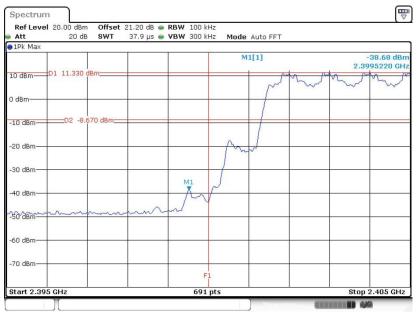


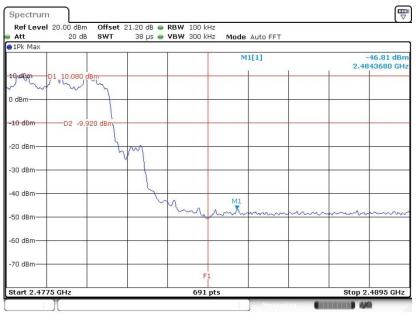
#### <2Mbps>

#### Hopping Mode Low Band Edge Plot



Date: 3.MAY.2020 12:23:22

#### Hopping Mode High Band Edge Plot

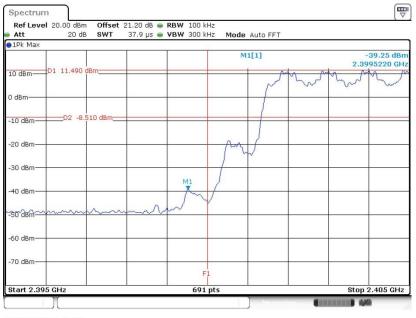


Date: 3.MAY.2020 12:29:41



#### <3Mbps>

#### Hopping Mode Low Band Edge Plot



Date: 3.MAY.2020 14:42:51

#### Hopping Mode High Band Edge Plot



Date: 3.MAY.2020 14:49:48



## 3.7 Conducted Spurious Emission Measurement

## 3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

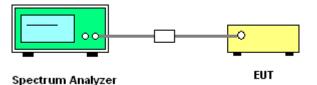
## 3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

## 3.7.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 7.8.8.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

## 3.7.4 Test Setup



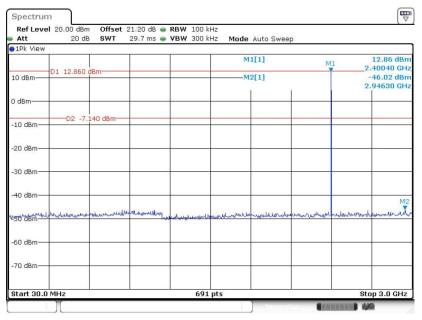
**Sporton International (Shenzhen) Inc.** TEL : +86-512-57900158 FAX : +86-512-57900958 FCC ID: 2ABZ2-EF014



## 3.7.5 Test Result of Conducted Spurious Emission

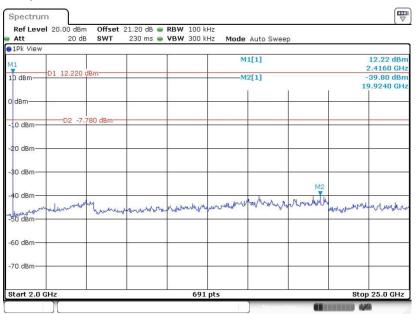
#### <1Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 3.MAY.2020 11:14:02

#### 1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



Date: 3.MAY.2020 11:14:36



Att	el 20.00 dBm 20 dB		21.20 dB	VBW 300 k		Auto Sweep	5	
1Pk View								
					M	1[1]	M	
10 dBm	D1 13.820 (	1Bm			M:	2[1]		2.43910 GH: -46.01 dBn 2.92480 GH:
D dBm								
-10 dBm—	D2 -6.:	180 dBm						
20 dBm—								
-30 dBm	-							
40 dBm				0.00				M2
stor all when	nunnighteriter	induction	withung	and and a service	Huteren	burrhymen	munduber	with a doct and a particular of a
60 dBm—								
70 dBm—							~	
Start 30.0					pts			Stop 3.0 GHz

