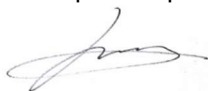



FCC & ISED CERTIFICATION TEST REPORT

Project Number : EA1912C-014
Test Report Number : TR-W1912-011
Type of Equipment : Digital Door Lock
Model Name : CDL-200L
FCC ID : CCECDL-200L
ISED Canada ID : 22254-CDL200L
Multiple Model Name : N/A
Applicant : COMMAX Co., Ltd.
Address : 494 Dunchon-Daero, Jungwon-Gu, Seongnam-si, Gyeonggi-do, South Korea
Manufacturer : COMMAX Co., Ltd.
Address : 494 Dunchon-Daero, Jungwon-Gu, Seongnam-si, Gyeonggi-do, South Korea
Regulation : FCC Part 15 Subpart C Section 15.225, ISED RSS-210 Issue9
Total page of Report : 18 Pages
Date of Receipt : 2019-11-12
Date of Issue : 2019-12-16
Test Result : PASS

This test report only contains the result of a single test of the sample supplied for the examination. It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by	Song, In-yong / Senior Engineer	 _____ Signature	2019-12-16 _____ Date
Reviewed by	Choi, Yeong-min / Technical Manager	 _____ Signature	2019-12-16 _____ Date

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Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W1912-011	2019-12-16	Initial Release
-	-	-

1.5 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Our test facilities are accredited as a Conformity Assessment Body (CAB) by the FCC and ISED Canada, designated by the RRA (National Radio Research Agency), and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea and approved by TUV Rheinland, TUV SÜD and Korean Register of Shipping according to the requirement of ISO/IEC 17025.

Laboratory Qualification	Registration No.	Mark
FCC	KR0160	
ISED Canada	12721A	
RRA	KR0160	 National Radio Research Agency
TUV Rheinland	UA 50314109-0002	
TUV SÜD	CARAT 094465 0004 Rev.00	
Korean Agency for Technology and Standards	KT733	
KOREAN REGISTER OF SHIPPING	PCT40841-TL001	

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2. EUT (Equipment Under Test) INFORMATION

2.1 General Description

The COMMAX Co., Ltd., Model CDL-200L (referred to as the EUT in this report) is a Digital Door Lock. The EUT is a device for transferring RFID (13.56 MHz) signal to an RFID TAG through wireless communication. The product specification described herein was obtained from product data sheet or user's manual. The EUT contains FCC and ISED approved ZigBee and Bluetooth Low Energy Modules.

Operating Frequency	ZigBee: 2 405 MHz to 2 480 MHz Bluetooth Low Energy (BLE): 2 402 MHz to 2 480 MHz RFID: 13.56 MHz
Contained ZigBee Module in the EUT	Model: CMX-ZG03 Modular Type: Single Modular Manufacturer: COMMAX Co., Ltd. FCC ID: CCECMX-ZG03 IC: 22254-CMXZG03
Contained BLE Module in the EUT	Model: CRM-24B Modular Type: Single Modular Manufacturer: COMMAX Co., Ltd. FCC ID: CCECRM-24B IC: 22254-CRM24B
Kind of Class	DXX- Part 15 Low Power Communication Device Transmitter
Modulation Types	ASK
Generated or used Freq. in EUT	32.768 kHz, 13.56 MHz, 16 MHz, 32 MHz
Type of Antenna	<input checked="" type="checkbox"/> Integrated Type <input type="checkbox"/> Dedicated Type PCB Pattern Antenna
Operating Temperature	-20 °C ~ + 70 °C
Normal Test Voltage	DC 6.0 V
Electrical Rating	DC 6.0 V
External Port(s)	N/A
Test SW Version	N/A
Software Version	V 1.0
Hardware Version	V 1.0

2.2 Additional Model

None

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
Digital Door Lock (EUT)	CDL-200L	N/A	COMMAX Co., Ltd.

3.2 Mode of operation during the test

For continuous transmitting modulation signal, press the password registration button on EUT and then insert AA battery acc. to the manufacturer's guidance. The used modulation type for the testing is ASK (13.56 MHz)

For continuous transmitting un-modulated signal, just insert AA battery in EUT acc. to the manufacturer's guidance.

