ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No.	**: OT-21N-RWD-058**
Reception No.	**: 2111004769**
Applicant	**: Samsung Electronics Co Ltd**
Address	**: 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States**
Manufacturer	**: Samsung Electronics Co Ltd**
Address	**: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea**
Type of Equipment	**: Motion Detection Sensor**
FCC ID.	**: A3LMDRBI303**
Model Name	**: MDRBI303**
Serial number	**: N/A**
Total page of Report	**: 35 pages (including this page)**
Date of Incoming	**: November 05, 2021**
Date of issue	**: November 30, 2021**

SUMMARY

The equipment complies with the regulation; ***FCC CFR 47 PART 15 SUBPART C Section 15.255***

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.

Tested by	Reviewed by	Approved by
Ju Yun Park / Assistant Manager	Tae-Ho, Kim / Senior Manager	Ki-Hong, Nam / General Manager
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

CONTENTS

PAGE

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-21N-RWD-058	November 30, 2021	Initial Release	All

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd

Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States

Contact Person : Youngjoong Noh / Principal Engineer

Telephone No. : +82-31-277-0598

FCC ID : A3LMDRBI303

Model Name : MDRBI303

Brand Name :

Serial Number : N/A

Date : November 30, 2021

DEVICE TYPE	DXT – Part 15 Low Power Transceiver, Rx Verified
E.U.T. DESCRIPTION	Motion Detection Sensor
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2020
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.255
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

2. GENERAL INFORMATION

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.255 (e) (1)	Emission & Occupied Bandwidth	Met the Limit / PASS
15.255 (c) (2)	Peak and Average EIRP Output Power	Met the Limit / PASS
15.255 (e)	Peak Output Power	Met the Limit / PASS
15.255 (d) (1) (2) (3) (4)	Spurious Emissions	Met the Limit / PASS
15.255 (f)	Frequency Stability	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

2.2 Product Description

The Samsung Electronics Co Ltd, Model MDRBI303 (referred to as the EUT in this report) is an Motion Detection Sensor, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Motion Detection Sensor Module
TRANSMITTING FREQUENCY	61.02 GHz ~ 61.48 GHz
MODULATION TECHNOLOGY	Pulse
MODULATION TYPE	FMCW
ANTENNA TYPE	Chip Antenna
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)	80.0 MHz

2.2.1 Description of Test Mode

Frequency (GHz)
61.02 ~ 61.48

2.3 Model Differences:

-. None

2.4 Related Submittal(s) / Grant(s)

Original submittal only

2.5 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.255.

2.6 Test Methodology

Testing was performed according to the procedures in ANSI C63.10-2020, Clause 9 – Procedures for testing millimeter-wave systems.

2.7 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
MDRTI301	N/A	N/A	N/A

3.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested: None

Model	Manufacturer	Description	Connected to
MDRBI303	Samsung Electronics Co Ltd	Motion Detection Sensor (EUT)	-
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	EUT

3.3 Equipment Modifications

-. None

3.4 Configuration of Test System

Line Conducted Test

The EUT was tested in a Transmitter mode. The EUT was connected to DC Power Supply.

All supporting equipment were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2020 to determine the worse operating conditions.

Radiated Emission Test

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available XYZ axis, and antenna ports. The worst case was found when positioned as the table below. Following was (were) selected for the final test as listed below:

-. Duty Cycle

Mode	Frequency Range(GHz)	Channel	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle (%)	Duty Correction Factor [dB]
Transmitting Mode 1	61.02 ~ 61.48	1	0.024	33.00	0.07	31.38
Transmitting Mode 2	61.02 ~ 61.48	1	0.064	33.00	0.19	27.12

Note 1. All Measurements Were performed on Mode 2 (Highest duty cycle) as the worst Case.

Testing Mode	EIRP Output Power	Radiated Emission
Transmitting Mode 2	Y-axis	Y-axis

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

3.5 Antenna Requirement

For intentional device, according to 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.

Antenna Construction:

The transmitter antenna of the EUT is a Chip Antenna so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode 2	X

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode 2	X

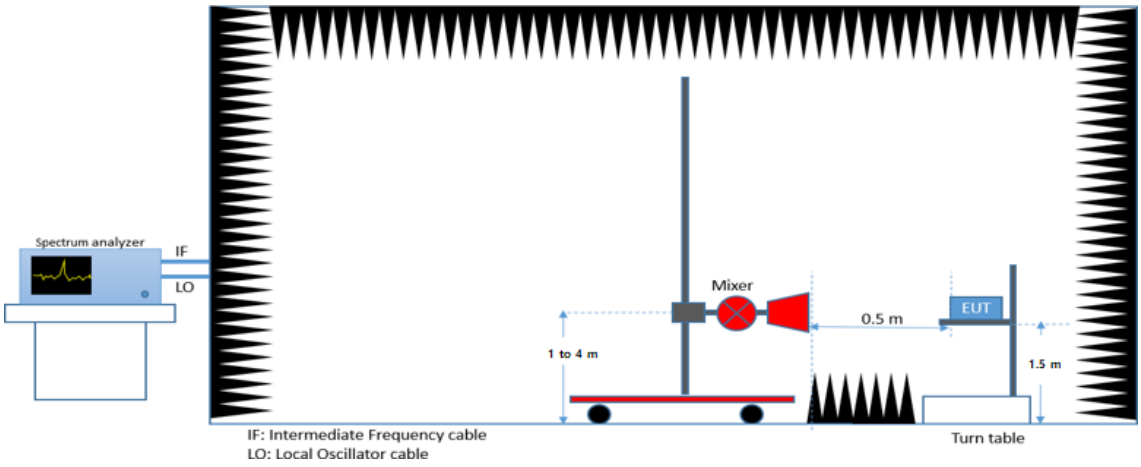
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

5. Test & System Description

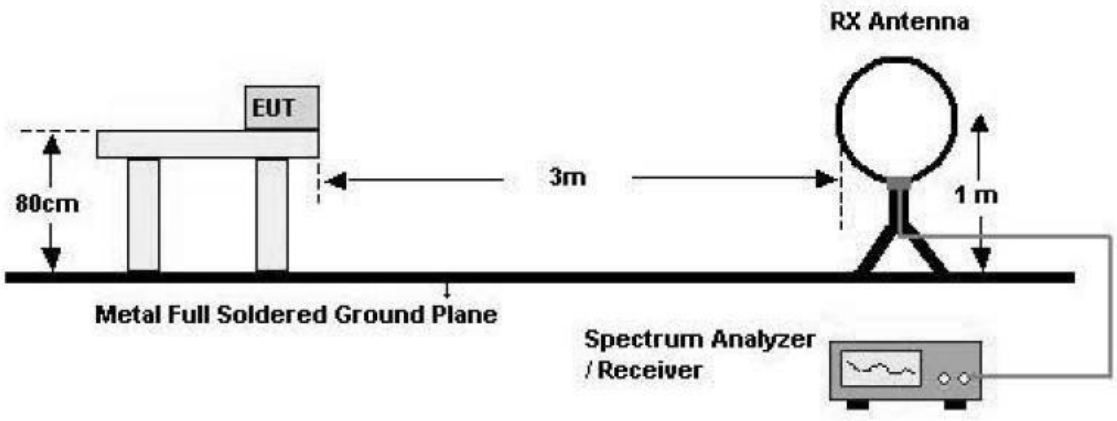
5.1 Measurement System

Measurements were performed using the following setups, made in accordance to the general provisions of ANSI C63.10-2020, Clause 9 – Procedures for testing millimeter-wave systems.