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 11:25:52

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

Att	20.00 dBm 20 dB		21.20 dB	VBW 300 k		Auto Swee	n		
1Pk View									
11					M	1[1]			13.78 dBr 2.4490 GH
LO dBm—	D1 13.780	dBm			M	2[1]	5		-41.02 dBi 6.4290 GH
) dBm									
10 dBm—	D2 -6.	220 dBm							
20 dBm—									
30 dBm—									
40 dBm-	muhallower	ne lunderhave	www.	humana	pherena	M2 har Man may h	www.rnk	ullun war	uMgArran.ur
60 dBm—								-	
70 dBm—									
Start 2.0					pts				0 25.0 GHz

Date: 3.MAY.2020 11:26:24



	el 20.00 dBm		21.20 dB 👄				24		
Att 1Pk View	20 dB	SWT	29.7 ms 👄	<b>VBW</b> 300 K	HZ Mode	Auto Sweej	)		
					М	1[1]		M1	12.57 dBn 2.47780 GHa
10 dBm	D1 12.570 dB	n			M:	2[1]	2		-46.06 dBn 1.08520 GH
0 dBm									
-10 dBm—	D2 -7.43	) dBm							
-20 dBm—									
-30 dBm									
-40 dBm			M2						
strack-	when the way	hallham	unululuryus	<u>n an an</u>	announderland	Muhalinanha	whichmapp	Jaho walle	heldentriken
60 dBm—									_
70 dBm—									_
Start 30.0				691	nte				Stop 3.0 GHz

### CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 11:31:19

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

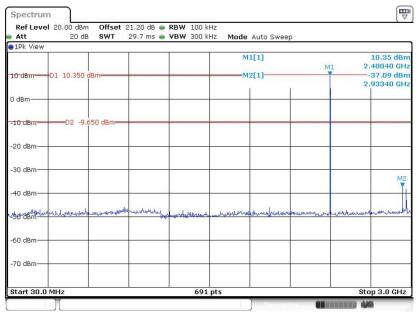
Ref Level : Att	20.00 dBm 20 dB		21.20 dB	VBW 300 k		Auto Swee			
1Pk View	20 UC	311	230 1115 🖷	VDW 300 K	HZ MOUE	AULU SWEE	1		
M1	1 12.400	dBm				1[1]			12.40 dBr 2.4830 GH
10 dBm						2[1]			-40.87 dBr 6.3960 GH
) dBm	—D2 -7.	600 dBm							
20 dBm									
30 dBm									
40 dBm	hallounda	Morenew	morenteerstelles	muhleumuth	nuturationation	M2 In Munnyh	wroughnet	whowever	myuna
50 dBm								-	
70 dBm				· · · · · · · · ·					
start 2.0 GH	-			691	nte			Pto	p 25.0 GHz

Date: 3.MAY.2020 11:32:08



#### <2Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 3.MAY.2020 13:46:35

#### CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

Ref Level 20.00 dBm Offset Att 20 dB SWT	21.20 dB  RBW 100 230 ms  VBW 300			
1Pk View	230 ms 🖷 VBW 300	kHz <b>Mode</b> Auto Swee	ab	
11 D dBm-D1 10.310 dBm-		M1[1] M2[1]		10.31 dBn 2.4160 GH 37.67 dBn 2.9490 GH
dBm				
D2 -9.690 dBm-				
20 dBm				
80 dBm				
o dBm	under and and the	wanterterned	humal when when we	unduradayaa
i0 dBm				
70 dBm				
tart 2.0 GHz	60	L pts		top 25.0 GHz

Date: 3.MAY.2020 13:47:06



Att 20 dB SWT	29.7 ms 👄 VBW 300	kHz Mode Auto Sweep		
1Pk View				
		M1[1]	M1	11.36 dBn 2.43910 GH
10 dBm D1 11.360 dBm		M2[1]	T	-36.78 dBn
		1		2.95920 GH
0 dBm				
10 dpm D2 -8.640 dBm				
-10 dBm02 -8.640 dBm				
-20 dBm				
-30 dBm				M
-40 dBm				
50 48 m	contraction and have been added	mather work the work of the source where	Munuhanger	abarthrough and the
NORM 201-1				
60 dBm				
70 dBm				
Start 30.0 MHz	60	1 pts		Stop 3.0 GHz