3.3 Preliminary Testing for Worst case configuration

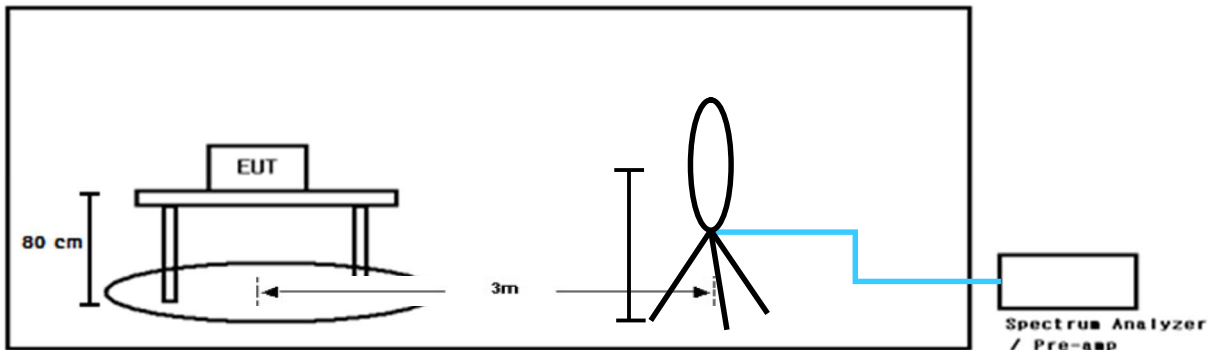
For finding worst case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission tests were performed with the EUT set to transmit and receive at the channel with the highest output power as worst case scenario. Since the EUT is a fixed type device, all spurious emission tests were performed in one axis direction.

3.3.1 Test Channel and Frequency

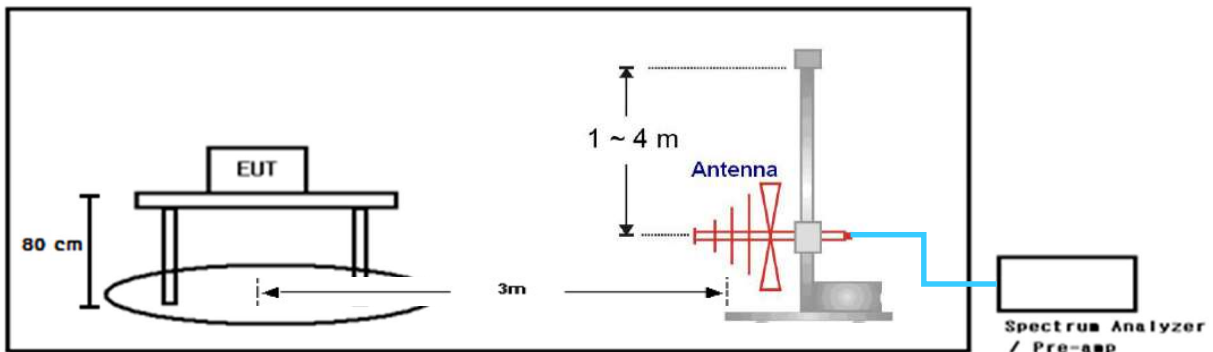
Test Channel	Channel	Frequency
Center Channel	-	13.56 MHz

