TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.231

TEST REPORT

For

Micron Electronics LLC.

1001 Yamato Road, Suite 400, Boca Raton, Florida 33431 United States

FCC ID: ZKQ-MHV

Report Type:	Product Type:
Original Report	Tracker

Test Engineer:	Matt Yao
Report Number:	RSHA190517003-00C
Report Date:	2019-07-03
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Micron Electronics LLC.
Tested Model	MH 1000V
Product Type	Tracker
Dimension	78.7mm(L)*44.6mm(W)*21.8mm(H)
Power Supply	DC 3.8V from Battery

Adapter information:
Model: JT-H050100
Input: AC 100-240V, 50/60Hz
Output: DC 5V, 1A

**All measurement and test data in this report was gathered from production sample serial number: 20190517003. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-05-17)*

Objective

This test report is prepared on behalf of *Micron Electronics LLC.* 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, 15.207, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

FCC Part 15B JAB and Part 15.247 DTS submittal with FCC ID: ZKQ-MHV.

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

EUT Exercise Software

RF test software: Secure CRT

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

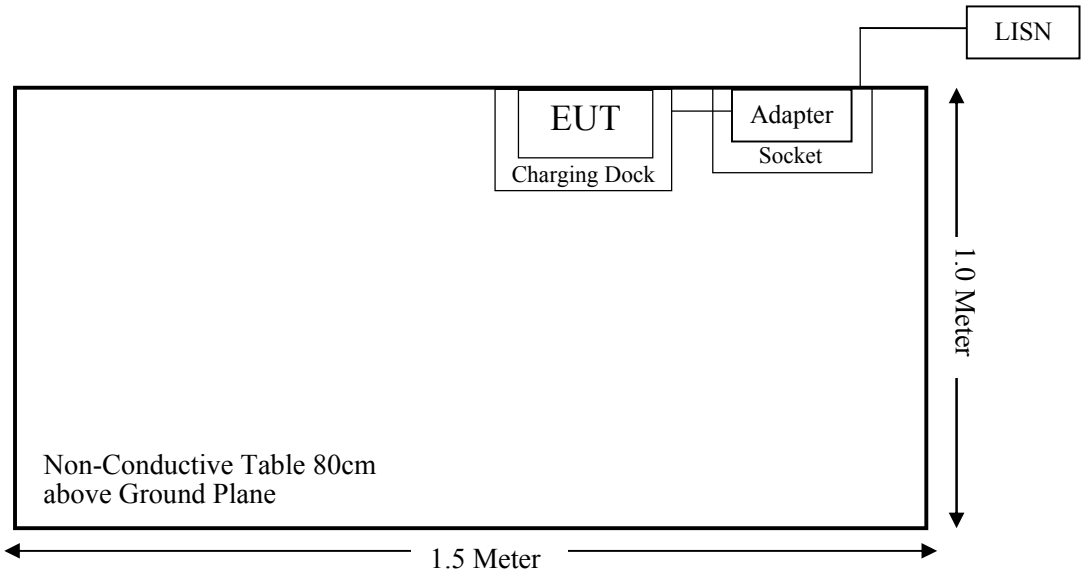
Manufacturer	Description	Model	Serial Number
/	Socket	/	/

External I/O Cable

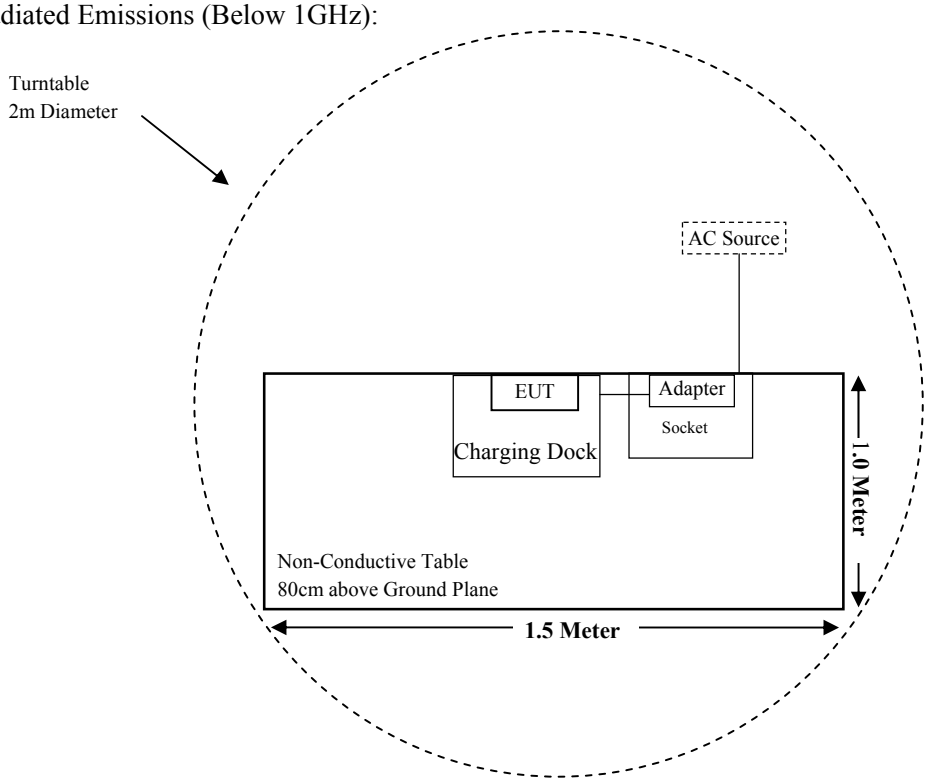
Cable Description	Length (m)	From Port	To
Power cable	1.0	Charging Base	Adapter