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 13:55:10

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

Ref Level 20 Att	0.00 dBm Offse 20 dB SWT	t 21.20 dB 👄 R 230 ms 👄 V	BW 100 kHz BW 300 kHz	Mode Auto Swe	en.	
1Pk View	20 00 011	200 110 🖉 🖡	BH GOO KHE	HOUE MULD SWE	юþ	
M1 10 dBm D1	9.970 dBm			M1[1] M2[1]		9.97 dBr 2.4490 GH -40.25 dBr 3.4810 GH
dBm						
10 dBm	-D2 -10.030 dBm					
-20 dBm						
-30 dBm						
40 dBm wybruwterub S0 dBm	whether hardres	undfrendhochark	wowhydry	mundulum	havennander	american
60 dBm						
70 dBm						
Start 2.0 GHz			691 pts			Stop 25.0 GHz

Date: 3.MAY.2020 13:55:45



M1[1] M2[1]	10.01 dBn M1 2.48210 GH •
Î Î	2 03340 CH
	2.9040 011
when you we have a second a second when the second and the	uniper would have been and
	Maying and and have been and the second of t

## CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 14:03:58

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

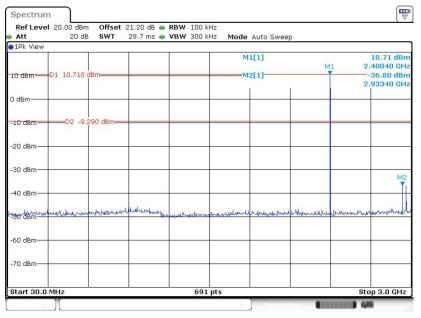
Ref Level 20.00 dB		0 dB 👄 RBW 100			
Att 20 c	B SWT 23	0 ms 👄 <b>VBW</b> 300	kHz Mode Auto Swe	зер	
10 dBm D1 8.280	dBm		M1[1] M2[1]		8.28 dBr 2.4830 GH -38.09 dBr 3.4480 GH
) dBm				+ +	
10 dBm	11.720 dBm				
20 dBm					
30 dBm					
40 dBm	munum	mbandaman	numeround	hrennen	annunuuhanna
60 dBm					
70 dBm					
Start 2.0 GHz		60	1 pts		Stop 25.0 GHz

Date: 3.MAY.2020 14:05:13



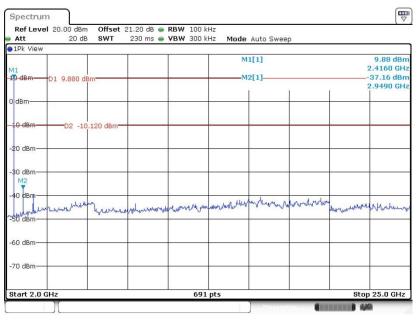
#### <3Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 3.MAY.2020 14:21:21

#### CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



Date: 3.MAY.2020 14:22:05



Att 20	dB SWT	29.7 ms 👄	VBW 300	kHz Mode	Auto Swee	р		
1Pk View				-				
				N	11[1]		M1	10.85 dBn 2.43910 GH
10 dBm D1 10.8	50 dBm=====			N	12[1]		Y	-37.74 dBn
					1	1		2.93340 GH
0 dBm		_		-				
-10 dBm D2	-9.150 dBm=							
20 dBm		-						
30 dBm								
								M2
-40 dBm				-				
Sought www.	andingunaries	underselenterenter	and maked and	- Red Brown Malidery	4 springer where	memore	mallan	Mapmonteral
-56 UBM								
-60 dBm								
70 dBm	_							
Start 30.0 MHz				L pts				Stop 3.0 GHz

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 14:29:42

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

Ref Level 2			21.20 dB 👄						
Att 1Pk View	20 dB	SWT	230 ms 🖷	<b>VBW</b> 300 k	Hz Mode	Auto Swee	)		
41	1 10.480 di	3m				1[1] 2[1]			10.48 dBr 2.4490 GH 37.03 dBr 2.9820 GH
dBm									
10 dBm	—D2 -9.5	20 dBm—							
0 dBm									
0 dBm	~								
O dBm	-haron haven	Unyanna	uppen when	newspread	million alles	nonnun	ghalinn	nuntrenance	boord joken as
0 dBm									
0 dBm									
tart 2.0 GH	,			691	nte			Stor	25.0 GH