1) Emission & Occupied Bandwidth & Peak and Average EIRP Output Power (57 ~ 64 GHz)

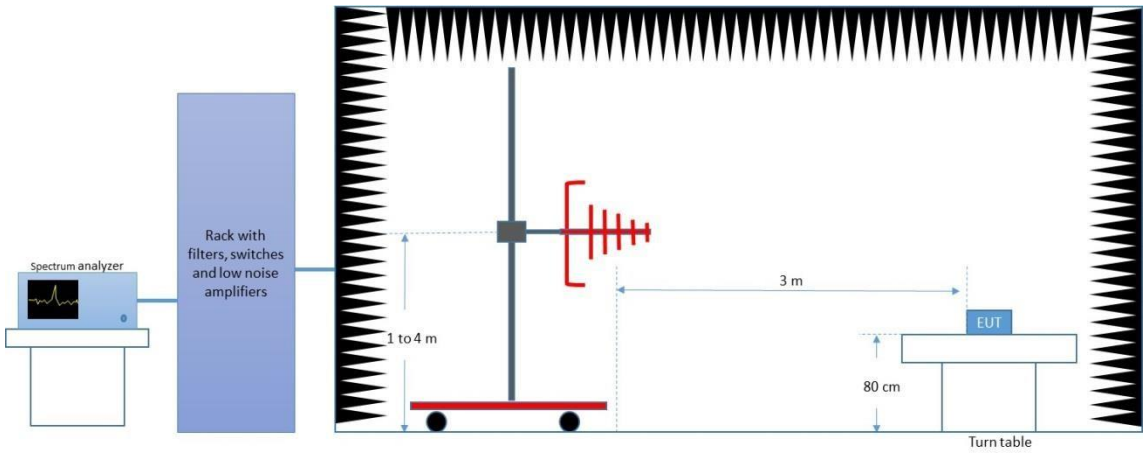


2) Radiated Setup (Below 30 MHz)

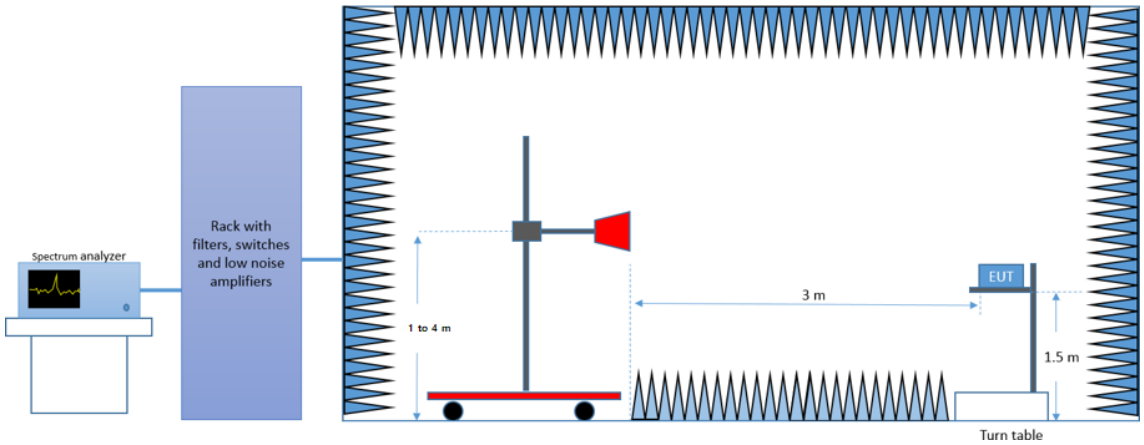


ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

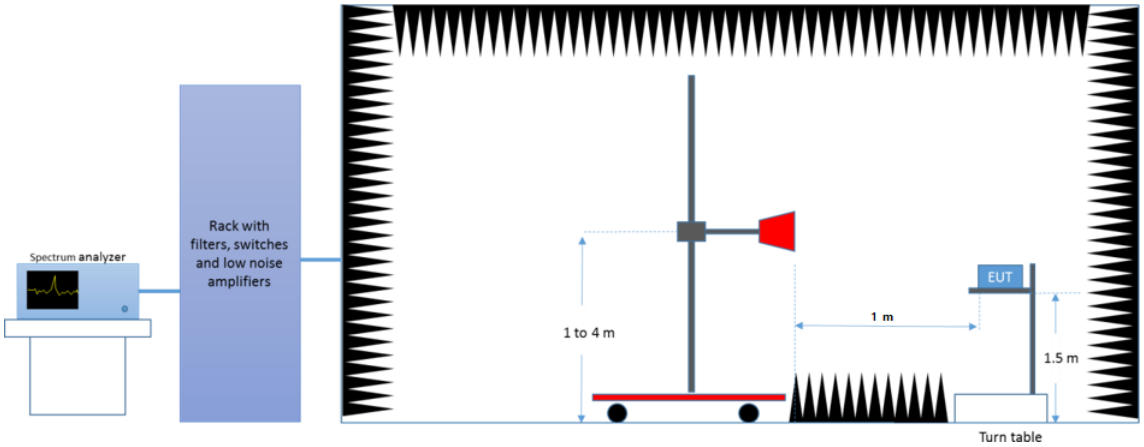
3) Radiated Setup (30 MHz ~ 1 GHz)



4) Radiated Setup (1 GHz ~ 18 GHz)

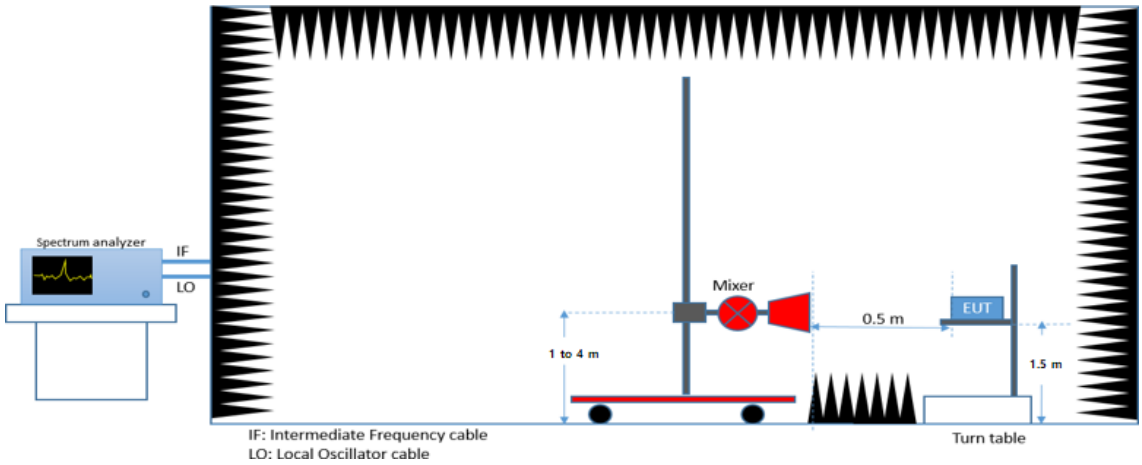


5) Radiated Setup (18 GHz ~ 40 GHz)

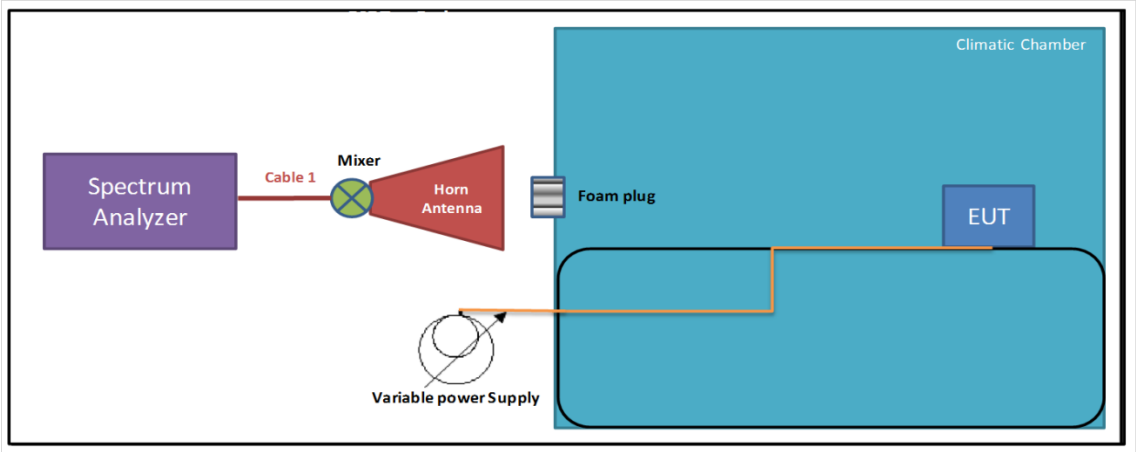


ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6) Radiated Setup (40 GHz ~ 200 GHz)



7) Frequency Stability Measurement Setup (57 – 71 GHz)



ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6. Test Results

6.1 Emission Bandwidth

6.1.1 Operating environment

Temperature : 23 °C

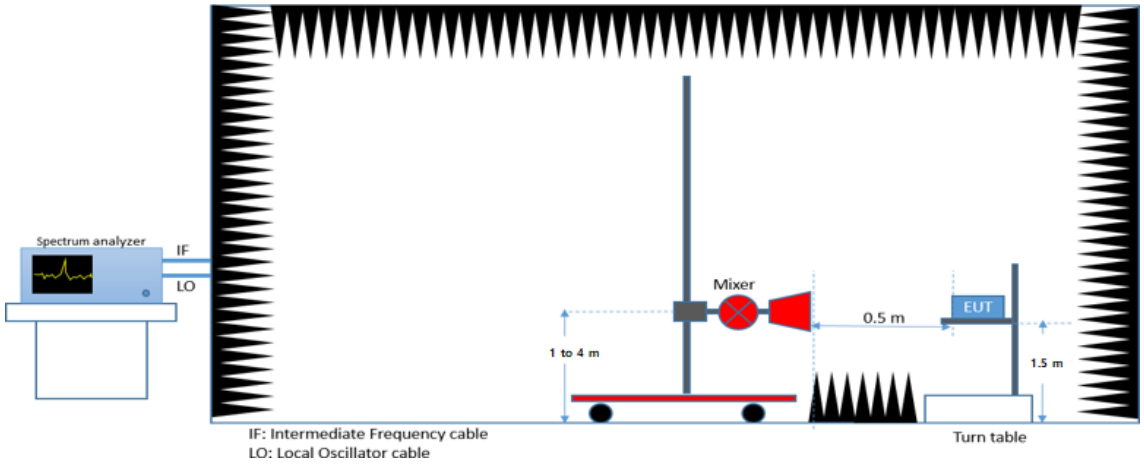
Relative humidity : 44 % R.H.