Block Diagram of Test Setup

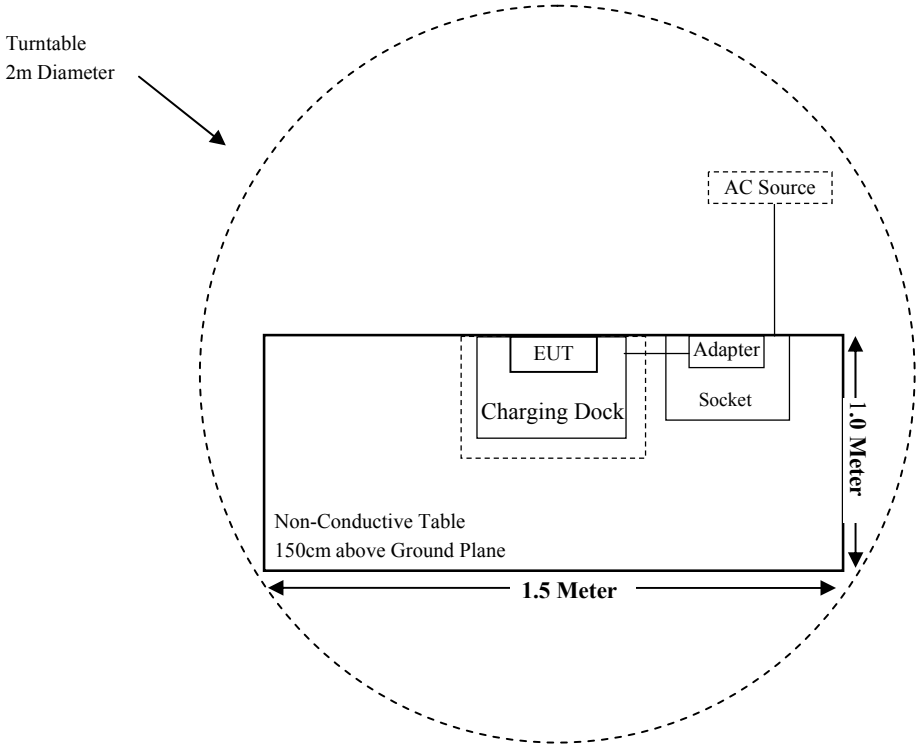
For Conducted Emissions:



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	Compliant
§15.205, §15.209, §15.231(e)	Radiated Emissions	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant
§15.231 (e)	Deactivation	Compliant

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	2018-11-30	2019-11-29
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2018-07-23	2019-07-22
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrunent	Pre-amplifier	310N	171205	2018-08-14	2019-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
Radiated Emission Test(Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2018-08-27	2019-08-26
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2017-07-15	2020-07-14
A.H.Systems, inc	Amplifier	2641-1	491	2019-02-20	2020-02-19
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2018-08-15	2019-08-14
Conducted Emission Test					
ROHDE&SCHWARZ	EMI Test receiver	ESR	1316.3003K03-102454-Qd	2019-06-25	2020-06-24
Audix	Test Software	e3	V9	--	--
Rohde & Schwarz	LISN	ENV216	3560655016	2018-11-30	2019-11-29
Narda	Attenuator/6dB	10690812-2	26850-6	2019-01-10	2020-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2018-08-15	2019-08-14

*** 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 an FPC antenna for 433.92MHz which was permanently attached and the antenna gain is 0.50 dBi; fulfill the requirement of this section. Please refer to EUT photos.

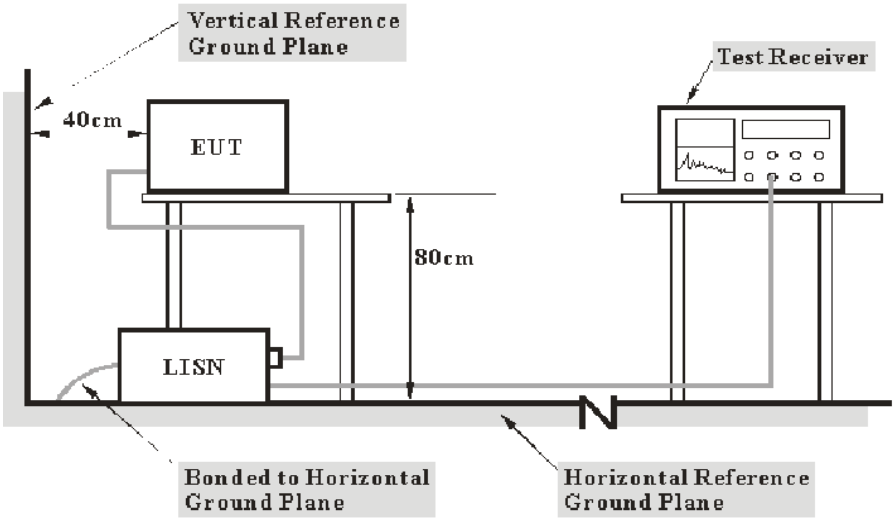
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

