FCC Radio Test Report

Equipment	: WGSoCAiP
Brand Name	: MRLOOP
Model No.	: ML60EF1
FCC ID	: 2AJAS60EFA100201606
Standard	: 47 CFR FCC Part 15.255
Applicant	: MR.Loop 7F.-6,NO.237,Sec.1,Datong Rd. Xizhi Dist., New Taipei City, Taiwan
Manufacturer	: Siliconware Precision Industries Co., Ltd No. 123, Sec.3,Da Fong Rd., Tantzu, Taichung 427, Taiwan, R.O.C

The product sample received on May 20, 2016 and completely tested on Jul. 14, 2016. We, SPORTON, 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Sam Chen
SPORTON INTERNATIONAL INC.

Testing Laboratory
1190

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Summary of Test Result

Standard Requirements and Conformance Test Specifications				
Report Clause	**Ref. Std. Clause**	**Description**	**Result**	**Remark**
3.1	FCC 15.207	AC Power Conducted Emissions	Complied	-
3.2	FCC 15.255(e)	Occupied Bandwidth	Complied	-
3.3	FCC 15.255(b)(1)	EIRP Power	Complied	-
3.4	FCC 15.255(e)	Peak Conducted Power	Complied	-
3.5	FCC 15.255(c)	Transmitter Spurious Emissions	Complied	-
3.6	FCC 15.255(f)	Frequency Stability	Complied	-
3.7	FCC 15.255(a),(h)	Operation Restriction and Group Installation	Complied	-

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR651828	Rev. 01	Initial issue of report	Aug. 10, 2016

1 General Description

1.1 Information

1.1.1 The Channel Plan(s)

Frequency Range	57-64 GHz
The Channel Plan(s)	
High-rate PHY (HRP) Band	Channel 2 HRP: 60.48 GHz Channel 3 HRP: 62.64 GHz

1.1.2 Transmit Operating Modes

The Different Transmit Operating Modes
☒ Operating mode 1: Smart Antenna Systems - with beam forming
☐ Operating mode 2: Smart Antenna Systems - without beam forming
☐ Operating mode 3: Single Antenna Equipment

1.1.3 Antenna Information

Antenna Information	
☐ Equipment placed on the market without antennas	
☒ Integral antenna	
Integral antenna gain	10.5 dBi for HRP
	☐ Temporary RF connector provided
	☒ No temporary RF connector provided
☐ External antenna (dedicated antennas)	
	☐ Single power level with corresponding antenna(s)
	☐ Multiple power settings and corresponding antenna(s)

1.1.4 Power Levels

Worst Power Levels for HRP			
Applicable power levels	☐ Conducted ☒ EIRP		
Antenna gain	10.5 dBi		
Frequency (GHz)	Highest setting (P_{high}): (dBm)		
	Modulation	AV Power	Peak Power
60.48	QPSK	12.11	23.97

1.1.5 Extreme Operating

The Extreme Operating Temperature Range that Apply to the Equipment			
☒ -40 °C to +80 °C			
☐ 0 °C to +40 °C			
☐ Other:			
EUT Power Type	From Host System		
Supply Voltage	☐ AC	State AC voltage	V
Supply Voltage	☒ DC	State DC voltage 5	V

1.1.6 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

1.1.7 User Condition

Intended Operation
☒ Indoor only
☐ Outdoor only

1.2 Additional Information Provided by the Submitter

1.2.1 Modulation

Modulation	
The HRP modulation is QPSK, 16-QAM.	
Can the transmitter operate un-modulated:	☒ Yes ☐ No

1.2.2 Duty Cycle

Duty Cycle			Duty Cycle Factor
The transmitter is intended for	HRP	100 %	0.00

1.3 Accessories

N/A

1.4 Support Equipment

Test Site: CO01-CB / For AC Power Conducted Emissions test

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	Inspiron 15	DoC
2	Earphone	SHYARO CHI	MIC-04	DoC
3	Mouse	Logitech	M-U0026	DoC
4	NB	DELL	E6430	DoC
5	Module (Device)	MR.Loop	ML60EF1	2AJAS60EFA100201606
6	Test fixture*2	MR.Loop	N/A	N/A

Test Site: 03CH01-CB / For Transmitter Spurious Emissions (below 1 GHz) test

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	E4300	DoC
2	Module (Device)	MRLOOP	ML60EF1	2AJAS60EFA100201606
3	Earphone	SHYARO CHI	MIC-04	N/A
4	Mouse	Logitech	M-U0026	DoC
5	NB	DELL	Inspiron 15	DoC
6	Test fixture*2	MR.Loop	N/A	N/A

Test Site: 03CH01-CB and TH01-CB / For Other test

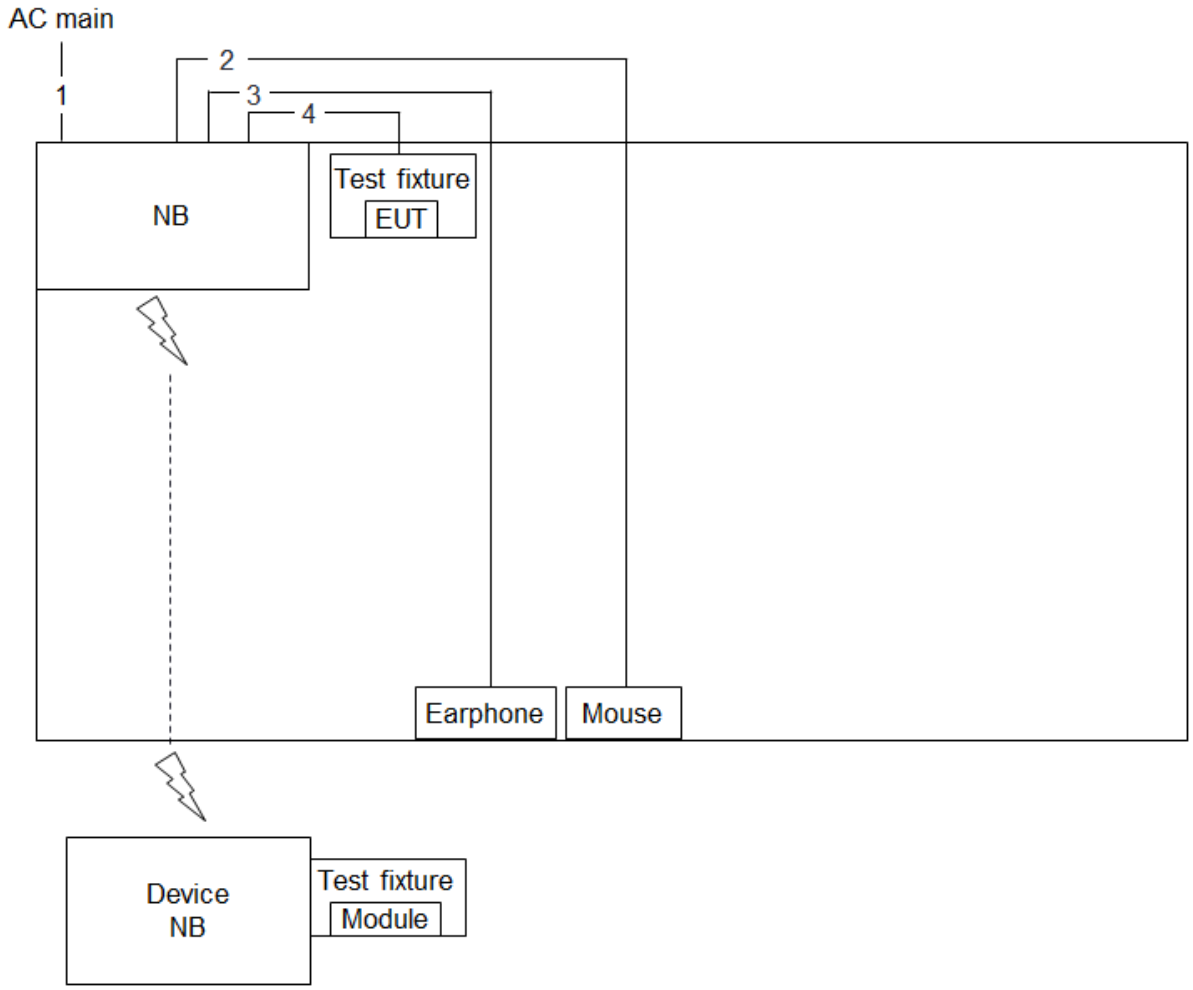
Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	Inspiron 15	DoC
2	Test fixture*2	MR.Loop	N/A	N/A

