FCC RADIO TEST REPORT

FCC ID	:	SWX-UBB
Equipment	:	UniFi Building Bridge
Brand Name	:	UBIQUITI
Model Name	:	UBB
Applicant	:	Ubiquiti Inc. 685 Third Avenue, New York, New York 10017 USA
Manufacturer	:	Ubiquiti Inc. 685 Third Avenue, New York, New York 10017 USA
Standard	:	47 CFR FCC Part 15.255

The product was received on Aug. 03, 2019, and testing was started from Aug. 21, 2019 and completed on Sep. 03, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013, 47 CFR FCC Part 15.255 and Millimeter Wave Test Procedures, FCC KDB 414788 D01 v01r01 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
FR951623-06	01	Initial issue of report	Dec. 23, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	FCC 15.255(e)	Occupied Bandwidth	PASS	-
3.2	FCC 15.255(c)	EIRP Power	PASS	-
3.3	FCC 15.255(c)	Peak Conducted Power	PASS	-
3.4	FCC 15.255(d)	Transmitter Spurious Emissions	PASS	-
3.5	FCC 15.255(f)	Frequency Stability	PASS	-
3.6	FCC 15.255(a),(h)	Operation Restriction and Group Installation	PASS	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Sandy Chuang

1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information	
Frequency Range	57-71 GHz
The Channel Plan(s)	Bandwidth: 2.16 GHz Channel 1: 58.32 GHz Channel 2: 60.48 GHz Channel 3: 62.64 GHz Channel 4: 64.80 GHz Bandwidth: 1.08 GHz Channel 1: 58.32 GHz Channel 2: 59.40 GHz Channel 3: 60.48 GHz Channel 4: 61.56 GHz Channel 5: 62.64 GHz Channel 6: 63.72 GHz Channel 7: 64.80 GHz Channel 8: 65.88 GHz

1.1.2 Modulation

IEEE 802.11ad Modulation Scheme

MCS Index	Modulation	Code rate	Data rate (Mbit/s)
0	π/2-BPSK	1/2	27.5
1	π/2-BPSK	1/2	385
2	π/2-BPSK	1/2	770
3	π/2-BPSK	5/8	962.5
4	π/2-BPSK	3/4	1155
5	π/2-BPSK	13/16	1251.25
6	π/2-QPSK	1/2	1540
7	π/2-QPSK	5/8	1925
8	π/2-QPSK	3/4	2310
9	π/2-QPSK	13/16	2502.5
10	π/2-16QAM	1/2	3080
11	π/2-16QAM	5/8	3850
12	π/2-16QAM	3/4	4620
12.1	π/2-16QAM	13/16	5005

1.1.3 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	PRA710-B2	Integral	N/A	17.2

Note: The above information was declared by manufacturer.

1.1.4 Operating Conditions

Operating Conditions				
☒ -40 °C to +70 °C				
☐ 0 °C to +40 °C				
☐ Other:				
EUT Power Type	From PoE			
Supply Voltage	☐ AC	State AC voltage		V
Supply Voltage	☒ DC	State DC voltage	48	V

1.1.5 Equipment Use Condition

Equipment Use Condition	
☐	Fixed field disturbance sensors at 61-61.5GHz
☐	Except fixed field disturbance sensors at 61-61.5GHz
☒	Except fixed field disturbance sensors

1.1.6 User Condition

Intended Operation	
☐	Indoor
☒	Outdoor (except outdoor fixed Point to Point)
☒	Outdoor fixed Point to Point

Note: The above information was declared by manufacturer.

1.1.7 Duty Cycle

Duty Cycle		Duty Cycle Factor
The transmitter is intended for	100 %	0

1.1.8 Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR951623-01.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Updating the firmware to add the bandwidth 1.08GHz (please refer to section 1.1.1 for detail channel list. 2. Updating applicant/manufacturer to “Ubiquiti Inc.” from “Ubiquiti Networks, Inc.”	1. Occupied Bandwidth 2. EIRP Power 3. Peak Conducted Power 4. Transmitter Spurious Emissions 5. Frequency Stability

1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15.255
- ANSI C63.10-2013 Section 9. “Procedures for testing millimeter-wave systems”

1.3 Testing Location

Testing Location			
☐	HWA YA	ADD :	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)
		TEL :	886-3-327-3456 FAX : 886-3-327-0973
☒	JHUBEI	ADD :	No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.
		TEL :	886-3-656-9065 FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
Radiated	03CH05-CB	Eason Chen	25.1-25.6°C / 61-64%	Aug. 21, 2019~ Sep. 03, 2019
RF Conducted	TH01-CB	Eddie Weng	24.6-26°C / 58-61%	Sep. 03, 2019

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

2 Test Configuration of Equipment under Test

2.1 Test Channel Frequencies

Test Channel Frequencies Configuration	
Low Channel (GHz)	58.32
Middle Channel (GHz)	62.64
High Channel (GHz)	65.88

2.2 Conformance Tests and Related Test Frequencies

Test Item	Test Frequencies (GHz)
Occupied Bandwidth	58.32, 62.64, 65.88
EIRP Power	58.32, 62.64, 65.88
Peak Conducted Power	58.32, 62.64, 65.88
Transmitter Spurious Emissions (below 1 GHz)	58.32
Transmitter Spurious Emissions (1 GHz-40 GHz)	58.32, 62.64, 65.88
Transmitter Spurious Emissions (above 40 GHz)	58.32, 62.64, 65.88
Frequency Stability	62.64

The following test modes were performed for all tests:

For Transmitter Spurious Emissions (below 1 GHz) test:

The EUT was performed at Y axis and Z axis position for Transmitter Spurious Emissions (above 1 GHz) test, and the worst case was found at Y axis for original test report. So the measurement will follow this same test configuration.

For Transmitter Spurious Emissions (above 1 GHz) test:

The EUT was performed at Y axis and Z axis position, and the worst case was found at Y axis for original test report. So the measurement will follow this same test configuration.

2.3 EUT Operation during Test

During the test, “Telnet” under WIN 7 was executed the test program to control the EUT continuously transmit RF signal.

2.4 Accessories

Accessories			
Equipment Name	**Brand Name**	**Model Name**	**Rating**
PoE	UBIQUITI	GP-V480-032G	INPUT: 100-240V ~ 50/60MHz, Max 0.5A OUTPUT: 48V, 0.32A

2.5 Support Equipment

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	Notebook	DELL	E4300	N/A

2.6 Far Field Boundary Calculations

The far-field boundary is given as:

far field = (2 * L^2) /**λ**

where:

