



# FCC RADIO TEST REPORT

**FCC ID** : TV7LHG60AD  
**Equipment** : RouterBOARD LHG-60ad  
**Brand Name** : MikroTik  
**Model Name** : RBLHG-60ad  
**Applicant** : Mikrotiks SIA  
Brivibas gatve 214i, Riga, LV-1039 Latvia  
**Manufacturer** : MIKROTIKLS SIA  
Brivibas gatve 214i, Riga, LV-1039 Latvia  
**Standard** : 47 CFR FCC Part 15.255

The product was received on May 14, 2018, and testing was started from Jul. 27, 2018 and completed on Oct. 15, 2018. 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 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 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: Cliff Chang

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



## Table of Contents

<b>History of this test report.....</b>	<b>3</b>
<b>Summary of Test Result.....</b>	<b>4</b>
<b>1 General Description .....</b>	<b>5</b>
1.1 Information.....	5
1.2 Accessories .....	6
1.3 Support Equipment.....	6
1.4 EUT Operation during Test .....	6
1.5 Test Setup Diagram .....	7
1.6 Testing Applied Standards .....	9
1.7 Testing Location .....	9
<b>2 Test Configuration of Equipment under Test.....</b>	<b>10</b>
2.1 Test Channel Frequencies .....	10
2.2 Conformance Tests and Related Test Frequencies.....	10
2.3 Far Field Boundary Calculations .....	10
<b>3 Transmitter Test Result .....</b>	<b>11</b>
3.1 AC Power Conducted Emissions .....	11
3.2 Occupied Bandwidth .....	16
3.3 EIRP Power .....	20
3.4 Peak Conducted Power.....	23
3.5 Transmitter Spurious Emissions.....	25
3.6 Frequency Stability .....	33
3.7 Operation Restriction and Group Installation .....	36
<b>4 Test Equipment and Calibration Data .....</b>	<b>37</b>
<b>5 Measurement Uncertainty .....</b>	<b>39</b>

### Appendix A. Test Photos

#### Photographs of EUT v01



TEL : 886-3-656-9065  
FAX : 886-3-656-9085  
Report Template No.: CB Ver1.0



## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	FCC 15.207	AC Power Conducted Emissions	PASS	-
3.2	FCC 15.255(e)	Occupied Bandwidth	PASS	-
3.3	FCC 15.255(c)	EIRP Power	PASS	-
3.4	FCC 15.255(c)	Peak Conducted Power	PASS	-
3.5	FCC 15.255(d)	Transmitter Spurious Emissions	PASS	-
3.6	FCC 15.255(f)	Frequency Stability	PASS	-
3.7	FCC 15.255(a),(h)	Operation Restriction and Group Installation	PASS	-

**Reviewed by: Sam Chen**

**Report Producer: Wendy Pan**



# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

RF General Information	
Frequency Range	57-71 GHz
The Channel Plan(s)	62.64
Modulation	$\pi/2$ -BPSK, $\pi/2$ -QPSK, $\pi/2$ -16QAM

### 1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MikroTik	60G-phased-array	Parabolic Dish Antenna	Soldered	42

### 1.1.3 EUT Power Type

EUT Power Type	From PoE
----------------	----------

### 1.1.4 Equipment Use Condition

Equipment Use Condition	
<input type="checkbox"/>	Fixed field disturbance sensors at 61-61.5GHz
<input type="checkbox"/>	Except fixed field disturbance sensors at 61-61.5GHz
<input checked="" type="checkbox"/>	Except fixed field disturbance sensors

### 1.1.5 User Condition

Intended Operation	
<input type="checkbox"/>	Indoor
<input type="checkbox"/>	Outdoor (except outdoor fixed Point to Point)
<input checked="" type="checkbox"/>	Outdoor fixed Point to Point

### 1.1.6 Duty Cycle

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



## 1.2 Accessories

Power	Brand	Model	Rating
Adapter	MLF	MLF-A00122400380U0141	Input: 100-240V ~ 50/60Hz, 0.4Amax Output: 24V, 0.38A
PoE	MikroTik	RBGPOE	Input: 9-48V
Others			
Standing dock (Round type)*1 Standing dock (Long type)*2 Screw clamps*2			

## 1.3 Support Equipment

For AC Power Conducted Emissions test:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E6430	N/A

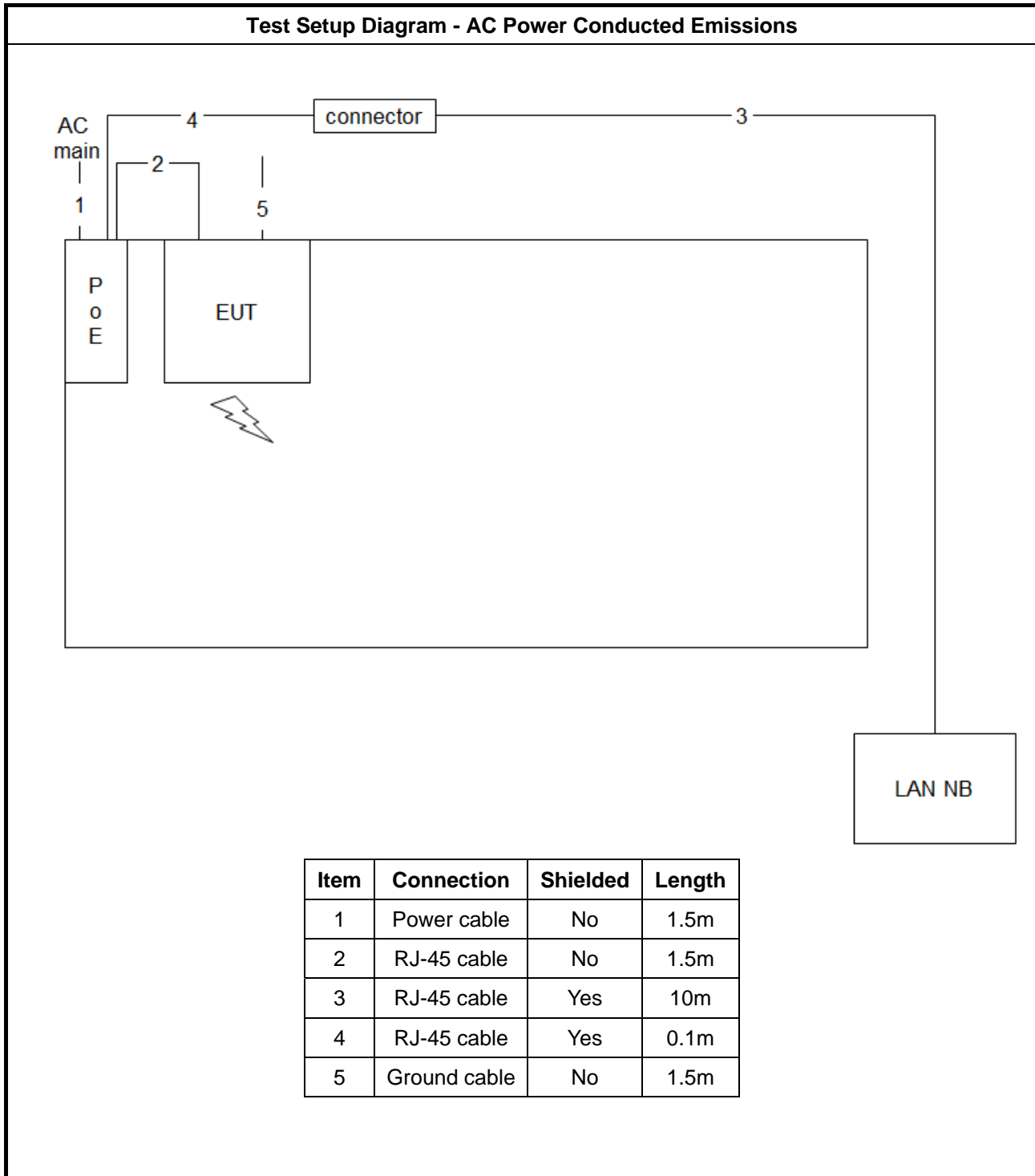
For others test:

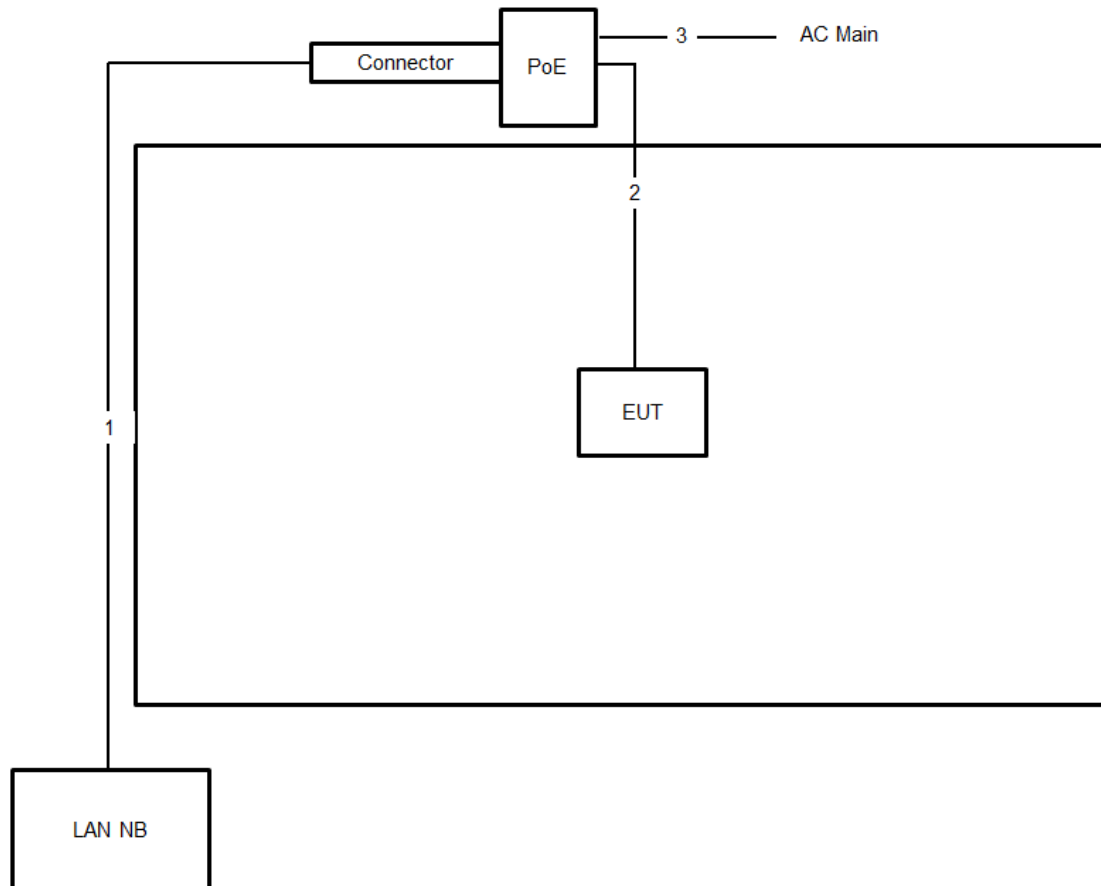
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E4300	N/A

## 1.4 EUT Operation during Test

During the test, executed the test program to control the EUT continuously transmit RF signal.

## 1.5 Test Setup Diagram



**Test Setup Diagram - Transmitter Spurious Emissions**


Item	Connection	Shielded	Length
1	RJ-45 cable	No	10m
2	RJ-45 cable	Yes	1.5m
3	Power Cable	No	1.5m





## 1.6 Testing Applied 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"

## 1.7 Testing Location

Testing Location		
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	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 Site No.		
CO01-CB	03CH01-CB	TH01-CB

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	
Channel (GHz)	62.64

### 2.2 Conformance Tests and Related Test Frequencies

Test Item	Test Frequencies (GHz)
AC Power Conducted Emissions	62.64
Occupied Bandwidth	62.64
EIRP Power	62.64
Peak Conducted Power	62.64
Transmitter Spurious Emissions (below 1 GHz)	62.64
Transmitter Spurious Emissions (1 GHz-40 GHz)	62.64
Transmitter Spurious Emissions (above 40 GHz)	62.64
Frequency Stability	Un-Modulation

Note: The EUT can only be used at standing position.

### 2.3 Far Field Boundary Calculations

The far-field boundary is given as:

$$\text{far field} = (2 * L^2) / \lambda$$

where:

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

$\lambda$  = wavelength in meters

Far Field (m)				
Frequency (GHz)	L (m)	Lambda (m)	d(Far Field) (m)	d(Far Field) (cm)
62.64	0.35	0.0047893	51.156	5115.60



### **3 Transmitter Test Result**

#### **3.1 AC Power Conducted Emissions**

##### **3.1.1 Limit of AC Power Conducted Emissions**

AC Power Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note: * Decreases with the logarithm of the frequency.		

##### **3.1.2 Measuring Instruments**

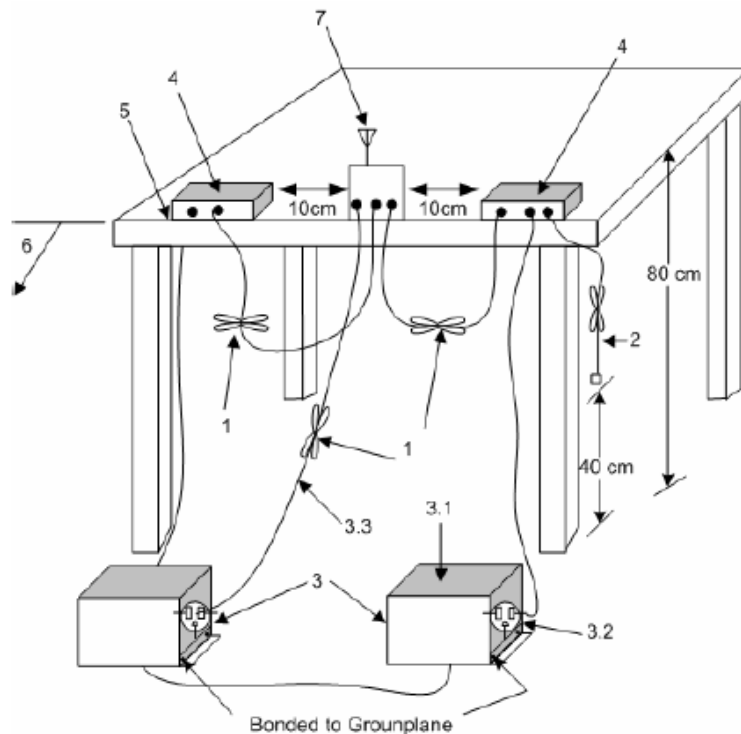
Refer a measuring instruments list in this test report.

##### **3.1.3 Test Procedures**

Method of measurement: Refer as ANSI C63.10-2013, clause 6.2.

### 3.1.4 Test Setup

#### AC Power Conducted Emissions



1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.

2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50  $\Omega$  loads. LISN may be placed on top of, or immediately beneath, reference ground plane.

3.1—All other equipment powered from additional LISN(s).

3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.

3.3—LISN at least 80 cm from nearest part of EUT chassis.

4—Non-EUT components of EUT system being tested.

5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop.

