FCC/ISED RF Test Report (300MHz)

Report No.: FCC_IC_RF_SL19110601-TCG-002_ Rev 1.0

FCC ID: HBW9546

IC: 2666A-9546

Test Model: MYQ-G0402

Series Model: 821LMC-SENSOR

Received Date: 12/20/2019

Test Date: 12/23/2019 - 02/07/2020

Issued Date: 02/07/2020

Applicant: Chamberlain Group, Inc

Address: 300 Windsor Drive, Oakbrook, IL 60523

Manufacturer: Jabil, Inc.

Address: Jabil Circuit India Pvt. Ltd.
B -26, MIDC Industrial Area, Ranjangaon
Taluka Shirur, Pune - 412220, Maharashtra, India

Issued By: Bureau Veritas Consumer Products Services, Inc.

Lab Address: 775 Montague Expressway, Milpitas, CA 95035

FCC Registration / Designation Number: 540430 / 4842D

TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL19110601-TCG002_300MHz	Orignal Release	1/31/2020
FCC_IC_RF_SL19110601-TCG-002_ Rev 1.0	Revised	02/07/2020

1 Certificate of Conformity

Product: Smart Garage Control – Door Sensor

Brand: Chamberlain

Test Model: MYQ-G0402

Sample Status: Engineering Sample

Applicant: Chamberlain Group, Inc

Test Date: 12/23/2019 - 02/07/2020

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.231)
ISED RSS-210 Issue 10
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** 02/07/2020
Yao-Wei Lee / Test Engineer

Approved by : _____ , **Date:** 02/07/2020
Shuo Zhang / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.231)/ISED RSS-210				
FCC Clause	RSS Section(s)	Test Item	Result	Remarks
15.207	RSS-Gen[8.8]	AC Power Conducted Emission	N/A	DC Powered EUT
15.205 &15.209 & 15.231(b)	RSS-210[A.1.2(1)]	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit.
15.231(b)	RSS-210[A.1.2]	Field Strength of Fundamental Signal	PASS	Meet the requirement of limit
15.231(c)	RSS-210[A.1.3]	20dB bandwidth	PASS	Meet the requirement of limit.
15.231(a)(1)	RSS-210[A.1.3]	Timing Requirement	PASS	Meet the requirement of limit.
15.203		Antenna Requirement	PASS	Helical Antenna is permanently attached

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Smart Garage Control – Door Sensor
Brand	Chamberlain
Test Model	MYQ-G0402
Identification No. of EUT	D431900327
Status of EUT	Engineering Sample
Power Supply Rating	14.2mA @ 3.3V
Modulation Type	OOK
Operating Frequency	311.885 MHz, 312.507 MHz, 313.126 MHz
Number of Channel	3
Antenna Type	Helical
Antenna Connector	N/A

3.2 Description of Test Modes

3 channels are provided to this EUT:

CHANNEL	FREQ (MHZ)
1	311.885
2	312.507
3	313.126

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	-	-	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-" means no effect.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Baud)
1 to 3	1,2,3	OOK	50k

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Baud)
1 to 3	2	OOK	50k

Antenna Port Conducted Measurement:

☐ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	3.3VDC	Yao Wei Lee
RE<1G	25deg. C, 65%RH	3.3VDC	Yao Wei Lee
PLC	N/A	N/A	N/A
APCM	N/A	N/A	N/A

3.3 Description of Support Units

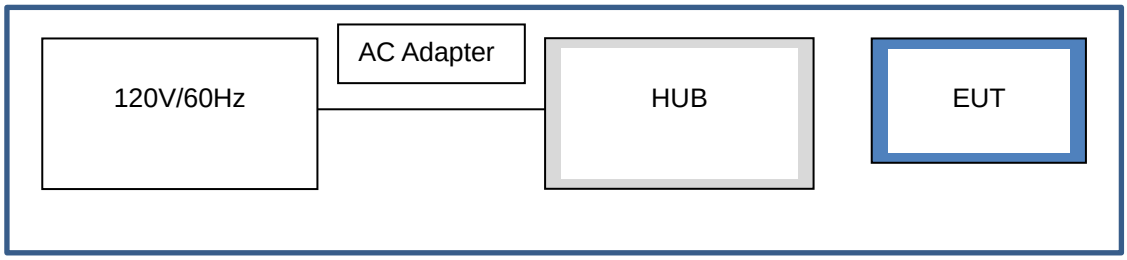
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Dell	Latitude 3550	2MHWY32	N/A	Provided by Lab

Note: The core(s) is (are) originally attached to the cable(s).