Date: 3.MAY.2020 14:30:18



Att	20 dB SWT	29.7 ms 👄	<b>VBW</b> 300 k	Hz Mode	Auto Swee	0		
1Pk View	1 9.930 dBm				1[1] 2[1]		M1	9.93 dBn 2.47780 GH: 
0 dBm								2.96780 GH
-10 dBm		1						
-20 dBm								
-30 dBm								м
-40 dBm								
SU asm	muniterent	muhammun	drahu sed met	muturoun	muninama	the ward the second	urline	howard while
-60 dBm								
-70 dBm		_						
Start 30.0 M			691					Stop 3.0 GHz

## CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 3.MAY.2020 14:37:26

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

Ref Level 20.00 Att 21		0 dB 👄 RBW 100   0 ms 👄 VBW 300		en	
1Pk View	5 45 5441 25	5 IIIS - 4 B44 500 I	KIZ HIDUE AUTO SWE	ieh.	
M1 19 dBm-D1 9.54	+0 dBm		M1[1] M2[1]	2 2	9.54 dBr 2.4830 GH 39.31 dBr 2.9820 GH
) dBm					
10 d8mD2	-10.460 dBm				
20 dBm					
30 dBm					
M2 40 dBm Juliu Walk walk walk	unger	water and a stranger	Jane Martin	a who where a second	mourine
50 dBm					
70 dBm	_				
itart 2.0 GHz			L pts		Stop 25.0 GHz

Date: 3.MAY.2020 14:38:01



## 3.8 Radiated Band Edges and Spurious Emission Measurement

## 3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

## 3.8.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



## 3.8.3 Test Procedures

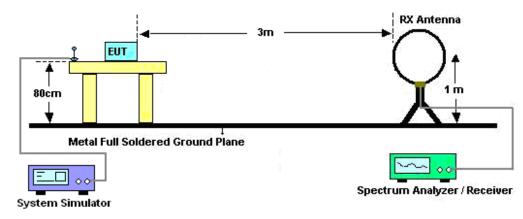
- 1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 4. Set to the maximum power setting and enable the EUT transmit continuously.
- 5. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time = N<sub>1</sub>\*L<sub>1</sub>+N<sub>2</sub>\*L<sub>2</sub>+...+N<sub>n-1</sub>\*LN<sub>n-1</sub>+N<sub>n</sub>\*L<sub>n</sub> Where N<sub>1</sub> is number of type 1 pulses, L<sub>1</sub> is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20\*log(Duty cycle)
- 6. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

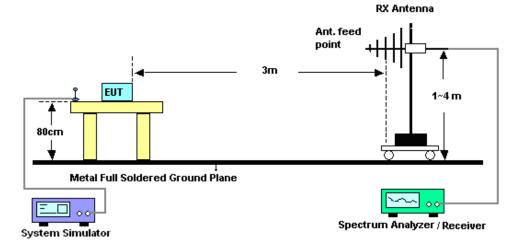


## 3.8.4 Test Setup

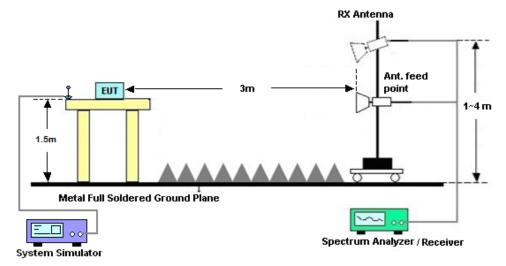
For radiated emissions below 30MHz



### For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



**Sporton International (Shenzhen) Inc.** TEL : +86-512-57900158 FAX : +86-512-57900958 FCC ID: 2ABZ2-EF014



## 3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

## 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

## 3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix C.

## 3.8.8 Duty cycle correction factor for average measurement

Please refer to Appendix D.