6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

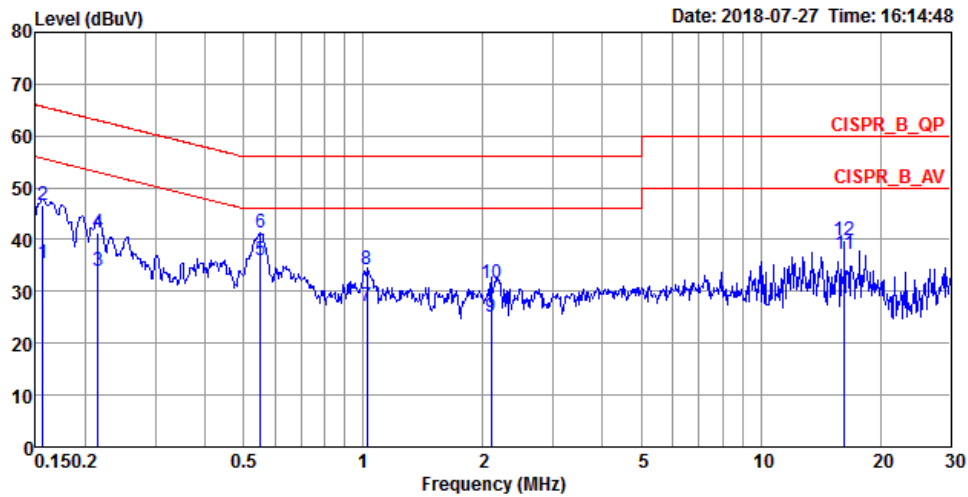


### 3.1.5 Test Result of AC Power Conducted Emissions

<b>Test Conditions</b>	see ANSI C63.10, clause 5.11
<b>Test Setup</b>	see ANSI C63.10, clause 6.2.3
<p>NOTE 1: 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. 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 5.12 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.</p> <p>NOTE 2: "&gt;20dB" means the tables in this clause should only list values of spurious emissions that exceed the level of 20 dB below the applicable limit, see ANSI C63.4, clause 10.1.8.1.</p>	



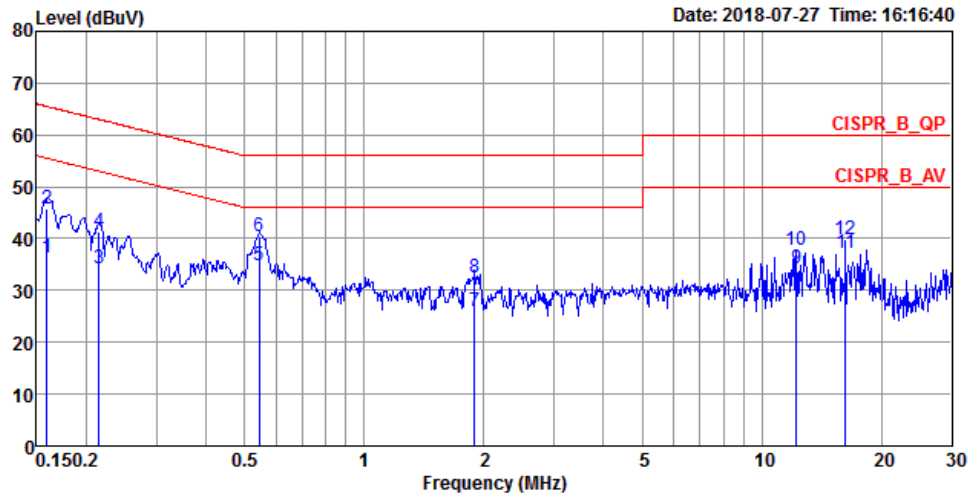
Temp	24°C	Humidity	58%
Test Engineer	Max Lin	Phase	Line
Configuration	CTX		



	Freq	Level	Over	Limit	Read	LISN	Cable		
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark	Pol/Phase
			dB	dBuV	dBuV	dB	dB		
1	0.1565	35.38	-20.27	55.65	25.31	9.91	0.16	Average	LINE
2	0.1565	46.65	-19.00	65.65	36.58	9.91	0.16	QP	LINE
3	0.2151	34.02	-18.99	53.01	23.97	9.91	0.14	Average	LINE
4	0.2151	41.36	-21.65	63.01	31.31	9.91	0.14	QP	LINE
5	0.5523	35.95	-10.05	46.00	25.88	9.92	0.15	Average	LINE
6	0.5523	41.23	-14.77	56.00	31.16	9.92	0.15	QP	LINE
7	1.0211	27.24	-18.76	46.00	17.11	9.93	0.20	Average	LINE
8	1.0211	34.17	-21.83	56.00	24.04	9.93	0.20	QP	LINE
9	2.0990	25.05	-20.95	46.00	14.87	9.96	0.22	Average	LINE
10	2.0990	31.61	-24.39	56.00	21.43	9.96	0.22	QP	LINE
11	16.2276	37.22	-12.78	50.00	26.70	10.30	0.22	Average	LINE
12	16.2276	39.95	-20.05	60.00	29.43	10.30	0.22	QP	LINE



Temp	24°C	Humidity	58%
Test Engineer	Max Lin	Phase	Neutral
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1590	36.22	-19.30	55.52	26.14	9.92	0.16	Average	NEUTRAL
2	0.1590	45.85	-19.67	65.52	35.77	9.92	0.16	QP	NEUTRAL
3	0.2151	34.11	-18.90	53.01	24.05	9.92	0.14	Average	NEUTRAL
4	0.2151	41.45	-21.56	63.01	31.39	9.92	0.14	QP	NEUTRAL
5	0.5436	34.77	-11.23	46.00	24.70	9.92	0.15	Average	NEUTRAL
6	0.5436	40.46	-15.54	56.00	30.39	9.92	0.15	QP	NEUTRAL
7	1.8979	26.12	-19.88	46.00	15.93	9.96	0.23	Average	NEUTRAL
8	1.8979	32.56	-23.44	56.00	22.37	9.96	0.23	QP	NEUTRAL
9	12.1979	34.10	-15.90	50.00	23.78	10.14	0.18	Average	NEUTRAL
10	12.1979	37.72	-22.28	60.00	27.40	10.14	0.18	QP	NEUTRAL
11	16.2276	37.09	-12.91	50.00	26.67	10.20	0.22	Average	NEUTRAL
12	16.2276	39.94	-20.06	60.00	29.52	10.20	0.22	QP	NEUTRAL



## 3.2 Occupied Bandwidth

### 3.2.1 Limit of Occupied Bandwidth

<b>6dBc Bandwidth</b> (see Note 1)	None
<b>99% Occupied Bandwidth</b> (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.	