3.3.1 Configuration of System under Test

Test Chamber



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.231)
ISED RSS-210 Issue 10
ANSI C63.10: 2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Fundamental and Spurious Emission

4.1.1 Limits of Radiated Fundamental and Spurious emission

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:

Frequencies (MHz)	Field Strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meters)
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.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140584	03/05/2019	03/05/2020
Horn Antenna ETS-Lindgren	3117	218554	11/06/2019	11/06/2020
Biconilog Antenna Sunol	JB1	A030702	03/09/2018	03/09/2020
Preamplifier RF BAY INC	LPA-6-30	11170601	04/27/2019	04/27/2020

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

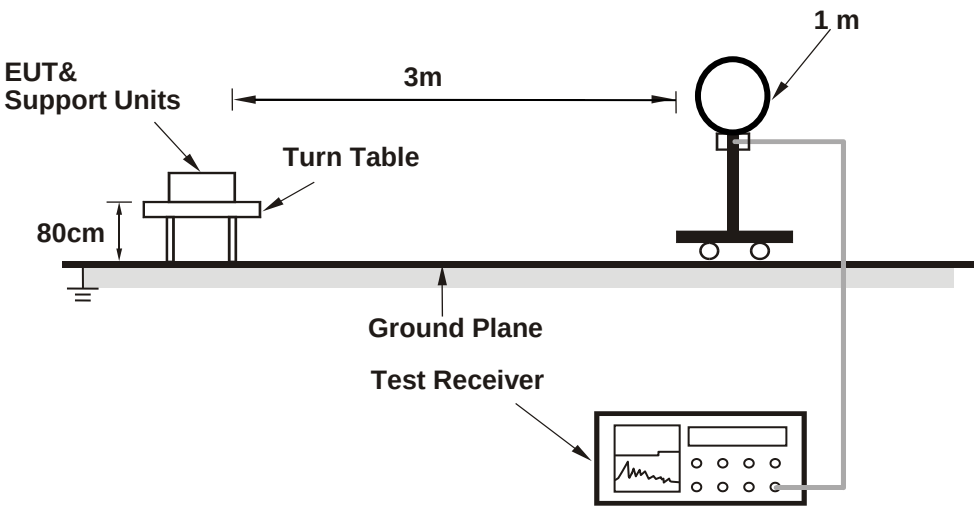
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

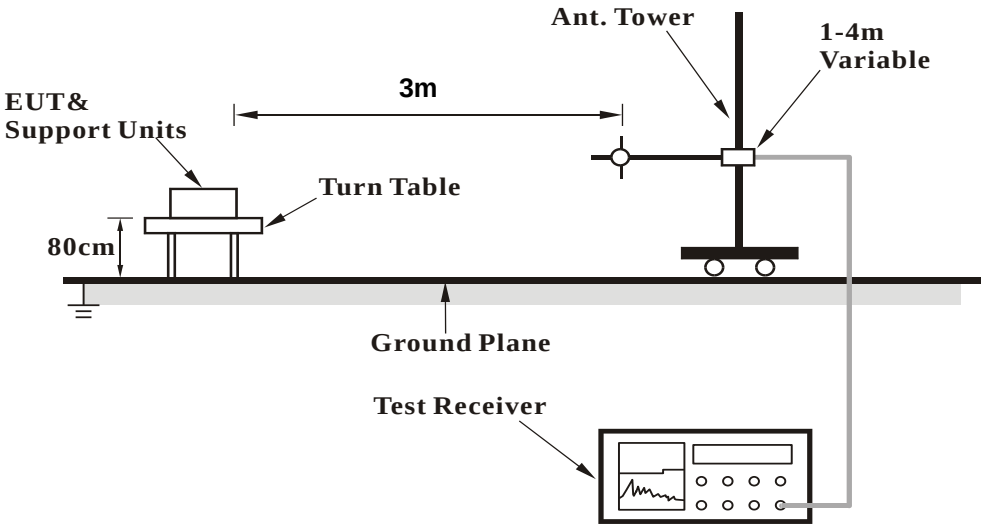
No deviation.