ANSI C63.10-2013 clause 6.2

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Over Limit Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit of 7dB means the emission is 7 dB above the limit. The equation for Over Limit calculation is as follows:

Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

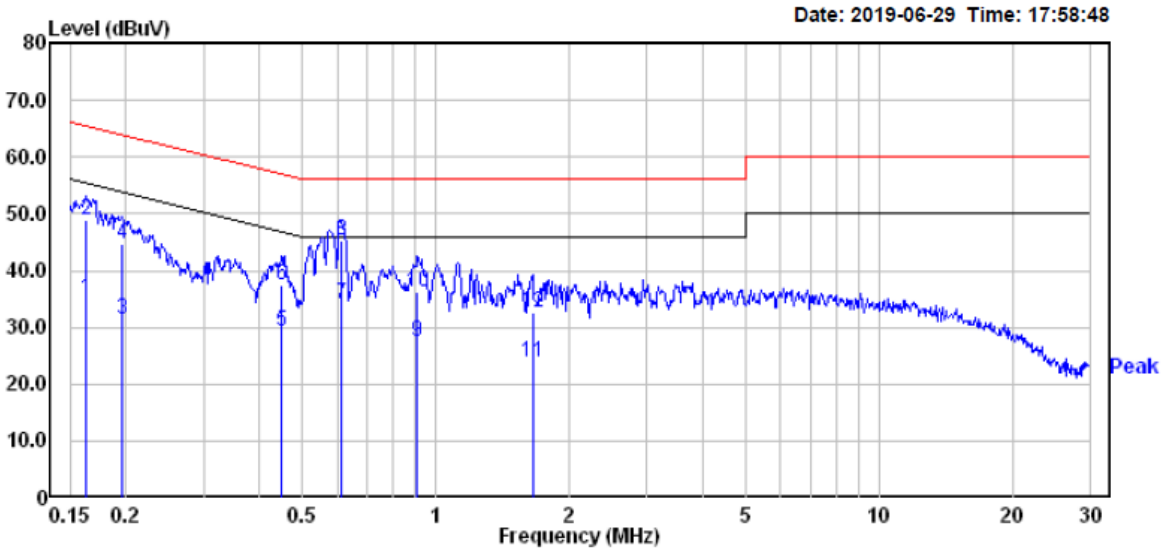
Temperature:	20.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Matt Yao on 2019-06-29.

Test Result: Compliant.