6.1.2 Test Date

November 05, 2021 ~ December 27, 2021

6.1.3 Test Procedure

The setup below was used to measure the 6dB & 99% Bandwidth.

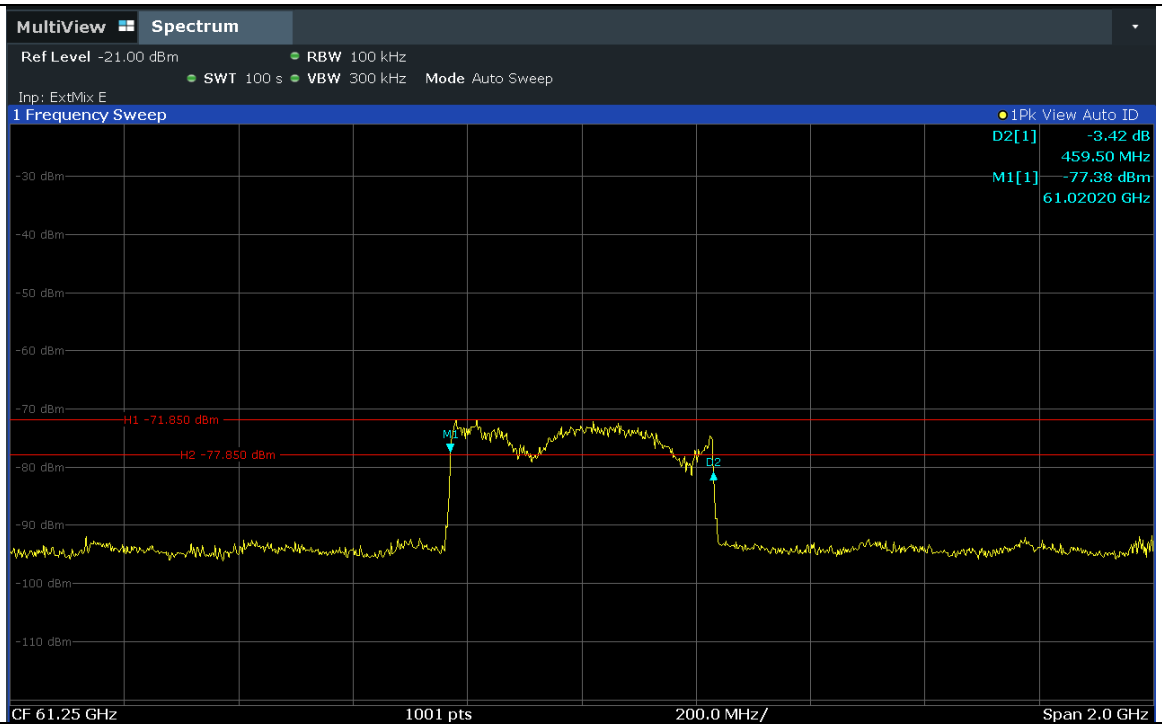


ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

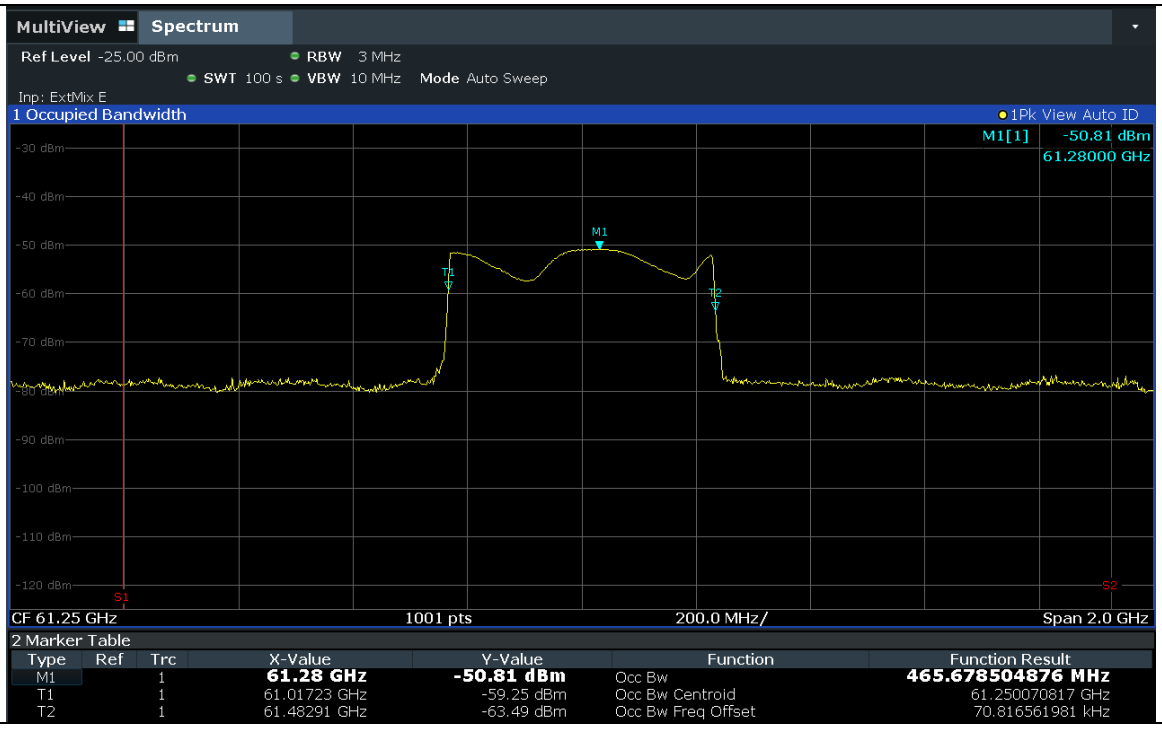
6.1.4 Test data Result

-. Test Result : Pass

Operating Freq. (GHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
61.02 ~ 61.48	459.50	465.68



6 dB Bandwidth



99% Bandwidth

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.2 Duty Cycle

6.2.1 Operating environment

Temperature : 23 °C

Relative humidity : 44 % R.H.

6.2.2 Test Date

November 05, 2021 ~ December 27, 2021

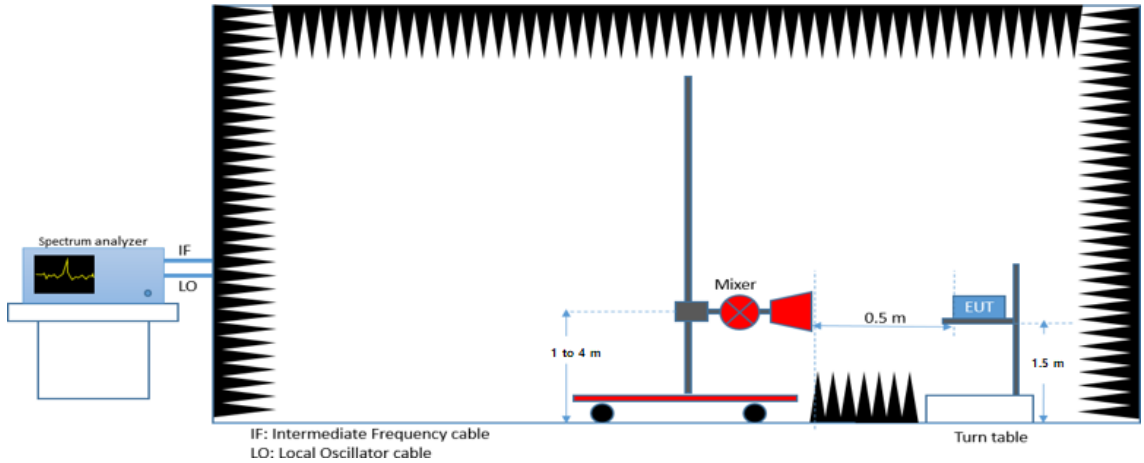
6.2.3 Test Limits

For Waiver DA 21-811 (granted July 09, 2021)

- Each individual radar device shall not exceed a maximum transmit duty cycle of 10% in any 33 milliseconds (ms) interval (i.e., the device will not transmit longer than a total of 3.3 ms in any 33 ms time period).
- Any radar off-time period between two successive radar pulses that is less than 2 ms shall be considered “on time” for purposes of computing the duty cycle.

