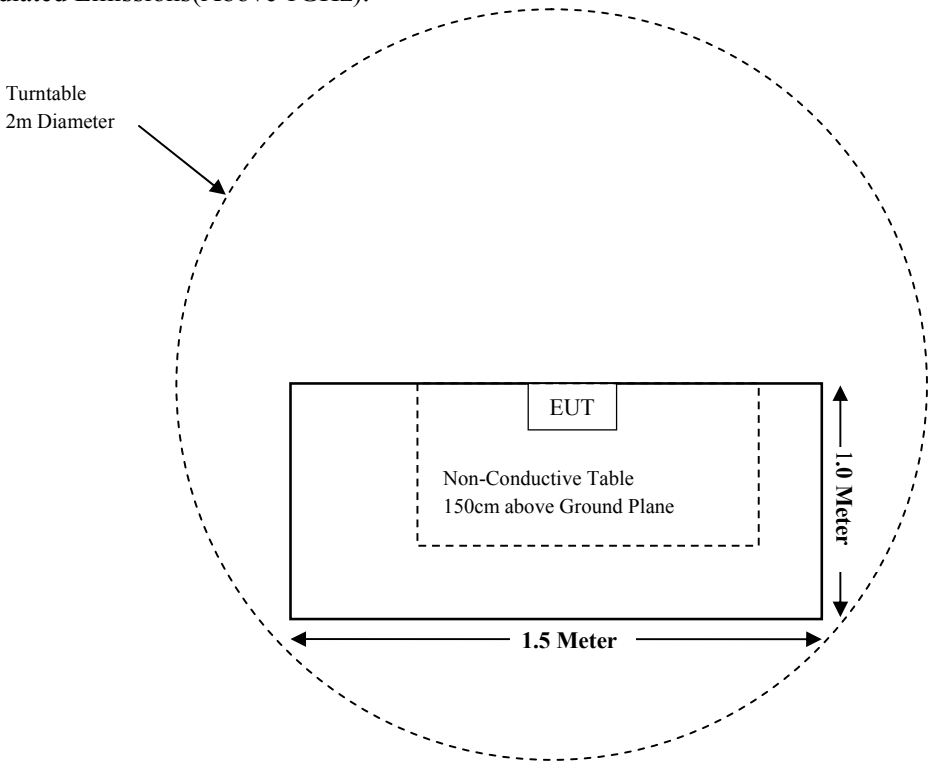
Cable Description	Length (m)	From Port	To
/	/	/	/

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	Compliant
§15.207(a)	Conducted Emissions	Not applicable (See Note)
§15.205, §15.209, §15.231(b)	Radiated Emissions	Compliant
§15.231 (a) (1)	Deactivation	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant

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	2019-12-14	2020-12-13
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2019-07-23	2020-07-22
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2017-12-26	2020-12-25
Sonoma Instrunent	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Radiated Emission Test(Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-08-27	2020-08-26
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2017-07-15	2020-07-14
A.H.Systems, inc	Amplifier	2641-1	491	2020-02-20	2021-02-19
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14

*** 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 which was permanently attached and the antenna gain is 1.0dBi; 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

Note: ** means Linear interpolations

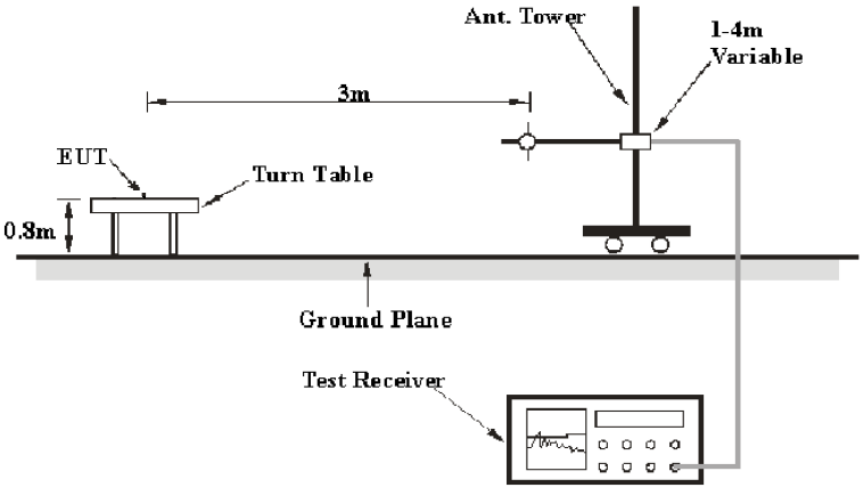
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(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.