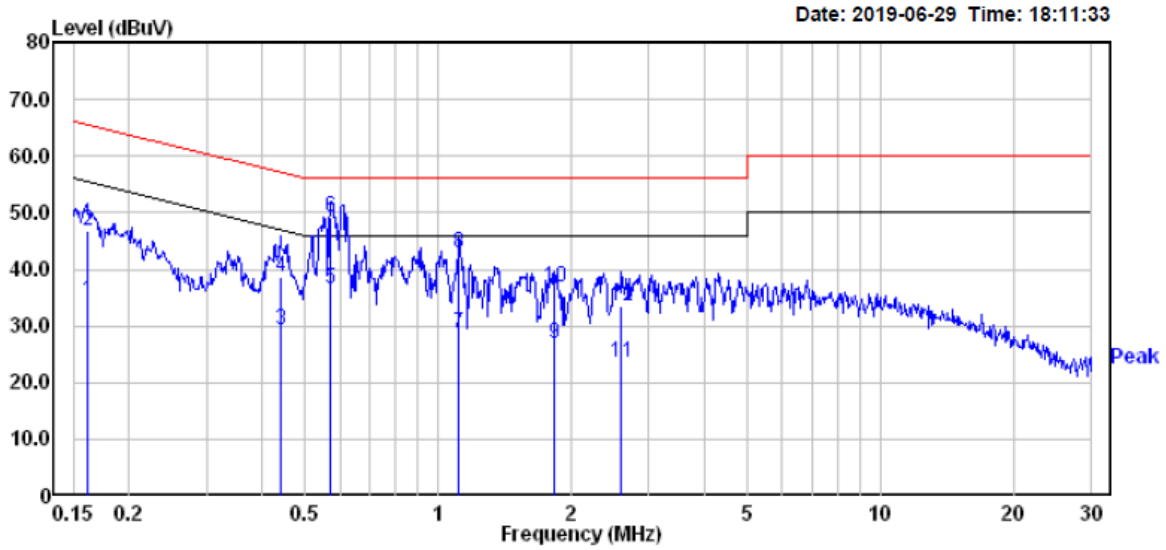
EUT operation mode: Transmitting

AC 120V/60 Hz, Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.163	15.30	19.83	35.13	55.30	-20.17	Average
2	0.163	29.00	19.83	48.83	65.30	-16.47	QP
3	0.197	11.50	19.82	31.32	53.76	-22.44	Average
4	0.197	24.80	19.82	44.62	63.76	-19.14	QP
5	0.449	9.50	19.75	29.25	46.89	-17.64	Average
6	0.449	17.60	19.75	37.35	56.89	-19.54	QP
7	0.611	14.30	19.75	34.05	46.00	-11.95	Average
8	0.611	25.50	19.75	45.25	56.00	-10.75	QP
9	0.909	7.60	19.74	27.34	46.00	-18.66	Average
10	0.909	16.50	19.74	36.24	56.00	-19.76	QP
11	1.654	3.90	19.84	23.74	46.00	-22.26	Average
12	1.654	12.70	19.84	32.54	56.00	-23.46	QP

AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.161	14.50	19.83	34.33	55.43	-21.10	Average
2	0.161	26.90	19.83	46.73	65.43	-18.70	QP
3	0.440	9.60	19.75	29.35	47.07	-17.72	Average
4	0.440	18.90	19.75	38.65	57.07	-18.42	QP
5	0.573	16.80	19.75	36.55	46.00	-9.45	Average
6	0.573	29.40	19.75	49.15	56.00	-6.85	QP
7	1.117	9.01	19.81	28.82	46.00	-17.18	Average
8	1.117	22.91	19.81	42.72	56.00	-13.28	QP
9	1.829	6.99	19.84	26.83	46.00	-19.17	Average
10	1.829	16.99	19.84	36.83	56.00	-19.17	QP
11	2.594	4.19	19.48	23.67	46.00	-22.33	Average
12	2.594	14.09	19.48	33.57	56.00	-22.43	QP

Note:

1) Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

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

Applicable Standard

FCC §15.205, §15.209,§15.231 (e)

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

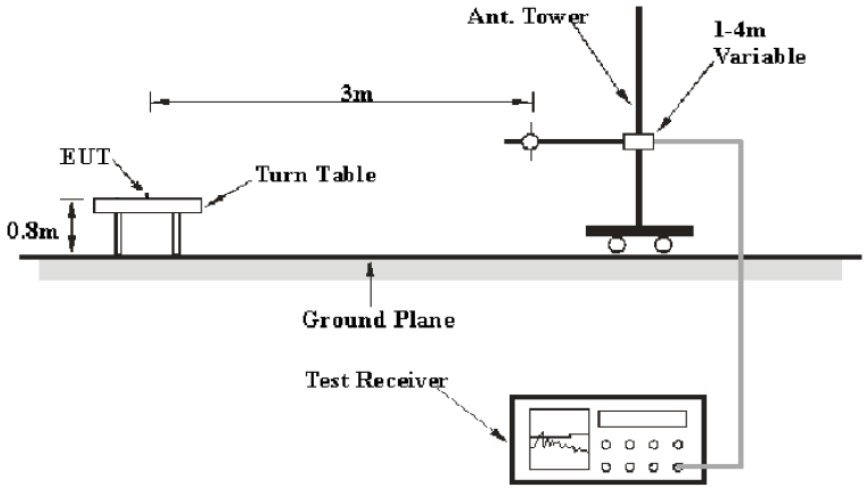
Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 *	50 to 150 *
174-260	1,500	150
260-470	1,500 to 5,000 *	150 to 500*
Above 470	5,000	500

*Linear interpolations.

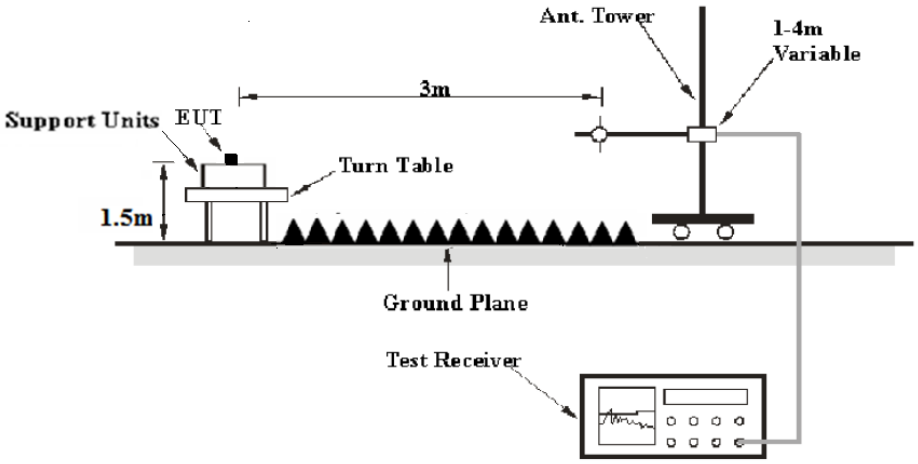
The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

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 – 1000MHz	100 kHz	300 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:

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 (e).