6.2.4 Test Procedure

For radiated measurements, connect the test antenna for the fundamental frequency band to a spectrum analyzer via an external mixer, or directly to the spectrum analyzer if the instrument supports the required frequency range.

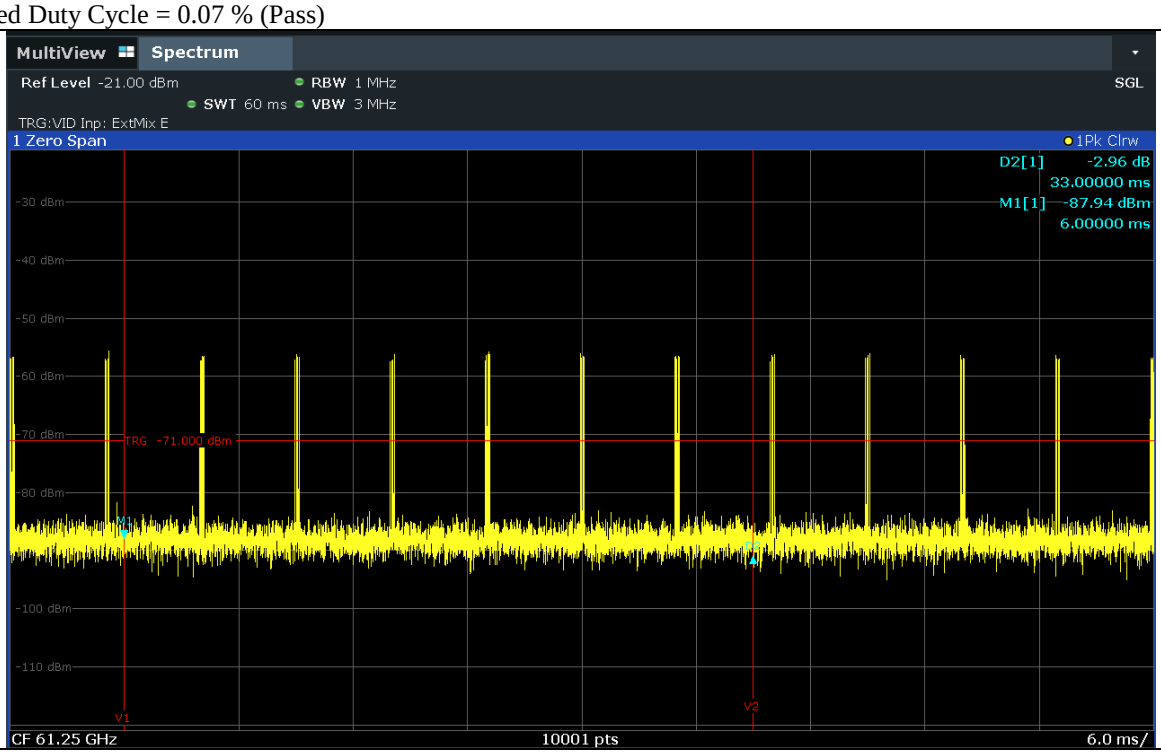


6.2.5 Verification Test Results

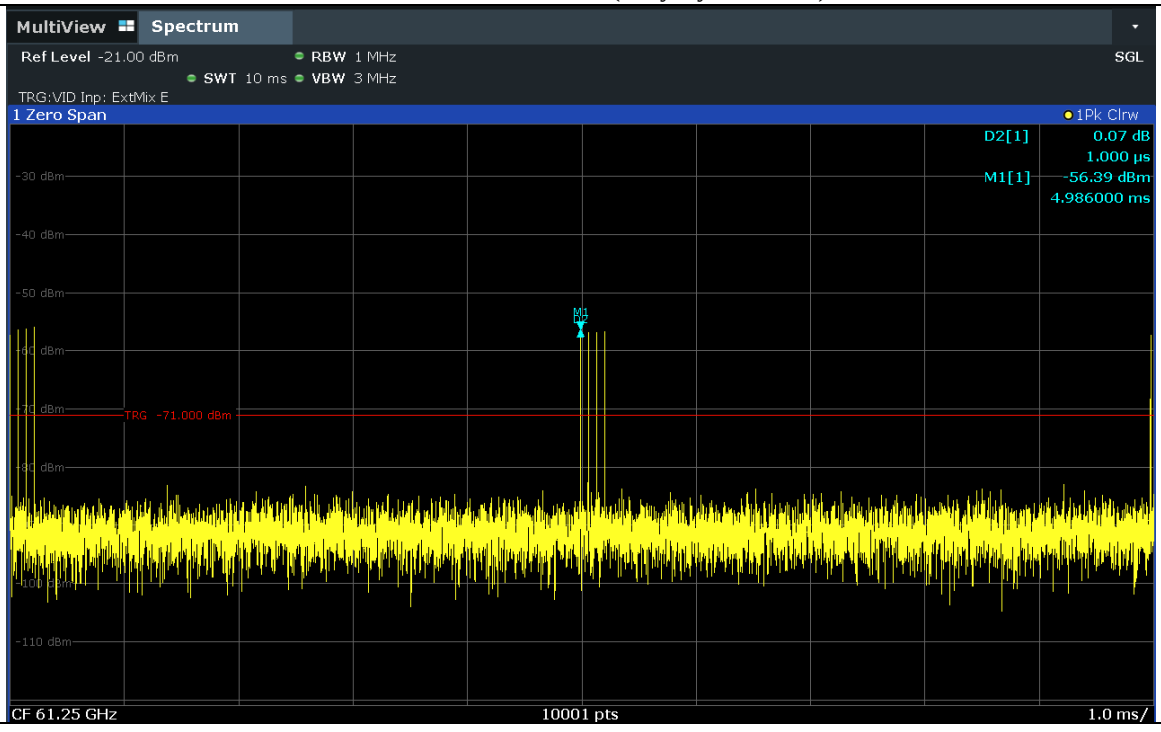
Transmitting Mode 1

Maximum ON Time in any 33 ms observation Period = (6 chirps) * (4 us/chirp) = 0.024 ms

Observed Duty Cycle = 0.07 % (Pass)



33ms Observation Period (Duty Cycle < 10%)



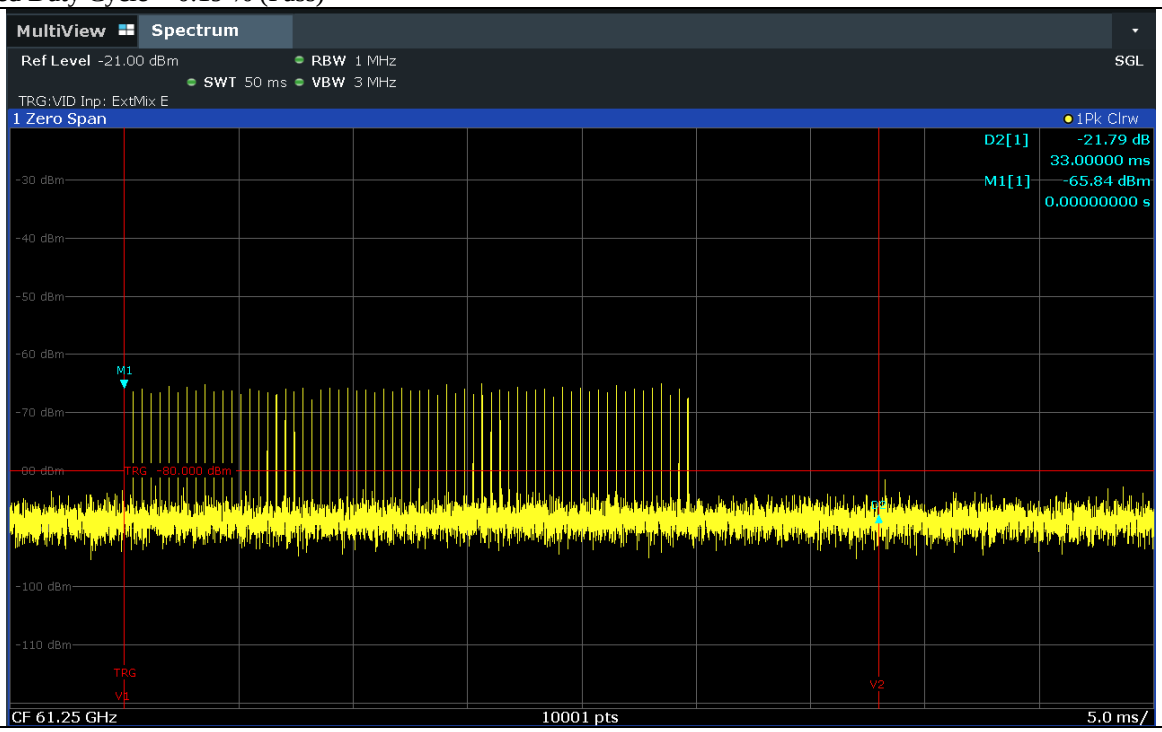
Single Chirp (1.00 us X 4)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