1.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

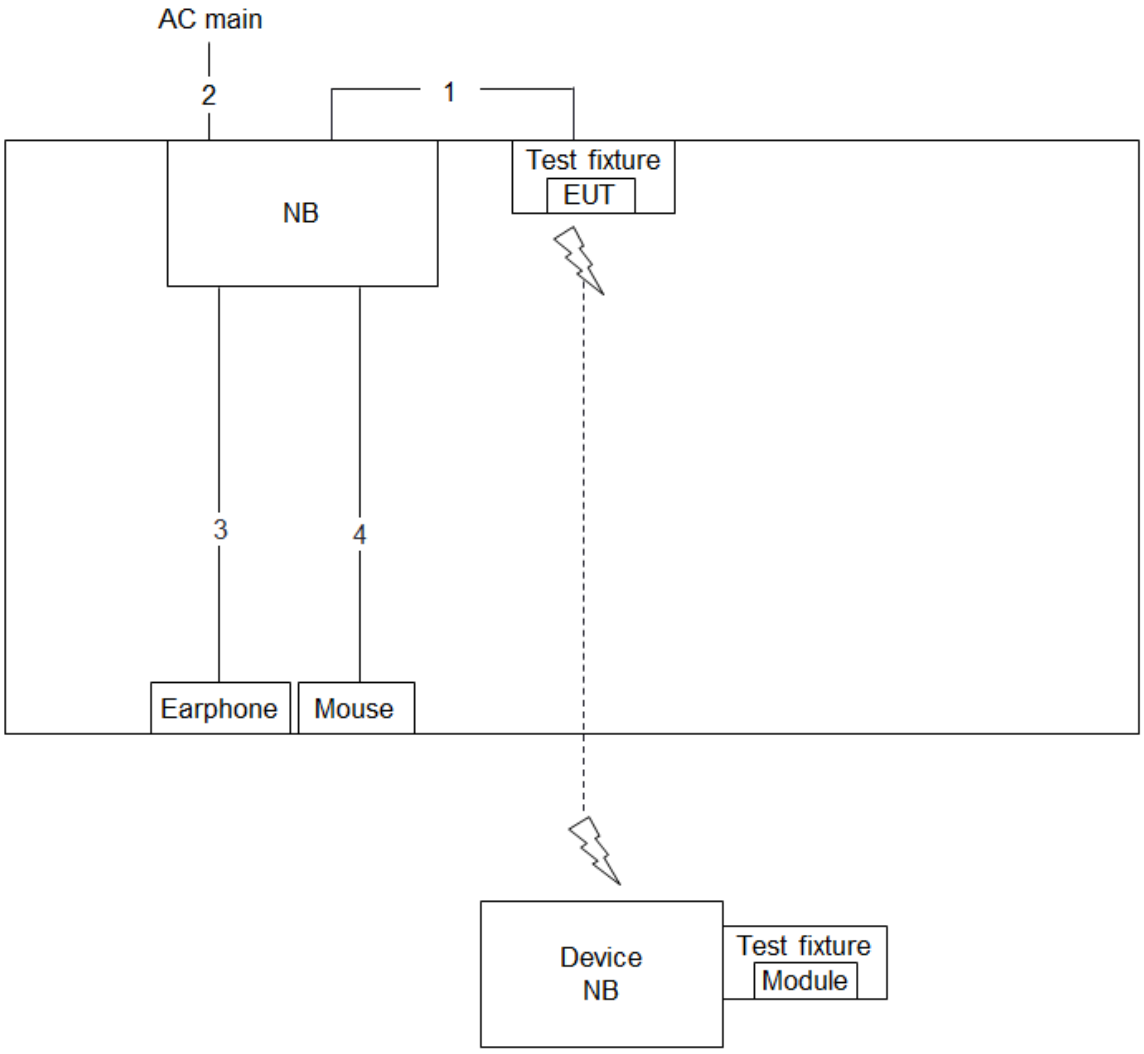
1.6 Test Setup Diagram

Test Setup Diagram - AC Power Conducted Emissions



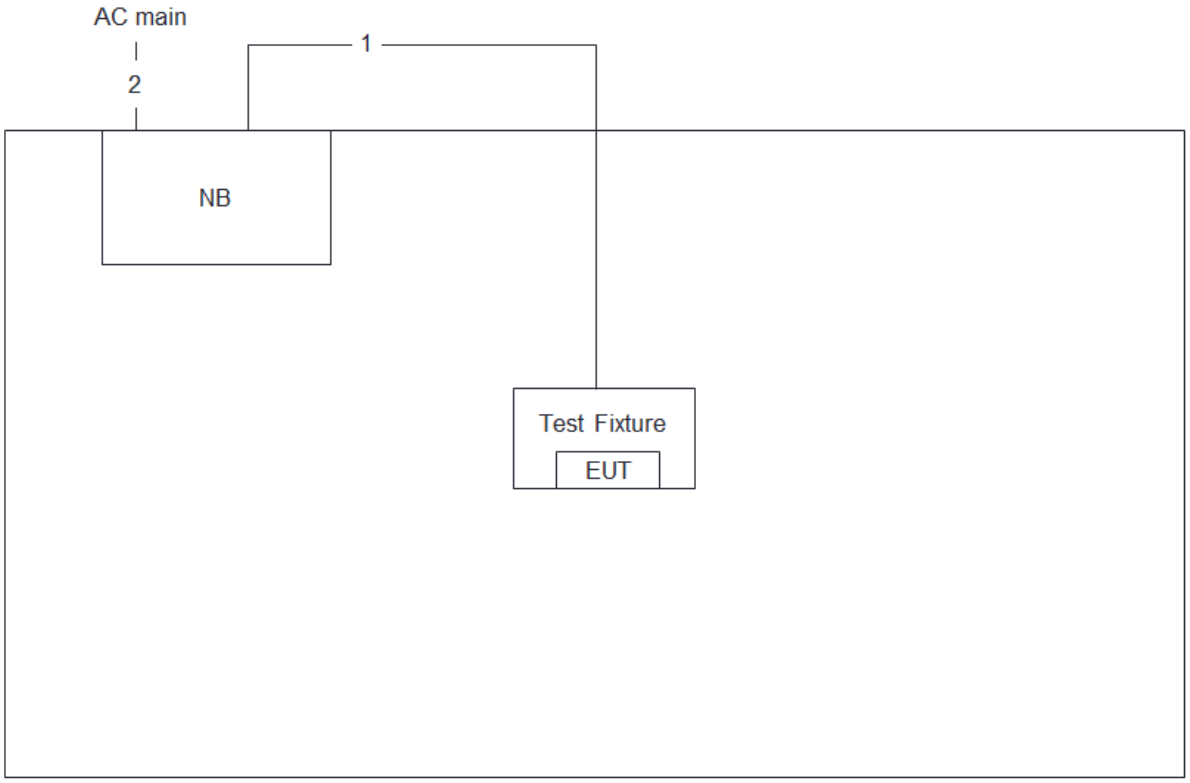
Item	Connection	Shielded	Length
1	Power cable	No	2.7m
2	USB cable	Yes	1.8m
3	Audio cable	No	1.4m
4	USB cable	Yes	1m

Test Setup Diagram - Transmitter Spurious Emissions below 1 GHz



Item	Connection	Shielded	Length
1	USB cable	Yes	1m
2	Power cable	No	2.7m
3	USB cable	Yes	1.8m
4	Audio cable	No	1.4m

Test Setup Diagram - Transmitter Spurious Emissions above 1 GHz



Item	Connection	Shielded	Length
1	USB cable	Yes	1.8m
2	Power cable	No	2.7m

1.7 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”

1.8 Testing Location

Testing Location				
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, 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 Site No.				
CO01-CB		03CH01-CB		TH01-CB

2 Test Configuration of Equipment under Test

2.1 Test Channel Frequencies

Nominal Channel Bandwidth			
Channel Plan (GHz)	**Low Channel (GHz)**	**Middle Channel (GHz)**	**High Channel (GHz)**
Channel 2 HRP: 60.48	-	60.48	-
Channel 3 HRP: 62.64	-	62.64	-