Test Data

Environmental Conditions

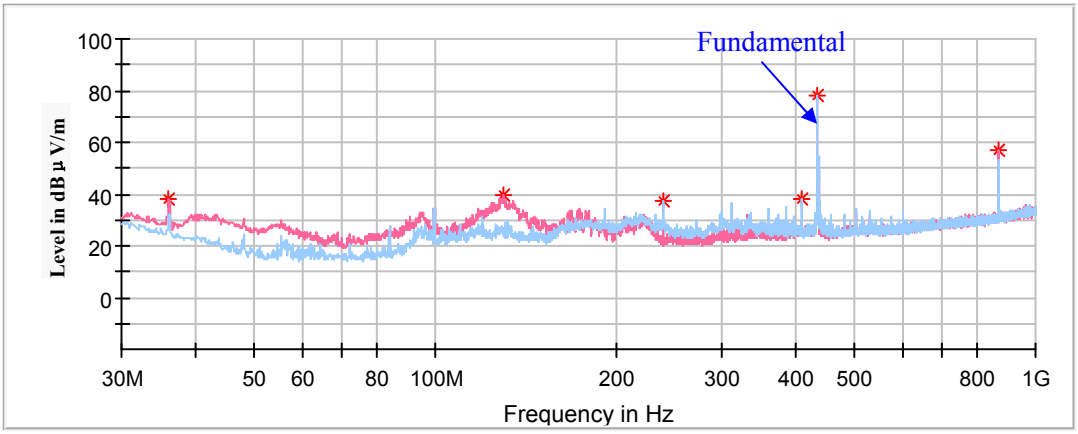
Temperature:	24.5℃
Relative Humidity:	51%
ATM Pressure:	101.2kPa

The testing was performed by Matt Yao on 2019-06-24.

Test mode: Transmitting

30MHz-1GHz

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



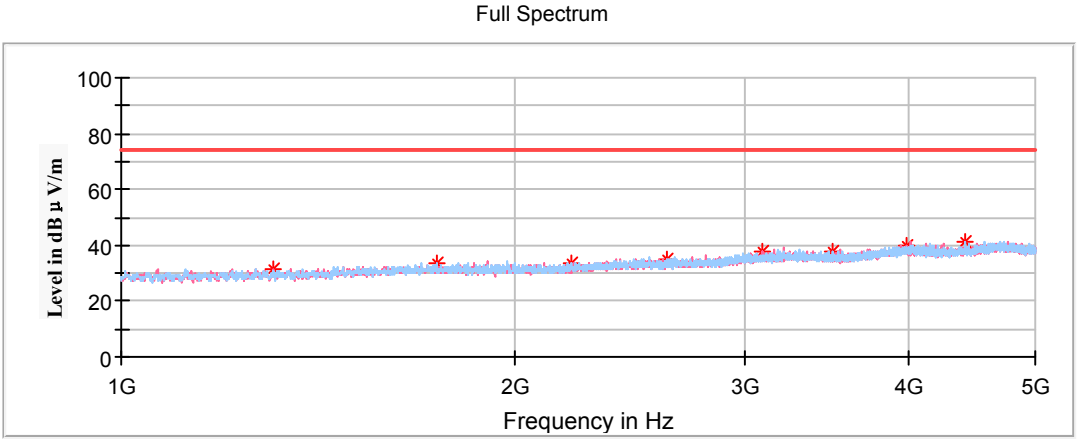
Frequency (MHz)	Corrected Amplitude MaxPeak (dBµV /m)	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polar (H/V)				
35.94125	37.99	100	V	156	-8.0	52.86	14.87
129.78875	39.52	100	V	217	-11.6	43.50	3.98
240.00500	37.53	150	H	152	-12.1	46.00	8.47
408.05750	38.31	100	H	159	-8.0	46.00	7.69
433.92000	78.26	100	H	86	-7.7	92.86	14.60
867.84000	56.90	150	V	280	-0.6	72.86	15.96

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(e)/205/209	
						Limit (dBµV/m)	Margin (dB)
433.92000	78.26	100	H	-6.15	72.11	72.86	0.75
867.84000	56.90	150	V	-6.15	50.75	52.86	2.11

1GHz-5 GHz

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-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)				
1301.76000	31.22	100	V	343	-11	74.00	42.78
1735.68000	33.23	150	H	0	-9.1	74.00	40.77
2169.60000	33.85	200	H	171	-7.7	74.00	40.15
2603.52000	35.12	100	H	4	-6.3	74.00	38.88
3037.44000	37.65	100	V	0	-4.2	74.00	36.35
3471.36000	38.05	200	H	86	-3.5	74.00	35.95
3905.28000	40.10	250	V	10	-1.9	74.00	33.90
4339.20000	41.30	150	H	256	-1.1	74.00	32.70

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(e)/205/209	
						Limit (dBμV/m)	Margin (dB)
1301.76000	31.22	100	V	-6.15	25.07	54.00	22.78
1735.68000	33.23	150	H	-6.15	27.08	54.00	20.77
2169.60000	33.85	200	H	-6.15	27.70	54.00	20.15
2603.52000	35.12	100	H	-6.15	28.97	54.00	18.88
3037.44000	37.65	100	V	-6.15	31.50	54.00	16.35
3471.36000	38.05	200	H	-6.15	31.90	54.00	15.95
3905.28000	40.1	250	V	-6.15	33.95	54.00	13.90
4339.20000	41.3	150	H	-6.15	35.15	54.00	12.70