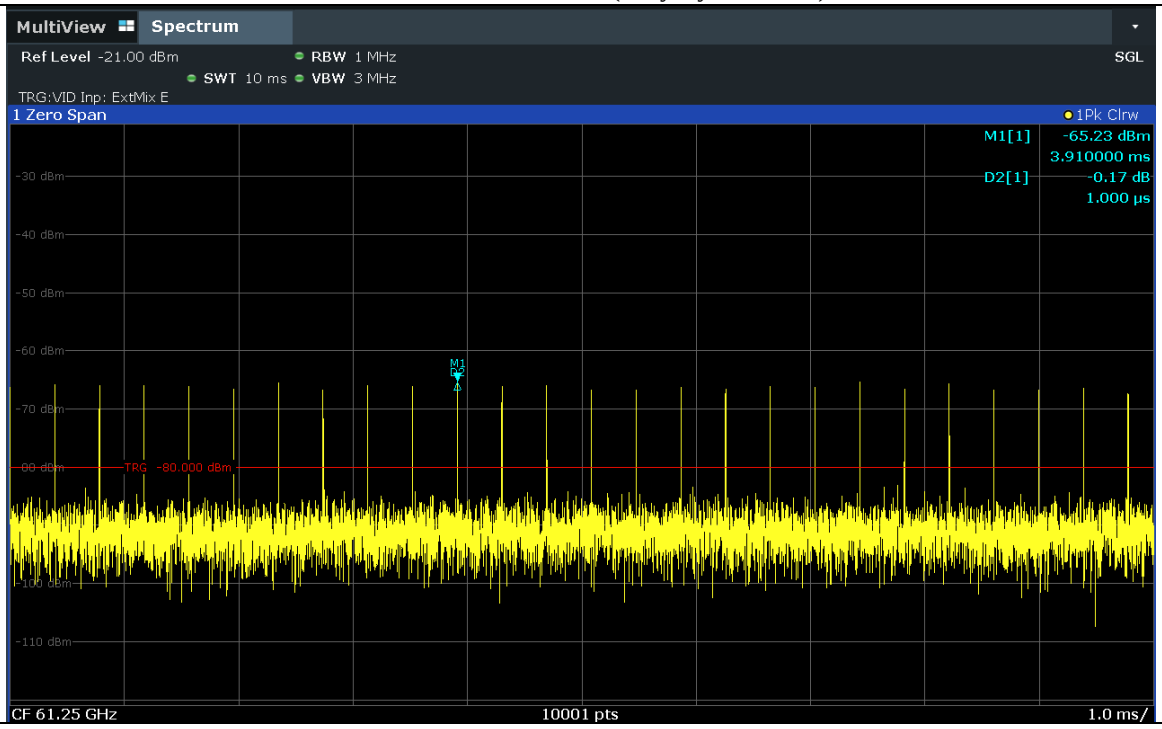
Transmitting Mode 2

Maximum ON Time in any 33 ms observation Period = (1 chirps) * (64 us/chirp) = 0.064 ms

Observed Duty Cycle = 0.19 % (Pass)



33ms Observation Period (Duty Cycle < 10%)



Single Chirp (1.00 us X 64)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.3 Peak and Average EIRP Output Power

6.3.1 Operating environment

Temperature : 23 °C

Relative humidity : 44 % R.H.

6.3.2 Test Date

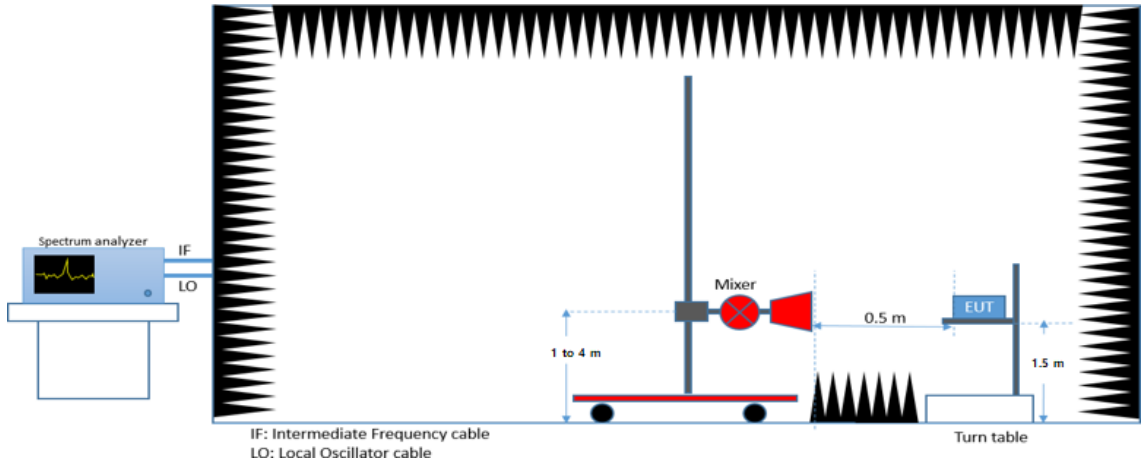
November 05, 2021 ~ December 27, 2021

6.3.3 Test Limits

FCC part	Limits
15.255 (c) (2)	For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

6.3.4 Test Procedure

For radiated measurements, connect the test antenna for the fundamental frequency band to a spectrum analyzer via an external mixer, or directly to the spectrum analyzer if the instrument supports the required frequency range.



According to ANSI C63.10-2020, Clause 9, the measurement should be performed at a distance greater than or equal to the far field boundary distance. This later is given by

$$R_{(Far\ Field)} = \frac{2L^2}{\lambda}$$

Where

L is the largest dimension of the transmit antenna in m

λ is the wavelength in m

Far field boundary calculation			
Frequency (GHz)	Wavelength (λ) (m)	L (m)	R far field (m)
61.02	0.0049	0.008	0.03
61.48	0.0049	0.008	0.03

Our measurement is performed at a minimum distance of 0.5 m > R far field

Perform radiated emission measurements to keep maximize the received signal from the EUT in the far field.

Using substitution measurement. Measured and note the power.

ANSI C63.10 Caluse 9.8 For FMCW emissions, the procedures in 4. 1.5.2.8 and

Annex L(Desensitization for peak detection) shall be used.

$$\alpha = \frac{1}{\sqrt{1+\left(\frac{2\ln(2)}{\pi}\right)^2\left(\frac{BW_{Chirp}}{T_{Chirp}B^2}\right)^2}}$$

where

α	is the reduction in amplitude
BW_{Chirp}	is the FMCW Chirp Bandwidth
T_{Chirp}	is the FMCW Chirp Time
B	is the 3 dB IF Bandwidth = RBW

And FMCW Desensitization Factor = 20 Log(a)

6.3.5 Test data Result

-. Test Result : Pass

Peak EIRP Output Power					
Frequency	Measure Level	Correction Factor	EIRP	Limit	Margin
(GHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
61.02 ~ 61.48	-38.58	62.69	29.32	43.00	13.68

Remark:

1. The EIRP was evaluated on vertical and horizontal polarization, the worst case is Vertical polarization.

2. Correction Factor = Mixer Conversion Loss + Cable Loss + Air Loss + FMCW Desensitization Factor

Average EIRP Power			
Frequency	EIRP	Limit	Margin
(GHz)	(dBm)	(dBm)	(dB)
61.02 ~ 61.48	2.20	40.00	37.80

Remark:

1. Average power = Peak Power – 10*log(1/duty cycle).

6.4 Conducted Peak Output Power

6.4.1 Operating environment

Temperature : 23 °C

Relative humidity : 44 % R.H.

6.4.2 Test Date

November 05, 2021 ~ December 27, 2021

6.4.3 Test Limits

FCC part	Limits
15.255 (e)	Except as specified paragraph (e)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (b) of this section.

6.4.4 Test Procedure

The peak output power in dBm is calculated by subtracting the DUT gain in dBi from the Peak EIRP in dBm found in section 6.3.

6.4.5 Test data Result

-. Test Result : Pass

Peak Output Power						
Frequency	Peak EIRP	EUT Antenna Gain	Output Power	Output Power	Limit	Margin
(GHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW)	(mW)
61.02 ~ 61.48	29.32	4.30	25.02	317.69	500.00	182.31

Remark:

1. Output Power = EIRP – EUT Antenna Gain

6.5 Spurious Emissions

6.5.1 Operating environment

Temperature : 23 °C

Relative humidity : 44 % R.H.