2.2 Conformance Tests and Related Test Frequencies

Test Item	**Test Frequencies (GHz) Channel Plan 2&3**
	HRP
AC Power Conducted Emissions	Normal Link
Occupied Bandwidth	60.48 & 62.64
EIRP Power	60.48 & 62.64
Peak Conducted Power	60.48 & 62.64
Transmitter Spurious Emissions (below 1 GHz)	Normal Link
Transmitter Spurious Emissions (1 GHz-40 GHz)	60.48 & 62.64
Transmitter Spurious Emissions (above 40 GHz)	60.48 & 62.64
Frequency Stability	Un-Modulation

2.3 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)**
60.48	0.02	0.0049603	0.161	16.13
62.64	0.02	0.0047893	0.167	16.70

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

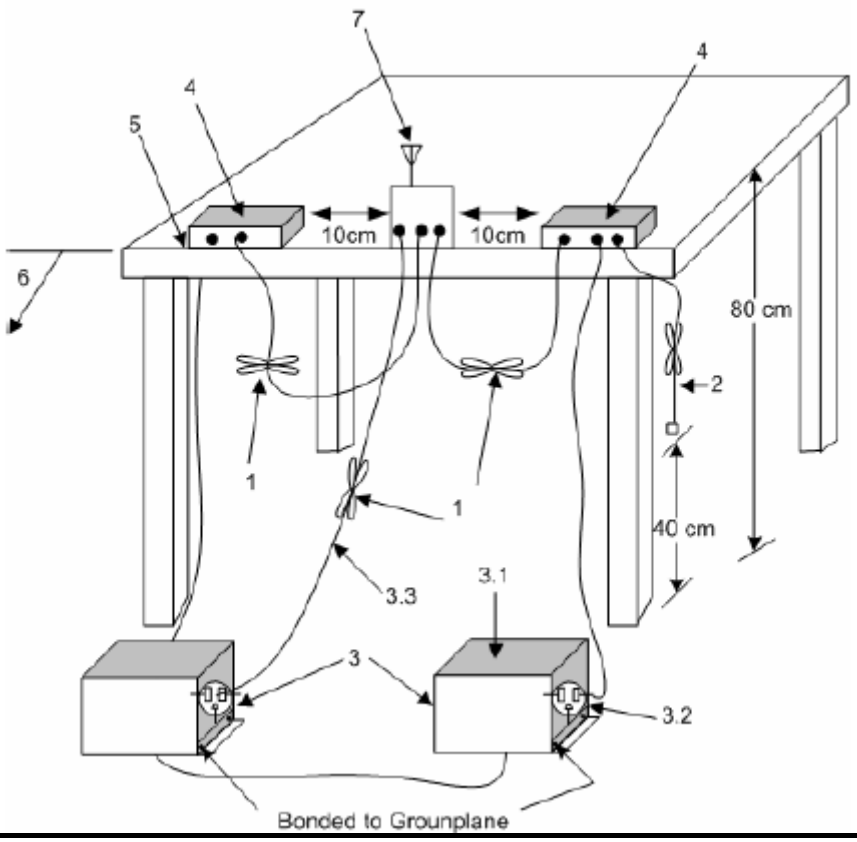
Refer a measuring instruments list in this test report.

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



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 (see ANSI C63.10, clause 6.2.3.2).
2. 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 (see ANSI C63.10, clause 6.2.2).
3. EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 ohm loads. LISN can be placed on top of, or immediately beneath, reference ground plane (see ANSI C63.10, clauses 6.2.2 and 6.2.3). 3.1. All other equipment powered from additional LISN(s). 3.2. A multiple-outlet strip can 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 (see ANSI C63.10, clause 6.2.3.2).
6. Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see ANSI C63.10, clause 6.2.2 for options).
7. Antenna may be integral or detachable. If detachable, the antenna shall be attached for this test.

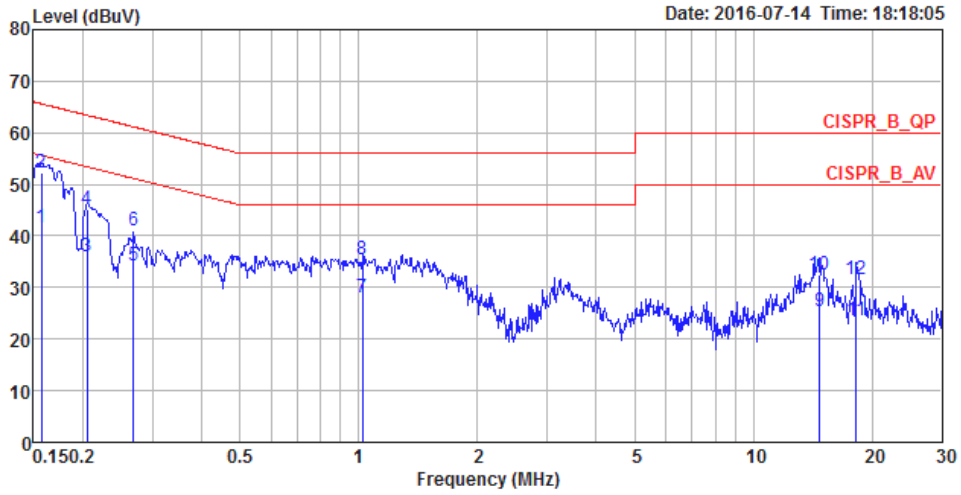
3.1.5 Test Result of AC Power Conducted Emissions

Test Conditions	see ANSI C63.10, clause 5.11
Test Setup	see ANSI C63.10, clause 6.2.3

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.

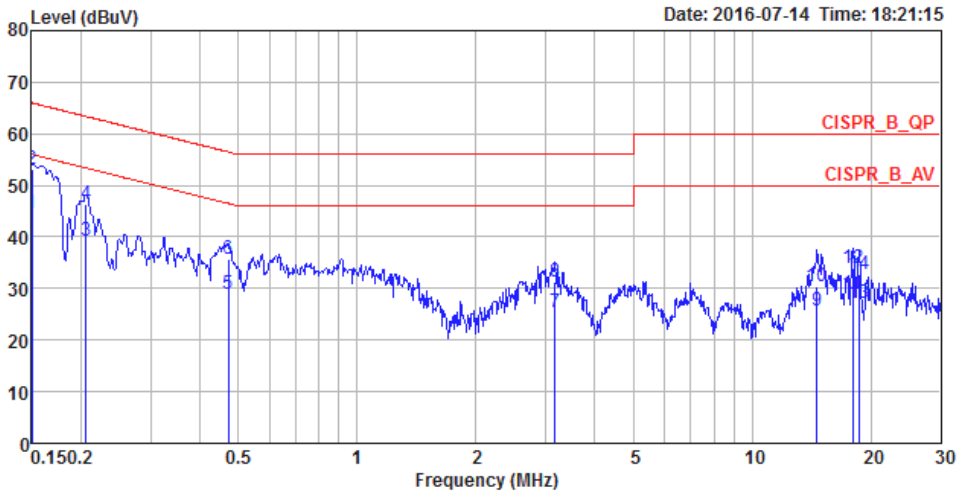
NOTE 2: “>20dB” means the tables in this clause should only list values of spurious emissions that exceed the level of 20 dB below the applicable limit, see ANSI C63.4, clause 10.1.8.1.

Temp	22°C	Humidity	59%
Test Engineer	GN Hou	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1573	41.52	-14.08	55.60	31.33	10.02	0.17	LINE	Average
2	0.1573	52.16	-13.44	65.60	41.97	10.02	0.17	LINE	QP
3	0.2050	35.92	-17.48	53.40	25.82	9.92	0.18	LINE	Average
4	0.2050	45.29	-18.11	63.40	35.19	9.92	0.18	LINE	QP
5	0.2687	34.14	-17.02	51.16	24.11	9.92	0.11	LINE	Average
6	0.2687	40.98	-20.18	61.16	30.95	9.92	0.11	LINE	QP
7	1.0211	28.03	-17.97	46.00	17.37	9.94	0.72	LINE	Average
8	1.0211	35.39	-20.61	56.00	24.73	9.94	0.72	LINE	QP
9	14.7497	25.26	-24.74	50.00	14.81	10.23	0.22	LINE	Average
10	14.7497	32.52	-27.48	60.00	22.07	10.23	0.22	LINE	QP
11	18.2316	23.76	-26.24	50.00	13.25	10.28	0.23	LINE	Average
12	18.2316	31.68	-28.32	60.00	21.17	10.28	0.23	LINE	QP