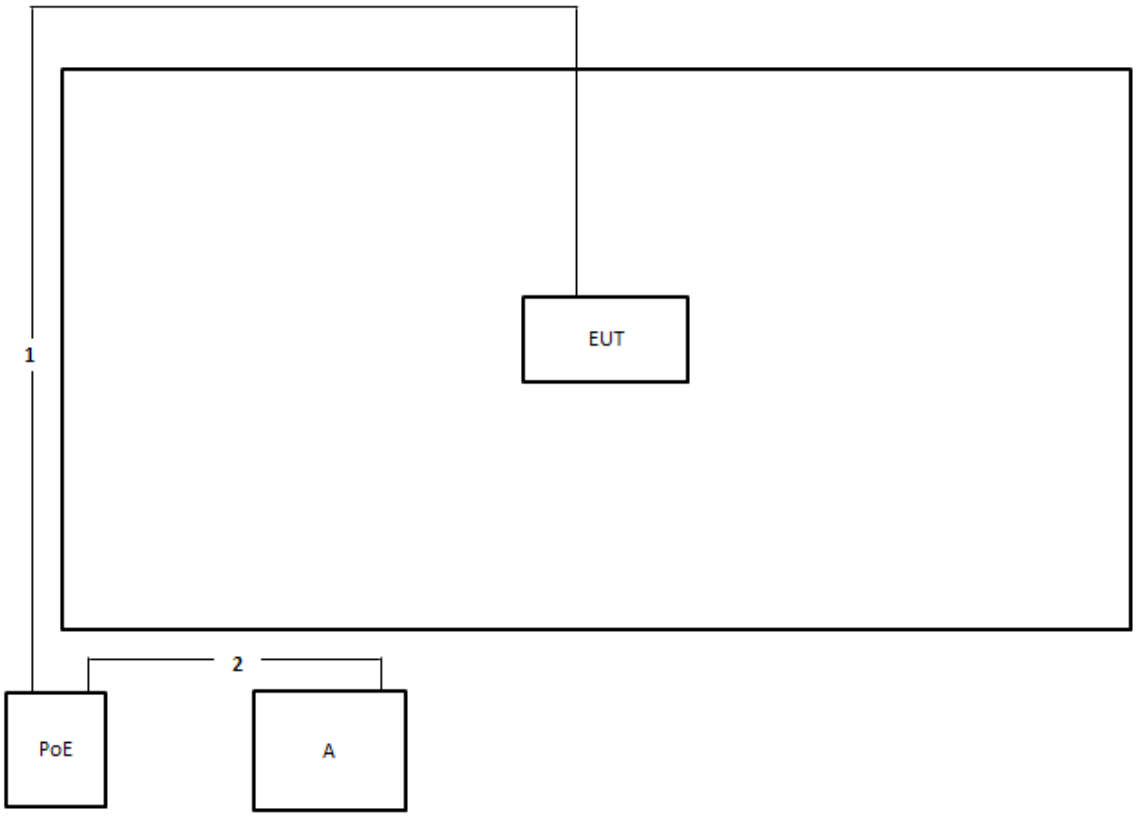
L = Largest Antenna Dimension, including the reflector, in meters

λ= wavelength in meters

Far Field (m)				
Frequency (GHz)	**L (m)**	**Lambda (m)**	**d(Far Field) (m)**	**d(Far Field) (cm)**
58.32	0.02	0.0051440	0.156	15.55
62.64	0.02	0.0047893	0.167	16.70
65.88	0.02	0.0045537	0.176	17.57

2.7 Test Setup Diagram

Test Setup Diagram - Transmitter Spurious Emissions



Item	Connection	Shielded	Length
1	RJ-45 cable	No	10m
2	RJ-45 cable	No	1m

3 Transmitter Test Result

3.1 Occupied Bandwidth

3.1.1 Limit of Occupied Bandwidth

6dBc Bandwidth (see Note 1)	None
99% Occupied Bandwidth (see Note 2)	None

NOTE 1: The 6dBc bandwidth is the frequency bandwidth of the signal power at the -6 dBc points when measured with a 100 kHz resolution bandwidth. These measurements shall also be performed at normal test conditions.

NOTE 2: The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1 % to 5 % of the occupied bandwidth (OBW). These measurements shall also be performed at normal test conditions.

3.1.2 Measuring Instruments

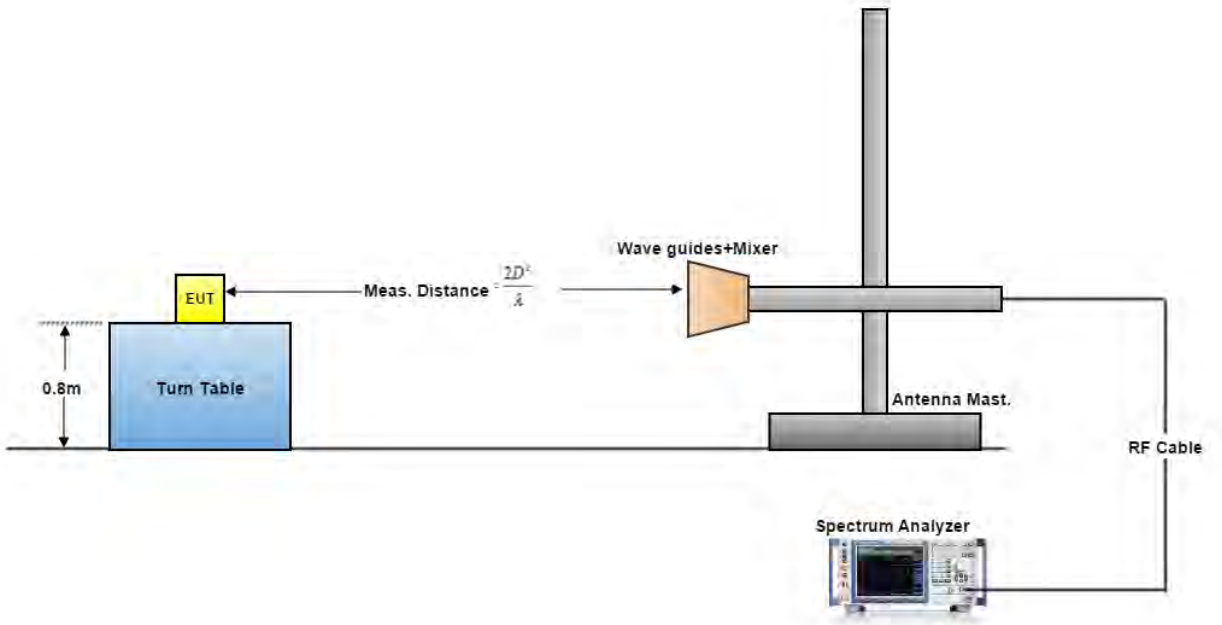
Refer a measuring instruments list in this test report.

3.1.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clauses 6.9.2.

3.1.4 Test Setup

Occupied Channel Bandwidth



3.1.5 Test Result of Occupied Bandwidth

Test Conditions	see ANSI C63.10, clause 5.11
Test Setup	see ANSI C63.10, clause 6.9.2

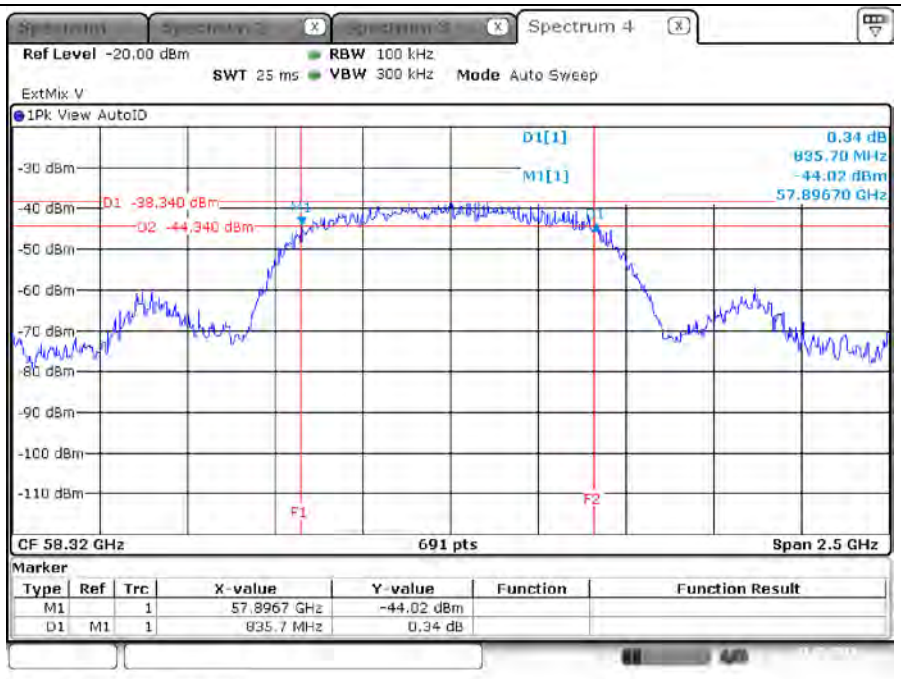
NOTE: If equipment having different transmit operating modes (see test report clause 1.1.2), the measurements are uninfluenced by different transmit operating modes, may not need to be repeated for all the operating modes. Similar, if the equipment supports different modulations and/or data rates, the measurements described in ANSI C63.10, clause 5.11 may not need to be repeated for all these modulations and data rates. Simple comparison of engineering test across all operating modes, modulations and data rates may need to be performed to define the worse case combination to be used for the conformance testing. Refer as ANSI C63.10, clause 15, observe and record with plotted graphs or photographs the worst-case (i.e., widest) occupied bandwidth produced by these different modulation sources.