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 corrected factor:

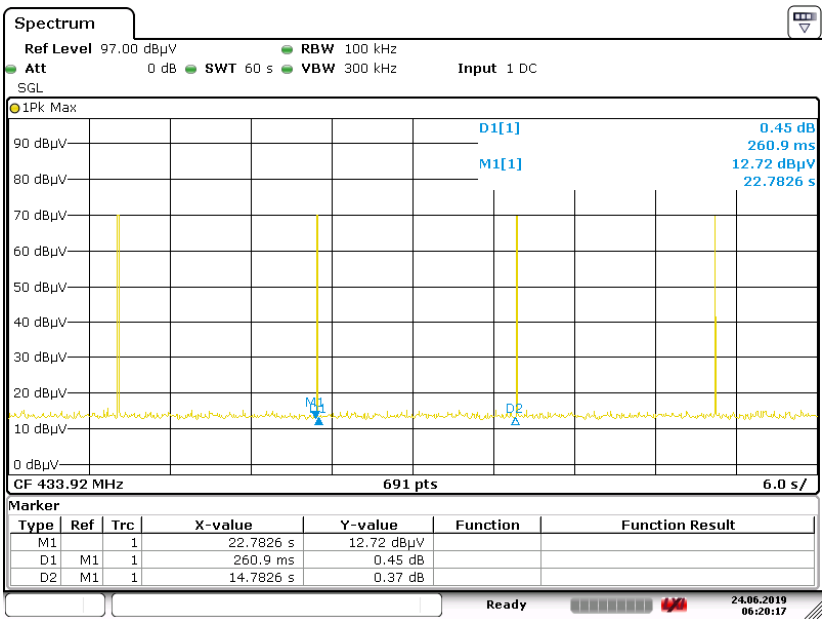
T_p=100ms

T_{on}= Burst*N = 49.275ms

Duty Cycle Corrected Factor =20*log(T_{on}/T_p) = 20*log(49.275ms/100ms)= -6.15dB

Average value = Peak value + Duty Cycle Corrected Factor

Duty Cycle



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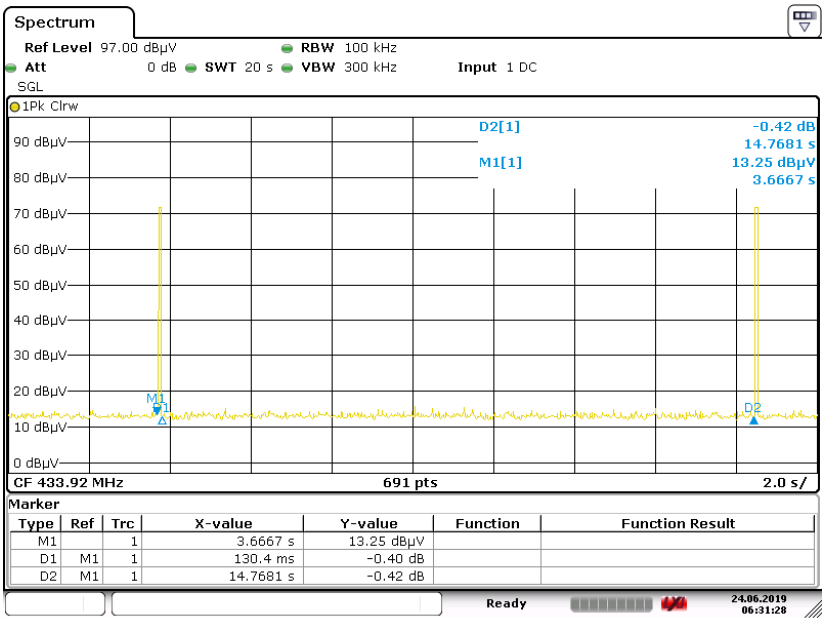
Duty Cycle



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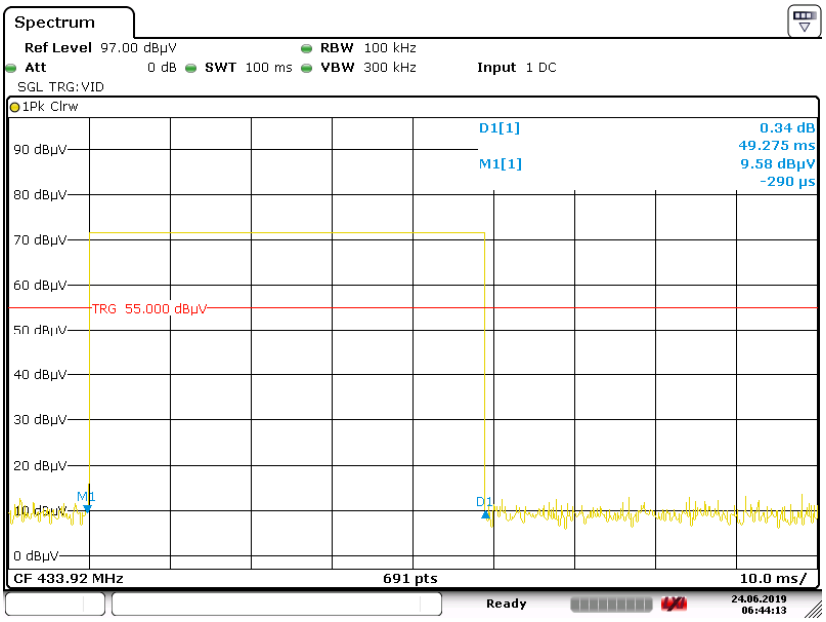
Burst
(Ton=49.275ms, N=1)