3.4 Test Setup Drawing

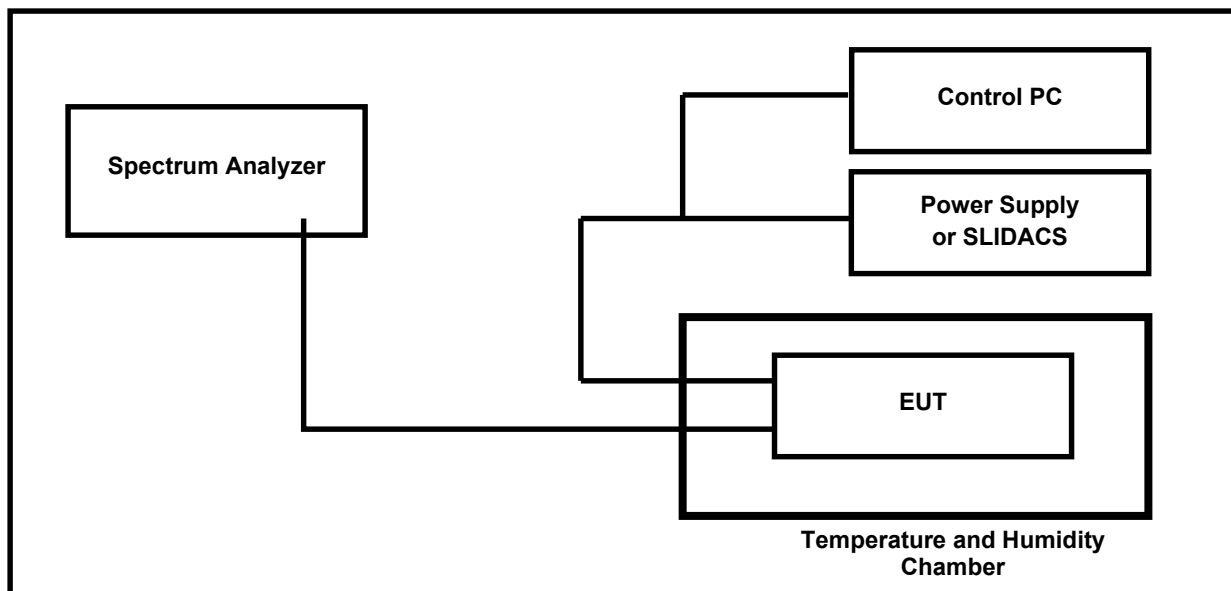
(Radiated Test below 30 MHz)



(Radiated Test below 1 GHz)



(Frequency Tolerance of Carrier Signal Test)



3.5 EUT Modifications

- No EMC Relevant Modifications were performed by this test laboratory.

4. ANTENNA REQUIREMENT

According to FCC CFR 47 Part 15 section 15.203, 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 provision of this section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.1 Conclusion

The EUT has an integral PCB loop antenna, so there is no consideration of replacement by the user.

5. TEST RESULT

5.1 Radiated emissions

5.1.1 Regulation

Acc. to section 15.225, 15.209 and RSS-210 Annex B.6, following table shall be applied.

Frequency (MHz)	Field strength limit ($\mu\text{V/m}$) @ 30 m	Field strength limit (dB $\mu\text{V/m}$) @ 30 m	Field strength limit (dB $\mu\text{V/m}$) @ 3 m
13.110 – 13.410	106	40.5	80.5
13.410 – 13.553	334	50.5	90.5
13.553 – 13.567	15,848	84.0	124.0
13.567 – 13.710	334	50.5	90.5
13.710 – 14.010	106	40.5	80.5

Frequency (MHz)	Field strength limit ($\mu\text{V/m}$)	Field strength limit (dB $\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	2400/F (kHz) = 266.7 – 4.9	48.5 – 13.8	300
0.490 – 1.705	24000/F (kHz) = 49.0 – 14.1	33.8 - 23.0	30
1.705 – 30.0	30	29.5	30
30 – 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

Note: The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands (9 – 90) kHz, (110 – 490) kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

5.1.2 Method of Measurement

The preliminary radiated emission test was performed using the procedure in ANSI C63.10 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. The measuring antenna is an electrically screened loop antenna. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Radiated Emissions Test, below 1 000 MHz

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna. The EUT is situated in three orthogonal planes(if appropriate)

5.1.3 Test Site Requirement for KDB 414788 D01

Acc. to KDB 414788 D01 Radiated Test Site v01r01, Semi Anechoic Chamber (SAC) shall be verified test results below 30 MHz with Open Area Test Site (OATS), so we compared test results between the measurements from our SAC and an OATS and found test results almost same, so we **declare test result for below 30 MHz from our SAC is valid and met the requirement acc. to KDB 414788 D01 Radiated Test Site v01r01.**

5.1.4 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	± 2.6 dB	30 MHz ~ 1 GHz	± 4.5 dB

5.1.5 Sample Calculated Example

At 80 MHz

Limit = 40.0 dBuV/m


Result(dBuV/m) = Receiver Reading (dBuV) + Antenna Factor (dB/m) - Corr. Factor (dB) = 30

Where, Corr. Factor (dB) = Pre-amplifier (dB) – Cable loss (dB)