### 3.2.2 Measuring Instruments

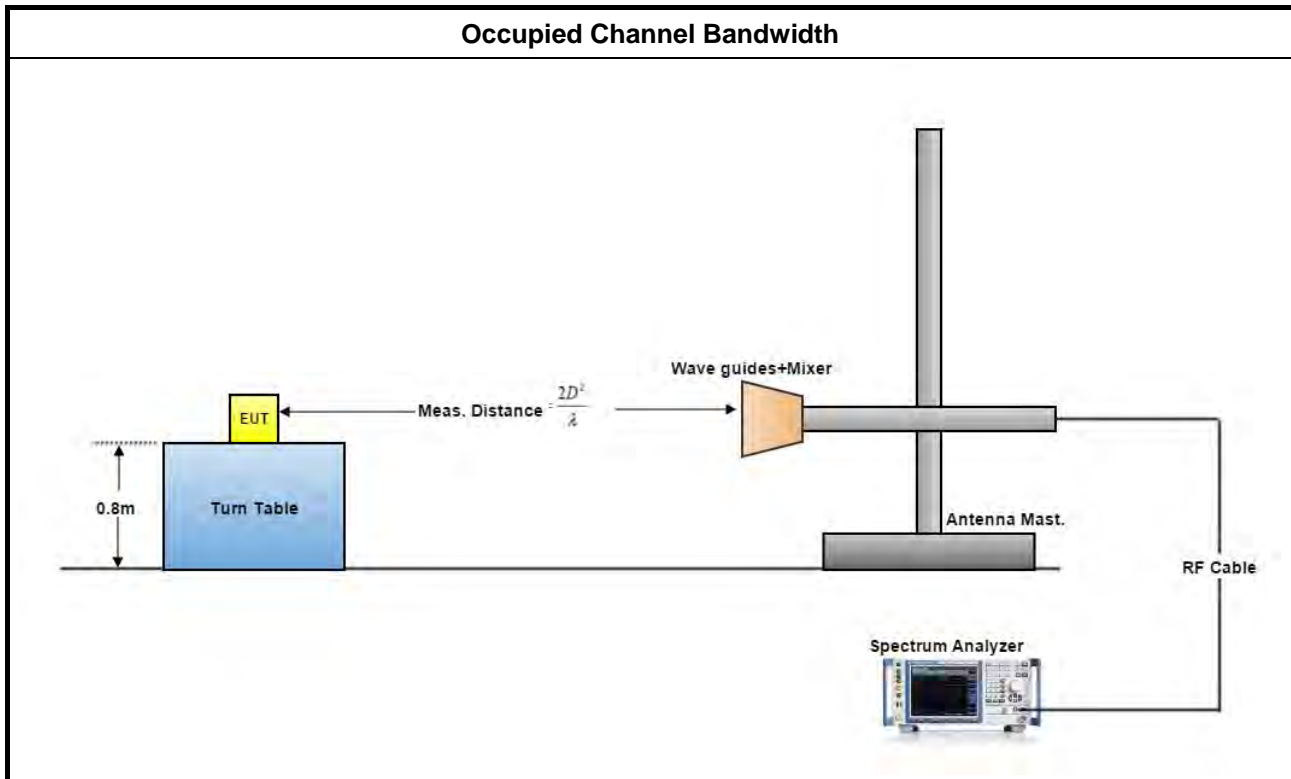
Refer a measuring instruments list in this test report.

### 3.2.3 Test Procedures

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



### 3.2.4 Test Setup



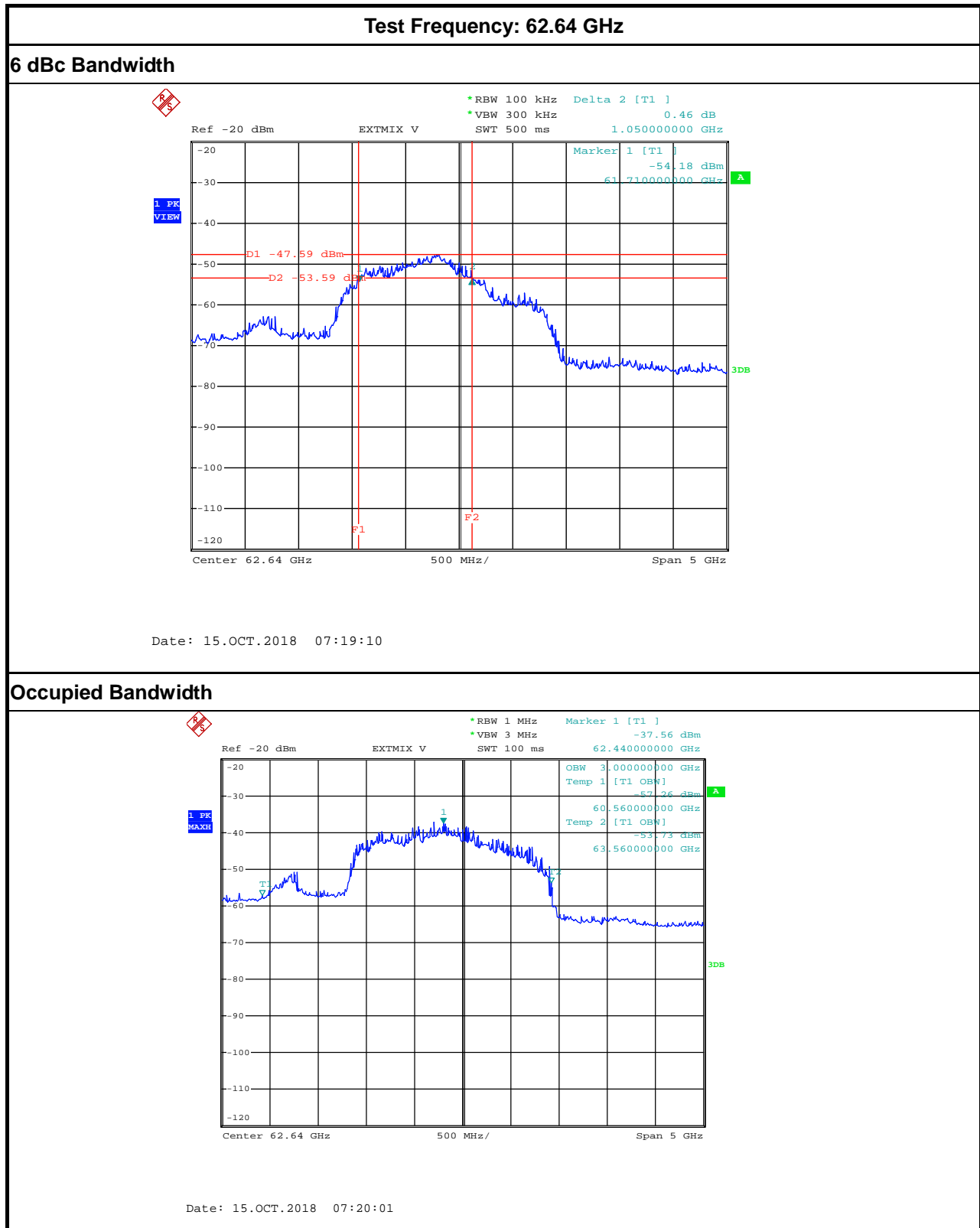
**3.2.5 Test Result of Occupied Bandwidth****Test Conditions** see ANSI C63.10, clause 5.11**Test Setup** see ANSI C63.10, clause 6.9.2

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.

Temp	25.2°C	Humidity	61%
Test Engineer	Gino Huang		
Test Results			
Test Freq. (GHz)	6 dBc Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
62.64	1050.00	3000.00	N/A



### 3.2.5.1 Bandwidth Plots





### 3.3 EIRP Power

#### 3.3.1 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
Note: 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.		