## 3.9 AC Conducted Emission Measurement

## 3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of omission (MHz)	Conducted	limit (dBµV)
Frequency of emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

## **3.9.2 Measuring Instruments**

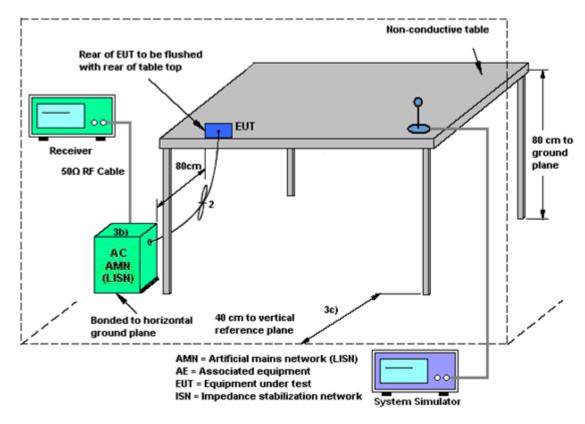
The measuring equipment is listed in the section 4 of this test report.

## 3.9.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



## 3.9.4 Test Setup



## 3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



## 3.10 Antenna Requirements

## 3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

## 3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

## 3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



# 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 16, 2020	May 01, 2020~ May 10, 2020	Apr. 15, 2021	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 26, 2019	May 01, 2020~ May 10, 2020	Dec. 25, 2020	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 26, 2019	May 01, 2020~ May 10, 2020	Dec. 25, 2020	Conducted (TH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 17, 2020	May 21, 2020	Apr. 16, 2021	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 29, 2019	May 21, 2020	May 28, 2020	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Jul. 19, 2019	May 21, 2020	Jul. 18, 2020	Radiation (03CH02-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Aug. 27, 2019	May 21, 2020	Aug. 26, 2020	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	TTA1840-35-H G	1871923	18GHz~40GHz	Jul. 22. 2019	May 21, 2020	Jul. 21. 2020	Radiation (03CH02-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 17, 2020	May 21, 2020	Apr. 16, 2021	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 18, 2019	May 21, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P- R	1943528	1GHz~18GHz	Oct. 18, 2019	May 21, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5Gh z	Oct. 18, 2019	May 21, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	6160100024 70	N/A	NCR	May 21, 2020	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	May 21, 2020	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	May 21, 2020	NCR	Radiation (03CH02-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2019	May 19, 2020	Dec. 25, 2020	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Oct. 17, 2019	May 19, 2020	Oct. 16, 2020	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 17, 2019	May 19, 2020	Oct. 16, 2020	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	6160200008 91	100Vac~250Vac	Jul. 23, 2019	May 19, 2020	Jul. 22, 2020	Conduction (CO01-SZ)

NCR: No Calibration Required



# 5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.6dB
of 95% (U = 2Uc(y))	2.008

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	3.00B

### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	5.00B

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	4.4dB
of 95% (U = 2Uc(y))	4.40D





# **Appendix A. Conducted Test Results**

# Appendix A. Test Result of Conducted Test Items

Test Engineer:	zeng meng hui	l emperature:	21~25	°C
Test Date:	2020/5/1~2020/5/10	Relative Humidity:	51~54	%

### Report Number : FR042007-02A

### **Bluetooth**

Test Engineer:	zeng meng hui	Temperature:	21~25	°C
Test Date:	2020/5/10	Relative Humidity:	51~54	%

			20dB	and 99	% Occup		<u>ULTS DATA</u> Ith and Hopping	Channel Separ	ation
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.892	0.825	1.003	0.5943	Pass
DH	1Mbps	1	39	2441	0.889	0.825	1.003	0.5924	Pass
DH	1Mbps	1	78	2480	0.886	0.828	0.999	0.5905	Pass
2DH	2Mbps	1	0	2402	1.272	1.172	0.968	0.8481	Pass
2DH	2Mbps	1	39	2441	1.268	1.169	0.994	0.8451	Pass
2DH	2Mbps	1	78	2480	1.268	1.172	0.994	0.8451	Pass
3DH	3Mbps	1	0	2402	1.233	1.155	0.981	0.8220	Pass
3DH	3Mbps	1	39	2441	1.233	1.149	0.999	0.8220	Pass
3DH	3Mbps	1	78	2480	1.233	1.152	0.994	0.8220	Pass

	<u>TEST RESULTS DATA</u> Dwell Time					
Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.8681	0.31	0.4	Pass
AFH	20	53.33	2.8681	0.15	0.4	Pass