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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

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2kPa

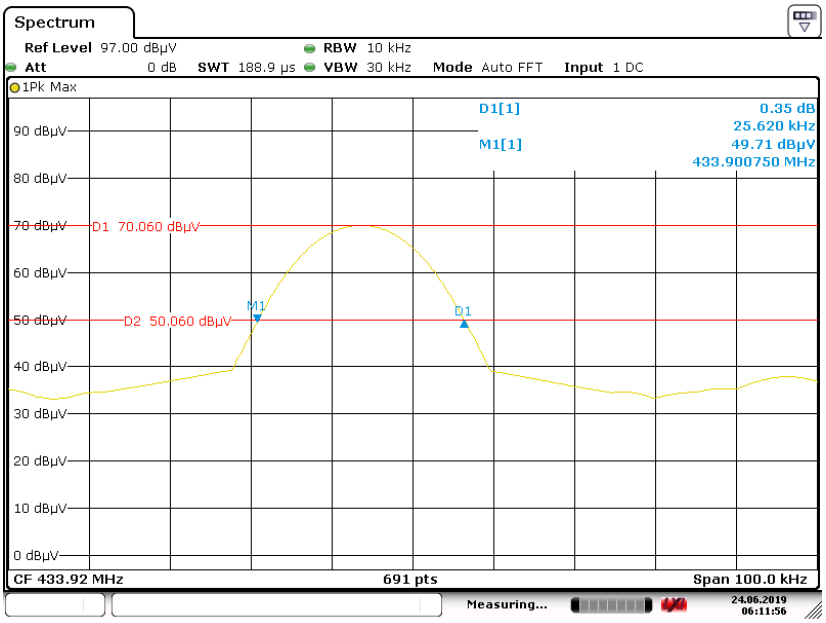
The testing was performed by Matt Yao on 2019-06-24.

Test Mode: Transmitting

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	25.62	1084.8	Pass

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

20 dB Emission Bandwidth



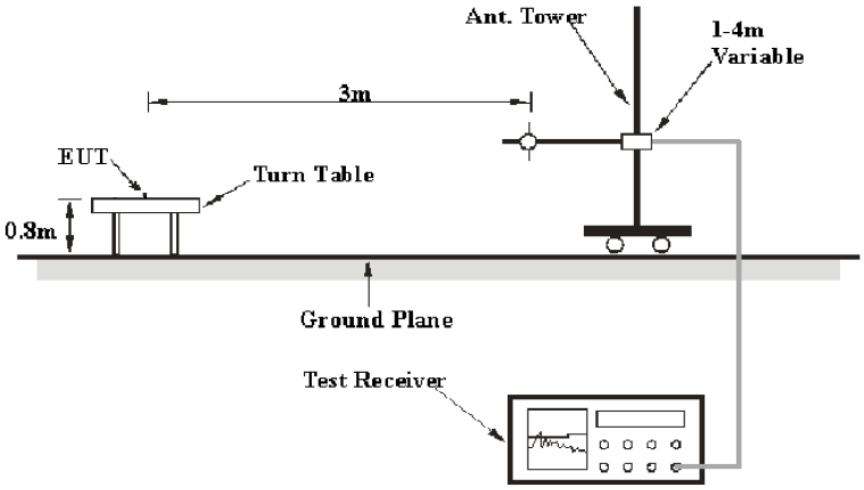
Date: 24.JUN.2019 06:11:57

FCC §15.231(e) - DEACTIVATION TESTING

Applicable Standard

Per 15.231(e), devices operated under the 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.

EUT Setup



The deactivation test was performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10- 2013. The specification used was the FCC 15.231(e) limits.

Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	53 %
ATM Pressure:	101.2 kPa

The testing was performed by Matt Yao on 2019-06-24.