Test Results			
Test Freq. (GHz)	**6 dBc Bandwidth (MHz)**	**99% Occupied Bandwidth (MHz)**	**Limit (MHz)**
58.32	835.70	991.32	N/A
62.64	781.50	965.99	N/A
65.88	795.90	973.23	N/A

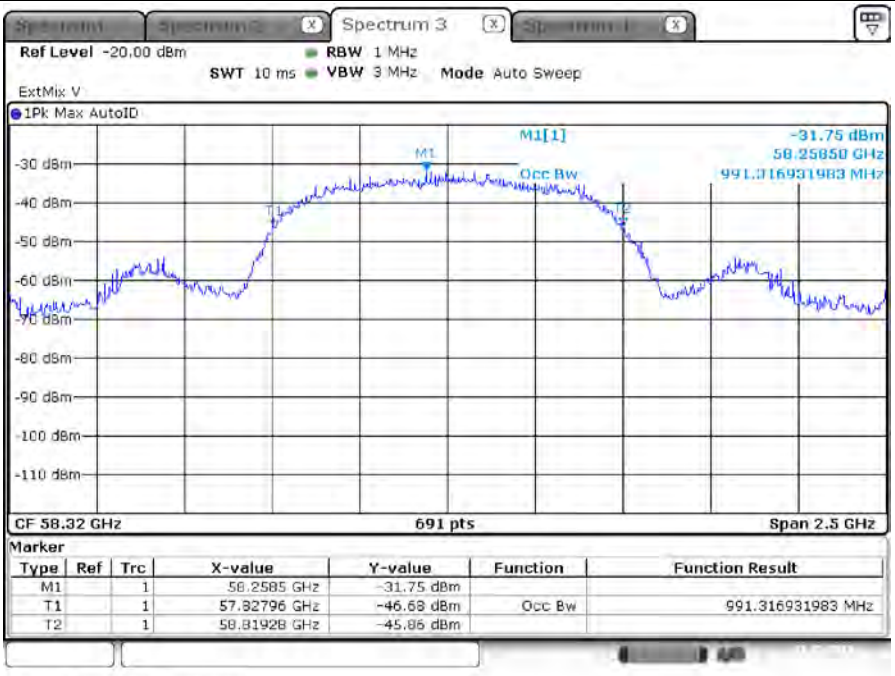
3.1.5.1 Bandwidth Plots

Test Frequency: 58.32 GHz

6 dBc Bandwidth

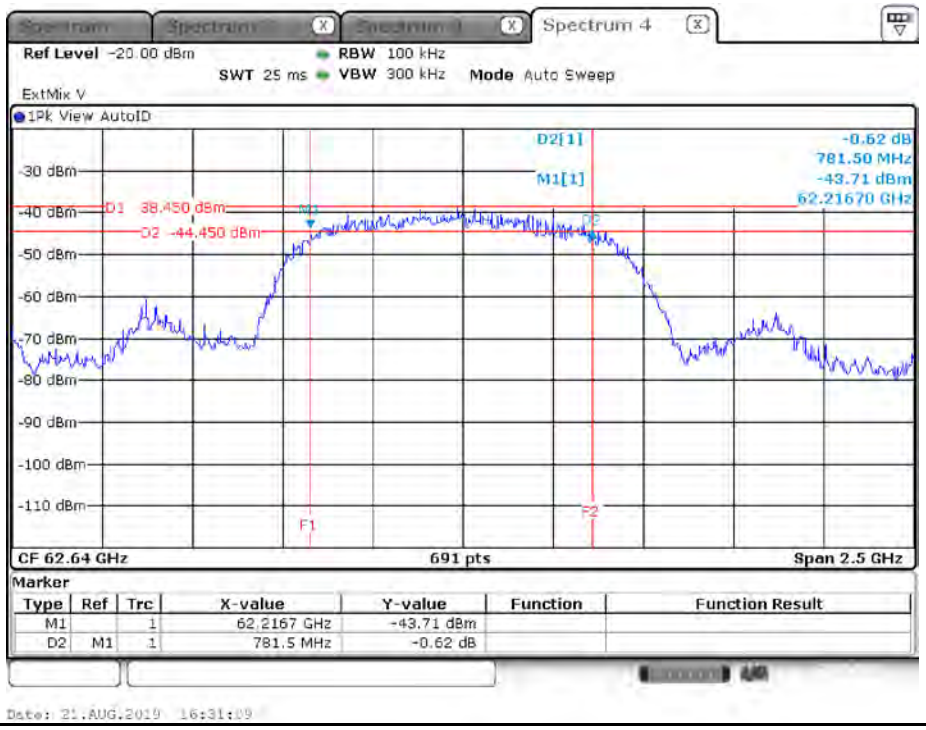


Occupied Bandwidth&26 dBc Bandwidth

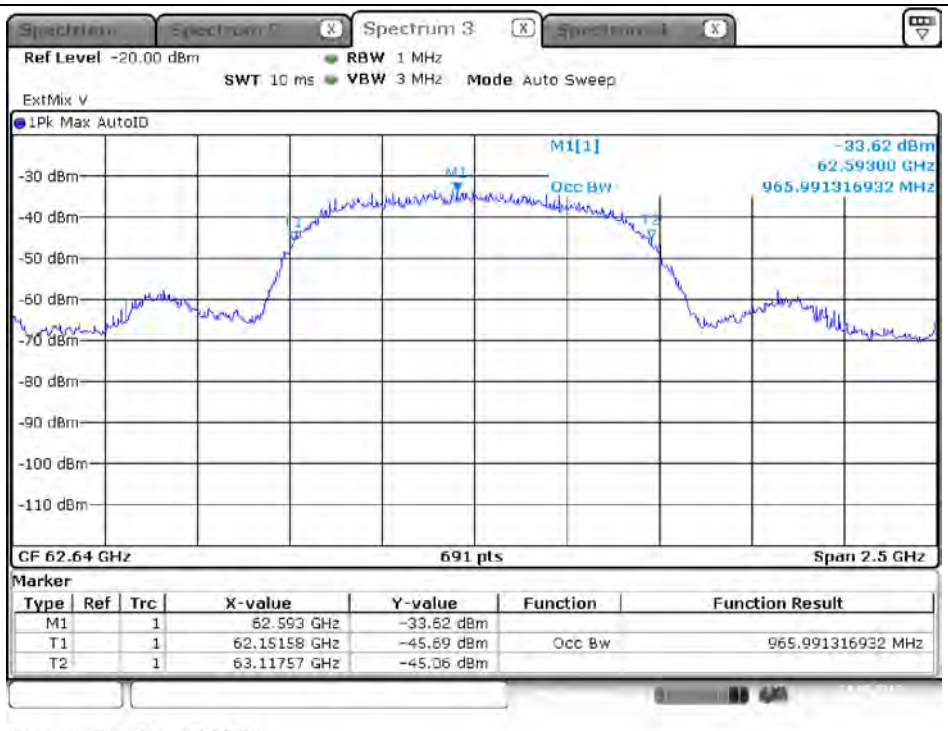


Test Frequency: 62.64 GHz

6 dBc Bandwidth

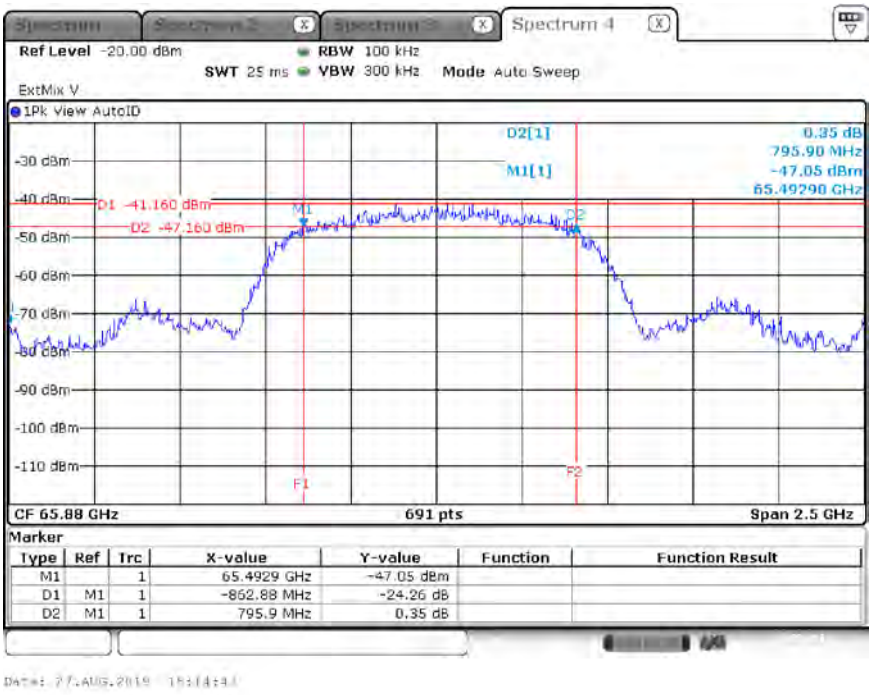


Occupied Bandwidth&26 dBc Bandwidth

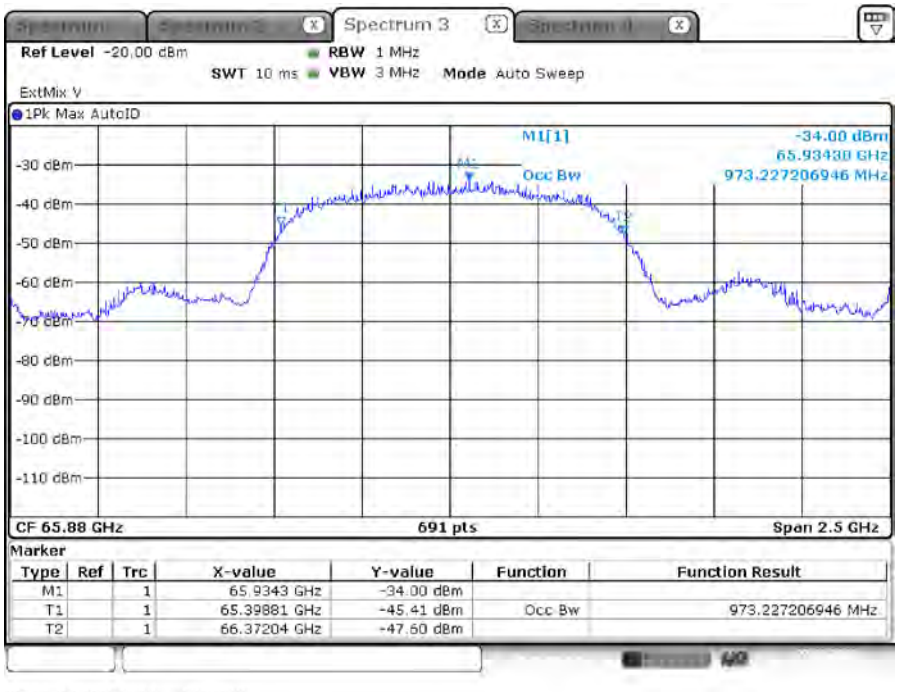


Test Frequency: 65.88 GHz

6 dBc Bandwidth



Occupied Bandwidth



3.2 EIRP Power

3.2.1 Limit of EIRP Power

EIRP Power Limit		
Use Condition	**EIRP Average Power**	**EIRP Peak Power**
Fixed field disturbance sensors at within the frequency band 61-61.5GHz	40 dBm	43 dBm
Fixed field disturbance sensors at outside of the band 61-61.5GHz	10 dBm	13 dBm
Except fixed field disturbance sensors at 61-61.5GHz	N/A	10 dBm
Except outdoor fixed Point to Point	40 dBm	43 dBm
Outdoor fixed Point to Point	82 dBm	85 dBm