Temp	22°C	Humidity	59%
Test Engineer	GN Hou	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1500	44.51	-11.49	56.00	34.33	10.02	0.16	NEUTRAL	Average
2	0.1500	53.25	-12.75	66.00	43.07	10.02	0.16	NEUTRAL	QP
3	0.2061	39.26	-14.10	53.36	29.16	9.92	0.18	NEUTRAL	Average
4	0.2061	46.21	-17.15	63.36	36.11	9.92	0.18	NEUTRAL	QP
5	0.4711	28.79	-17.70	46.49	18.73	9.92	0.14	NEUTRAL	Average
6	0.4711	35.66	-20.83	56.49	25.60	9.92	0.14	NEUTRAL	QP
7	3.1731	25.32	-20.68	46.00	15.26	9.98	0.08	NEUTRAL	Average
8	3.1731	31.28	-24.72	56.00	21.22	9.98	0.08	NEUTRAL	QP
9	14.5942	25.55	-24.45	50.00	15.12	10.22	0.21	NEUTRAL	Average
10	14.5942	30.31	-29.69	60.00	19.88	10.22	0.21	NEUTRAL	QP
11	17.9441	28.94	-21.06	50.00	18.43	10.28	0.23	NEUTRAL	Average
12	17.9441	33.80	-26.20	60.00	23.29	10.28	0.23	NEUTRAL	QP

3.2 Occupied Bandwidth

3.2.1 Limit of Occupied Bandwidth

6dBc Bandwidth (see Note 1)	None
26dBc Bandwidth	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.

3.2.2 Measuring Instruments

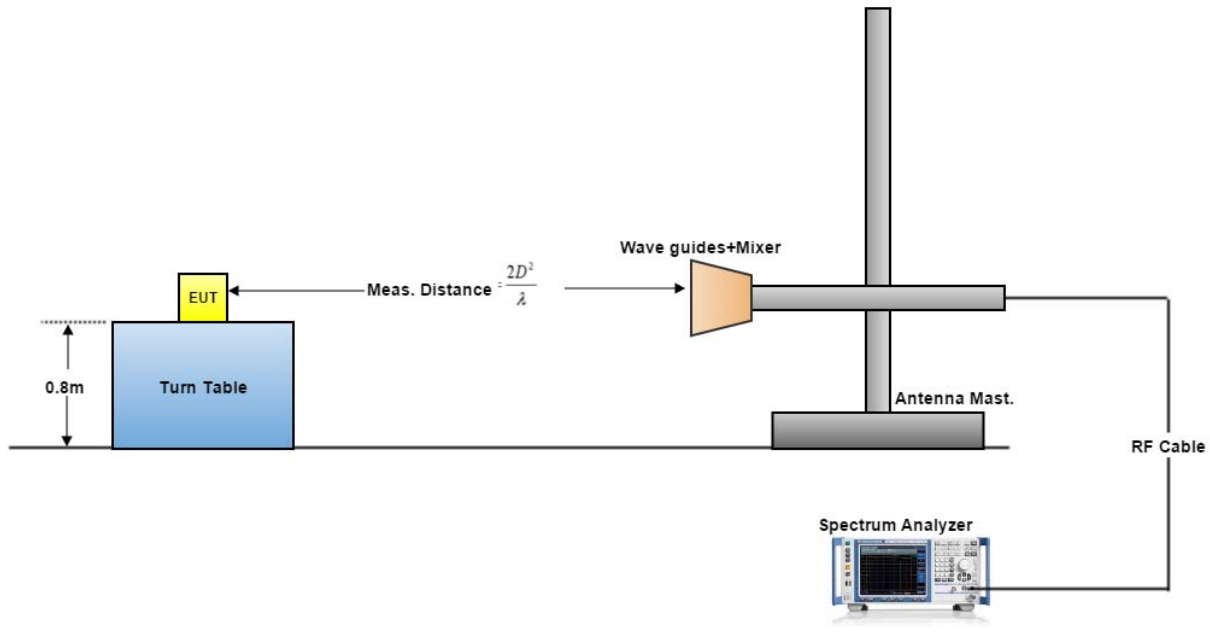
Refer a measuring instruments list in this test report.

3.2.3 Test Procedures

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

3.2.4 Test Setup

Occupied Channel Bandwidth



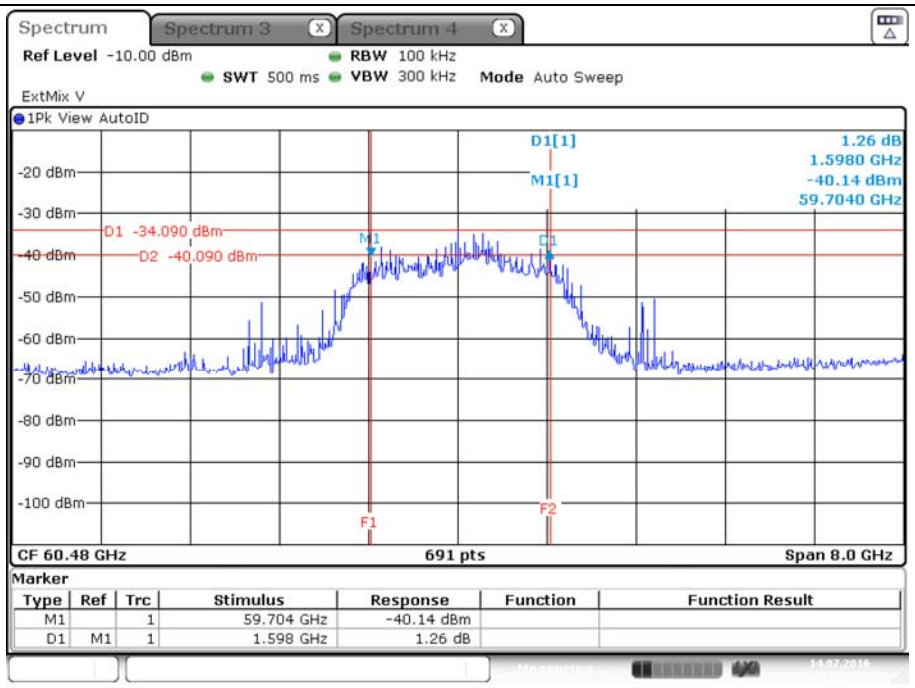
3.2.5 Test Result of Occupied Bandwidth

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	23℃	**Humidity**	61%		
Test Engineer	Peter Wu				
Test Results					
Channel Plan (GHz)	**Test Freq. (GHz)**	**6 dBc Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**	**26 dBc Bandwidth (MHz)**	**Limit (MHz)**
Channel 2 HRP: 60.48	60.48	1598	2257.60	3195.00	N/A
Channel 3 HRP: 62.64	62.64	1866.9	2720.69	3716.00	N/A