					T RESUL
				<i>P</i> (	eak Powe
DU	011	NITY	Peak Power	Power Limit	Test
DH	CH.	NTX	(dBm)	(dBm)	Result
	0	1	13.30	20.97	Pass
DH1	39	1	14.30	20.97	Pass
	78	1	13.00	20.97	Pass
2DH	CH.	NTX	Peak Power	Power Limit	Test
2011	-	шл	(dBm)	(dBm)	Result
	0	1	13.70	20.97	Pass
2DH1	39	1	14.10	20.97	Pass
	78	1	12.70	20.97	Pass
3DH	CH.	NTX	Peak Power	Power Limit	Test
			(dBm)	(dBm)	Result
	0	1	14.20	20.97	Pass
3DH1	39	1	14.60	20.97	Pass
	78	1	13.30	20.97	Pass

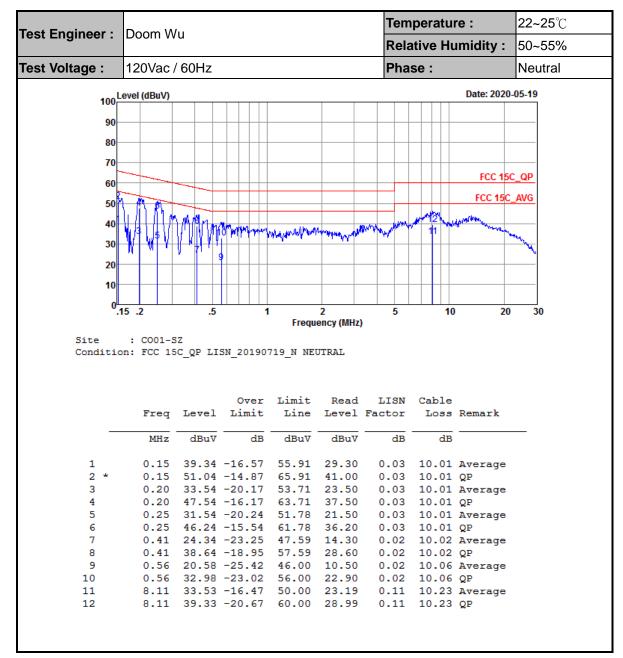
		<u>TEST RE</u> Number of H	<u>SULTS DA</u> oppina Fre		
Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail		
79	20	> 15	Pass		