4.1.5 Test Setup

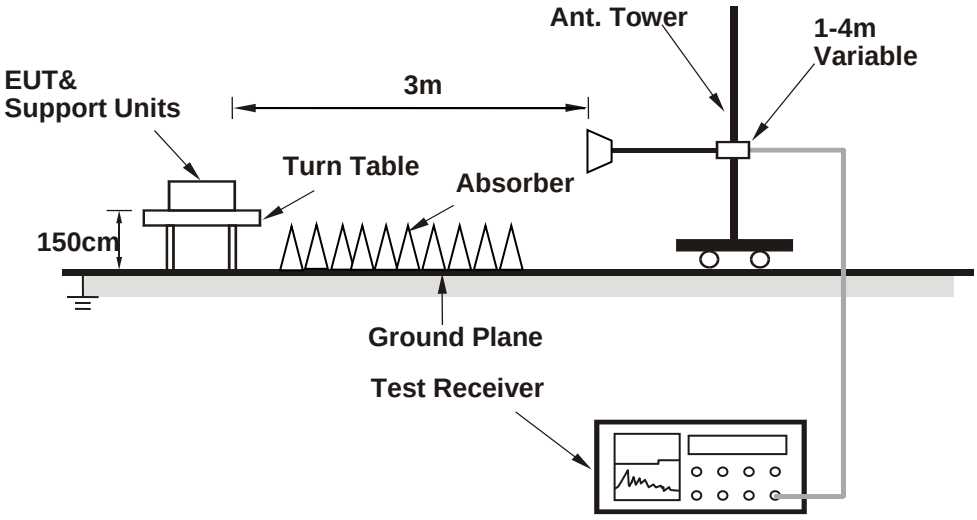
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

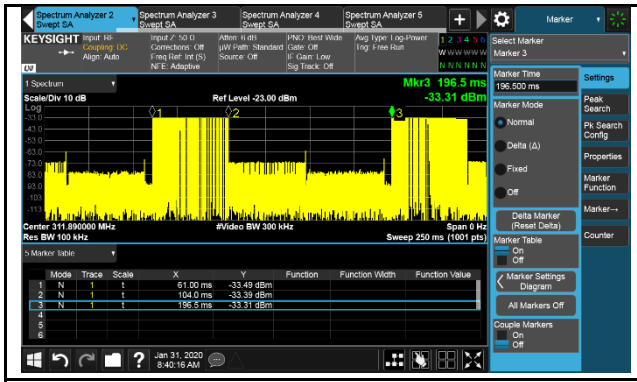
4.1.6 EUT Operating Conditions

a. EUT is powered by connecting an AC power source.

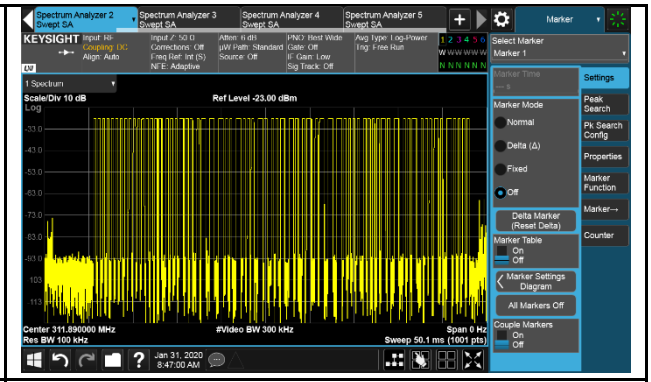
b. Controlling software has been activated to set the EUT on specific status.