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

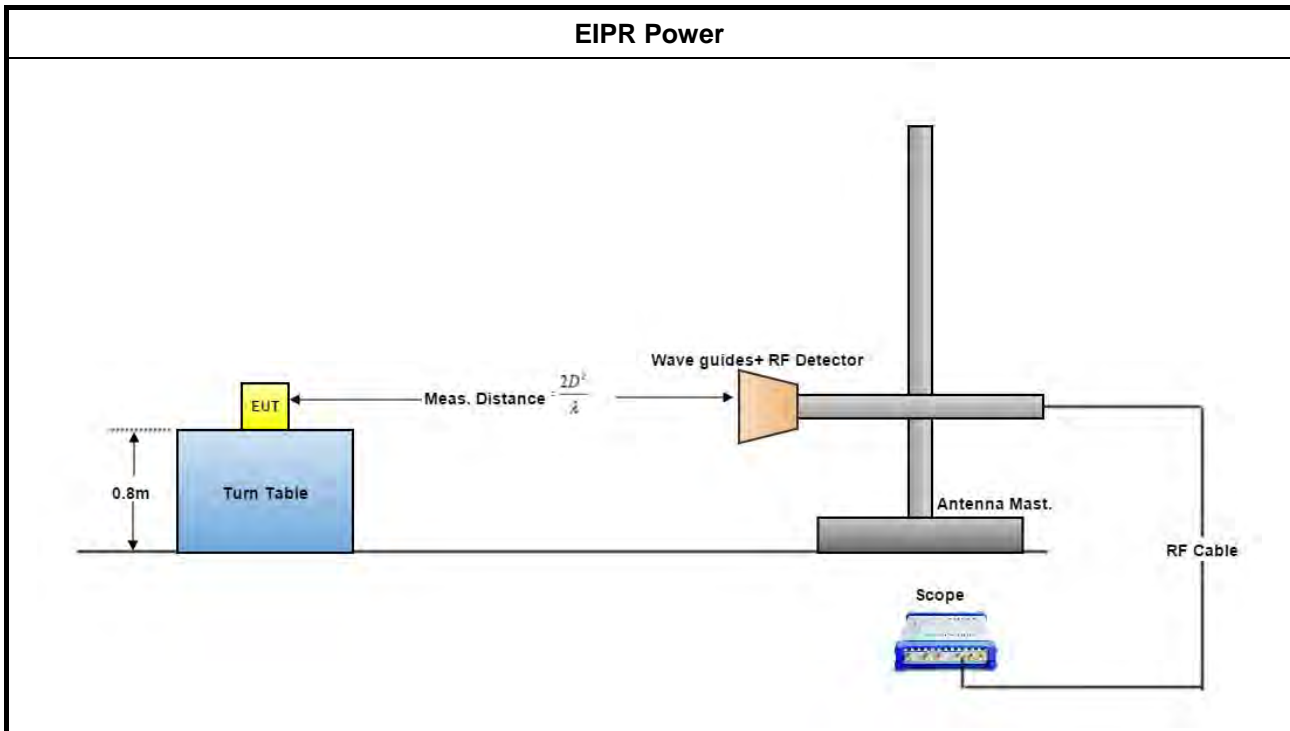
#### 3.3.2 Measuring Instruments

Refer a measuring instruments list in this test report.

#### 3.3.3 Test Procedures

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

### 3.3.4 Test Setup



### 3.3.5 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.



## 3.3.5.1 Test Result of EIRP Power

Temp				25.2℃				Humidity				61%			
Test Engineer				Gino Huang				Test Distance				52 m			
Test Date				Oct. 15, 2018											
Test Results															
Test Freq. (GHz)	Rx Gain (dBi)	DSO (mV)		Power Measured (dBm)		E <sub>Meas</sub> (dBuV/m)		EIRP (dBm)		EIRP Limit (dBm) (note 1)					
		Peak	AV	Peak	AV	Peak	AV	Peak	AV	Peak	AV				
62.64	23.6	1.39	0.19	-32.06	-45.13	117.53	104.46	47.05	33.98	67	64				
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)”.															



### 3.4 Peak Conducted Power

#### 3.4.1 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)	

#### 3.4.2 Measuring Instruments

Refer a measuring instruments list in this test report.

#### 3.4.3 Test Procedures

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

#### 3.4.4 Test Result of Peak Conducted Power

<b>Test Conditions</b>	see ANSI C63.10, clause 5.11 & clause 9
<b>Test Setup</b>	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.	

**3.4.4.1 Peak Conducted Power**

Temp	25.2℃	Humidity	61%			
Test Engineer	Gino Huang					
Test Date	Oct. 15, 2018					
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)
62.64	47.05	42	5.05	3.202	1050.00	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 0.						
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.						





### **3.5 Transmitter Spurious Emissions**

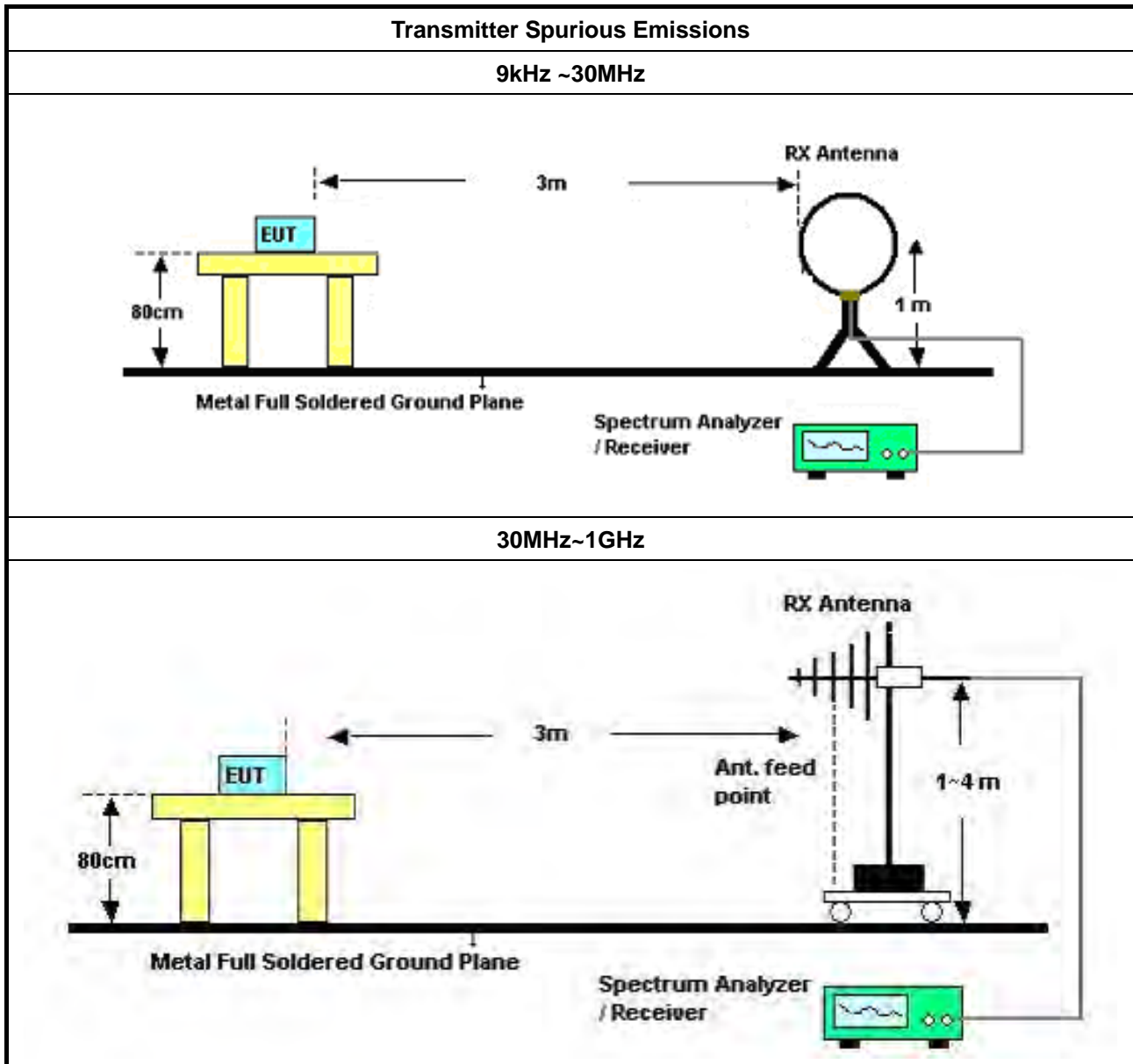
#### **3.5.1 Limit of Transmitter Spurious Emissions**