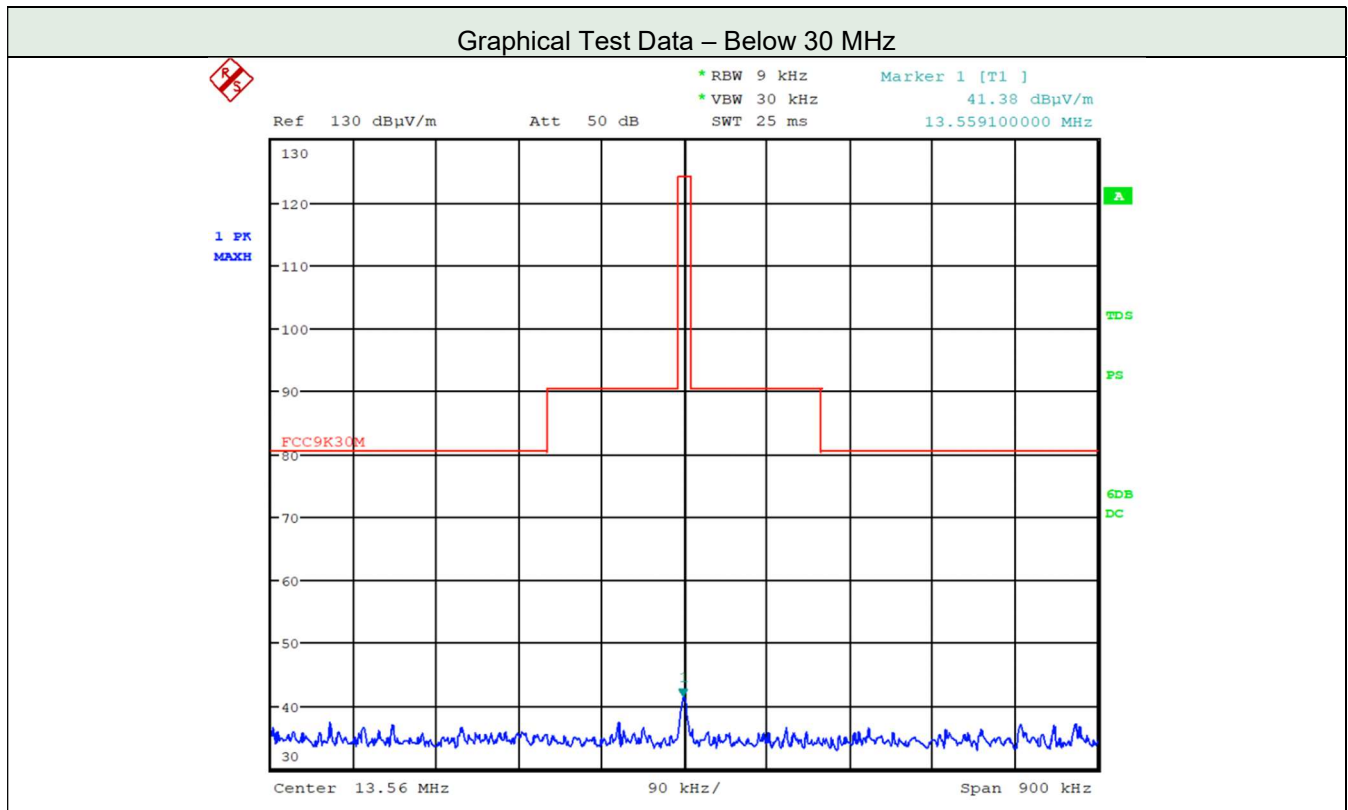
Margin = Limit – Result = 40 – 30 = 10

so the EUT has 10.0 dB margin at 80 MHz

5.1.6 Test Data

Date of Test	2019-12-11	Temperature	(21.3 ± 2.7) °C		
		Relative humidity	(45.1 ± 5.9) % R.H.		
Measurement Frequency Range		9 kHz ~ 1 GHz			
Test Result	PASS	Tested By	Do-heon Kim 		
Frequency range	Detector Mode	Resolution BW	Video BW	Video Filtering	Measurement distance
Below 30 MHz	Peak or Q.P.	9 kHz	30 kHz	-	3 m
30 MHz ~ 1 000 MHz	Peak or Q.P.	100 kHz	300 kHz	-	3 m