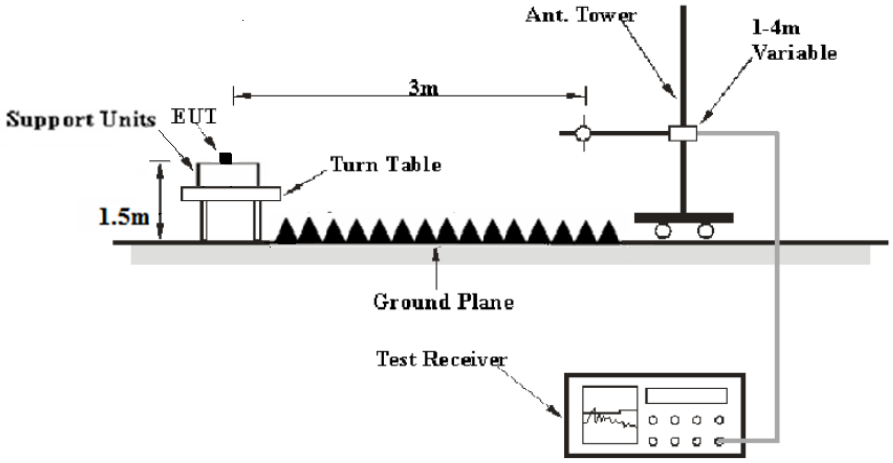
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in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

EUT Setup

Below 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	100 kHz	300 kHz	/	PK
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:

Corrected Amplitude (dBμV/m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

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 (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

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

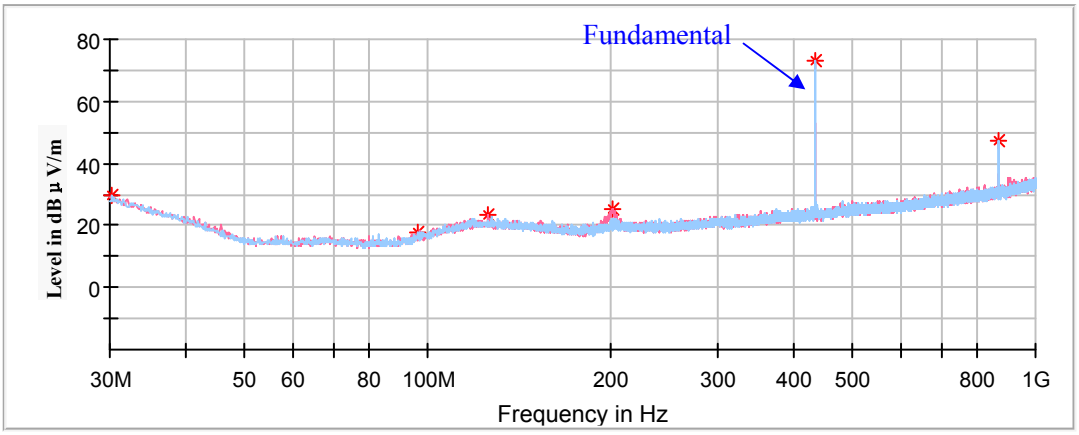
Temperature:	21.5~25.3 ℃
Relative Humidity:	50~52 %
ATM Pressure:	101.1~102.3 kPa

The testing was performed by Chao Gao from 2020-03-08 to 2020-03-11.

Test mode: Transmitting

30MHz-1GHz

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)*

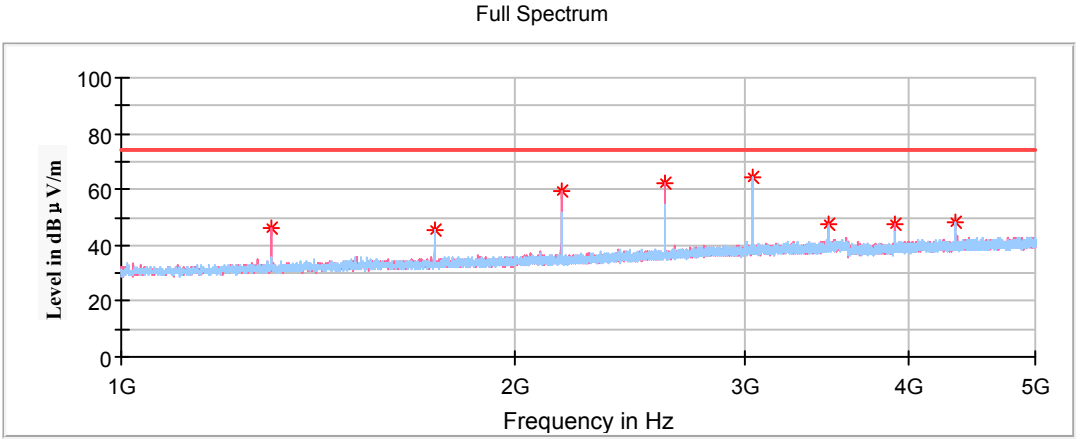


Frequency (MHz)	Corrected Amplitude Max Peak (dBµV/m)	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polar (H/V)				
30.24	29.79	100	H	76	-4.1	60.83	31.04
96.20	17.77	100	H	0	-15.9	60.83	43.06
125.67	23.29	200	V	106	-11.4	43.50	20.21
201.48	25.20	100	V	0	-12.3	60.83	35.63
433.92	72.99	100	H	40	-7.7	80.83	7.84
867.84	47.18	100	H	34	-0.6	60.83	13.65