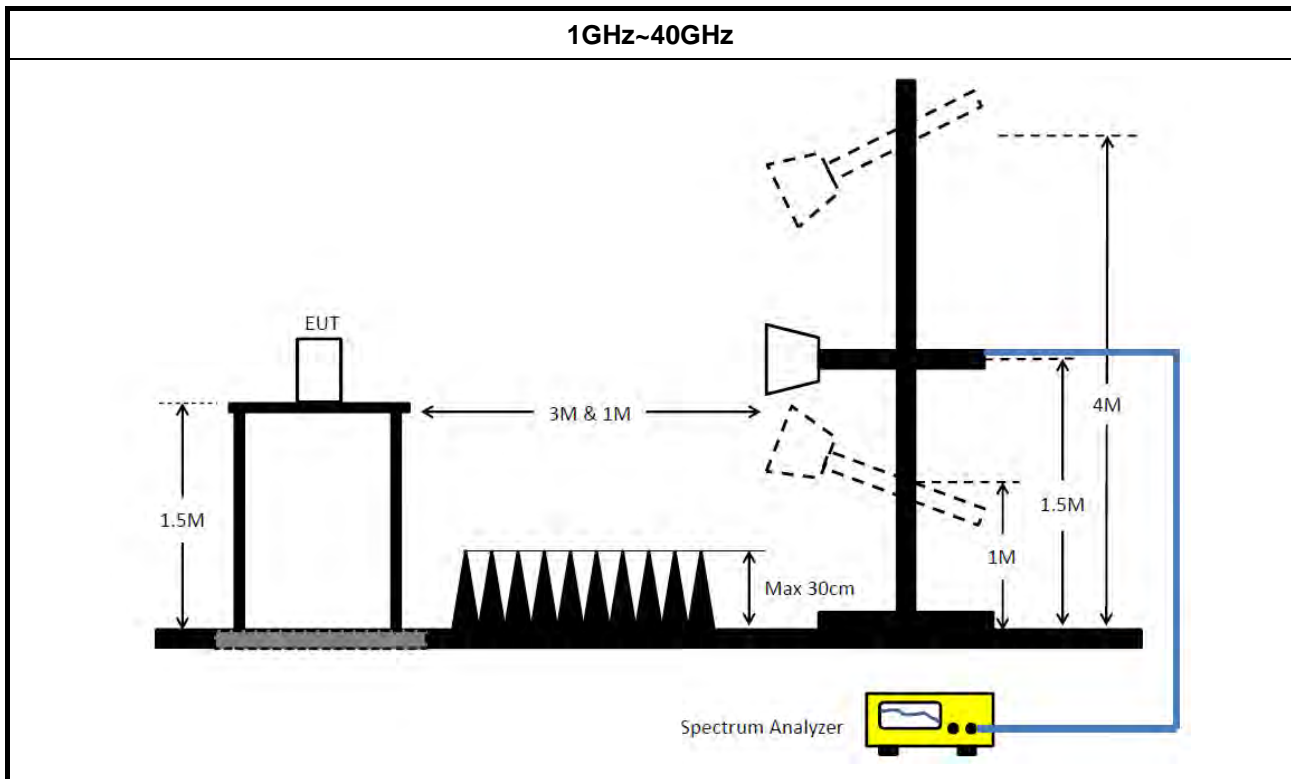
Frequency Range	Limit
Radiated emissions below 40 GHz	FCC 15.209
Radiated emissions above 40 GHz – 200GHz	90 pW/cm <sup>2</sup> @ 3 m (Equivalent EIRP 102 µW, -9.91dBm)
NOTE 1: For the applicable limit, see FCC 15.255(d)	
NOTE 2: Spurious emissions shall not exceed the level of the fundamental emission.	

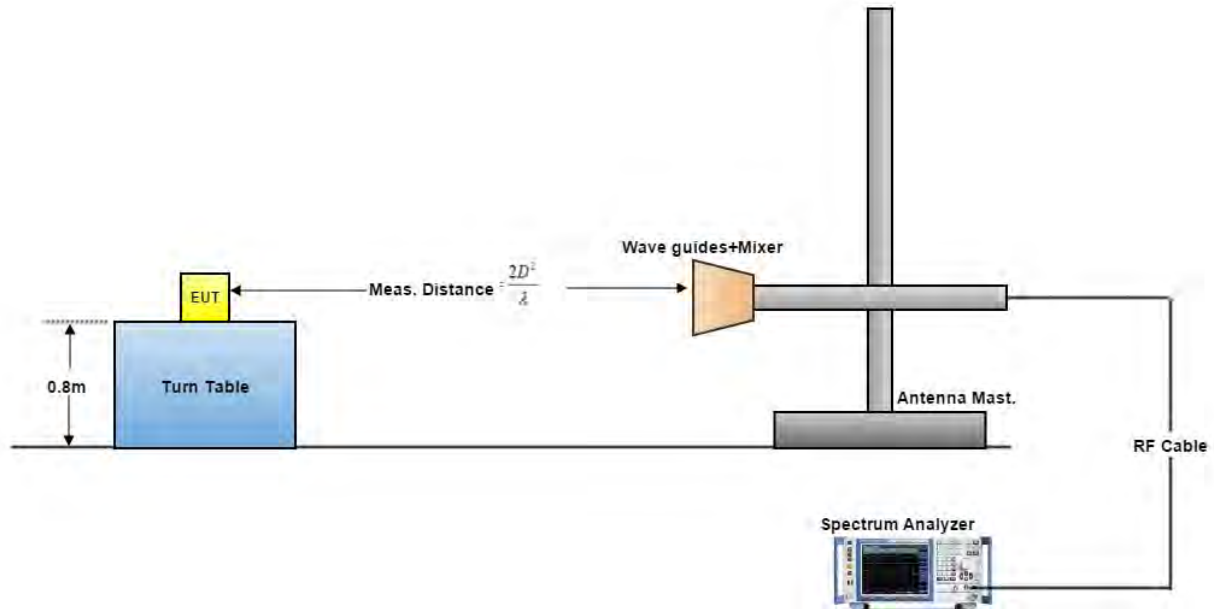
#### **3.5.2 Test Procedures**

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

### 3.5.3 Test Setup





**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 =  $20 \log (\text{spec. distance [3 m]} / \text{measurement distance [N m]})$  (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.

### 3.5.4 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.

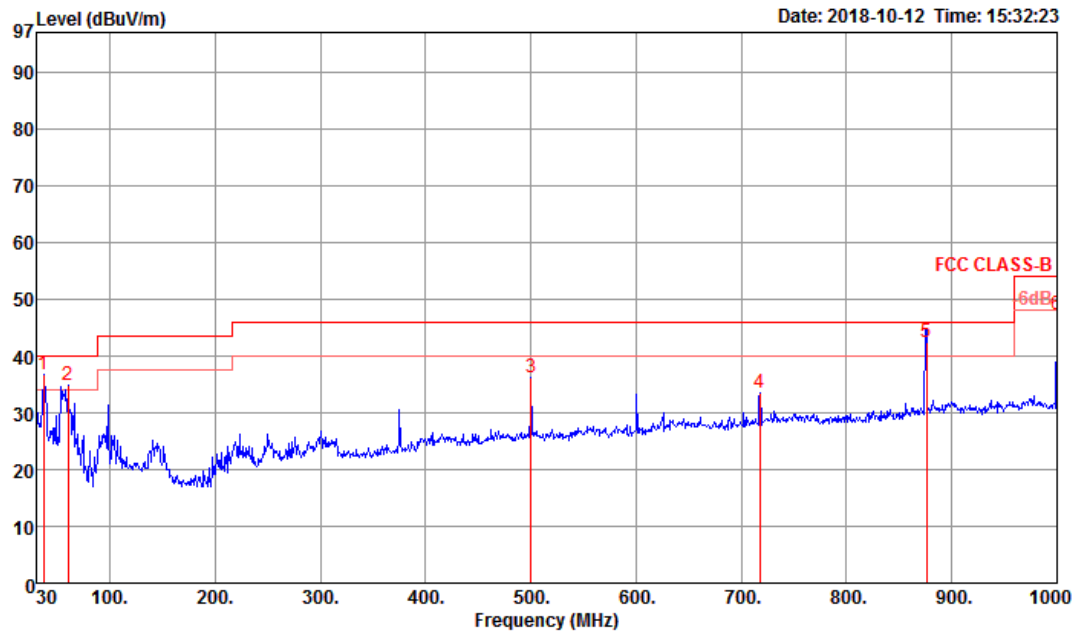
#### 3.5.4.1 Test Result of Transmitter Spurious Emissions (Below 30MHz)