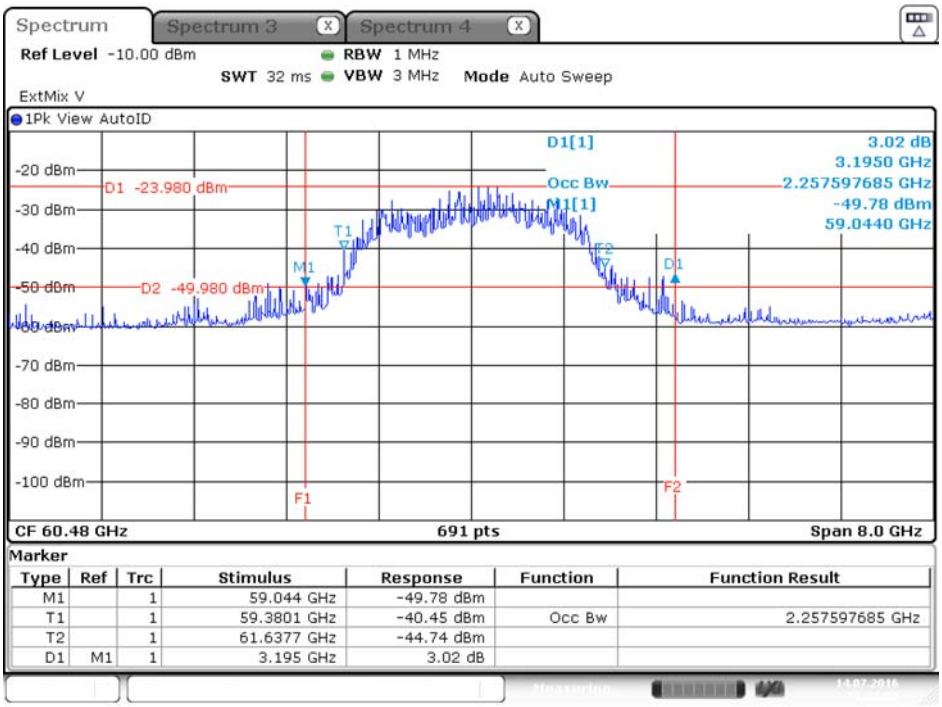
3.2.5.1 Bandwidth Plots

Channel Plan: Channel 2 HRP: 60.48 GHz
Test Frequency: 60.48 GHz
6 dBc Bandwidth



Date: 14.JUL.2016 11:17:10

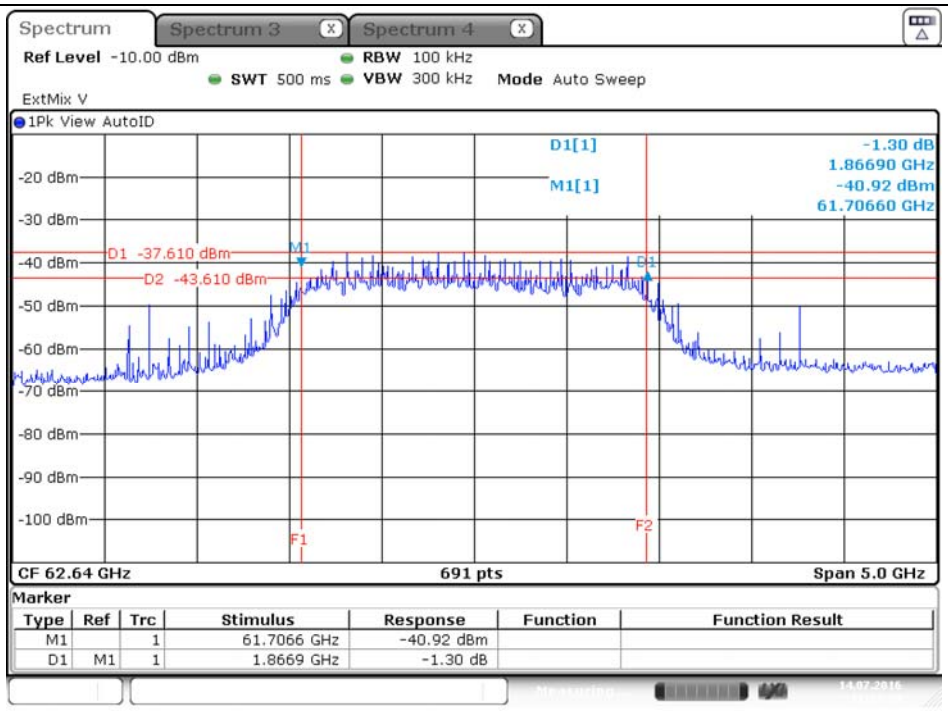
Occupied Bandwidth&26 dBc Bandwidth



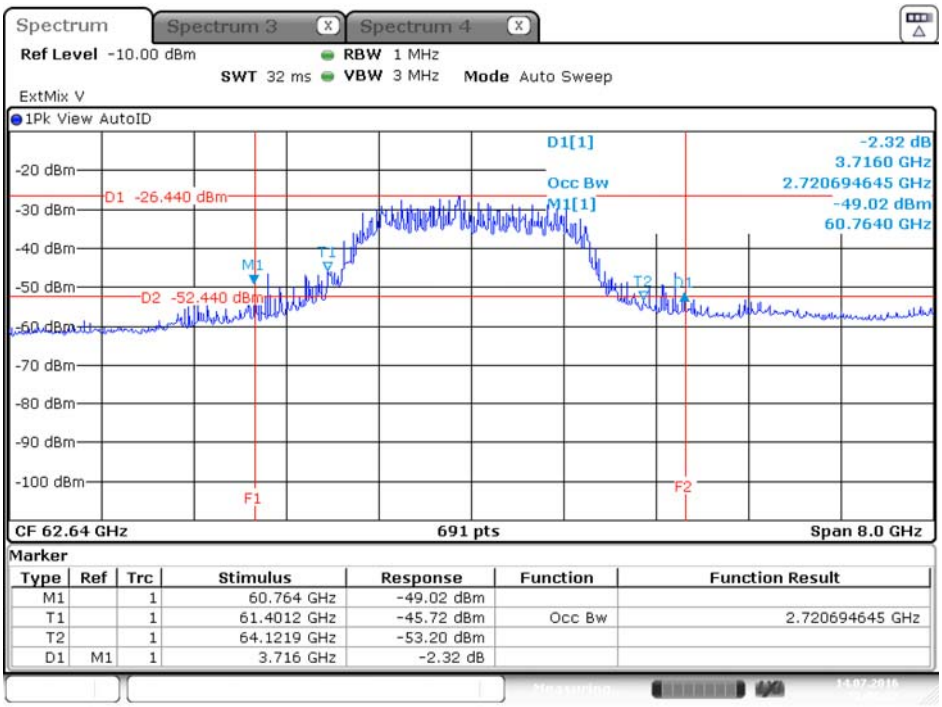
Date: 14.JUL.2016 11:13:16

Channel Plan: Channel 3 HRP: 62.64 GHz
Test Frequency: 62.64 GHz

6 dBc Bandwidth



Occupied Bandwidth&26 dBc Bandwidth



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 61-61.5GHz	10 dBm	13 dBm
Except fixed field disturbance sensors at 61-61.5GHz	N/A	10 dBm
Except fixed field disturbance sensors(indoor)	40 dBm	43 dBm
Except fixed field disturbance sensors(outdoor)	82 dBm	85 dBm

Note: For outdoor device minus 2 dB for every dB that the antenna gain is less than 51 dBi.

For the applicable limit, see FCC 15.255 (b)

3.3.2 Measuring Instruments

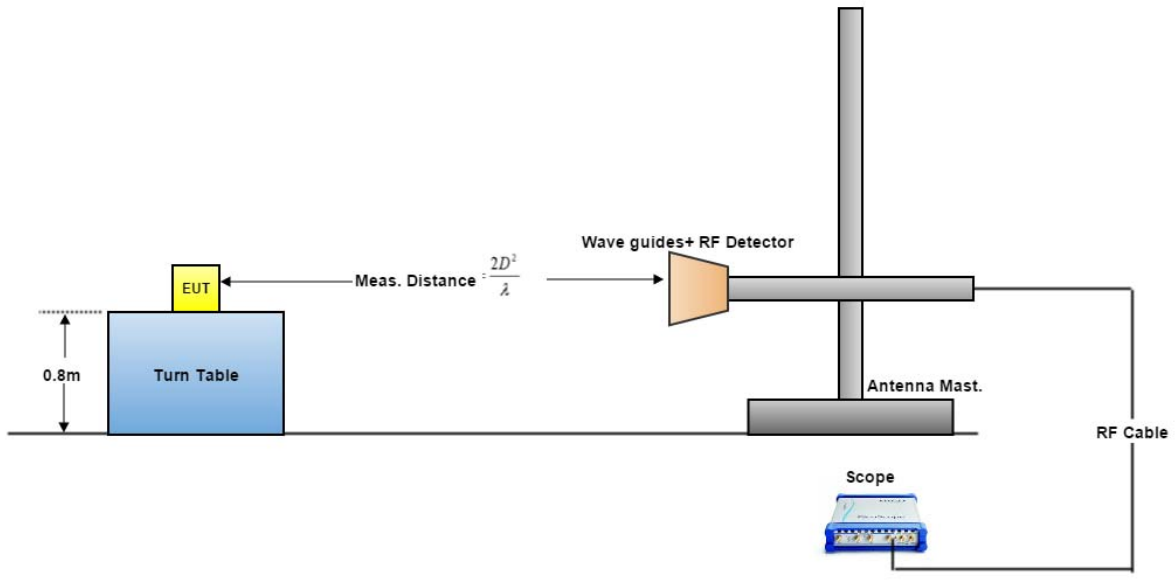
Refer a measuring instruments list in this test report.

3.3.3 Test Procedures

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

3.3.4 Test Setup

EIPR Power



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	23℃				Humidity		61%			
Test Engineer	Peter Wu				Test Distance		0.25			
Test Results										
Channel Plan (GHz)	Test Freq. (GHz)	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
Channel 2 HRP: 60.48	60.48	108.27	11.33	-9.08	-20.94	140.81	128.95	23.97	12.11	43	40
Channel 3 HRP: 62.64	62.64	102.14	8.06	-9.84	-22.78	140.35	127.41	23.51	10.57	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.