Note1: For fixed point-to-point transmitters located outdoors, the average power of any emission shall not exceed 82 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The peak power of any emission shall not exceed 85 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. Note2: For fixed point-to-point transmitters located outdoors to reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits specified in average 40dBm & Peak 43dBm.		

NOTE: For the applicable limit, see FCC 15.255 (c)

3.2.2 Measuring Instruments

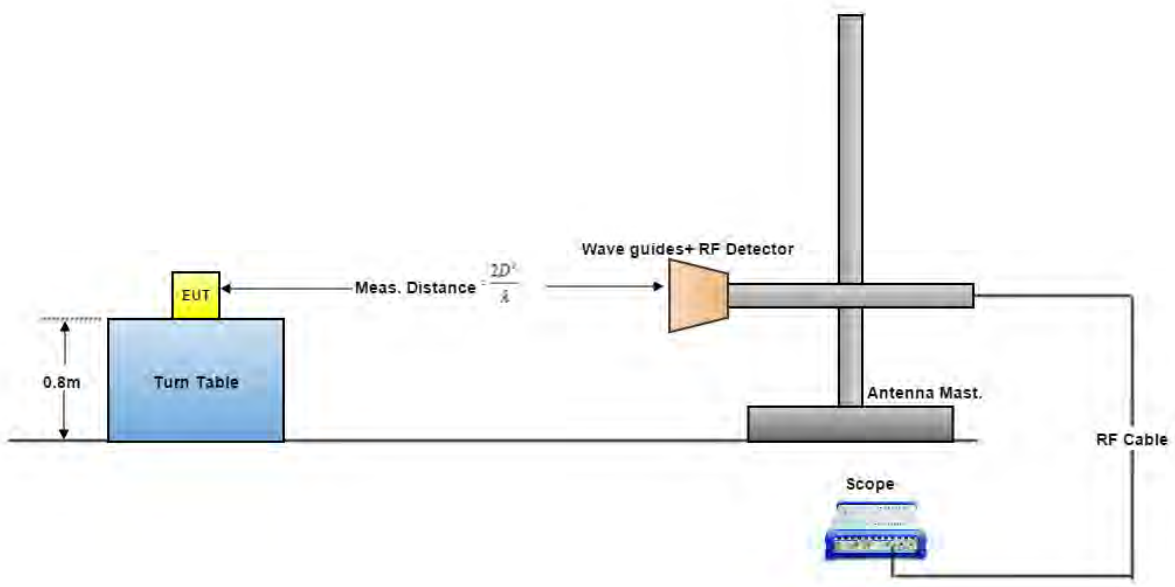
Refer a measuring instruments list in this test report.

3.2.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.3 & 9.5.

3.2.4 Test Setup

EIPR Power



3.2.5 Test Result of EIRP Power

Test Conditions	see ANSI C63.10, clause 5.11 & clause 9
Test Setup	see ANSI C63.10, clause 9.11

NOTE: If the equipment supports different modulations and/or data rates, the measurements described in ANSI C63.10, clause 5.11 may not need to be repeated for all these modulations and data rates. Simple comparison of engineering test across all operating modes, modulations and data rates may need to be performed to define the worst case combination to be used for the conformance testing.