Note: If the spurious emissions maximized peak measured value complies with the average limit, it is unnecessary to perform an Average measurement

1GHz-5 GHz

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)*



Frequency (MHz)	Corrected Amplitude MaxPeak (dBµV/m)	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polar (H/V)				
1301.76	46.06	150	V	0	-11.0	74.00	27.94
1735.68	45.13	150	H	2	-9.1	80.83	35.70
2169.60	59.41	200	V	72	-7.8	80.83	21.42
2603.52	62.33	200	V	0	-6.4	80.83	18.50
3037.44	64.14	200	H	352	-4.3	80.83	16.69
3471.36	47.90	150	V	305	-3.6	80.83	32.93
3905.28	47.47	150	V	20	-2.2	74.00	26.53
4339.20	48.35	200	H	7	-1.3	74.00	25.65

Field Strength of Average Emission

Frequency (MHz)	Peak Measurement@3m (dBμV/m)	Height (cm)	Polar (H/V)	Duty Cycle Corrected Factor (dB)	Corrected Ampitude (dBμV/m)	FCC Part 15.231(b)/205/209	
						Limit (dBμV/m)	Margin (dB)
1301.76	46.06	150	V	-9.74	36.32	54.00	17.68
1735.68	45.13	150	H	-9.74	35.39	60.83	25.44
2169.60	59.41	200	V	-9.74	49.67	60.83	11.16
2603.52	62.33	200	V	-9.74	52.59	60.83	8.24
3037.44	64.14	200	H	-9.74	54.40	60.83	6.43
3471.36	47.90	150	V	-9.74	38.16	60.83	22.67
3905.28	47.47	150	V	-9.74	37.73	54.00	16.27
4339.20	48.35	200	H	-9.74	38.61	54.00	15.39

Note 1:
Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Note 2:
Calculate Average value based on Duty Cycle correction factor:

Button 1
Tp=53.4707ms
Ton= Burst1*N1+ Burst2*N2= 1.2971*7+0.46232*18=17.40146ms
Duty Cycle Corrected Factor =20*log (Ton/Tp) =20*log (17.40146ms/53.4707ms)=-9.75dB

Button 2
Tp=53.4467ms
Ton= Burst1*N1+ Burst2*N2= 1.2971*7+0.46232*18=17.40146ms
Duty Cycle Corrected Factor =20*log (Ton/Tp) =20*log (17.40146ms/53.4467ms)=-9.75dB

Button 3
Tp=53.4467ms
Burst1*N1+ Burst2*N2= 1.2971*7+0.46232*18=17.40146ms
Duty Cycle Corrected Factor =20*log (Ton/Tp) =20*log (17.40146ms/53.4467ms)=-9.75dB

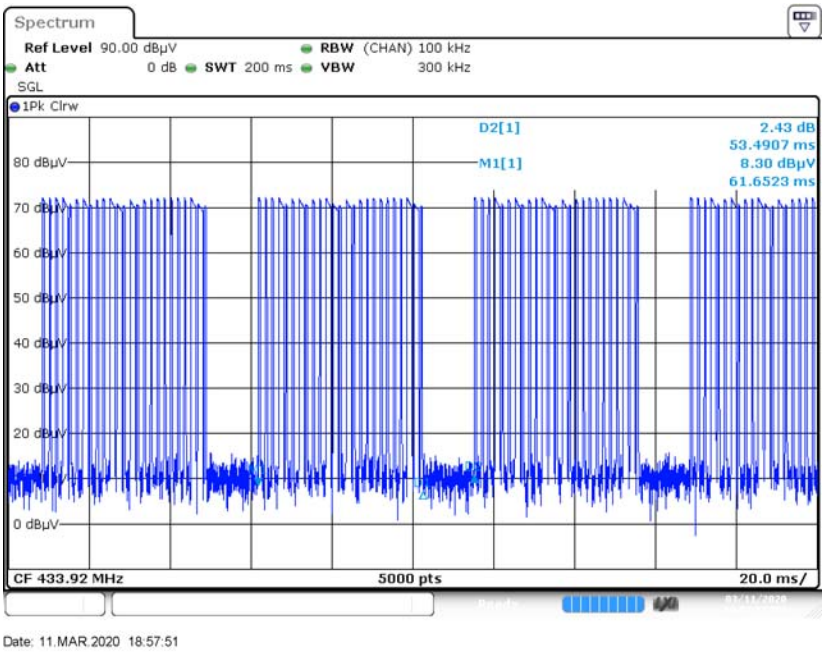
Button 4
Tp=53.4347ms
Ton=Burst1*N1+ Burst2*N2= 1.2971*6+0.46232*19=16.56686ms
Duty Cycle Corrected Factor =20*log (Ton/Tp) =20*log (16.5668ms/53.4347ms)=-10.17dB