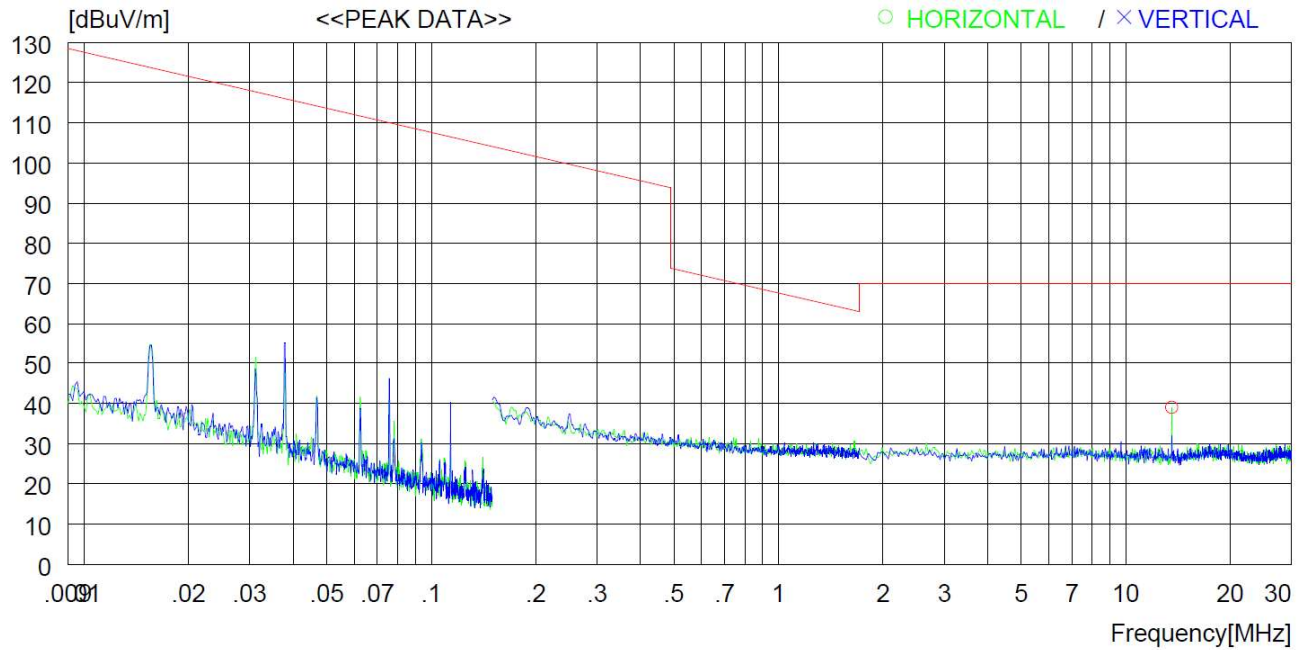
5.1.6.1 Test Data below 30 MHz



Tabulated Test Data under 15.225(a), (b)&(c)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
13.56	Peak	H	41.38	124.00	82.62	0	0