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

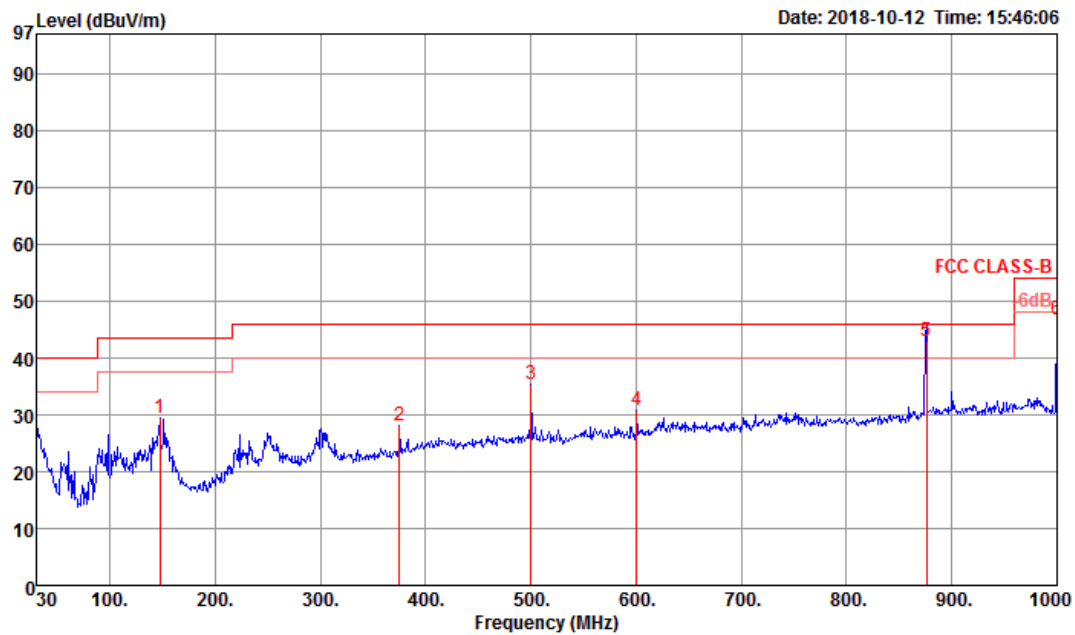
The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

**3.5.4.2 Test Result of Transmitter Spurious Emissions**

Temp	25.2°C	Humidity	61%
Test Engineer	Jeff Wu	Test Distance	3 m
Test Range	30 MHz – 1000 MHz	Test Configuration	CTX

**Vertical**

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	36.79	36.61	40.00	-3.39	45.01	1.07	22.02	31.49	400	0 Peak	VERTICAL
2	60.07	34.96	40.00	-5.04	52.86	1.26	12.50	31.66	400	0 Peak	VERTICAL
3	500.45	36.08	46.00	-9.92	41.59	2.94	23.63	32.08	400	0 Peak	VERTICAL
4	717.73	33.42	46.00	-12.58	36.54	3.45	25.70	32.27	400	0 Peak	VERTICAL
5	875.84	42.31	46.00	-3.69	43.77	3.60	27.10	32.16	102	162 QP	VERTICAL
6	1000.00	47.22	54.00	-6.78	47.76	3.67	28.00	32.21	400	0 Peak	VERTICAL

**Horizontal**

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	147.37	29.35	43.50	-14.15	42.91	1.10	17.10	31.76	100	360	Peak HORIZONTAL
2	375.32	28.06	46.00	-17.94	36.43	2.22	21.32	31.91	100	360	Peak HORIZONTAL
3	500.45	35.49	46.00	-10.51	41.00	2.94	23.63	32.08	100	360	Peak HORIZONTAL
4	600.36	30.87	46.00	-15.13	36.23	1.85	25.00	32.21	100	360	Peak HORIZONTAL
5	875.84	42.86	46.00	-3.14	44.32	3.60	27.10	32.16	112	200	QP HORIZONTAL
6	1000.00	46.68	54.00	-7.32	47.22	3.67	28.00	32.21	100	360	Peak HORIZONTAL



<b>Temp</b>	25.2°C	<b>Humidity</b>	61%
<b>Test Engineer</b>	Jeff Wu	<b>Test Distance</b>	3 m
<b>Test Range</b>	1 GHz – 40 GHz	<b>Test Configuration</b>	CTX
<b>Test Date</b>	Oct. 12, 2018		

**Vertical**

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	7815.56	51.40	54.00	-2.60	41.37	7.74	37.07	34.78	166	181	Average VERTICAL
2	7819.76	67.00	74.00	-7.00	56.98	7.75	37.06	34.79	166	181	Peak VERTICAL
3	15798.00	60.89	74.00	-13.11	45.68	11.56	38.55	34.90	162	186	Peak VERTICAL
4	15804.00	48.74	54.00	-5.26	33.53	11.56	38.55	34.90	162	186	Average VERTICAL

**Horizontal**

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	7819.40	48.42	54.00	-5.58	38.40	7.75	37.06	34.79	166	188	Average HORIZONTAL
2	7819.76	63.38	74.00	-10.62	53.36	7.75	37.06	34.79	166	188	Peak HORIZONTAL
3	15800.00	47.25	54.00	-6.75	32.04	11.56	38.55	34.90	108	190	Average HORIZONTAL
4	15800.00	60.68	74.00	-13.32	45.47	11.56	38.55	34.90	108	190	Peak HORIZONTAL



<b>Temp</b>	25.2°C	<b>Humidity</b>	61%
<b>Test Engineer</b>	Gino Huang	<b>Test Date</b>	Oct. 15, 2018
<b>Test Range</b>	40GHz – 200GHz		

<b>Test Frequency (GHz)</b>	<b>Rx Antenna Gain (dBi)</b>	<b>Measurement Distance (m)</b>	<b>Read Worse Frequency (GHz)</b>	<b>Read Level (dBm)</b>
62.64	23.6	1.00	57.00	-68.74
<b>EIRP (dBm)</b>	<b>Specification Distance (m)</b>	<b>Power Density (pW/cm<sup>2</sup>)</b>	<b>Limit (pW/cm<sup>2</sup>)</b>	<b>Test Result</b>
-24.78	3	2.9409	90	PASS

Note:

$EIRP = Prx - Grx + \text{Free Space Path Loss} = Prx - Grx + 20\log(4\pi d / \lambda)^2$