Button 5 (worst case)
Tp=53.3987ms
Ton=Burst1*N1+ Burst2*N2= 1.2971*7+0.46232*18=17.40146ms
Duty Cycle Corrected Factor =20*log (Ton/Tp) =20*log (17.40146ms/53.3987ms)=-9.74dB

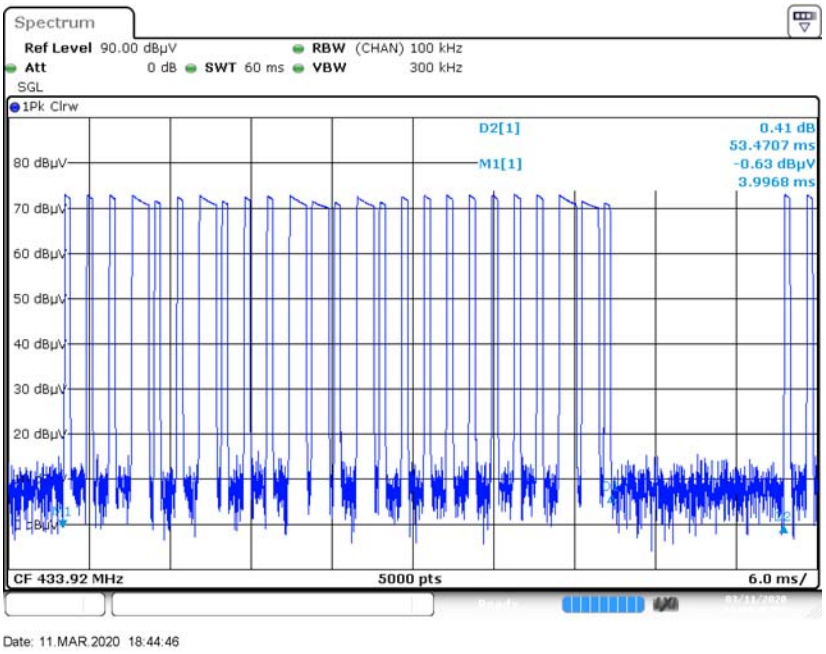
Average value = Peak value + Duty Cycle Corrected Factor