3.2.5.1 Test Result of EIRP Power

Test Distance		0.5m									
Test Results											
Test Freq. (GHz)	Rx Gain (dBi)	DSO (mV)		Power Measured (dBm)		E_{Meas} (dBuV/m)		EIRP (dBm)		EIRP Limit (dBm) (note 1)	
		Peak	AV	Peak	AV	Peak	AV	Peak	AV	Peak	AV
58.32	23.6	372.40	101.86	-3.70	-13.01	145.27	135.96	34.45	25.14	43	40
62.64	23.6	309.85	78.90	-5.15	-14.70	144.44	134.89	33.62	24.07	43	40
65.88	23.6	248.03	56.00	-6.87	-16.08	143.16	133.95	32.34	23.13	43	40

The measured power level is converted to EIRP using the Friis equation:

For radiated emissions, calculate the field strength (E) in dBμV/meter.

E = 126.8 – 20log(λ) + P - G

where:

E : is the field strength of the emission at the measurement distance, in dBμV/m

P : is the power measured at the output of the test antenna, in dBm

λ: is the wavelength of the emission under investigation [300/fMHz], in m

G : is the gain of the test antenna, in dBi For radiated emissions, calculate the EIRP (dBm). If the measurement was performed in the far field, calculate the EIRP.

EIRP = E-meas +20log(d-meas)-104.7

where:

EIRP : is the equivalent isotopically radiated power, in dBm

E-meas. : is the field strength of the emission at the measurement distance, in dBμV/m

d-meas. : is the measurement distance, in m

NOTE 1: For the applicable limit, see FCC 15.255 (c)

NOTE 2: The comparison method which replaces EUT with a signal generator is used to find the correct conversion factor between “DSO(mV)” & “Power Measured(dBm)”.

3.3 Peak Conducted Power

3.3.1 Limit of Peak Conducted Power

Peak Conducted Power Limit	
6dBc Bandwidth	**Peak Conducted Power (note 1)**
> 100MHz	500mW
≤ 100MHz	500mW x (BW/100) (see note 2)
NOTE 1: For the applicable limit, see FCC 15.255(c) NOTE 2: BW= 6dB bandwidth (measured at RBW 100kHz)	

3.3.2 Measuring Instruments

Refer a measuring instruments list in this test report.

3.3.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clause 9.5

3.3.4 Test Result of Peak Conducted Power

Test Conditions	see ANSI C63.10, clause 5.11 & clause 9
Test Setup	see ANSI C63.10, clause 9.11
NOTE: If the equipment supports different modulations and/or data rates, the measurements described in ANSI C63.10, clause 5.11 may not need to be repeated for all these modulations and data rates. Simple comparison of engineering test across all operating modes, modulations and data rates may need to be performed to define the worst case combination to be used for the conformance testing.	

3.3.4.1 Peak Conducted Power

Test Results						
Test Freq. (GHz)	**EIRP (dBm)**	**Max. Ant. Gain (dBi)**	**Peak Power (dBm)** (note1)	**Peak Power (mW)**	**6dBc BW (MHz)** (note2)	**Peak Power Limit (mW)** (note3)
58.32	34.45	17.2	17.25	53.129	835.70	500.00
62.64	33.62	17.2	16.42	43.894	781.50	500.00
65.88	32.34	17.2	15.14	32.674	795.90	500.00

NOTE 1: Because EUT used for the integral antenna without temporary RF connector provided. Therefore peak conducted power is equal to EIRP power subtract the antenna gain.

NOTE 2: For the 6dBc bandwidth, see test report clause 3.1.5.

NOTE 3: For the applicable limit, see FCC 15.255(c)

NOTE 4: For radiated emission measurements, calculate conducted transmitter output power P(cond)(dBm)

P(cond) = EIRP - G(dBi)

where:

G(dBi) is gain of EUT antenna.

3.4 Transmitter Spurious Emissions

3.4.1 Limit of Transmitter Spurious Emissions

Frequency Range	Limit
Radiated emissions below 40 GHz	FCC 15.209
Radiated emissions above 40 GHz – 200GHz	90 pW/cm^2 @ 3 m (Equivalent EIRP 102 μW, -9.91dBm)
NOTE 1: For the applicable limit, see FCC 15.255(d)	
NOTE 2: Spurious emissions shall not exceed the level of the fundamental emission.	

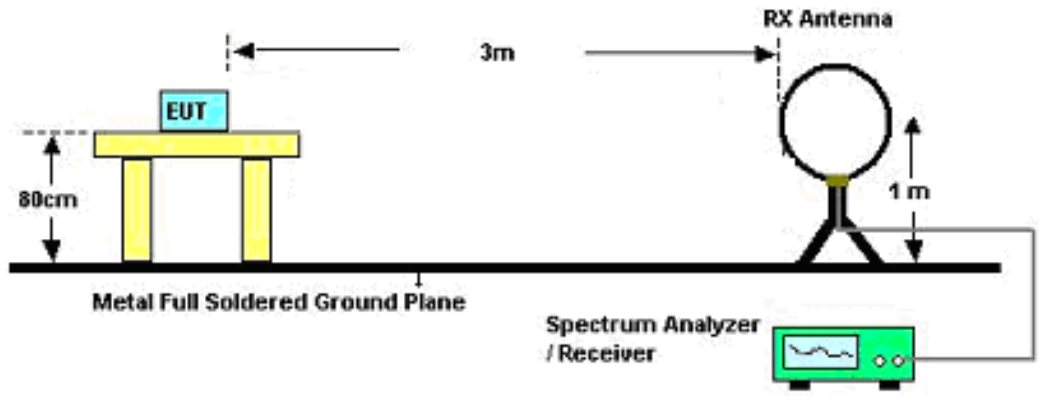
3.4.2 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clause 9.12