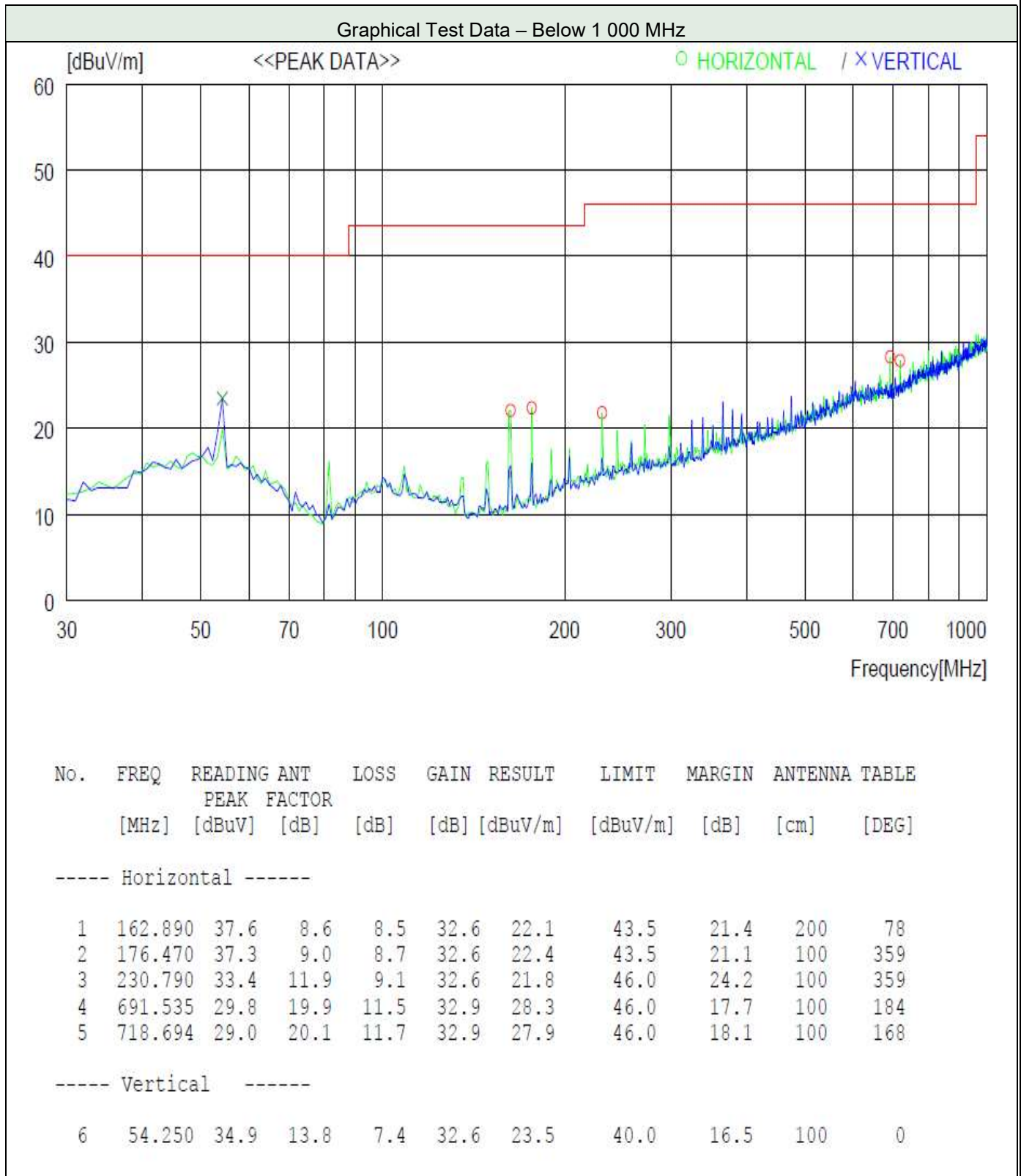
Graphical Test Data – Below 30 MHz



Tabulated Test Data under 15.225(d), 15.209

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
* Spurious emissions that 20 dB below the limits didn't be recorded										

5.1.6.2 Test Data from 30 MHz to 1 GHz

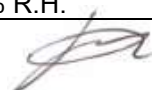


5.2 20 dB bandwidth

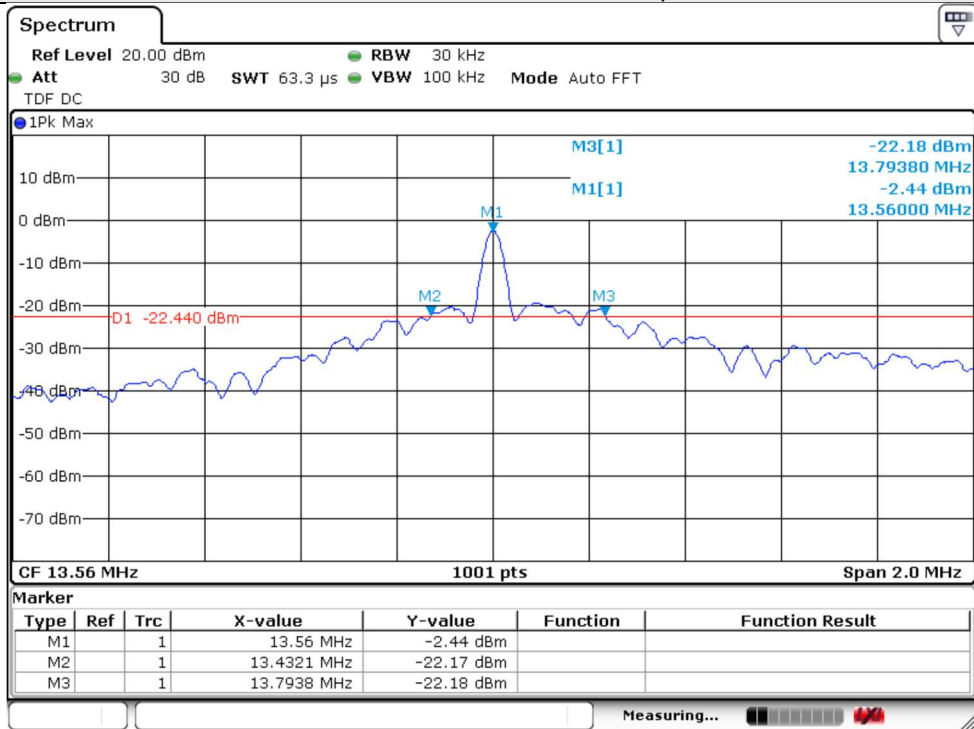
5.2.1 Method of Measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution is set to 30 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.