This duty cycle is the worst case for the EUT

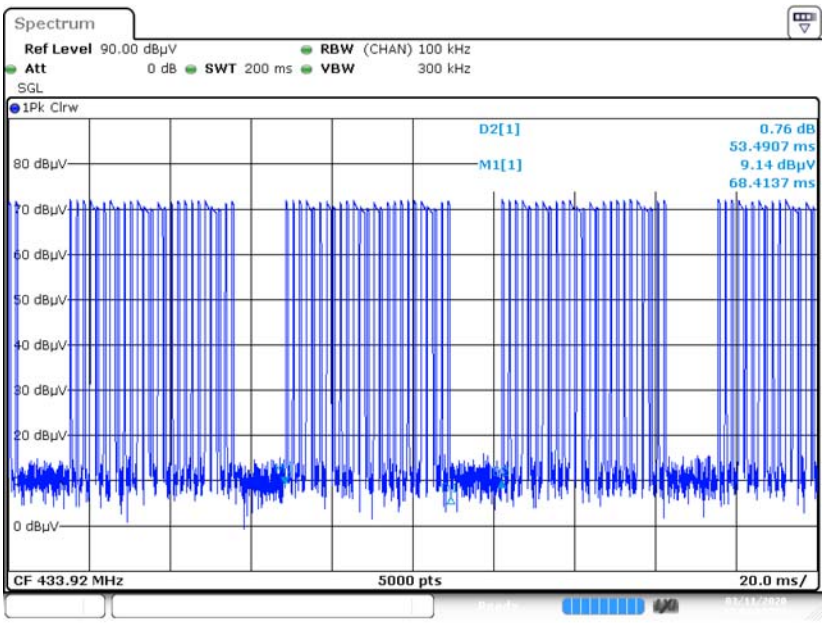
Duty Cycle-Button 1



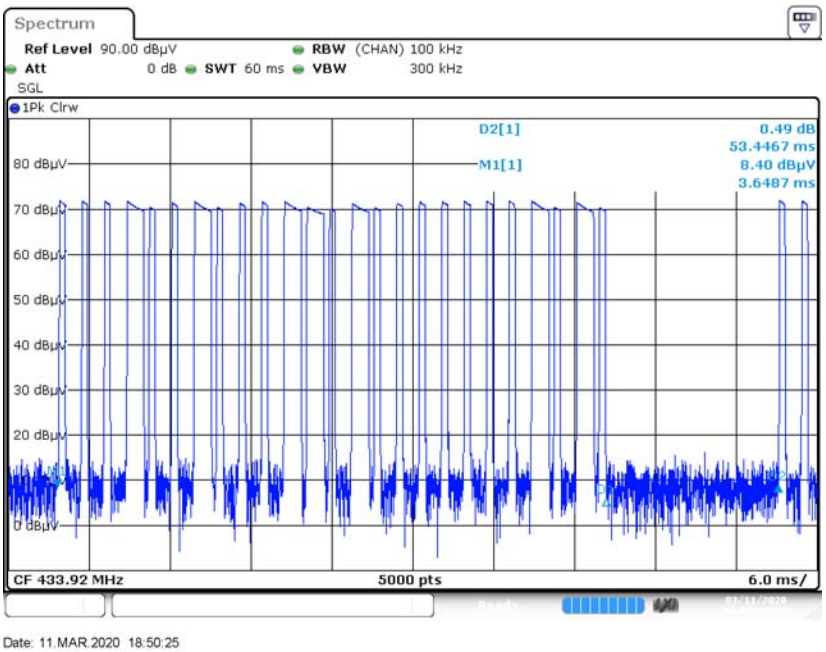
Zoom in Pulse Train
N1=7, N2=18



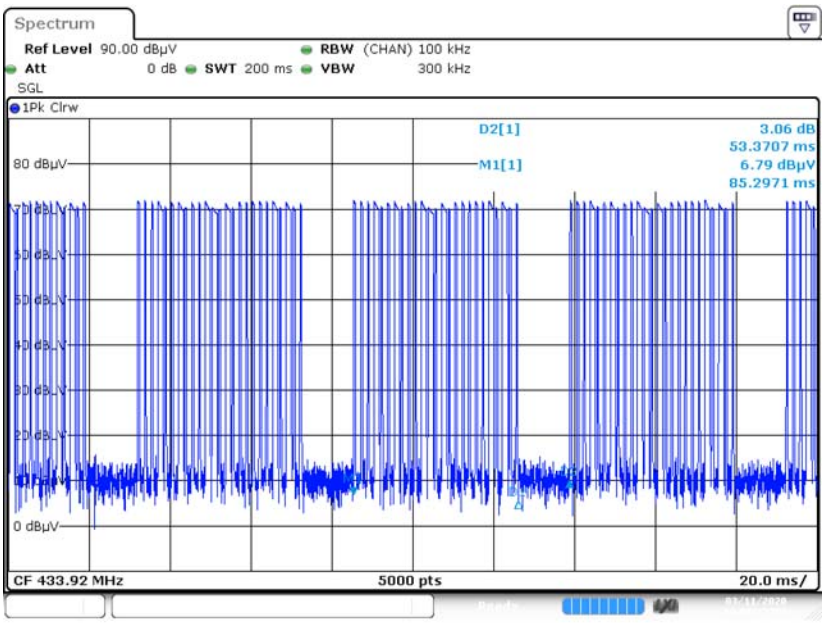
Duty Cycle-Button 2



Zoom in Pulse Train
N1=7, N2=18

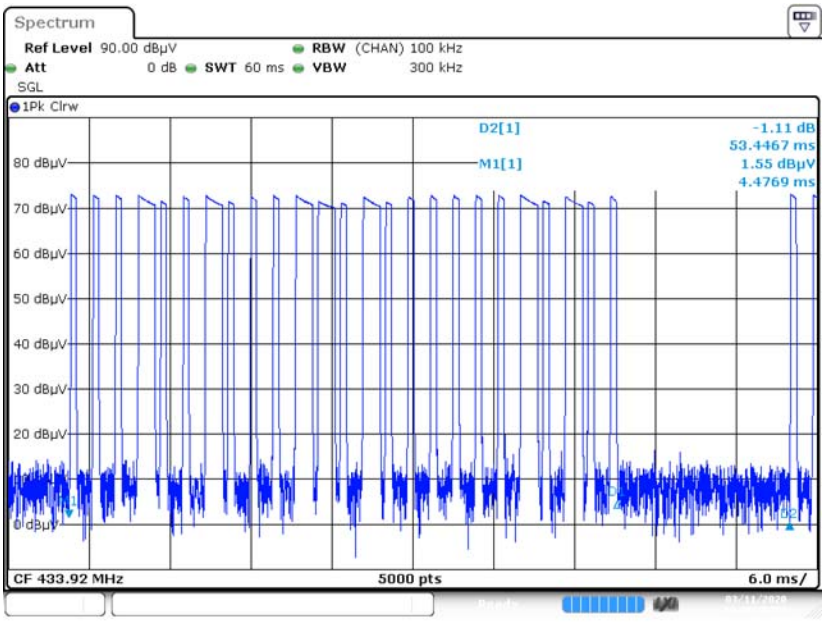