$E = 126.8 – 20\log(\lambda) + P - G$

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 (b)

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(e)	
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

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.	

3.4.4.1 Peak Conducted Power

Temp	23℃	Humidity	61%
Test Engineer	Peter Wu		
Test Date	Jul. 06, 2016 ~ Jul. 14, 2016		

Test Results

Channel Plan (GHz)	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)
Channel 2 HRP: 60.48	60.48	23.97	10.5	13.47	22.226	1598.00	500.00
Channel 3 HRP: 62.64	62.64	23.51	10.5	13.01	20.014	1866.90	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 3.2.5.

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

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

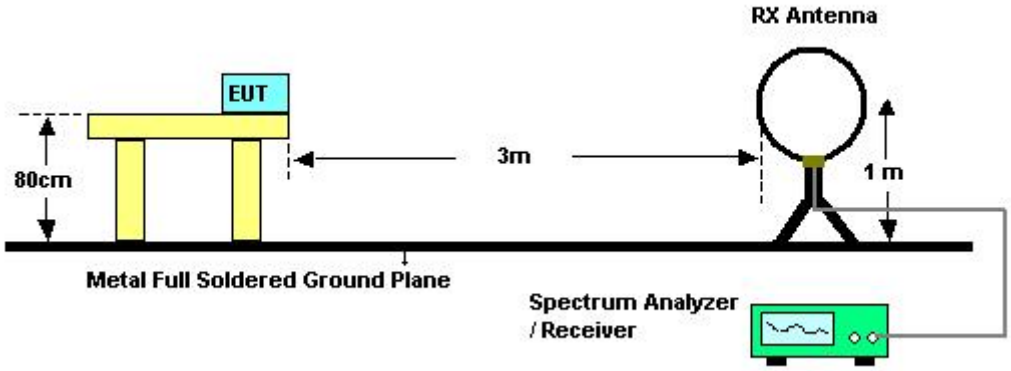
Frequency Range	Limit
Radiated emissions below 40 GHz	FCC 15.209
Radiated emissions above 40 GHz – 200GHz	90 pW/cm^2 @ 3 m (Equivalent EIRP 102 μW, -9.91dBm)
NOTE 1: For the applicable limit, see FCC 15.255(c) NOTE 2: Spurious emissions shall not exceed the level of the fundamental emission. NOTE 3: publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57-64 GHz band, are permitted in the 57-57.05 GHz band. The development of standards for this channel shall be performed pursuant to authorizations issued under part 5 of this chapter.	

3.5.2 Test Procedures

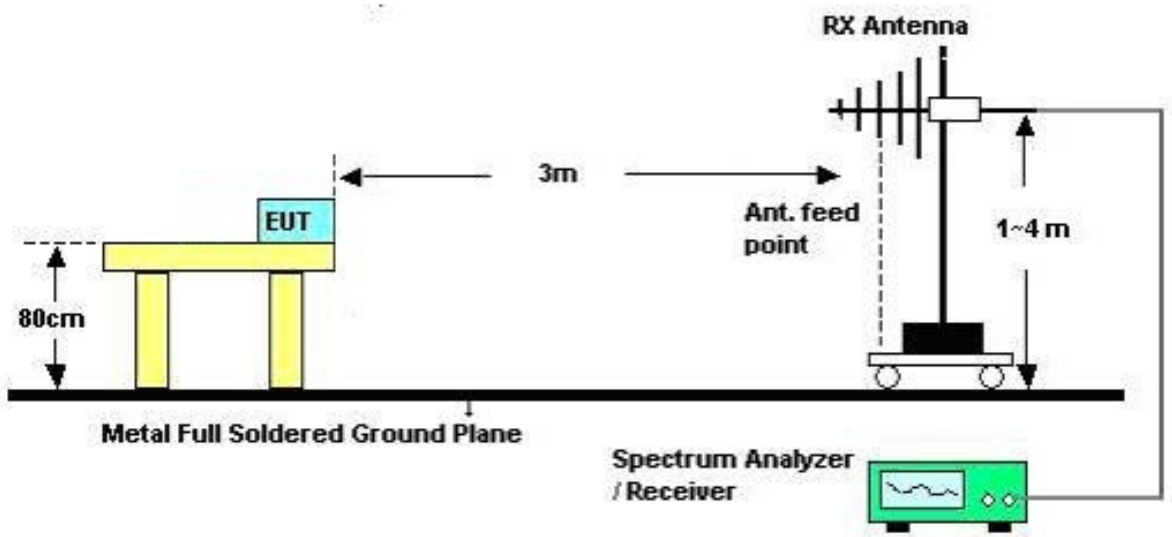
Method of measurement: Refer as ANSI C63.10-2013, clause 9.12

3.5.3 Test Setup

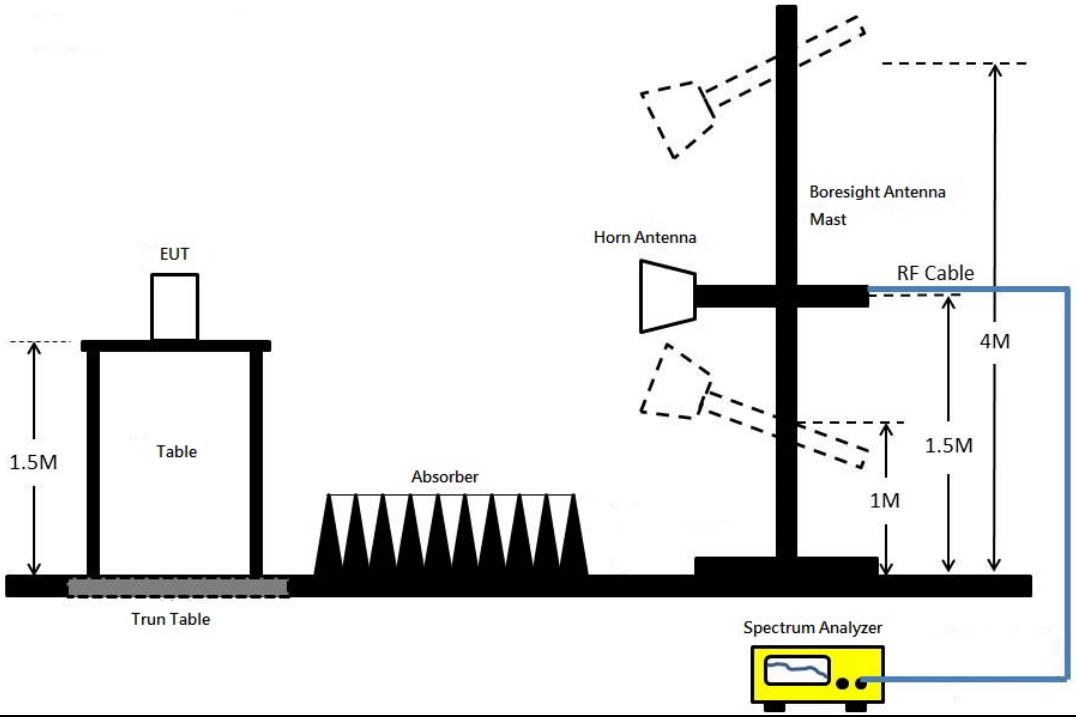
Transmitter Spurious Emissions
9kHz ~30MHz