6.5.2 Test Date

November 05, 2021 ~ December 27, 2021

6.5.3 Test Limits

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.255 (d) (1) (2) (3) (4)</td><td>(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm2 at a distance of 3 meters.
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.</td></tr>
<tr><td>15.209</td><td>Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:
<table>
<tr><th>Frequencies (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function,corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.5.4 Test Procedure

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 3meterchamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3meters 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.

For Radiated emission 30MHzto 40GHz

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 3meter 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(30MHz-18GHz) / 1 meters (18GHz-40GHz) 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) and Average detection (AV) at frequency above 1GHz.

For Radiated emission above 40GHz

a. Connect the test antenna covering the appropriate frequency range to a spectrum analyzer via an external mixer to the spectrum analyzer.

b. Set spectrum analyzer RBW = 1 MHz, VBW =3 MHz, average detector.

c. Calculate the distance to the far field boundary and determine the maximum measurement distance.

d. Perform an exploratory search for emissions and determine the approximate direction at which each observed emission emanates from the EUT.

e. Exploratory measurements be made at a closer distance than the validated maximum measurement distance.

f. Perform a final measurement; begin with the test antenna at the approximate position where the maximum level occurred during the exploratory scan.

g. Slowly scan the test antenna around this position, slowly vary the test antenna polarization by rotating through at least 0° to 180°, and slowly vary the orientation of the test antenna to find the final position, polarization, and orientation at which the maximum level of the emission is observed.

h. Record the measured reading with the test antenna fixed at this maximized position, polarization, and orientation. Record the measurement distance.

i. Calculate the maximum field strength of the emission at the measurement distance and the adjusted/corrected power at the output of the test antenna.

j. Calculate the EIRP from the measured field strength and then convert to the linear.

k. Calculate the power density at the distance specified by the limit from the field strength at the distance specified by the limit.

Power density formula as follows: Power density = EIRP / (4 * Pi * r^2)

r is the standard distance at 3 meter

l. Repeat the preceding sequence for every emission observed in the frequency band under investigation.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.5.5 Test data Result

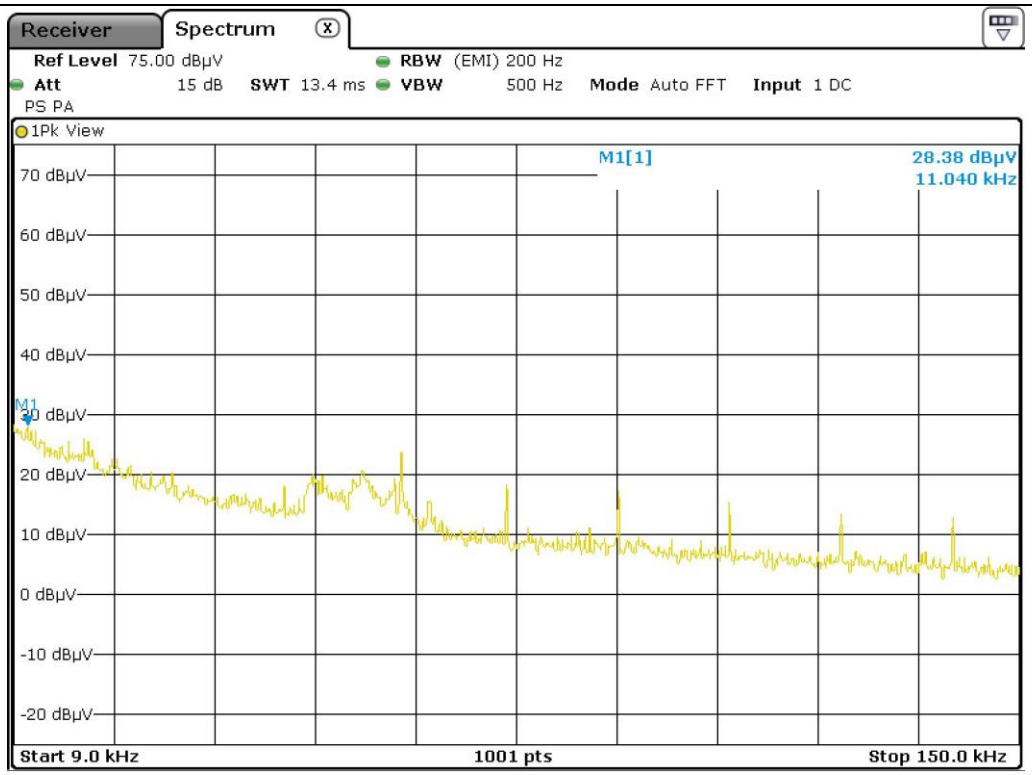
6.5.5.1 Spurious Radiated Emission Below 30 MHz

-. Test Result : Pass

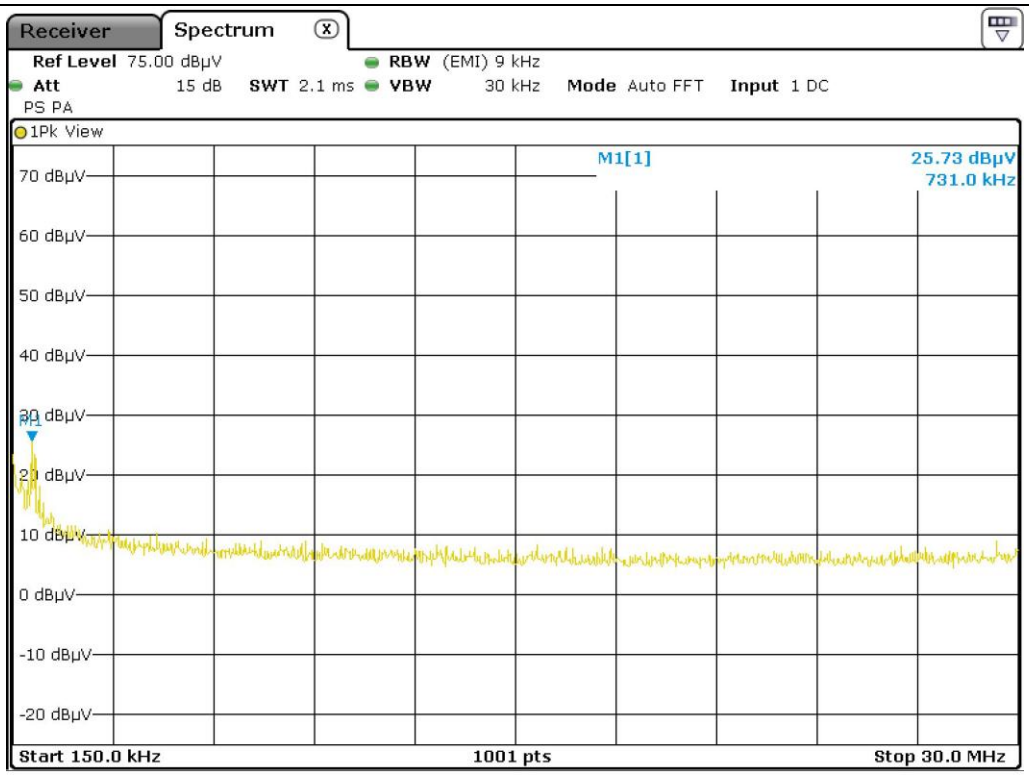
Radiated Emission		Ant	Correction Factors		Total	FCC	
Freq. (kHz)	Amplitud (dBµV)	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11.04	28.38	H	18.67	0.31	47.36	126.74	79.38
731.00	25.73	H	18.97	0.35	45.05	50.33	5.28

Limit calculation: Limit at specified distance + 40log (300/3) = Limit + 80 dB for up to 0.49 MHz

Limit at specified distance + 40log (30/3) = Limit + 40 dB for above 0.49 MHz



9.00 kHz ~ 150.00 kHz

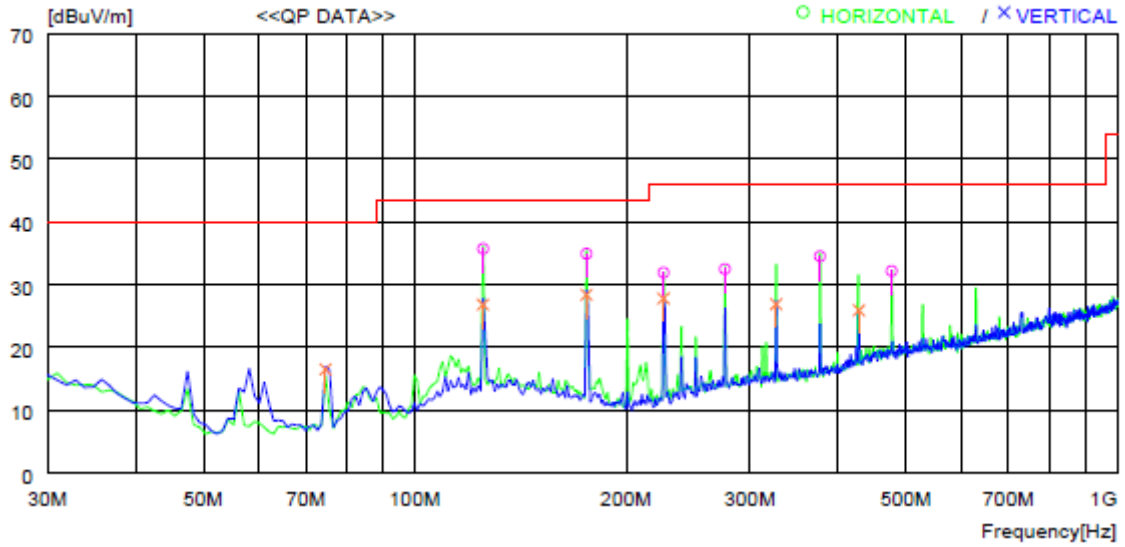


150.00 kHz ~ 30.00 MHz

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.5.5.2 Spurious Radiated Emission below 1 GHz