Duty Cycle-Button 3



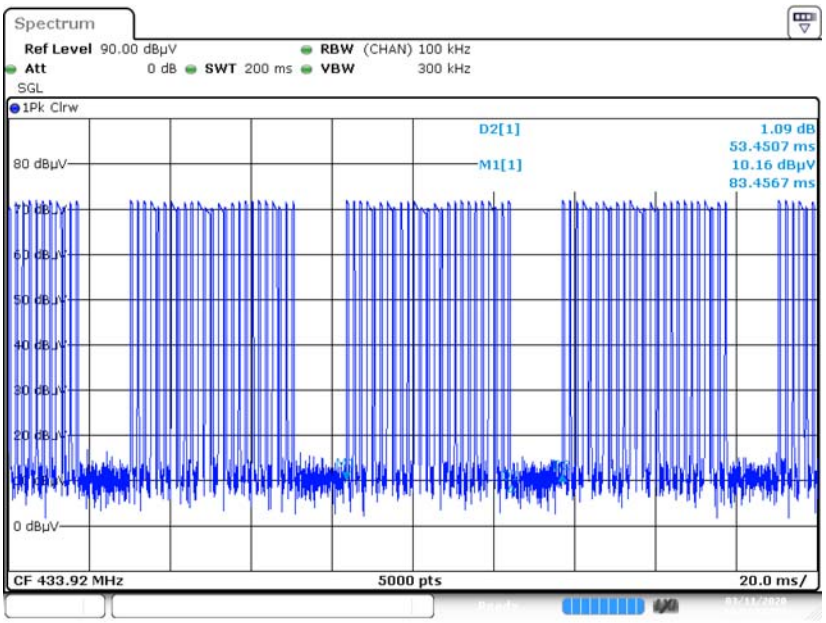
Date: 11.MAR.2020 18:59:32

Zoom in Pulse Train
N1=7, N2=18



Date: 11.MAR.2020 18:46:40

Duty Cycle-Button 4



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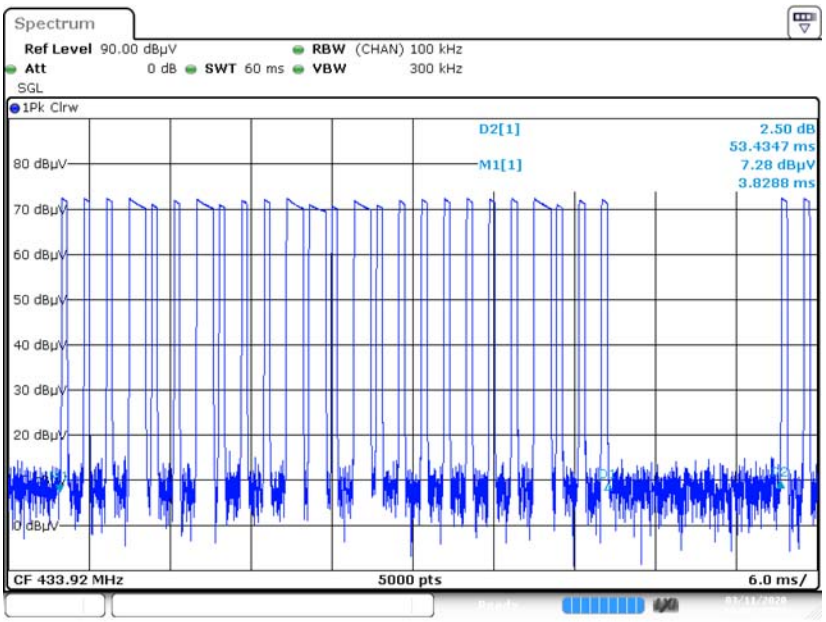
Zoom in Pulse Train
N1=6, N2=19