4.1.7 Test Results

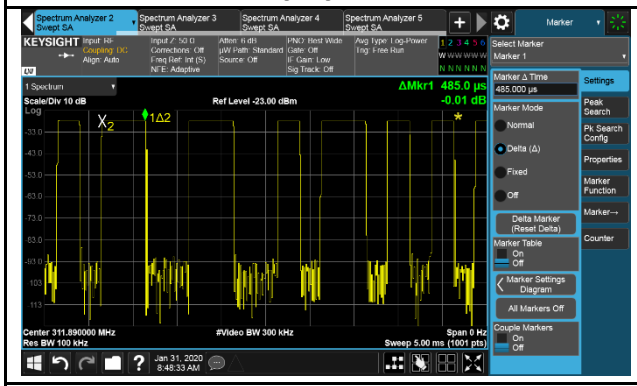
Correction Factor Measurement Result



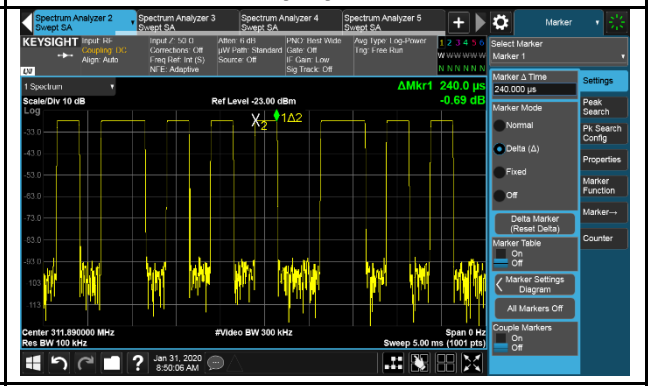
Duty Cycle 1#



Duty Cycle 2#



Duty Cycle 3#



Duty Cycle 4#

Wide Pulse: 0.485ms
Narrow Pulse: 0.24ms
Duty cycle=
(0.485*19+0.24*49)/100*100%=20.98%
Correction Factor:
20*log (Duty Cycle) =-13.57

Pulse Duty Cycle

EMISSION WORST-CASE DATA:

Freq (MHz)	Reading (dBuV/m)	Angle (Deg)	Height (m)	Polar H/V	Factors (dB)	CF	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
622	9.5	210	186	H	26.3	-	35.8	82	46.2	Peak
622	-	-	-	H	-	-13.57	22.23	62	39.77	Average
622	8.47	223	192	V	26.4	-	34.87	82	47.13	Peak
622	-	-	-	V	-	-13.57	21.3	62	40.7	Average
624	17.82	160	175	H	26.4	-	44.22	82	37.78	Peak
624	-	-	-	H	-	-13.57	30.65	62	31.35	Average
624	9.96	168	180	V	26.4	-	36.36	82	45.64	Peak
624		-	-	V	-	-13.57	22.79	62	39.21	Average
626	18.44	211	192	H	26.6	-	45.04	82	36.96	Peak
626	-	-	-	H	-	-13.57	31.47	62	30.53	Average
626	14.12	233	179	V	26.5	-	40.62	82	41.38	Peak
626	-	-	-	V	-	-13.57	27.05	62	34.95	Average
933	4.81	256	181	H	30.6	-	35.41	82	46.59	Peak
933	-	-	-	H	-	-13.57	21.84	62	40.16	Average
933	8.16	212	176	V	30.5	-	38.66	82	43.34	Peak
933	-	-	-	V	-	-13.57	25.09	62	36.91	Average
936	20.01	65	199	H	30.4	-	50.41	82	31.59	Peak
936	-	-	-	H	-	-13.57	36.84	62	25.16	Average
936	11.73	30	200	V	30.6	-	42.33	82	39.67	Peak
936	-	-	-	V	-	-13.57	28.76	62	33.24	Average
939	20.17	199	179	H	30.7	-	50.87	82	31.13	Peak
939	-	-	-	H	-	-13.57	37.3	62	24.7	Average
939	5.87	178	189	V	30.8	-	36.67	82	45.33	Peak
939	-	-	-	V	-	-13.57	23.1	62	38.9	Average

REMARKS:

1. Peak Emission level (dBuV/m) = Reading Value (dBuV) + Factors(dB)
2. Average Emission level (dBuV/m) = Peak Emission level (dBuV/m) + Correction Factor (CF)
3. Frequency range is up to 4GHz.
4. The emission levels of other frequencies were less than 20dB margin against the limit.
5. Margin value = Emission level – Limit value.