5.2.2 Test Data

Date of Test	2019-12-10	Temperature	(22.2 ± 0.5) °C
		Relative humidity	(46.2 ± 3.1) % R.H.
Test Result	PASS	Tested by	Do-heon Kim 
Operating Frequency (MHz)	Measured Value (MHz)	Limit	
13.56	13.432	F _L > 13.110 MHz	
	13.794	F _H < 14.010 MHz	

20 dB bandwidth measurement plot



Note: F_L : Lowest frequency at 20 dB bandwidth

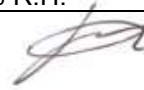
F_H : Highest frequency at 20 dB bandwidth

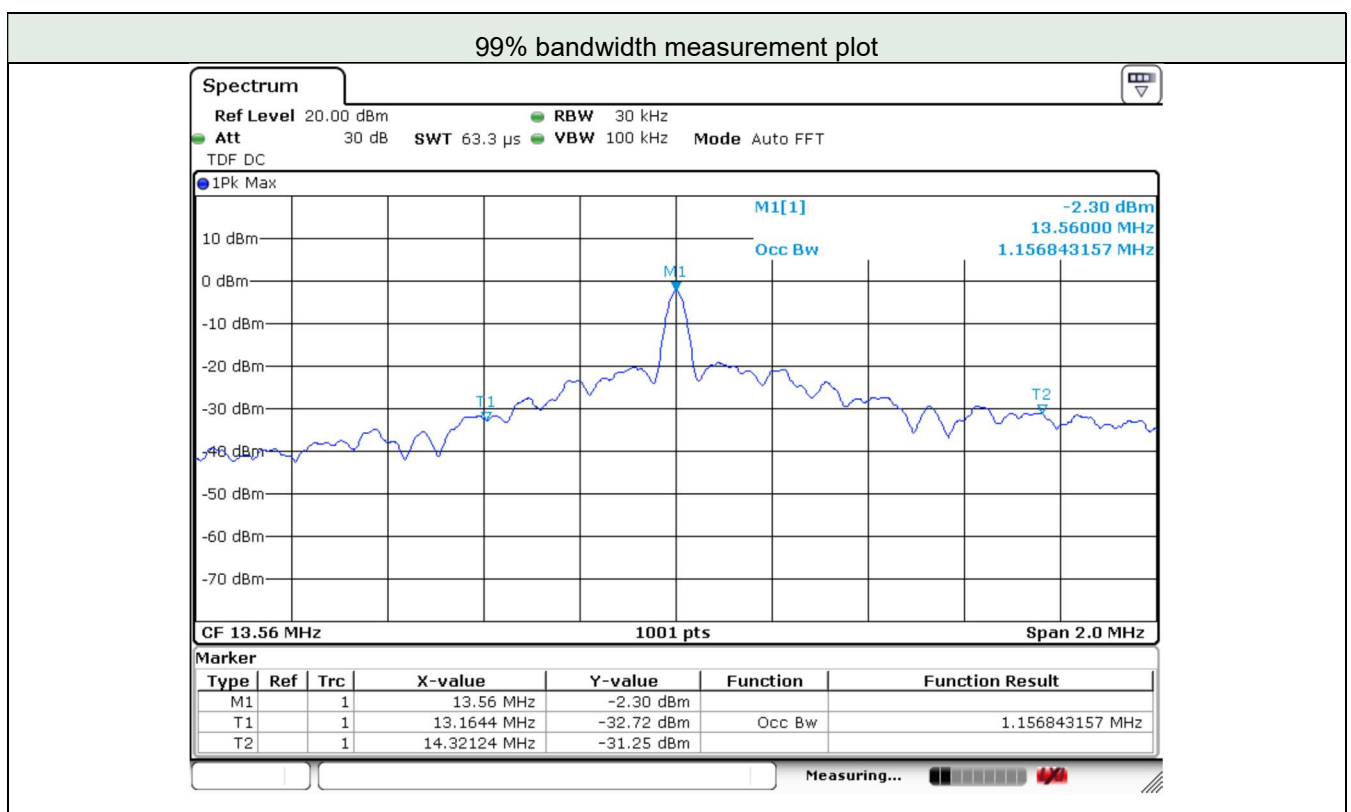
5.3 99% Power bandwidth

5.3.1 Method of Measurement

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

5.3.2 Test Data

Date of Test	2019-12-10	Temperature	(20.5 ± 0.5) °C
		Relative humidity	(46.2 ± 3.1) % R.H.
Test Result	PASS	Tested by	Do-heon Kim 
Operating Frequency (MHz)	Measured Value (MHz)		Limit
13.56	1.16		-



5.4 Frequency tolerance of carrier signal

5.3.1 Regulation

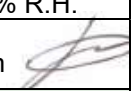
FCC 47CFR15-15.225(e) and RSS-210 Annex B.6

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery-operated equipment, the equipment tests shall be performed using a new battery.

5.3.2 Method of Measurement

The EUT output was connected to the spectrum analyzer through an attenuator. Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn on EUT and measured EUT operating frequency and turn off the EUT after the measurement. The temperature was raised 10 °C step from -20 °C to +50 °C. Repeat above method for frequency measurement every 10 °C step and then record all measured frequencies on each temperature step. An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.

5.3.3 Test Data

Date of Test		2019-12-10		Temperature		(22.2 ± 0.5) °C			
				Relative humidity		(46.2 ± 3.1) % R.H.			
Test Result		PASS		Tested by		Do-heon Kim 			
Carrier Frequency: 13.560 000 MHz, LIMIT: within ±1 356 Hz									