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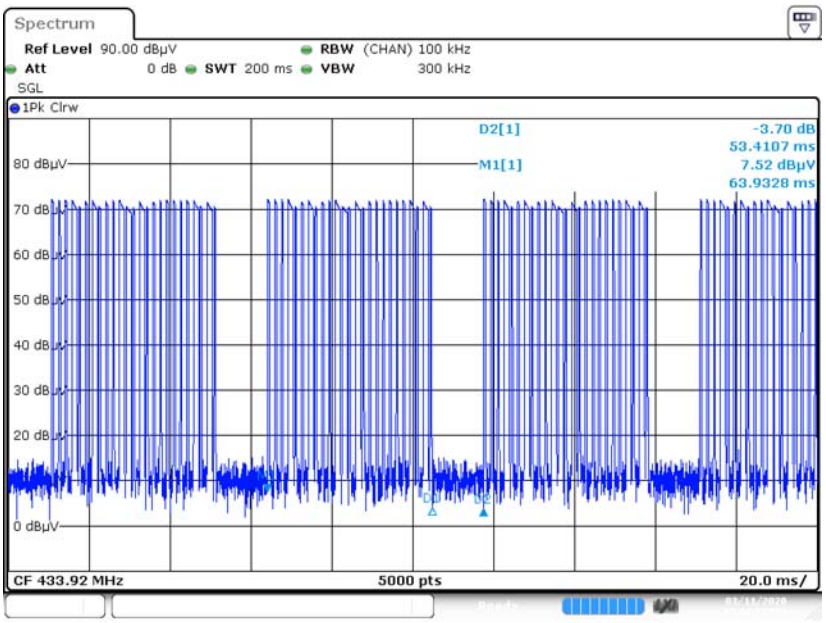
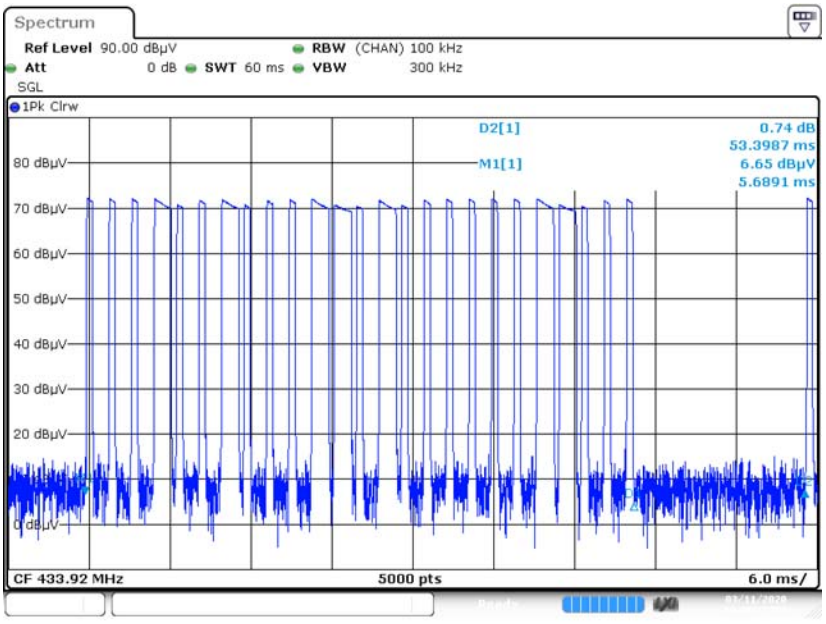
Duty Cycle-Button 5



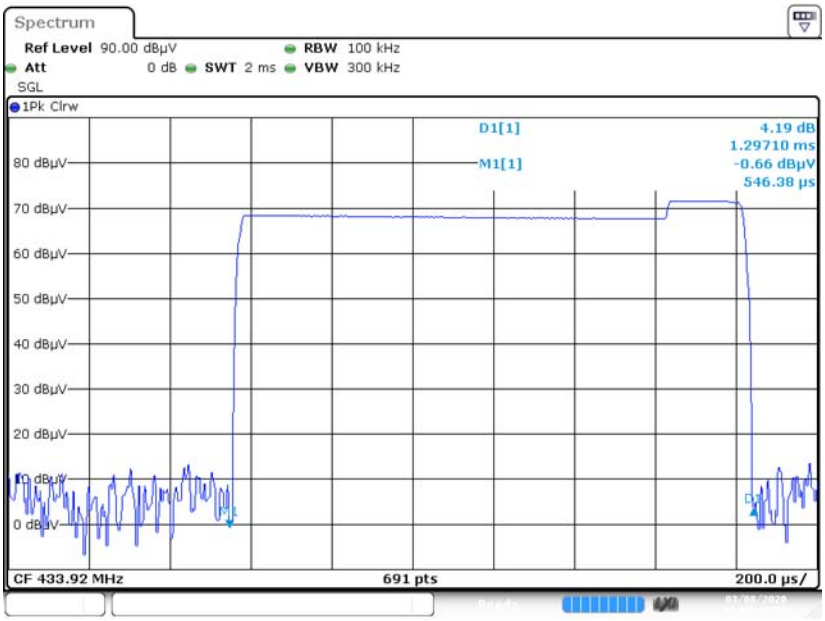
Date: 11.MAR.2020 19:02:00

Zoom in Pulse Train
N1=7, N2=18

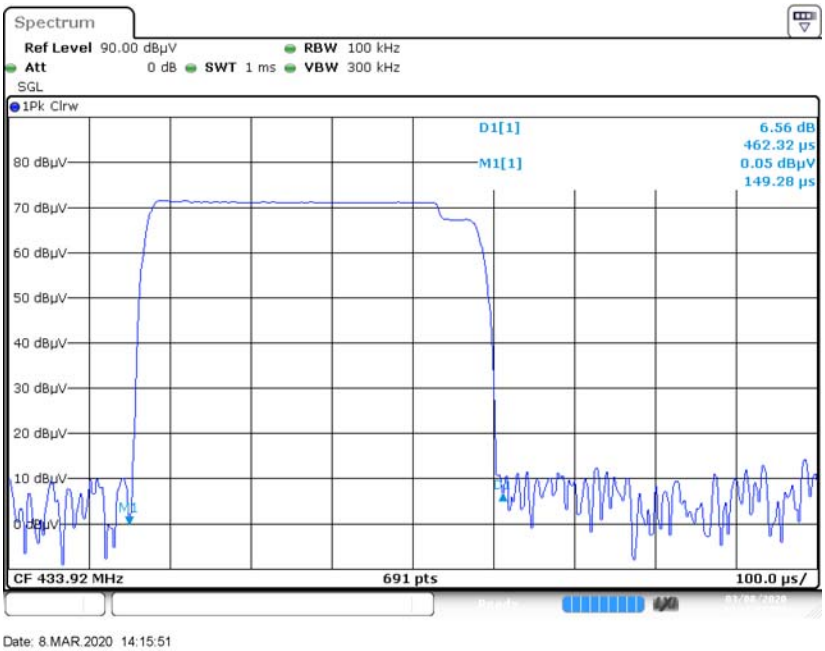


Date: 11.MAR.2020 18:48:38

Duty Cycle Burst 1



Duty Cycle Burst 2



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. With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100k VBW=300k Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