Field Strength of Fundamental Signal

Freq (MHz)	Reading (dBuV/m)	Angle (Deg)	Height (m)	Polar H/V	Factors (dB)	CF	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
311	66.69	260	169	H	20.2	-	86.89	95	8.11	Peak
311	-	-	-	H	-	-13.57	73.32	75	1.68	Average
311	55.29	245	171	V	20.1	-	75.39	95	19.61	Peak
311	-	-	-	V	-	-13.57	61.82	75	13.18	Average
312	67.22	60	182	H	20.2	-	87.42	95	7.58	Peak
312	-	-	-	H	-	-13.57	73.85	75	1.15	Average
312	55.24	80	196	V	20.2	-	75.44	95	19.56	Peak
312		-	-	V	-	-13.57	61.87	75	13.13	Average
313	67.59	315	177	H	20.3	-	87.89	95	7.11	Peak
313	-	-	-	H	-	-13.57	74.32	75	0.68	Average
313	55.82	298	179	V	20.2	-	76.02	95	18.98	Peak
313	-	-	-	V	-	-13.57	62.45	75	12.55	Average

REMARKS:

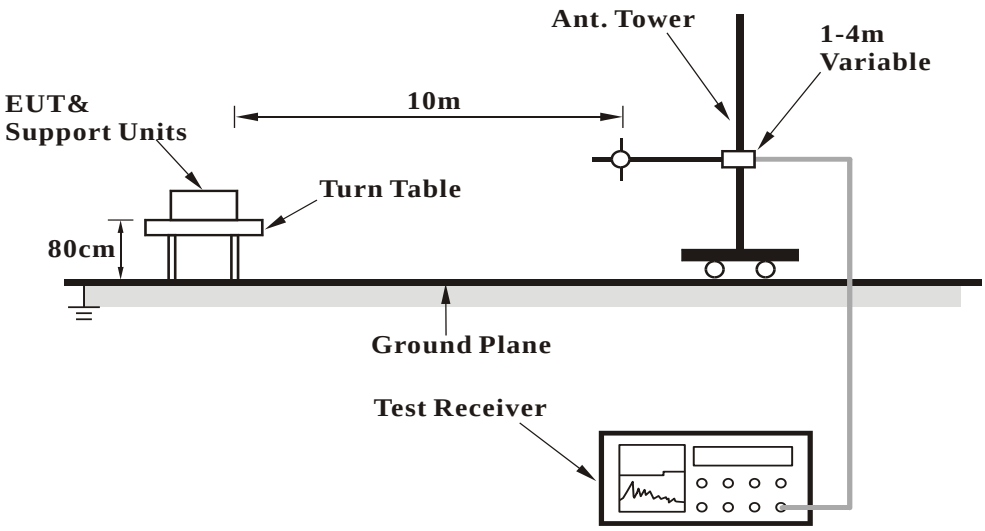
1. Peak Emission level (dBuV/m) = Reading Value (dBuV) + Factors(dB)
2. Average Emission level (dBuV/m) = Peak Emission level (dBuV/m) + Correction Factor (CF)
3. Frequency range is up to 4GHz.
4. The emission levels of other frequencies were less than 20dB margin against the limit.
5. Margin value = Emission level – Limit value.

4.2 20dB Channel Bandwidth & 99% Bandwidth measurement

4.2.1 Limits of Emission Bandwidth

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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

4.2.2 Test Setup



4.2.3 Test Procedure

1. Turn on the EUT and 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.
2. Connect a dipole antenna to the measurement instrument. Make sure waveform is received by test antenna which is connected to the spectrum analyzer. Plot the 20 dB bandwidth

4.2.4 Deviation from Test Standard

No Deviation.