# **Appendix B. AC Conducted Emission Test Results**

Toot Engineer .	Doom W					Ten	nperatu	re :	<b>22~25</b> ℃
Test Engineer :		ľ				Rela	ative Hu	umidity :	50~55%
Test Voltage :	120Vac	/ 60Hz				Pha	ise :		Line
100 <sup>L</sup>	evel (dBuV)							Date: 2020	-05-19
90									
80									
70									
60								FCC 150	C_QP
	-A-p-							FCC 15C	AVG
50	WII (I A	05-100 m					Mar		
40	1 <b>3</b> 1 5 1 1	1 Million	***********	ورجعها المرجع		Allow when them	- 12 m	and the second	
30		¥₩) II		. Ya ku dhank ku	and the second second	III Yuqqar		V	W-T-T-T
20									
10									
oL	15.2	.5	1		2	5	10	) 20	
Conditio	: CO01-5 on: FCC 15		SN_20190	719_L LI	NE				
Conditic			SN_20190	719_L LI	NE				
Conditic	on: FCC 15	SC_QP LI	Over	Limit	Read				
Conditic	on: FCC 15	SC_QP LI	_	Limit	Read	LISN Factor		Remark	
Conditic	on: FCC 15	SC_QP LI	Over Limit	Limit	Read	Factor		Remark	
Conditio  1	Freq MHz	Level	Over Limit	Limit Line dBuV	Read Level dBuV	Factor 	Loss dB	Remark	
 1 2 *	Freq MHz 0.15 0.15	Level 	Over Limit 	Limit Line dBuV 56.00 66.00	Read Level dBuV 31.00 44.60	Factor dB 0.03 0.03	Loss dB 10.01 10.01	Remark  Average QP	
1 2 * 3	Freq MHz 0.15 0.20	Level dBuV 41.04 54.64 35.64	Over Limit 	Limit Line dBuV 56.00 66.00 53.49	Read Level dBuV 31.00 44.60 25.60	Factor dB 0.03 0.03 0.03	Loss dB 10.01 10.01 10.01	Remark Average QP Average	
1 2 * 3 4	Freq MHz 0.15 0.20 0.20	Level dBuV 41.04 54.64 35.64 49.74	Over Limit 	Limit Line dBuV 56.00 66.00 53.49 63.49	Read Level dBuV 31.00 44.60 25.60 39.70	Factor dB 0.03 0.03 0.03 0.03 0.03	Loss dB 10.01 10.01 10.01 10.01	Remark Average QP Average QP	
1 2 * 3 4 5	Freq MHz 0.15 0.20 0.20 0.24	Level 	Over Limit dB -14.96 -11.36 -17.85 -13.75 -18.21	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95	Read Level dBuV 31.00 44.60 25.60 39.70 23.70	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03	Loss dB 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average	
1 2 * 3 4 5 6	Freq MHz 0.15 0.20 0.20 0.24 0.24	Level dBuV 41.04 54.64 35.64 49.74 33.74 47.54	Over Limit dB -14.96 -11.36 -17.85 -13.75 -13.75 -18.21 -14.41	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95 61.95	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP	
1 2 * 3 4 5	Freq MHz 0.15 0.15 0.20 0.20 0.24 0.24 0.29	Level 	Over Limit dB -14.96 -11.36 -17.85 -13.75 -13.75 -18.21 -14.41 -23.37	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95 61.95 50.41	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP Average	
1 2 * 3 4 5 6 7	Freq MHz 0.15 0.15 0.20 0.20 0.24 0.24 0.29 0.29	Level dBuV 41.04 54.64 35.64 49.74 33.74 47.54 27.04 43.24	Over Limit dB -14.96 -11.36 -17.85 -13.75 -13.75 -18.21 -14.41	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95 61.95 50.41 60.41	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00 33.20	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP Average	
1 2 * 3 4 5 6 7 8	Freq MHz 0.15 0.15 0.20 0.20 0.24 0.24 0.29 0.29 0.39	Level dBuV 41.04 54.64 35.64 49.74 33.74 47.54 27.04 43.24 26.24	Over Limit dB -14.96 -11.36 -17.85 -13.75 -13.75 -18.21 -14.41 -23.37 -17.17	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95 61.95 50.41 60.41 48.17	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00 33.20 16.20	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP Average QP Average	
1 2 * 3 4 5 6 7 8 9	Freq MHz 0.15 0.15 0.20 0.20 0.24 0.24 0.24 0.29 0.29 0.29 0.39 0.39	Level dBuV 41.04 54.64 35.64 49.74 33.74 47.54 27.04 43.24 26.24 40.64	Over Limit dB -14.96 -11.36 -17.85 -13.75 -18.21 -14.41 -23.37 -17.17 -21.93	Limit Line dBuV 56.00 66.00 53.49 63.49 51.95 61.95 50.41 60.41 48.17 58.17	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00 33.20 16.20 30.60	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP Average QP Average	
1 2 * 3 4 5 6 7 8 9 10	Freq MHz 0.15 0.20 0.20 0.24 0.24 0.29 0.29 0.29 0.39 0.39 8.32	Level dBuV 41.04 54.64 35.64 47.54 27.04 43.24 26.24 40.64 33.02	Over Limit dB -14.96 -11.36 -17.85 -13.75 -18.21 -14.41 -23.37 -17.17 -21.93 -17.53	Limit Line dBuV 56.00 66.00 53.49 61.95 50.41 60.41 48.17 58.17 50.00	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00 33.20 16.20 30.60 22.50	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01	Remark Average QP Average QP Average QP Average QP Average QP Average	
1 2 * 3 4 5 6 7 8 9 10 11	Freq MHz 0.15 0.20 0.20 0.24 0.24 0.29 0.29 0.29 0.39 0.39 8.32	Level dBuV 41.04 54.64 35.64 47.54 27.04 43.24 26.24 40.64 33.02	Over Limit dB -14.96 -11.36 -17.85 -13.75 -18.21 -14.41 -23.37 -17.17 -21.93 -17.53 -16.98	Limit Line dBuV 56.00 66.00 53.49 61.95 50.41 60.41 48.17 58.17 50.00	Read Level dBuV 31.00 44.60 25.60 39.70 23.70 37.50 17.00 33.20 16.20 30.60 22.50	Factor dB 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.0	Loss dB 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.01 10.23	Remark Average QP Average QP Average QP Average QP Average QP Average	