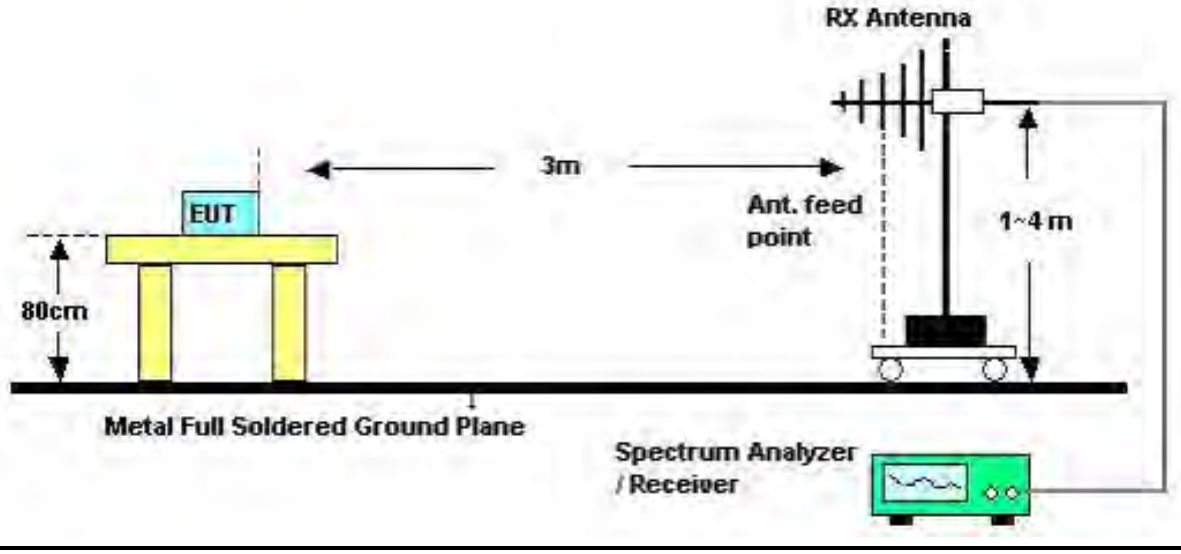
3.4.3 Test Setup

Transmitter Spurious Emissions

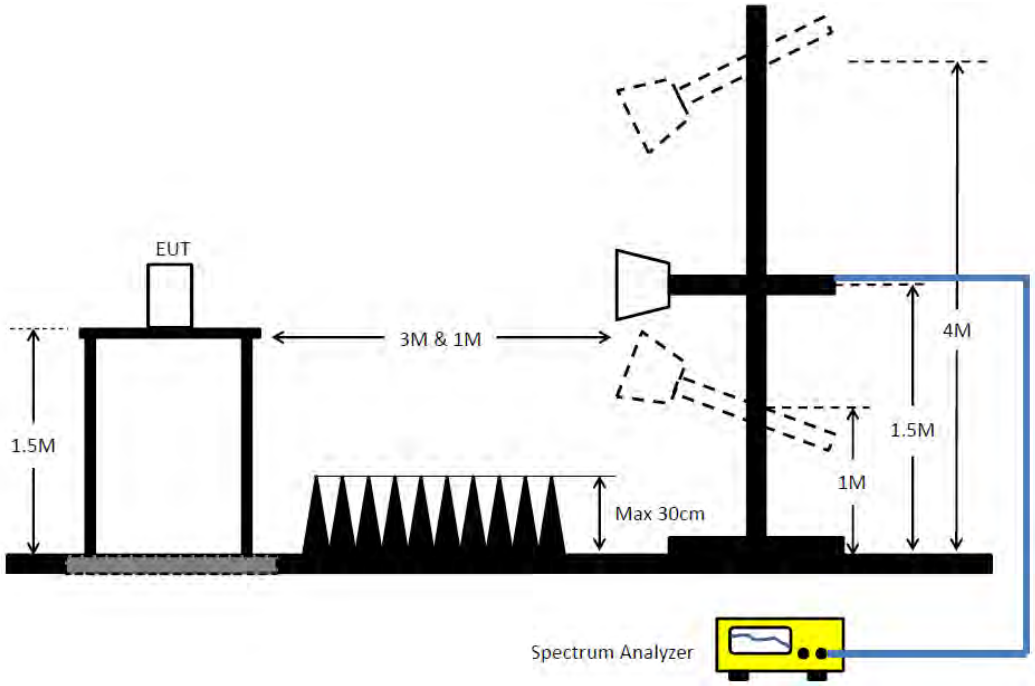
9kHz ~30MHz

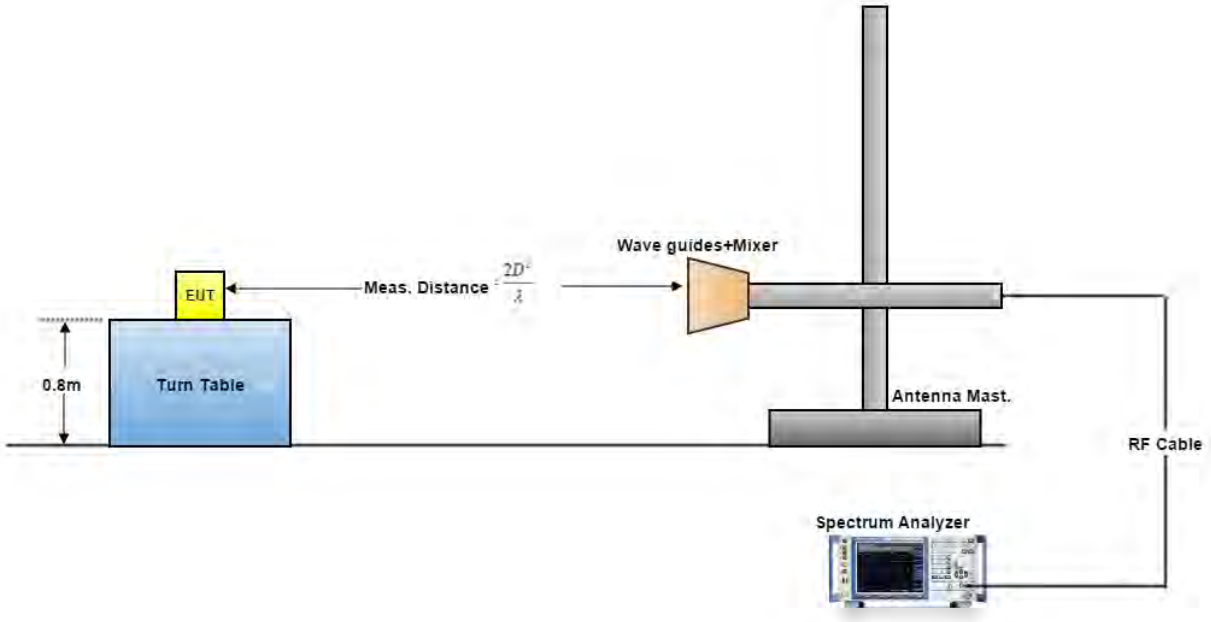


30MHz~1GHz



1GHz~40GHz



Above 40GHz


A measuring distance of at 3 m shall be used for measurements at frequencies up to 15 GHz. For frequencies above 15 GHz, any suitable measuring distance may be used. The measurement distance is chosen up to far field distance, depending on the test system noise floor for detecting spurious emission signals. Then above 15 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from spec. distance (3 m) to measurement distance. Distance extrapolation factor = 20 log (spec. distance [3 m] / measurement distance [N m]) (dB) .The measurements described in ANSI C63.10, clause 7.8.6. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

3.4.4 Test Result of Transmitter Spurious Emissions

Test Conditions	see ANSI C63.10, clause 5.11 & clause 9
Test Setup	see ANSI C63.10, clause 9.12 、9.13
NOTE: If equipment having different channel plan and nominal channel bandwidth modes (see test report clause 1.1.1), the measurements are uninfluenced by different channel plan and nominal channel bandwidth modes, may not need to be repeated for all modes.	

3.4.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

3.4.5.1 Test Result of Transmitter Spurious Emissions (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

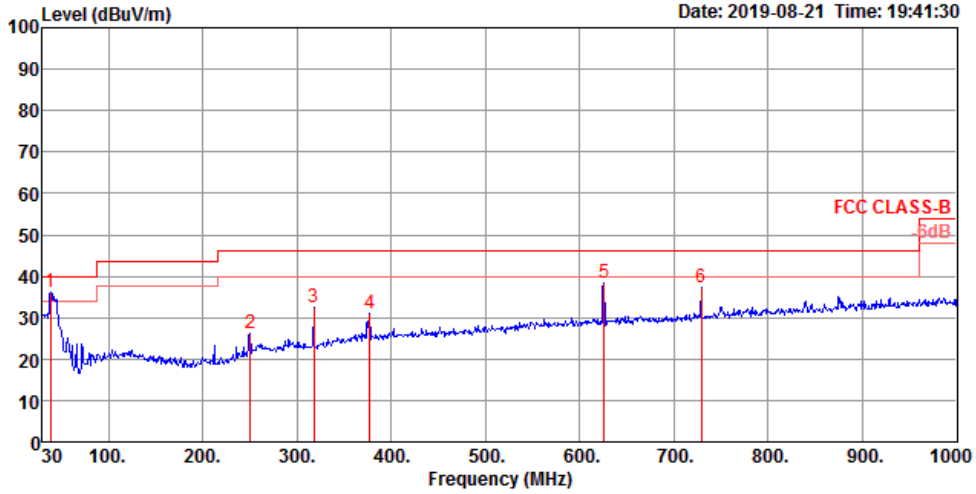
All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.4.5.2 Test Result of Transmitter Spurious Emissions