Temp. (°C)	Volt. (V)	Carrier Frequency Measured with Time Elapsed							
		Start Up		2 minutes		5 minutes		10 minutes	
		(MHz)	Err (Hz)	(MHz)	Err (Hz)	(MHz)	Err (Hz)	(MHz)	Err (Hz)
+50	6.00	13.559 920	80	13.559 923	77	13.559 890	110	13.559 886	114
+40	6.00	13.559 879	121	13.559 874	126	13.559 873	127	13.559 870	130
+30	6.00	13.559 869	131	13.559 868	132	13.559 871	129	13.559 874	126
+20	6.90	13.559 877	123	13.559 878	122	13.559 889	111	13.559 895	105
	6.00	13.559 876	124	13.559 878	122	13.559 888	112	13.559 896	104
	5.10	13.559 875	125	13.559 879	121	13.559 888	112	13.559 896	104
+10	6.00	13.559 909	91	13.559 914	86	13.559 918	82	13.559 930	70
0	6.00	13.559 936	64	13.559 941	59	13.559 946	54	13.559 953	47
-10	6.00	13.559 960	40	13.559 962	38	13.559 964	36	13.559 966	34
-20	6.00	13.559 964	36	13.559 964	36	13.559 960	40	13.559 952	48

Appendix I – Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal. Date	Cal. Interval
Signal Analyzer	FSV 13	101243	Rohde & Schwarz	2020-01-18	1 Y
Attenuator	10 dB	ENG-1	Rohde & Schwarz	2020-01-18	1 Y
Temperature & Humidity Chamber	PR-3KP	14004209	Espec	2020-07-26	1 Y
DC Power Supply	E3610A	MY40005644	AGILENT	2020-04-22	1 Y
Test Receiver	ESU 26	100303	Rohde & Schwarz	2020-01-18	1 Y
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2021-04-22	2 Y
TRILOG Broadband Antenna	VULB9163	9163.799	Schwarzbeck	2021-11-12	2 Y
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2020-01-18	1 Y
Pre-Amplifier	310N	344015	Sonoma Instrument	2020-01-18	1 Y
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A	N/A
Antenna Master	MA4000-XP-ET	-	INNCO SYSTEM	N/A	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A	N/A
CO3000 Controller	Co3000-4Port	CO3000/807/ 34130814/L	INNCO SYSTEM	N/A	N/A

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.