-. Test Result : Pass



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	125.060	47.6	18.9	2.2	33.0	35.7	43.5	7.8	400	275
2	175.500	48.4	17.0	2.5	33.0	34.9	43.5	8.6	300	359
3	225.940	46.1	15.9	2.9	33.0	31.9	46.0	14.1	100	359
4	276.380	43.5	18.8	3.2	33.0	32.5	46.0	13.5	100	359
5	377.260	43.3	20.4	3.8	33.0	34.5	46.0	11.5	100	359
6	477.171	38.0	23.0	4.3	33.1	32.2	46.0	13.8	100	229
----- Vertical ------										
7	74.620	35.2	12.8	1.6	33.1	16.5	40.0	23.5	200	298
8	125.060	38.7	18.9	2.2	33.0	26.8	43.5	16.7	300	68
9	175.500	41.9	17.0	2.5	33.0	28.4	43.5	15.1	300	43
10	225.940	42.0	15.9	2.9	33.0	27.8	46.0	18.2	200	359
11	326.820	36.8	19.6	3.5	33.0	26.9	46.0	19.1	200	359
12	428.671	33.1	21.9	4.0	33.1	25.9	46.0	20.1	300	224

6.5.5.3 Spurious Radiated Emission 1 GHz ~ 18 GHz

-. Test Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	AMP Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1.110	53.14	Peak	H	25.10	46.98	3.31	34.57	74.00	39.43
	41.91	Average	H	25.10	46.98	3.31	23.34	54.00	30.66
7.139	52.19	Peak	H	36.00	45.15	6.62	49.66	74.00	24.34
	39.86	Average	H	36.00	45.15	6.62	37.33	54.00	16.67
15.529	51.04	Peak	H	37.90	45.41	8.33	51.86	74.00	22.14
	37.93	Average	H	37.90	45.41	8.33	38.75	54.00	15.25

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	AMP Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1.195	53.10	Peak	V	25.40	46.98	3.31	34.83	74.00	39.17
	42.03	Average	V	25.40	46.98	3.31	23.76	54.00	30.24
10.111	51.57	Peak	V	39.30	46.27	7.07	51.67	74.00	22.33
	40.40	Average	V	39.30	46.27	7.07	40.50	54.00	13.50
11.861	51.71	Peak	V	38.80	46.09	7.10	51.52	74.00	22.48
	40.06	Average	V	38.80	46.09	7.10	39.87	54.00	14.13

Remark - “H”: Horizontal, “V”: Vertical

Emission Level (dBμV/m) = Reading (dBμV) + Antenna Factor (dB/m) + Cable loss (dB) – AMP Factor (dB)

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.5.5.4 Spurious Radiated Emission 18 GHz ~ 40 GHz

-. Test Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	AMP Factor	Distance Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
19.593	59.88	Peak	H	37.70	55.34	9.54	9.63	42.33	74.00	31.67
	48.97	Average	H	37.70	55.34	9.54	9.63	31.42	54.00	22.58
38.055	60.81	Peak	H	42.90	57.11	9.54	14.77	51.83	74.00	22.17
	49.13	Average	H	42.90	57.11	9.54	14.77	40.15	54.00	13.85

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	AMP Factor	Distance Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
19.3810	59.52	Peak	V	37.80	55.34	9.54	9.63	42.07	74.00	31.93
	48.68	Average	V	37.80	55.34	9.54	9.63	31.23	54.00	22.77
37.9670	60.50	Peak	V	43.20	57.11	9.54	14.77	51.82	74.00	22.18
	48.48	Average	V	43.20	57.11	9.54	14.77	39.80	54.00	14.20

Remark - “H”: Horizontal, “V”: Vertical

Emission Level (dBμV/m) = Reading (dBμV) + Antenna Factor (dB/m) + Cable loss (dB) – AMP Factor (dB) – Distance Factor(dB)

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Note : Shorter measurement distances was used to improve the measurement system’s noise floor. As standard description is based on the measurement in distance of 3 meters, the data obtained at 1-meterdistance was extrapolate results to the 3-mdistance:

Test value at 3 meter distance (dBuV) = Test value at 1 meter distance (dBuV) - 20log(3/1)(dB)

= Test value at 1 meter distance (dBuV) - 9.54 (dB).

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.5.5.5 Spurious Radiated Emission 40 GHz ~ 200 GHz

-. Test Result : Pass

Frequency (GHz)	EIRP Level (dBm)	Result (pW/cm2)	Limit (pW/cm2)	Margin (pW/cm2)
41.508	-39.00	0.111 31	90.00	89.888 69
71.712	-33.57	0.388 64	90.00	89.611 36

No other spurious identified up to 200 GHz with level above the value reported in the table.

6.6 FREQUENCY STABILITY

6.6.1 Operating environment

Temperature : 23 °C

Relative humidity : 44 % R.H.

6.6.2 Test Date

November 05, 2021 ~ December 27, 2021

6.6.3 Test Limits

FCC part	Limits
15.255 (f)	Frequency stability. Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

6.6.4 Test Procedure

1. These measurements are repeated for each step of temperature variation from (-20 to 50 ºC) at the nominal voltage.
2. These measurements are repeated for an input voltage variation of 85% to 110% at the reference temperature
3. The frequency excursion is recorded by checking at each time if the 20 dB bandwidth of the fundamental emission is contained within the frequency band over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.

6.6.5 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

-. Test Result : Pass

Power Supply (Vdc)	Temperature (˚C)	Min Frequency (GHz)	Limit (GHz)
5.00	-20	61.016 574	> 57
5.00	-10	61.016 576	> 57
5.00	0	61.016 569	> 57
5.00	10	61.016 566	> 57
5.00	20	61.016 570	> 57
5.00	30	61.016 576	> 57
5.00	40	61.016 573	> 57
5.00	50	61.016 568	> 57

Power Supply (Vdc)	Temperature (˚C)	Max Frequency (GHz)	Limit (GHz)
5.00	-20	61.483 658	< 71
5.00	-10	61.483 656	< 71
5.00	0	61.483 652	< 71
5.00	10	61.483 648	< 71
5.00	20	61.483 650	< 71
5.00	30	61.483 659	< 71
5.00	40	61.483 661	< 71
5.00	50	61.483 647	< 71

6.6.6 FREQUENCY STABILITY WITH VOLTAGE VARIATION

-. Test Result : Pass

Power Supply (Vdc)	Temperature (˚C)	Min Frequency(GHz)	Limit (GHz)
5.00	20	61.016 570	> 57
4.25	20	61.016 566	> 57
5.75	20	61.016 565	> 57

Power Supply (Vdc)	Temperature (˚C)	Max Frequency (GHz)	Limit (GHz)
5.00	20	61.483 650	< 71
4.25	20	61.483 657	< 71
5.75	20	61.483 649	< 71

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.7 CONDUCTED EMISSION TEST

6.7.1 Operating environment

Temperature : 23 °C

Relative humidity : 41 % R.H.