Test Data

Environmental Conditions

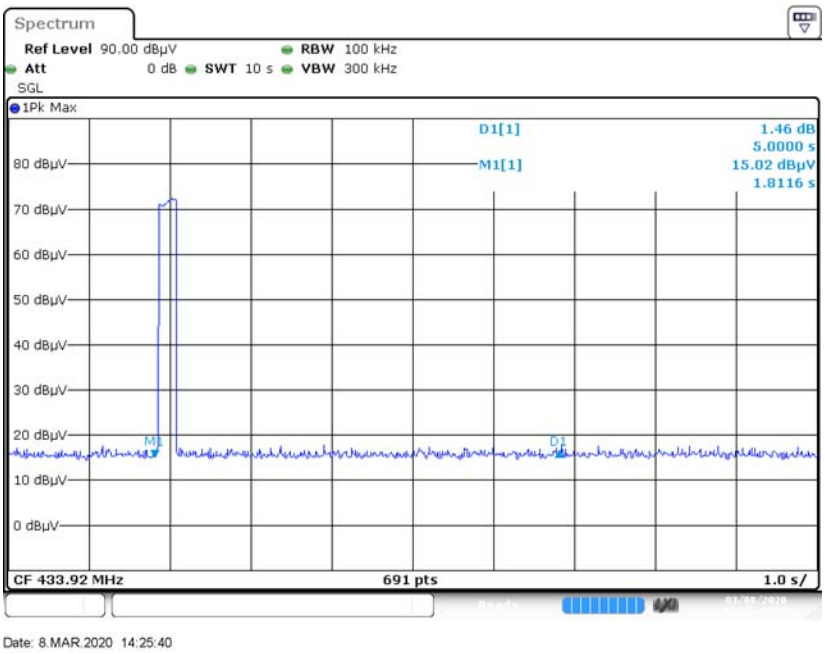
Temperature:	21.5 ℃
Relative Humidity:	52 %
ATM Pressure:	101.1 kPa

The testing was performed by Chao Gao on 2020-03-08.

Test mode: Transmitting

Channel Frequency (MHz)	Limit (s)	Result
433.92	<5	Pass

T_{stop} <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:	21.5 ℃
Relative Humidity:	52 %
ATM Pressure:	101.9 kPa

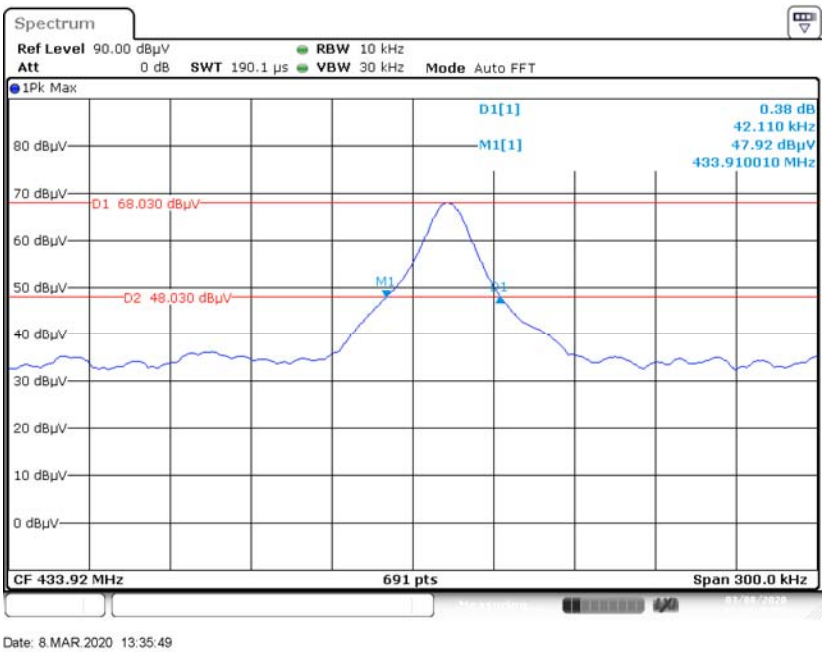
The testing was performed by Chao Gao on 2020-03-08.

Test Mode: Transmitting

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	42.11	1084.8	Pass

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

20 dB Emission Bandwidth



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