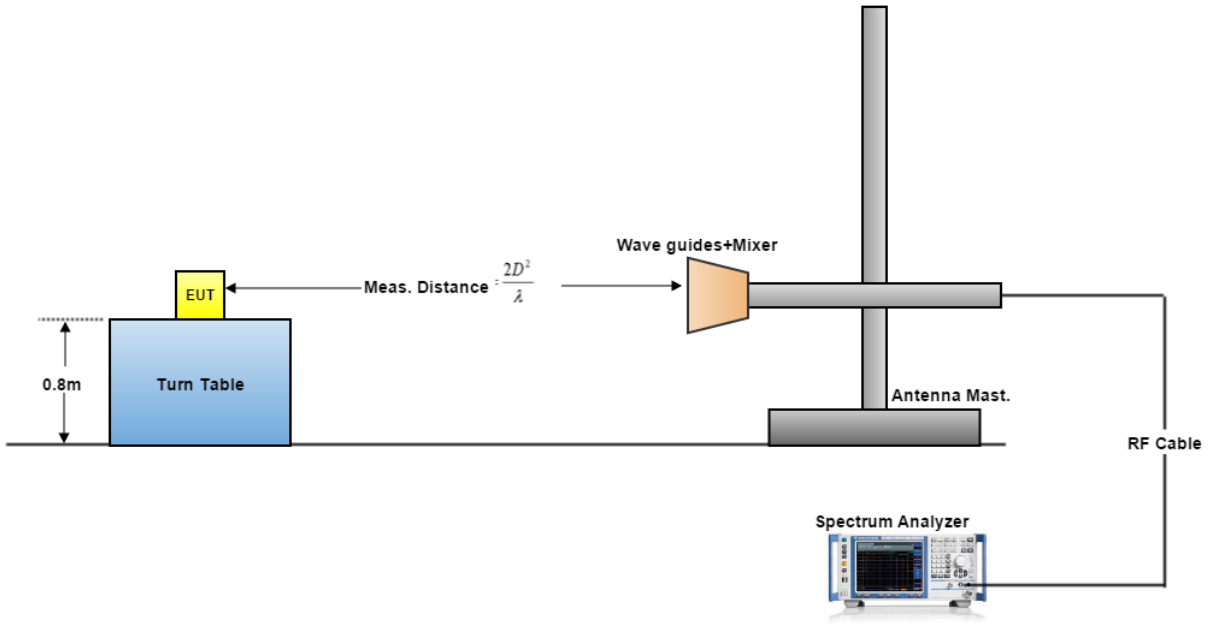


30MHz~1GHz



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.

3.5.4 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.	

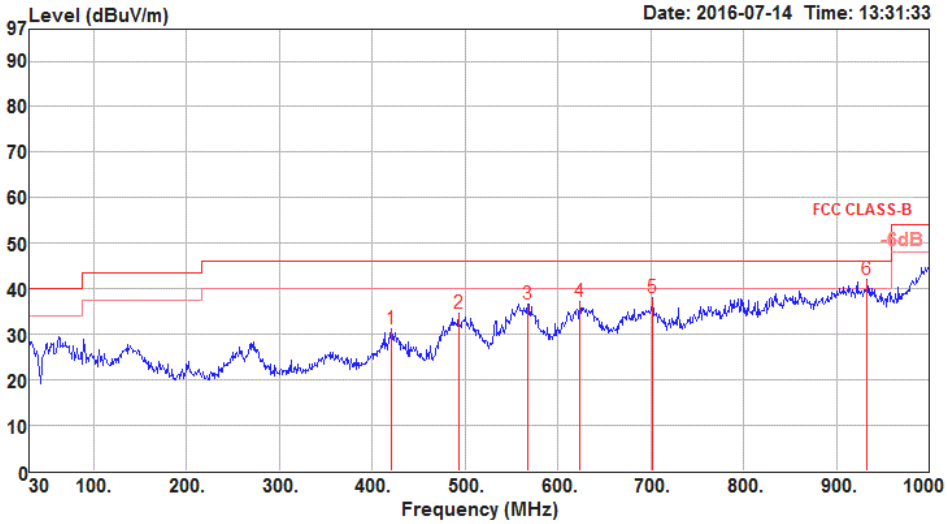
3.5.4.1 Test Result of Transmitter Spurious Emissions (Below 30MHz)

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

3.5.4.2 Test Result of Transmitter Spurious Emissions

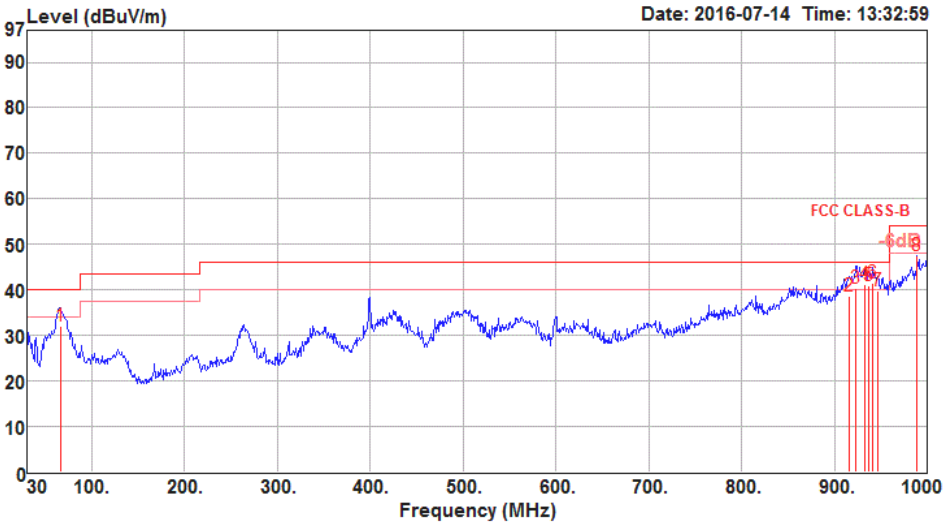
Temp	23°C	**Humidity**	61%
Test Engineer	Peter Wu	**Test Distance**	3 m
Test Range	30 MHz – 1000 MHz	**Test Configuration**	Normal Link

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	420.91	31.13	46.00	-14.87	34.58	2.41	22.55	28.41	100	360	Peak	VERTICAL
2	492.69	34.51	46.00	-11.49	37.17	2.57	23.51	28.74	150	360	Peak	VERTICAL
3	567.38	36.71	46.00	-9.29	37.95	2.75	24.80	28.79	100	360	Peak	VERTICAL
4	623.64	37.16	46.00	-8.84	37.78	2.91	25.24	28.77	125	360	Peak	VERTICAL
5	702.21	38.07	46.00	-7.93	37.93	3.16	25.62	28.64	200	360	Peak	VERTICAL
6	933.07	42.03	46.00	-3.97	38.43	3.56	27.93	27.89	100	360	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	65.89	32.02	40.00	-7.98	46.51	1.42	12.48	28.39	125	360	QP	HORIZONTAL
2	915.61	38.52	46.00	-7.48	35.20	3.50	27.77	27.95	125	360	QP	HORIZONTAL
3	923.37	40.44	46.00	-5.56	37.01	3.52	27.83	27.92	100	250	QP	HORIZONTAL
4	932.10	41.10	46.00	-4.90	37.50	3.56	27.93	27.89	150	360	QP	HORIZONTAL
5	936.95	40.85	46.00	-5.15	37.20	3.57	27.97	27.89	125	360	QP	HORIZONTAL
6	941.80	41.57	46.00	-4.43	37.80	3.59	28.03	27.85	125	360	QP	HORIZONTAL
7	946.65	39.65	46.00	-6.35	35.80	3.60	28.07	27.82	150	360	QP	HORIZONTAL
8	989.33	47.54	54.00	-6.46	43.30	3.74	28.18	27.68	100	360	Peak	HORIZONTAL

Test Plan: Channel 2 HRP: 60.48

Temp	23°C	**Humidity**	61%
Test Engineer	Peter Wu	**Test Distance**	3 m
Test Range	1 GHz – 18 GHz	**Test Freq. (GHz)**	60.48
Test Date	Jul. 06, 2016 ~ Jul.14, 2016		

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	1152.29	52.79	74.00	-21.21	59.43	3.28	24.32	34.24	151	75	Peak	VERTICAL
2	1161.28	40.65	54.00	-13.35	47.25	3.29	24.36	34.25	151	75	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	1145.13	57.10	74.00	-16.90	63.77	3.27	24.30	34.24	160	121	Peak	HORIZONTAL
2	1151.23	43.49	54.00	-10.51	50.13	3.28	24.32	34.24	160	121	Average	HORIZONTAL

Temp	24°C	Humidity	64%
Test Engineer	Peter Wu	Test Distance	1 m
Test Range	18 GHz – 40 GHz	Test Freq. (GHz)	60.48
Test Date	Jul. 06, 2016 ~ Jul.14, 2016		

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	29000.27	39.83	63.54	-23.71	37.95	10.56	40.10	48.78	100	126	Average	VERTICAL
2	29000.27	53.65	83.54	-29.89	51.77	10.56	40.10	48.78	100	126	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	36875.70	42.85	63.54	-20.69	42.69	11.69	42.05	53.58	100	244	Average	HORIZONTAL
2	36875.70	57.15	83.54	-26.39	56.99	11.69	42.05	53.58	100	244	Peak	HORIZONTAL