6.7.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

6.7.3 Test Date

November 05, 2021 ~ December 27, 2021

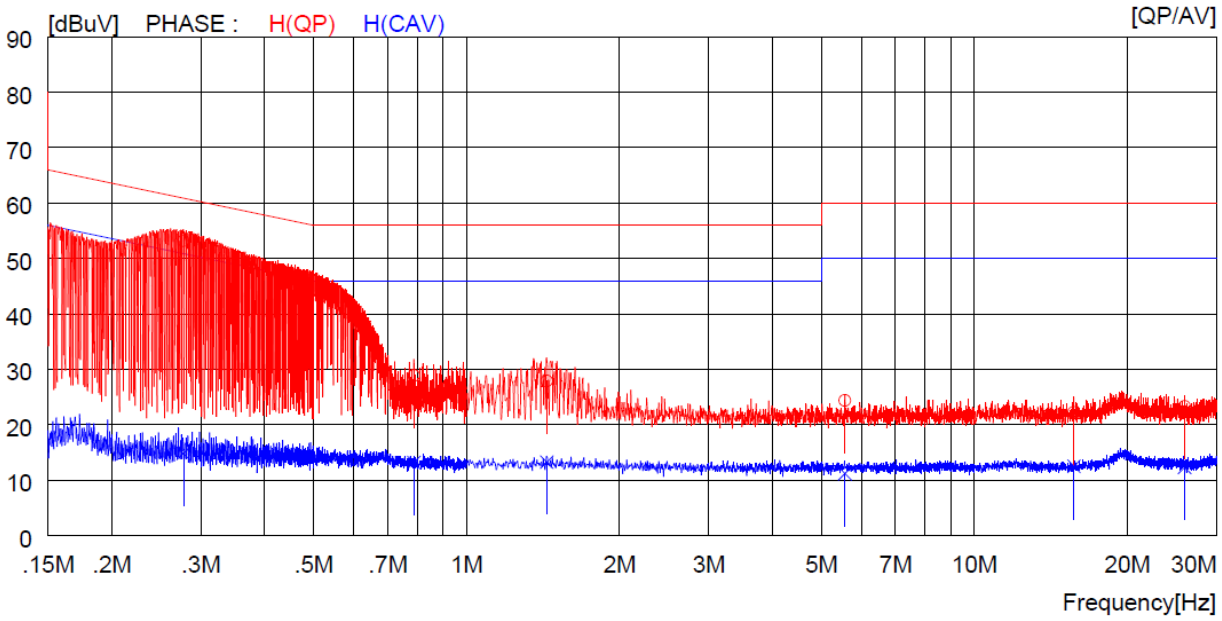
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

6.7.4 Test data

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

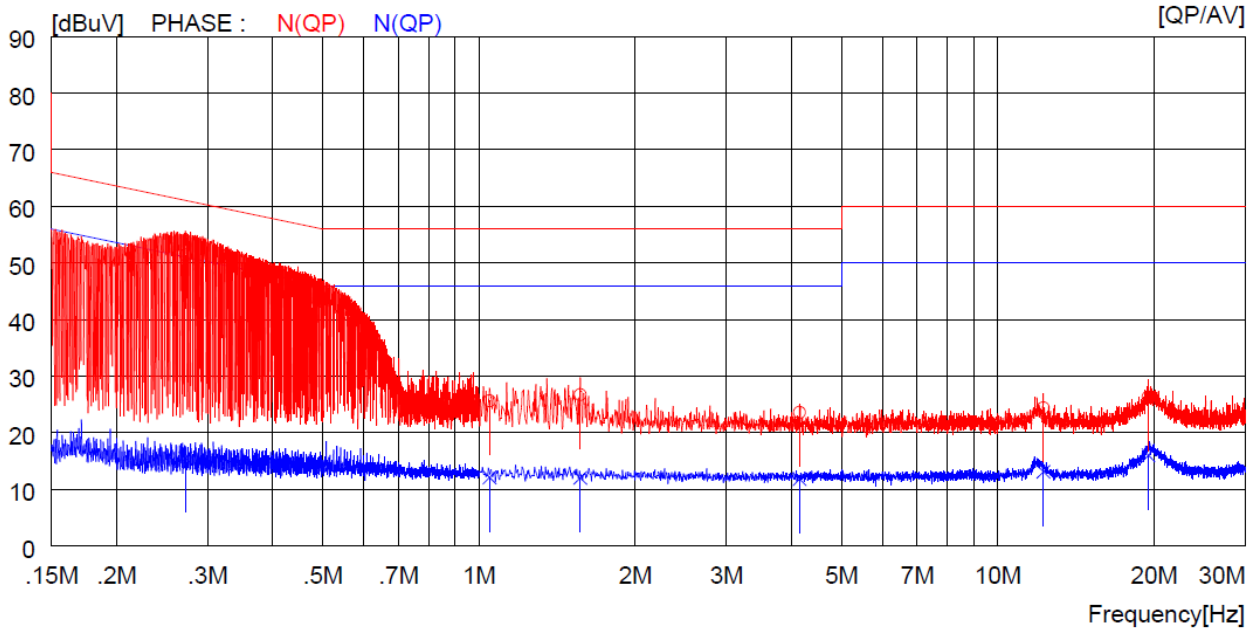
-. Tested Line : HOT LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.27700	43.2	----	10.0	53.2	----	60.9	----	7.7	----	H(QP)
2	0.78800	18.9	----	10.0	28.9	----	56.0	----	27.1	----	H(QP)
3	1.44000	17.8	----	10.1	27.9	----	56.0	----	28.1	----	H(QP)
4	5.56500	14.2	----	10.2	24.4	----	60.0	----	35.6	----	H(QP)
5	15.72000	11.9	----	10.3	22.2	----	60.0	----	37.8	----	H(QP)
6	25.97000	12.8	----	10.5	23.3	----	60.0	----	36.7	----	H(QP)
7	0.27700	----	4.8	10.0	----	14.8	----	50.9	----	36.1	H(CAV)
8	0.78800	----	3.2	10.0	----	13.2	----	46.0	----	32.8	H(CAV)
9	1.44000	----	3.2	10.1	----	13.3	----	46.0	----	32.7	H(CAV)
10	5.56500	----	1.0	10.2	----	11.2	----	50.0	----	38.8	H(CAV)
11	15.72000	----	2.2	10.3	----	12.5	----	50.0	----	37.5	H(CAV)
12	25.97000	----	1.8	10.5	----	12.3	----	50.0	----	37.7	H(CAV)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.27200	41.4	----	10.0	51.4	----	61.1	----	9.7	----	N(QP)
2	1.04800	15.5	----	10.1	25.6	----	56.0	----	30.4	----	N(QP)
3	1.56800	16.6	----	10.1	26.7	----	56.0	----	29.3	----	N(QP)
4	4.15200	13.5	----	10.1	23.6	----	56.0	----	32.4	----	N(QP)
5	12.25000	14.1	----	10.3	24.4	----	60.0	----	35.6	----	N(QP)
6	19.53000	15.9	----	10.4	26.3	----	60.0	----	33.7	----	N(QP)
7	0.27200	----	5.5	10.0	----	15.5	----	51.1	----	35.6	N(CAV)
8	1.04800	----	2.0	10.1	----	12.1	----	46.0	----	33.9	N(CAV)
9	1.56800	----	1.9	10.1	----	12.0	----	46.0	----	34.0	N(CAV)
10	4.15200	----	1.7	10.1	----	11.8	----	46.0	----	34.2	N(CAV)
11	12.25000	----	2.8	10.3	----	13.1	----	50.0	----	36.9	N(CAV)
12	19.53000	----	5.6	10.4	----	16.0	----	50.0	----	34.0	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

7. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
ESW 44	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 23, 2021 (1Y)
FSW43	Rohde & Schwarz	Signal Analyzer	104544	Jul. 14, 2021 (1Y)
CO3000	Innco System	Controller	CO3000/904/ 37211215/L	N/A
DT3000	Innco System	Turn Table	930611	N/A
MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
310N	Sonoma Instrument	Pre-Amplifier	392756	Oct. 14, 2021 (1Y)
HLP-2008	TDK	Hybrid Antenna	131316	Feb. 27, 2020 (2Y)
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2020(2Y)
SCU18	Rohde & Schwarz	Pre-Amplifer	102266	Jul. 14, 2021 (1Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 20, 2021 (1Y)
SCU40	R/S	Signal Conditioning unit	100436	Feb. 28, 2021(1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2021(1Y)
M19HWD	OML, Inc.	Harmonic Mixer	180912-1	Oct. 21, 2021(1Y)
M12HWD	OML, Inc.	Harmonic Mixer	180912-1	Jul. 22, 2021(1Y)
M08HWD	OML, Inc.	Harmonic Mixer	180912-1	Jul. 22, 2021(1Y)
M05HWD	OML, Inc.	Harmonic Mixer	180912-1	Jul. 22, 2021(1Y)
S19MS-A	OML, Inc.	Millimeter Wave Source Module	180912-1	Jul. 19, 2021(1Y)
S12MS-A	OML, Inc.	Millimeter Wave Source Module	180912-1	Jul. 19, 2021(1Y)
S08MS-A	OML, Inc.	Millimeter Wave Source Module	180912-1	Jul. 19, 2021(1Y)
S05MS-A	OML, Inc.	Millimeter Wave Source Module	180912-1	Jul. 19, 2021(1Y)
PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Feb. 16, 2020 (1Y)
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 06, 2021(1Y)
ESCI	Rohde & Schwarz	EMI TEST RECEIVER	101012	Oct. 20, 2021 (1Y)
NSLK8126	Schwarzbeck	AMN	8126-404	Mar. 16, 2021 (1Y)
ESH3-Z2	Rohde & Schwarz	PULSE LIMITER	100655	Mar. 15, 2021 (1Y)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)