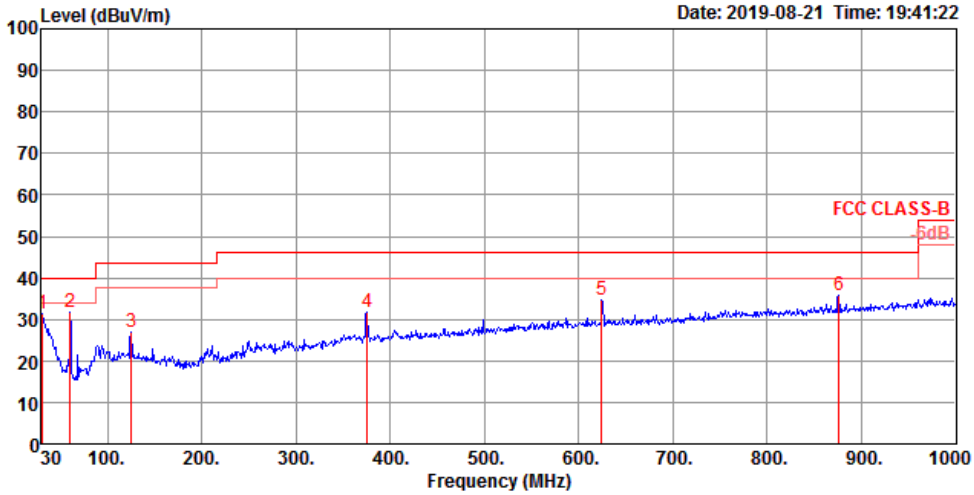
Test Range	30 MHz – 1000 MHz	Test Distance	3 m
Test Configuration	CTX		

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	38.73	36.24	40.00	-3.76	46.42	0.81	20.51	31.50	125	244	Peak	VERTICAL
2	250.19	26.15	46.00	-19.85	37.24	2.04	18.90	32.03	200	188	Peak	VERTICAL
3	318.09	32.36	46.00	-13.64	41.84	2.31	20.31	32.10	300	67	Peak	VERTICAL
4	377.26	31.15	46.00	-14.85	38.88	2.52	21.92	32.17	300	67	Peak	VERTICAL
5	625.58	38.20	46.00	-7.80	42.14	3.28	25.21	32.43	100	108	Peak	VERTICAL
6	729.37	37.34	46.00	-8.66	40.20	3.57	25.96	32.39	100	81	Peak	VERTICAL

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	30.97	31.28	40.00	-8.72	37.04	0.69	25.11	31.56	125	358	Peak	HORIZONTAL
2	60.07	31.64	40.00	-8.36	49.90	0.99	12.60	31.85	200	205	Peak	HORIZONTAL
3	125.06	27.03	43.50	-16.47	38.84	1.44	18.60	31.85	300	95	Peak	HORIZONTAL
4	375.32	31.74	46.00	-14.26	39.52	2.51	21.88	32.17	100	101	Peak	HORIZONTAL
5	624.61	34.53	46.00	-11.47	38.47	3.28	25.21	32.43	150	359	Peak	HORIZONTAL
6	875.84	35.62	46.00	-10.38	36.60	3.92	27.50	32.40	100	208	Peak	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	1 GHz – 18 GHz	Test Distance	3 m
Test Configuration	CTX	Test Freq. (GHz)	58.32

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2124.94	33.51	54.00	-20.49	39.41	3.71	27.25	36.86	210	72	Average	VERTICAL
2	2125.05	40.21	74.00	-33.79	46.11	3.71	27.25	36.86	210	72	Peak	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2124.98	30.46	54.00	-23.54	36.36	3.71	27.25	36.86	117	39	Average	HORIZONTAL
2	2125.06	39.84	74.00	-34.16	45.74	3.71	27.25	36.86	117	39	Peak	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	1 GHz – 18 GHz	Test Distance	3 m
Test Configuration	CTX	Test Freq. (GHz)	62.64

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2125.04	39.81	74.00	-34.19	45.71	3.71	27.25	36.86	208	74	Peak	VERTICAL
2	2125.08	33.28	54.00	-20.72	39.18	3.71	27.25	36.86	208	74	Average	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2124.96	37.40	74.00	-36.60	43.30	3.71	27.25	36.86	115	35	Peak	HORIZONTAL
2	2125.00	30.26	54.00	-23.74	36.16	3.71	27.25	36.86	115	35	Average	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	1 GHz – 18 GHz	Test Distance	3 m
Test Configuration	CTX	Test Freq. (GHz)	65.88

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2124.86	39.45	74.00	-34.55	45.35	3.71	27.25	36.86	209	74	Peak	VERTICAL
2	2125.02	33.32	54.00	-20.68	39.22	3.71	27.25	36.86	209	74	Average	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2124.98	38.31	74.00	-35.69	44.21	3.71	27.25	36.86	120	38	Peak	HORIZONTAL
2	2125.02	30.17	54.00	-23.83	36.07	3.71	27.25	36.86	120	38	Average	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	18 GHz – 40 GHz	Test Distance	1 m
Test Configuration	CTX	Test Freq. (GHz)	58.32

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	26912.40	50.33	63.54	-13.21	41.77	15.84	39.45	46.73	150	321	Average	VERTICAL
2	26931.00	63.69	83.54	-19.85	55.13	15.85	39.44	46.73	150	321	Peak	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	26910.40	63.50	83.54	-20.04	54.94	15.84	39.45	46.73	150	138	Peak	HORIZONTAL
2	26918.00	50.15	63.54	-13.39	41.59	15.84	39.45	46.73	150	138	Average	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	18 GHz – 40 GHz	Test Distance	1 m
Test Configuration	CTX	Test Freq. (GHz)	62.64

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	24658.50	48.11	63.54	-15.43	42.00	15.18	39.03	48.10	150	211	Average	VERTICAL
2	24664.50	61.35	83.54	-22.19	55.24	15.18	39.03	48.10	150	211	Peak	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	24656.20	60.92	83.54	-22.62	54.81	15.18	39.03	48.10	150	124	Peak	HORIZONTAL
2	24661.00	48.44	63.54	-15.10	42.33	15.18	39.03	48.10	150	124	Average	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	18 GHz – 40 GHz	Test Distance	1 m
Test Configuration	CTX	Test Freq. (GHz)	65.88

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	24675.96	61.02	83.54	-22.52	54.90	15.18	39.03	48.09	150	283	Peak	VERTICAL
2	24687.44	46.94	63.54	-16.60	40.81	15.19	39.02	48.08	150	283	Average	VERTICAL

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	24675.36	46.81	63.54	-16.73	40.69	15.18	39.03	48.09	150	315	Average	HORIZONTAL
2	24675.76	61.18	83.54	-22.36	55.06	15.18	39.03	48.09	150	315	Peak	HORIZONTAL

Note: Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Range	40GHz – 200GHz

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
58.32	23.6	0.50	56.41	-77.77
EIRP (dBm)	**Specification Distance (m)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**	**Test Result**
-39.92	3	0.0900	90.00	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
62.64	23.6	0.50	52.83	-70.76
EIRP (dBm)	**Specification Distance (m)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**	**Test Result**
-33.48	3	0.3967	90.00	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
65.88	23.6	0.50	56.99	-62.82
EIRP (dBm)	**Specification Distance (m)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**	**Test Result**
-24.88	3	2.8720	90.00	PASS

Note:
EIRP = Prx – Grx + Free Space Path Loss = Prx – Grx + 20Log(4πd/ λ)2
Which
Prx = Read Level.
Grx = Rx Antenna Gain.
A distance factor is offset and the formula is 20LOG(D1/D2)
Which
D1 = Specification Distance
D2 = Measurement Distance

3.5 Frequency Stability

3.5.1 Limit of Frequency Stability

Frequency Stability	Limit
Refer as FCC 15.255(f) and ANSI C63.10-2013, clause 9.14	within the frequency bands
Note: These measurements shall also be performed at normal and extreme test conditions.	