Which

$Prx = \text{Read Level.}$

$Grx = \text{Rx Antenna Gain.}$

A distance factor is offset and the formula is  $20\log(D1/D2)$

Which

$D1 = \text{Specification Distance}$

$D2 = \text{Measurement Distance}$



### 3.6 Frequency Stability

#### 3.6.1 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.	

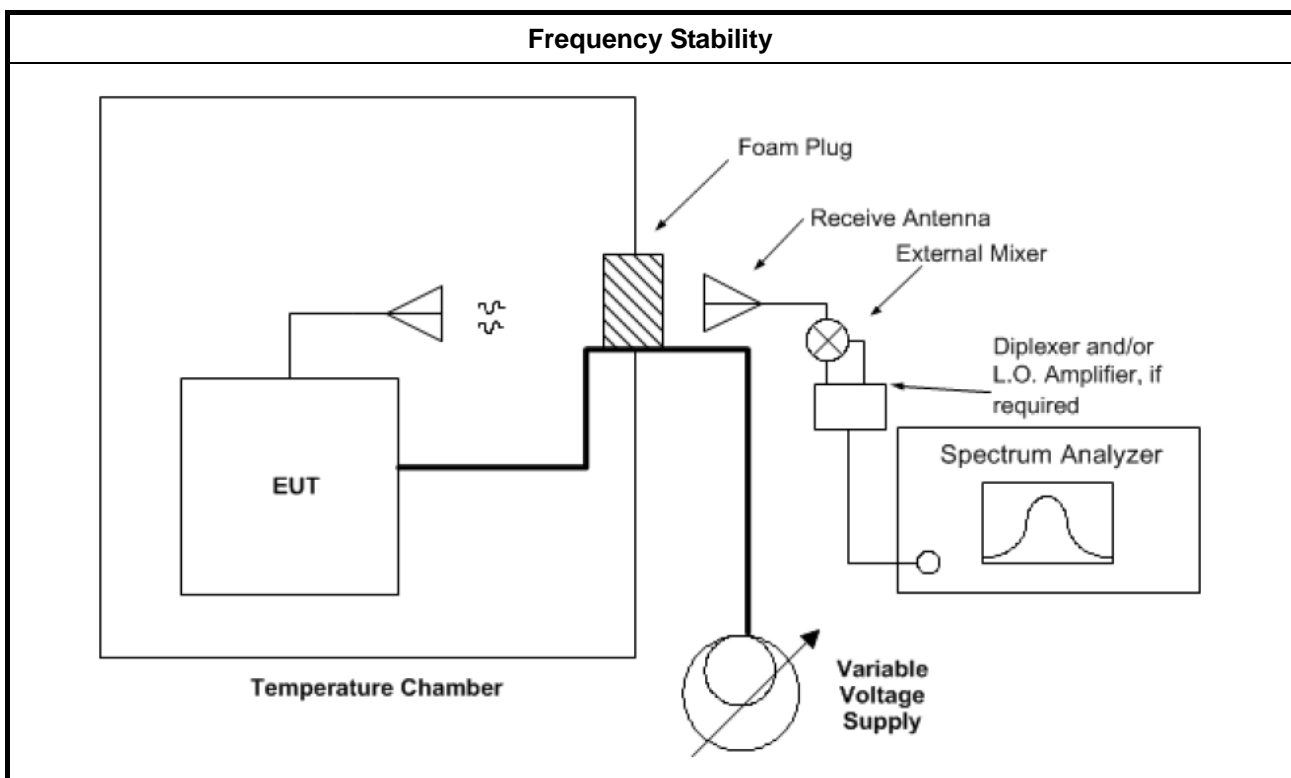
#### 3.6.2 Measuring Instruments

Refer a measuring instruments list in this test report.

#### 3.6.3 Test Procedures

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

#### 3.6.4 Test Setup



**3.6.5 Test Result of Frequency Stability**

<b>Test Conditions</b>	see ANSI C63.10, clause 5.11 & clause 9
<b>Test Setup</b>	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.	

**3.6.5.1 Frequency Stability with Respect to Ambient Temperature**

Frequency Stability with Respect to Ambient Temperature			
<b>Temp</b>	25.2°C	<b>Humidity</b>	61%
<b>Test Engineer</b>	Gino Huang	<b>Test Date</b>	Oct. 15, 2018
Test Results			
Test Temperature (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	62470.98	980	Within band
-30	62470.85	850	Within band
-20	62470.78	780	Within band
-10	62470.63	630	Within band
0	62470.54	540	Within band
10	62470.42	420	Within band
20	62470	Reference	Within band
30	62470.19	190	Within band
40	62470.31	310	Within band
50	62470.65	650	Within band
60	62470.72	720	Within band
70	62470.83	830	Within band
NOTE: The manufacturer's specified temperature range of -40 to 70°C.			

**3.6.5.2 Frequency Stability When Varying Supply Voltage**

Frequency Stability When Varying Supply Voltage			
Temp	25.2°C	Humidity	61%
Test Engineer	Gino Huang	Test Date	Oct. 15, 2018
Test Results			
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
93.5	62470.56	560	Within band
110	62470	Reference	Within band
126.5	62470.84	840	Within band
NOTE: For the applicable limit, see FCC 15.255(f).			



### **3.7 Operation Restriction and Group Installation**

#### **3.7.1 Limit of Operation Restriction and Group Installation**

Item	Limit
Operation Restriction	Operation is not permitted for the following products: <ul style="list-style-type: none"><li>♦ Equipment used on aircraft or satellites. (Refer as FCC 15.255 (a))</li><li>♦ Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. (Refer as FCC 15.255 (a))</li></ul>
Group Installation	Operation is not permitted for the following products: <ul style="list-style-type: none"><li>♦ External phase-locking (Refer as FCC 15.255 (h))</li></ul>

#### **3.7.2 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.

#### **3.7.3 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
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 31, 2018	Jan. 30, 2019	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 20, 2017	Dec. 19, 2018	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 29, 2017	Dec. 28, 2018	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	150kHz ~ 30MHz	May 22, 2018	May 21, 2019	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 27, 2018	Aug. 26, 2019	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 2019	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 28, 2018	Jun. 27, 2019	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2018	May 01, 2019	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 09, 2018	Jan. 08, 2019	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 04, 2018	Jul. 03, 2019	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 23, 2017	Nov. 22, 2018	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100354	9kHz ~ 2.75GHz	Dec. 08, 2017	Dec. 07, 2018	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz ~ 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz ~ 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-08	1 GHz ~26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz ~26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz ~26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Mixer	OML	M19HW/A	U91113-1	40 ~ 60 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH01-CB)
Mixer	OML	M15HW/A	V91113-1	50 ~ 75 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH01-CB)
Mixer	OML	M12HW/A	E91113-1	60 ~ 90 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH01-CB)
Mixer	OML	M08HW/A	F91113-1	90 ~ 140 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH01-CB)
Mixer	OML	M05HW/A	G91113-1	140 ~ 220 GHz	*Oct. 12, 2017	*Oct. 11, 2019	Radiation (03CH01-CB)
Detector	Millitech	DET-15-RPF W0	#A18185(074)	50 ~ 75 GHz	*Jan. 29, 2018	*Jan. 29, 2020	Radiation (03CH01-CB)
Pico Scope	Pico	Pico Scope 6402C	CX372/002	N/A	Jul. 13, 2018	Jul. 12, 2019	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	M19RH	U91113-A	40 ~ 60 GHz	N.C.R	N.C.R	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	M15RH	V91113-A	50 ~ 75 GHz	N.C.R	N.C.R	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	M12RH	E91113-A	60 ~ 90 GHz	N.C.R	N.C.R	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	M08RH	F91113-A	90 ~ 140 GHz	N.C.R	N.C.R	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	M05RH	G91113-A	140 ~ 220 GHz	N.C.R	N.C.R	Radiation (03CH01-CB)
Temp. and Humidity Chamber	Gaint Force	GTH-408-40-CP-AR	MAA1410-011	-40~100 degree	Sep. 14, 2018	Sep. 13, 2019	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
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Radiated Emission (40GHz ~ 220GHz)	4.7 dB	Confidence levels of 95%
Temperature	0.7°C	Confidence levels of 95%