4.2.5 EUT Operating Condition

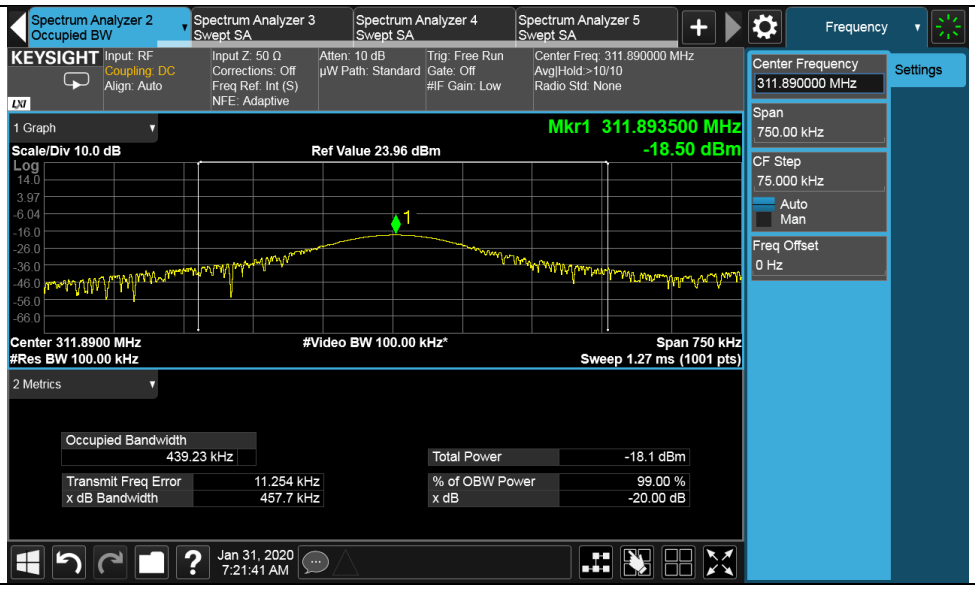
Same as 4.1.6

4.2.6 Test Results

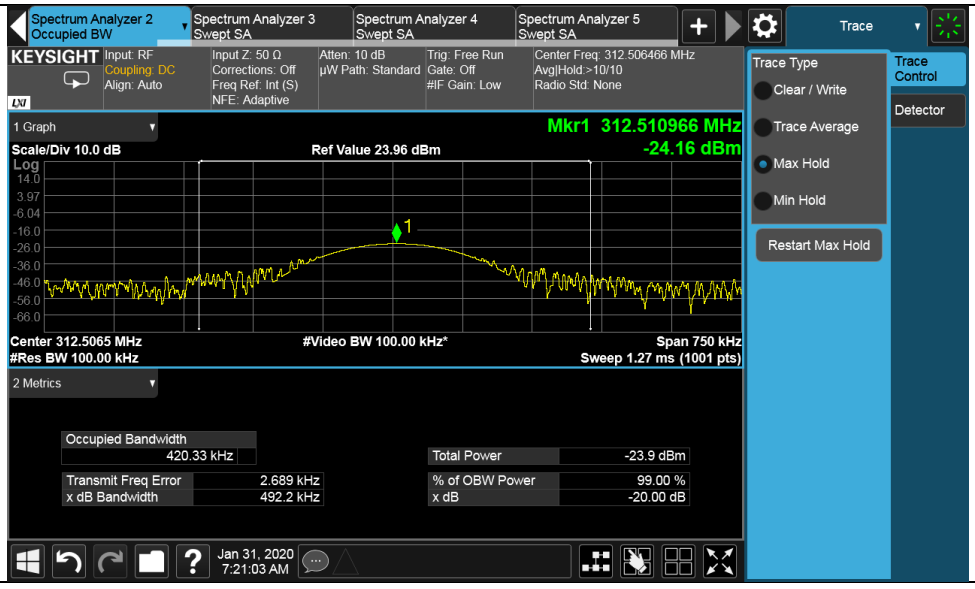
Channel	Frequency(MHz)	20 dB Bandwidth(MHz)	99% OBW (MHz)	Limit(MHz)	Results
1	311.885	0.457	0.439	0.78	Pass
2	312.507	0.492	0.420	0.78	Pass
3	313.126	0.611	0.489	0.78	Pass