Test mode: Transmitting

Deactivation

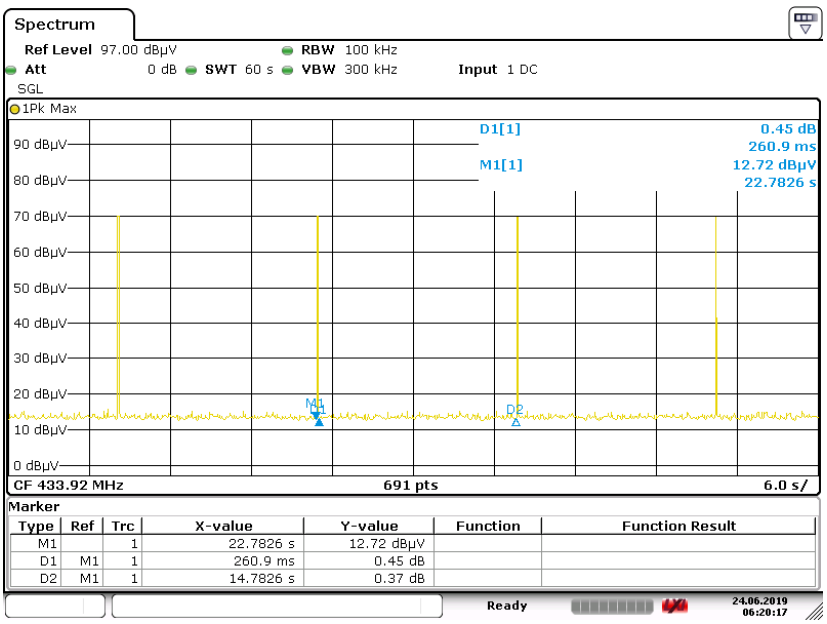
duration *time* (s)	Limit (s)	Result
0.0496	< 1	Pass

Silent period

Silent period (s)	Limit (s)	Result
14.6377	>10	Pass

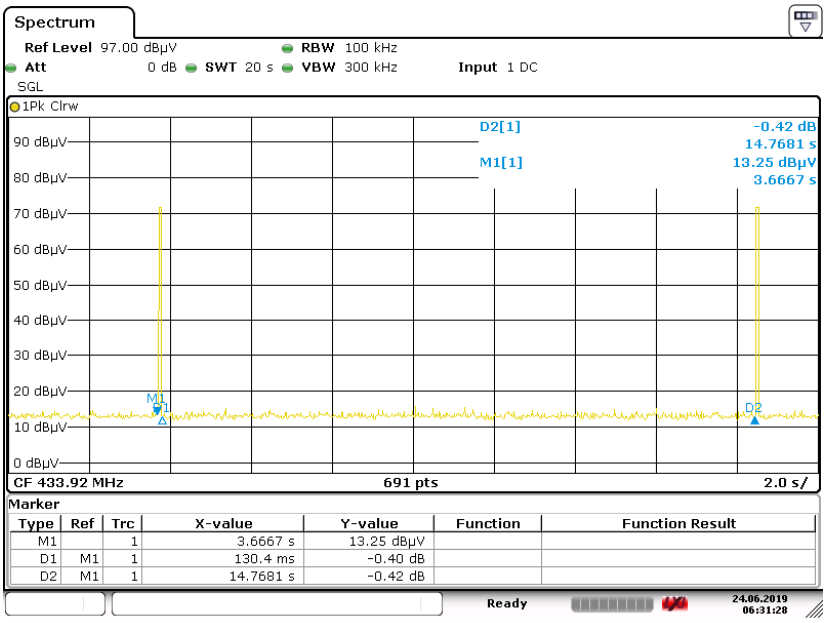
Note: The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.
*The duration time is 0.0496s, 0.0496*30 = 1.488s.*

Transmission period



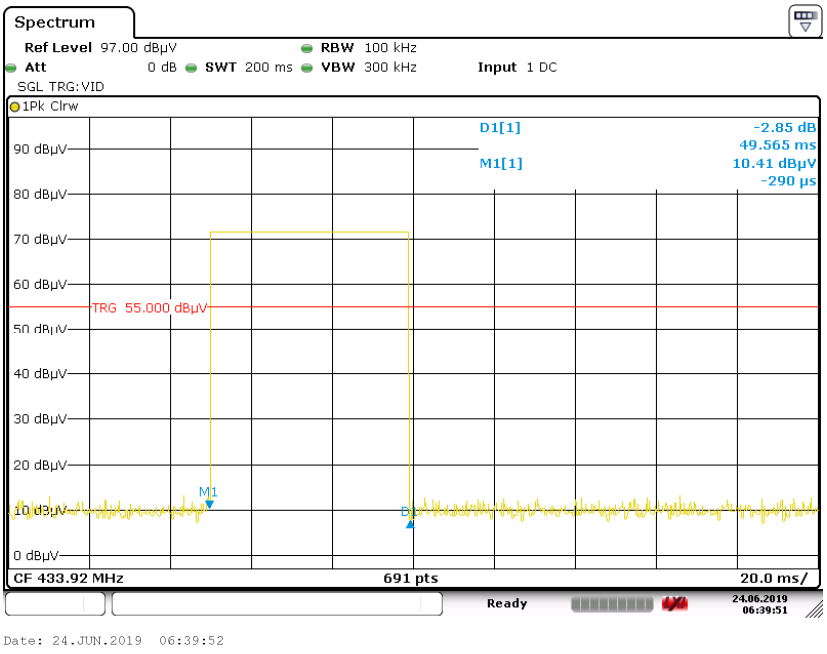
Date: 24.JUN.2019 06:20:17

Silent period



Date: 24.JUN.2019 06:31:28

Duration time



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