Test Plan: Channel 3 HRP: 62.64

Temp	23°C	**Humidity**	61%
Test Engineer	Peter Wu	**Test Distance**	3 m
Test Range	1 GHz – 18 GHz	**Test Freq. (GHz)**	62.64
Test Date	Jul. 06, 2016 ~ Jul.14, 2016		

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	1152.29	52.96	74.00	-21.04	59.60	3.28	24.32	34.24	143	67	Peak	VERTICAL
2	1160.68	40.52	54.00	-13.48	47.12	3.29	24.36	34.25	143	67	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	1144.76	57.26	74.00	-16.74	63.93	3.27	24.30	34.24	161	109	Peak	HORIZONTAL
2	1152.00	43.62	54.00	-10.38	50.26	3.28	24.32	34.24	161	109	Average	HORIZONTAL

Temp	24°C	**Humidity**	64%
Test Engineer	Peter Wu	**Test Distance**	1 m
Test Range	18 GHz – 40 GHz	**Test Freq. (GHz)**	62.64
Test Date	Jul. 06, 2016 ~ Jul.14, 2016		

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	36391.57	42.27	63.54	-21.27	42.09	11.52	42.11	53.45	100	314	Average	VERTICAL
2	36391.57	56.54	83.54	-27.00	56.36	11.52	42.11	53.45	100	314	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	36700.04	42.44	63.54	-21.10	42.20	11.63	42.12	53.51	100	264	Average	HORIZONTAL
2	36700.04	56.20	83.54	-27.34	55.96	11.63	42.12	53.51	100	264	Peak	HORIZONTAL

Temp	23°C	Humidity	61%
Test Engineer	Peter Wu	Test Date	Jul. 06, 2016 ~ Jul. 14, 2016
Test Range	40GHz – 200GHz		

Test Plan: Channel 2 HRP: 60.48

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
60.48	23.0	0.25	42.33	-78.48
EIRP (dBm)	**Specification Distance (m)**	**Power Density (pW/m^2)**	**Limit (pW/cm^2)**	**Test Result**
-48.55	3	0.1236	90.00	Complied

Test Plan: Channel 3 HRP: 62.64

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
62.64	23.0	0.25	43.77	-77.62
EIRP (dBm)	**Specification Distance (m)**	**Power Density (pW/m^2)**	**Limit (pW/cm^2)**	**Test Result**
-47.40	3	0.1611	90.00	Complied

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

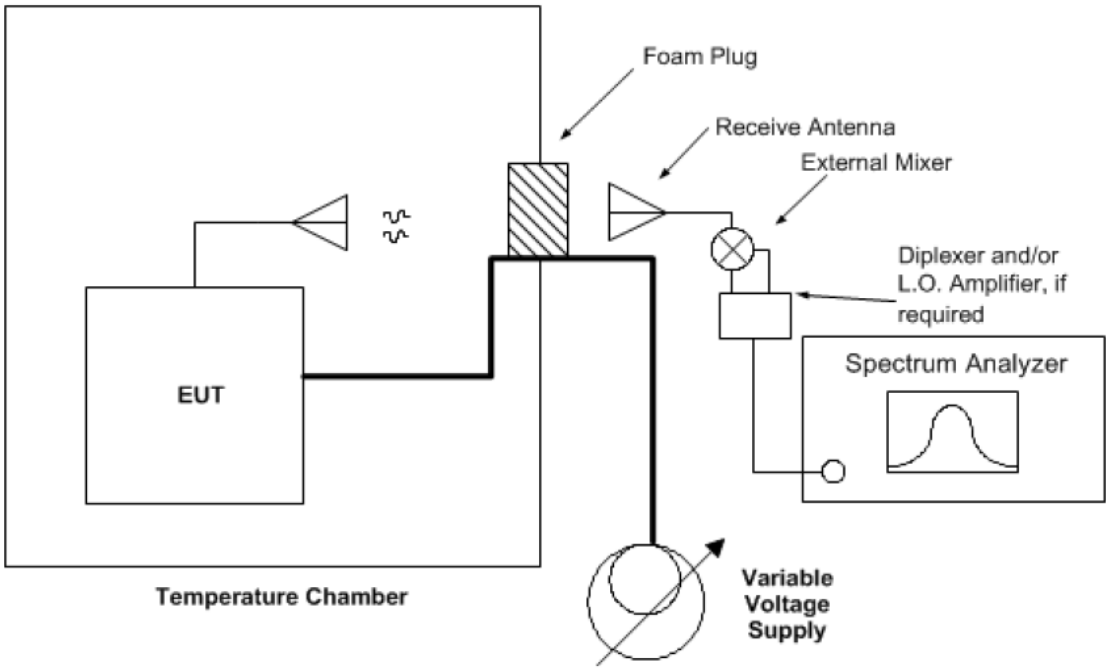
Refer a measuring instruments list in this test report.

3.6.3 Test Procedures

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

3.6.4 Test Setup

Frequency Stability



3.6.5 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.	

3.6.5.1 Frequency Stability with Respect to Ambient Temperature

Frequency Stability with Respect to Ambient Temperature			
Temp	23℃	**Humidity**	61%
Test Engineer	Peter Wu	**Test Date**	Jul. 06, 2016 ~ Jul. 14, 2016
Test Results			
Test Temperature (°C)	**Measured Frequency (MHz)**	**Delta Frequency (kHz)**	**Limit (±kHz)**
-40	60485.5	-500	Within band
-30	60491.5	5500	Within band
-20	60491.5	5500	Within band
-10	60515	29000	Within band
0	60503.5	17500	Within band
10	60503.5	17500	Within band
20	60486	Reference	Within band
30	60491.5	5500	Within band
40	60485.5	-500	Within band
50	60480	-6000	Within band
60	60486	0	Within band
70	60480	-6000	Within band
80	60492	6000	Within band
NOTE: 1. For the applicable limit, see FCC 15.255(f). 2. The manufacturer's specified temperature range of -40 to 80°C.			

3.6.5.2 Frequency Stability When Varying Supply Voltage

Frequency Stability When Varying Supply Voltage			
Temp	23℃	**Humidity**	61%
Test Engineer	Peter Wu	**Test Date**	Jul. 06, 2016 ~ Jul. 14, 2016
Test Results			
Test Voltage: (Vdc)	**Measured Frequency (MHz)**	**Delta Frequency (kHz)**	**Limit (±kHz)**
4.25	60503.5	17500	Within band
5	60486	Reference	Within band
5.75	60503	17000	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: ♦ 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))

3.7.2 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	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 27, 2016	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 08, 2015	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 23, 2015	Conduction (CO01-CB)
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 27, 2016	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 12, 2015*	Radiation (03CH01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	37880	20MHz ~ 2GHz	Sep. 03, 2015	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170585	18GHz ~ 40GHz	Sep. 22, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Mar. 15, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 13, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 16, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Mixer	OML	M19HW/A	U91113-1	40 ~ 60 GHz	Sep. 09, 2015*	Radiation (03CH01-CB)
Mixer	OML	M15HW/A	V91113-1	50 ~ 75 GHz	Sep. 14, 2015*	Radiation (03CH01-CB)
Mixer	OML	M12HW/A	E91113-1	60 ~ 90 GHz	Sep. 17, 2015*	Radiation (03CH01-CB)
Mixer	OML	M08HW/A	F91113-1	90 ~ 140 GHz	Sep. 21, 2015*	Radiation (03CH01-CB)
Mixer	OML	M05HW/A	G91113-1	140 ~ 220 GHz	Sep. 24, 2015*	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	HO19R	U91113-A	40 ~ 60 GHz	Sep. 09, 2015*	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	HO15R	V91113-A	50 ~ 75 GHz	Sep. 14, 2015*	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	HO12R	E91113-A	60 ~ 90 GHz	Sep. 17, 2015*	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	HO08R	F91113-A	90 ~ 140 GHz	Sep. 21, 2015*	Radiation (03CH01-CB)
Standard Horn Antenna	Custom Microwave	HO05R	G91113-A	140 ~ 220 GHz	Sep. 24, 2015*	Radiation (03CH01-CB)
Pico Scope	Pico	Pico Scope 6402C	CX372/002	N/A	Jul. 06, 2015	Radiation (03CH01-CB)
RF Detector	millitech	DET-15-RPFW0	38	50 ~ 75 GHz	Oct. 31, 2015*	Radiation (03CH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 03, 2016	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%