Note: Limit = 0.25% * 312.507 MHz = 781.27 kHz

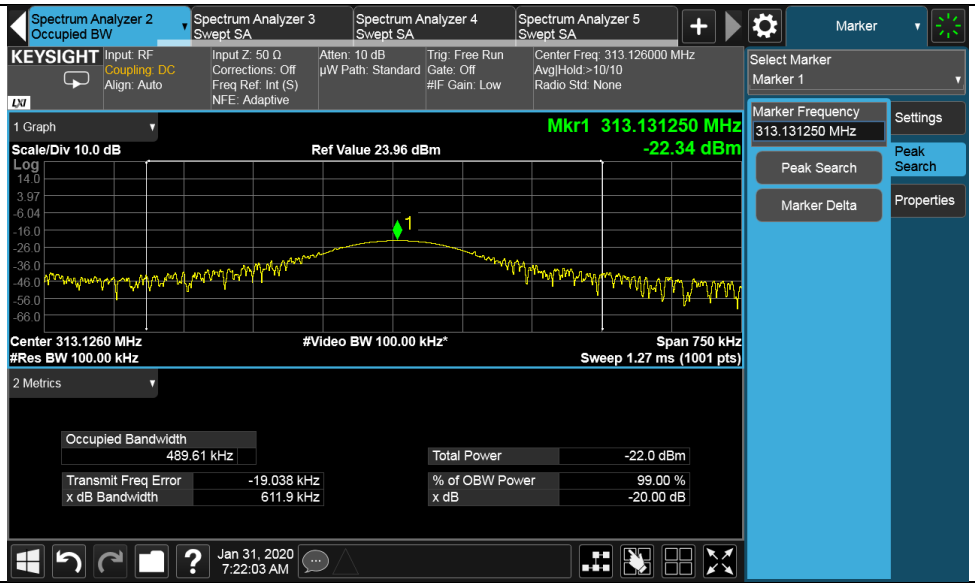
Test Plots:



311.885MHz



312.507MHz


Spectrum Analyzer 2
Occupied BW
Spectrum Analyzer 3
Swept SA
Spectrum Analyzer 4
Swept SA
Spectrum Analyzer 5
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
Atten: 10 dB
µW Path: Standard
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 313.126000 MHz
Avg|Hold:>10/10
Radio Std: None
Select Marker
Marker 1
1 Graph
Mkr1 313.131250 MHz
-22.34 dBm
Scale/Div 10.0 dB
Ref Value 23.96 dBm
Log
14.0
3.97
-6.04
-16.0
-26.0
-36.0
-46.0
-56.0
-66.0
Center 313.1260 MHz
#Res BW 100.00 kHz
#Video BW 100.00 kHz*
Span 750 kHz
Sweep 1.27 ms (1001 pts)
Marker Frequency
313.131250 MHz
Settings
Peak Search
Marker Delta
Peak Search
Properties
2 Metrics
Occupied Bandwidth
489.61 kHz
Total Power
-22.0 dBm
Transmit Freq Error
-19.038 kHz
x dB Bandwidth
611.9 kHz
% of OBW Power
99.00 %
x dB
-20.00 dB
Jan 31, 2020
7:22:03 AM