3.5.2 Measuring Instruments

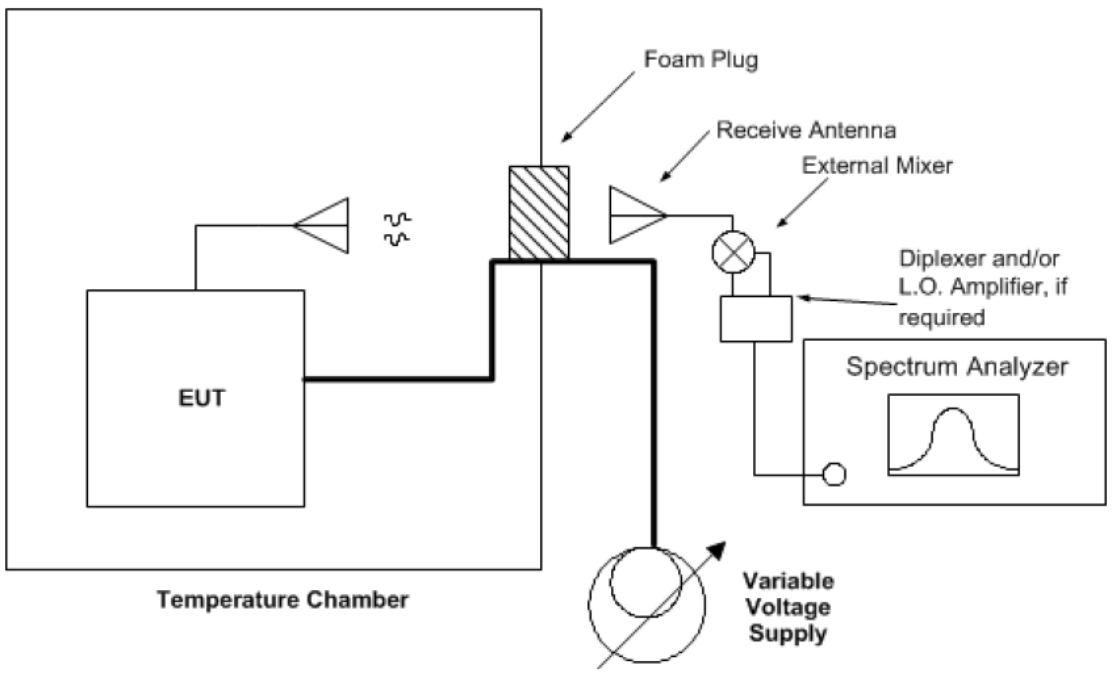
Refer a measuring instruments list in this test report.

3.5.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clauses 9.14.

3.5.4 Test Setup

Frequency Stability



3.5.5 Test Result of Frequency Stability

Test Conditions	see ANSI C63.10, clause 5.11 & clause 9
Test Setup	see ANSI C63.10, clause 9.14
NOTE: If equipment having different channel plan and nominal channel bandwidth modes (see test report clause 1.1.1), the measurements are uninfluenced by different channel plan and nominal channel bandwidth modes, may not need to be repeated for all modes.	

3.5.5.1 Frequency Stability with Respect to Ambient Temperature

Frequency Stability with Respect to Ambient Temperature			
Test Results			
Test Temp.erature (°C)	**Measured Frequency (MHz)**	**Delta Frequency (kHz)**	**Limit (±kHz)**
-40	62640.7482	3.2	Within band
-30	62640.7488	3.8	Within band
-20	62640.7485	3.5	Within band
-10	62640.748	3.0	Within band
0	62640.748	3.0	Within band
10	62640.745	0.0	Within band
20	62640.745	Reference	Within band
30	62640.7452	0.2	Within band
40	62640.744	-1.0	Within band
50	62640.7432	-1.8	Within band
60	62640.7416	-3.4	Within band
70	62640.7405	-4.5	Within band
NOTE: The manufacturer's specified temperature range of -40 to 70°C.			

3.5.5.2 Frequency Stability When Varying Supply Voltage

Frequency Stability When Varying Supply Voltage			
Test Results			
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
40.8	62640.741	-4.0	Within band
48	62640.745	Reference	Within band
55.2	62640.748	3.0	Within band
NOTE: For the applicable limit, see FCC 15.255(f).			

3.6 Operation Restriction and Group Installation

3.6.1 Limit of Operation Restriction and Group Installation

Item	Limit
Operation Restriction	Operation is not permitted for the following products: ♦ Equipment used on aircraft or satellites. (Refer as FCC 15.255 (a)) ♦ Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. (Refer as FCC 15.255 (a))
Group Installation	Operation is not permitted for the following products: ♦ External phase-locking (Refer as FCC 15.255 (h))

3.6.2 Result of Operation Restriction

Manufacturer declares that EUT will not been used on aircraft or satellites. Then user manual will include a statement to caution EUT is not permitted for used on aircraft or satellites. EUT is a wireless video area network (WVAN) for the connection of consumer electronic (CE) audio and video devices.

3.6.3 Result of Group Installation

The frequency, amplitude and phase of the transmit signal are set within the EUT. There are no external phase-locking inputs or any other means of combining two or more units together to realize a beam-forming array.

4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Bilog Antenna with 6dB Attenuator	TESE & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 28, 2019	Mar. 27, 2020	Radiation (03CH05-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 29, 2019	Mar. 28, 2020	Radiation (03CH05-CB)
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1291	1GHz~18GHz	Oct. 12, 2018	Oct. 11, 2019	Radiation (03CH05-CB)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170507	15GHz ~ 40GHz	Jun. 12, 2019	Jun. 11, 2020	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	May 02, 2019	May 01, 2020	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC12630SE	980287	1GHz – 26.5GHz	Mar. 28, 2019	Mar. 27, 2020	Radiation (03CH05-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 03, 2019	Jul. 02, 2020	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Aug, 15, 2019	Aug, 14, 2020	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	May 15, 2019	May 14, 2020	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	May 15, 2019	May 14, 2020	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	LOW Cable-04+23	30MHz~1GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-04	1GHz~18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-04+23	30MHz~18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 24, 2019	Jul. 23, 2020	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH05-CB)
Mixer	OML	M19HW/A	U91113-1	40 ~ 60 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH05-CB)
Mixer	OML	M15HW/A	V91113-1	50 ~ 75 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH05-CB)
Mixer	OML	M12HW/A	E91113-1	60 ~ 90 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH05-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Mixer	OML	M08HW/A	F91113-1	90 ~ 140 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH05-CB)
Mixer	OML	M05HW/A	G91113-1	140 ~ 220 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH05-CB)
Detector	Millitech	DET-15-RPF W0	#A18185(074)	50 ~ 75 GHz	*Jan. 29, 2018	*Jan. 29, 2020	Radiation (03CH05-CB)
Pico Scope	Pico	Pico Scope 6402C	CX372/002	N/A	Jul. 07, 2019	Jul. 06, 2020	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M19RH	U91113-A	40 ~ 60 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M15RH	V91113-A	50 ~ 75 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M12RH	E91113-A	60 ~ 90 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M08RH	F91113-A	90 ~ 140 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M05RH	G91113-A	140 ~ 220 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	May 30, 2019	May 29, 2020	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

"*" Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

5 Measurement Uncertainty

Test Items	Uncertainty	Remark
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	5.1 dB	Confidence levels of 95%
Radiated Emission (40GHz ~ 60GHz)	4.6 dB	Confidence levels of 95%
Radiated Emission (60GHz ~ 90GHz)	5.1 dB	Confidence levels of 95%
Radiated Emission (90GHz ~ 200GHz)	5.6 dB	Confidence levels of 95%
Temperature	1°C	Confidence levels of 95%