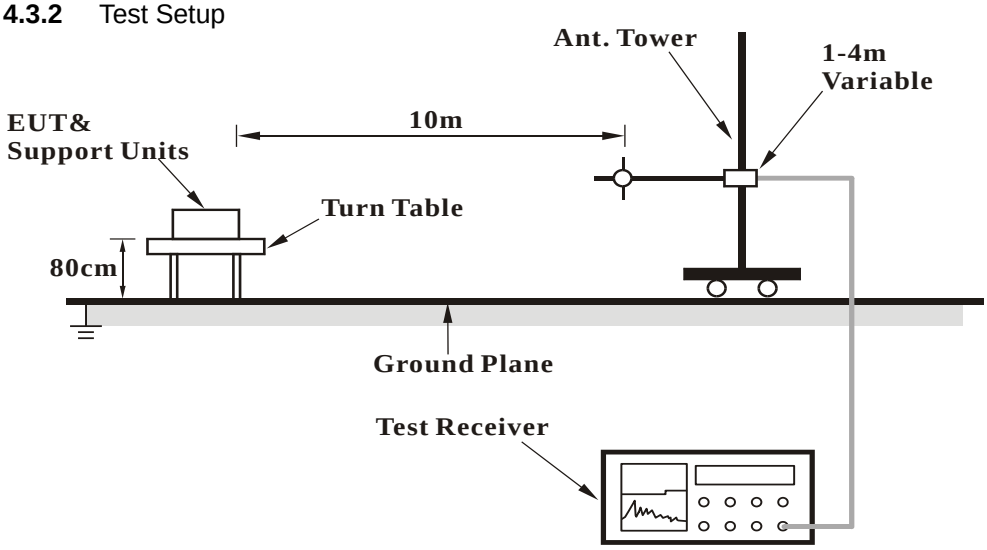
313.126MHz

4.3 TIMING REQUIREMENT

4.3.1 Limits of Timing Requirement

Per FCC §15.231(a) (1) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

4.3.2 Test Setup



4.3.3 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.

4.3.4 Deviation from Test Standard

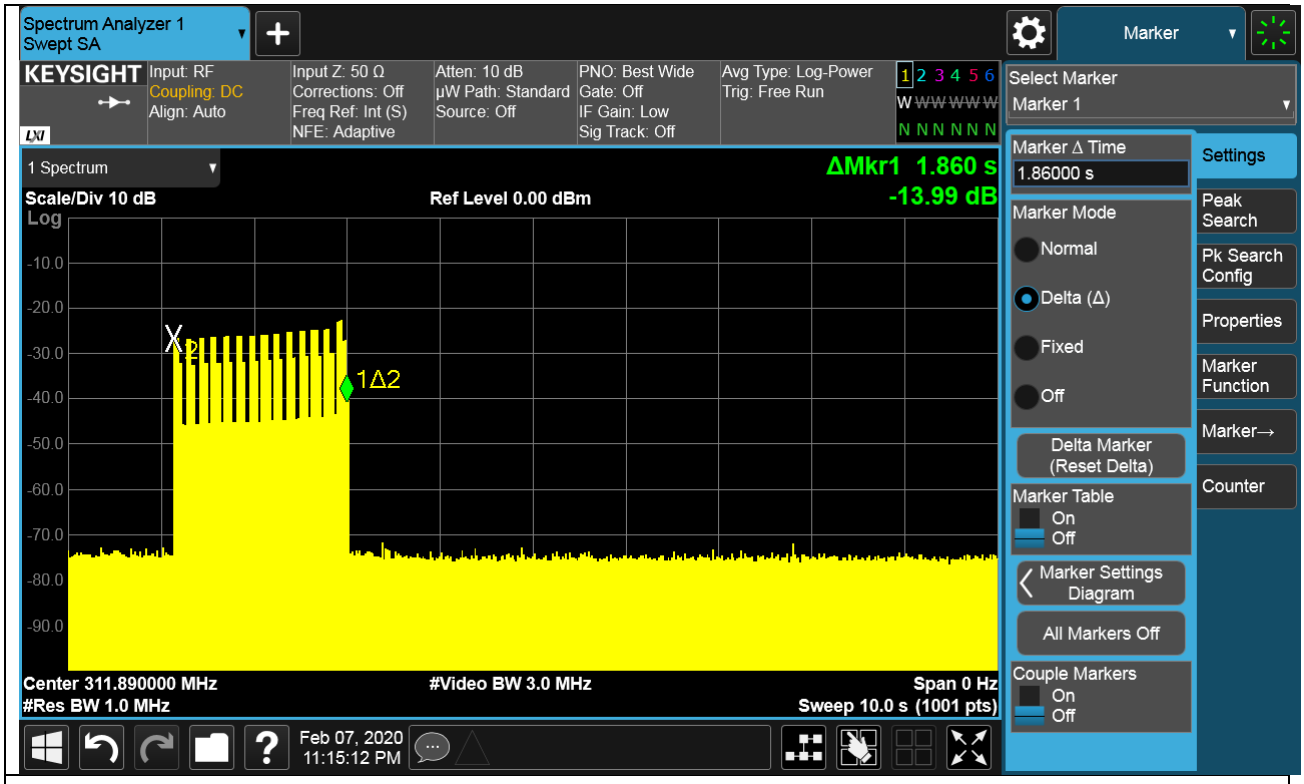
No Deviation.

4.3.5 EUT Operating Condition

Same as 4.1.6

4.3.6 Test Results

Test Plot



Stop transmit time < 5 seconds

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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