Note:

1. Level(dBµV) = Read Level(dBµV) + LISN Factor(dB) + Cable Loss(dB)

2. Over Limit(dB) = Level(dBµV) – Limit Line(dBµV)



# Appendix C. Radiated Spurious Emission

## 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

вт	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	( dB )	( dBµV/m )	(dBµV)	(dB/m)	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
		2357.04	43.46	-30.54	74	38.46	27.83	7.51	30.34	147	290	Р	Н
		2357.04	18.67	-35.33	54	-	-	-	-	147	290	А	н
D.T.	*	2402	107.08	-	-	102.2	27.7	7.54	30.36	147	290	Р	Н
ВТ СН00	*	2402	82.29	-	-	-	-	-	-	147	290	А	н
2402MHz		2353.68	43.83	-30.17	74	38.83	27.83	7.51	30.34	280	7	Р	V
240211112		2353.68	19.04	-34.96	54	-	-	-	-	280	7	А	V
	*	2402	97.64	-	-	92.76	27.7	7.54	30.36	280	7	Р	V
	*	2402	72.85	-	-	-	-	-	-	280	7	А	V
		2346.12	43.75	-30.25	74	38.68	27.9	7.51	30.34	100	294	Р	н
		2346.12	18.96	-35.04	54	-	-	-	-	100	294	А	н
	*	2441	107.21	-	-	102.45	27.6	7.54	30.38	100	294	Р	н
	*	2441	82.42	-	-	-	-	-	-	100	294	А	н
		2485.37	43.48	-30.52	74	38.87	27.47	7.53	30.39	100	294	Р	н
BT		2485.37	18.69	-35.31	54	-	-	-	-	100	294	А	н
CH 39 2441MHz		2325.82	44.2	-29.8	74	39.12	27.93	7.48	30.33	263	34	Р	V
2441191172		2325.82	19.41	-34.59	54	-	-	-	-	263	34	А	V
	*	2441	100.84	-	-	96.08	27.6	7.54	30.38	263	34	Р	V
	*	2441	76.05	-	-	-	-	-	-	263	34	А	V
		2486.21	43.5	-30.5	74	38.89	27.47	7.53	30.39	263	34	Р	V
		2486.21	18.71	-35.29	54	-	-	-	-	263	34	А	V



	*	2480	106.03	-	-	101.42	27.47	7.53	30.39	104	73	Р	Н
	*	2480	81.24	-	-	-	-	-	-	104	73	А	н
		2495	42.59	-31.41	74	38.06	27.4	7.53	30.4	104	73	Р	н
BT		2495	17.8	-36.2	54	-	-	-	-	104	73	А	н
CH 78 2480MHz	*	2480	95.24	-	-	90.63	27.47	7.53	30.39	272	99	Р	V
240010112	*	2480	70.45	-	-	-	-	-	-	272	99	А	V
		2495.24	43.38	-30.62	74	38.85	27.4	7.53	30.4	272	99	Р	V
		2495.24	18.59	-35.41	54	-	-	-	-	272	99	А	V
Remark		o other spuriou Il results are PA		Peak and	d Average lir	nit line.							



ВТ	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol
		(MHz)	(dBµV/m)	(dB)	( dBµV/m )	(dBµV)	( dB/m )	(dB)	(dB)	( cm )	( deg )		(H/\
		4804	39.92	-34.08	74	53.34	31.1	9.86	54.38	111	159	Р	н
ВТ		4804	15.13	-38.87	54	-	-	-	-	111	159	А	н
CH 00		4804	39.83	-34.17	74	53.25	31.1	9.86	54.38	151	219	Р	V
2402MHz		4804	15.04	-38.96	54	-	-	-	-	151	219	А	V
		4882	40.27	-33.73	74	53.59	31.13	9.9	54.35	112	263	Р	н
		4882	15.48	-38.52	54	-	-	-	-	112	263	А	н
		7323	43.34	-30.66	74	49.59	36.4	11.88	54.53	194	69	Р	н
BT		7323	18.55	-35.45	54	-	-	-	-	194	69	А	н
CH 39		4882	39.64	-34.36	74	52.96	31.13	9.9	54.35	150	258	Р	V
2441MHz		4882	14.85	-39.15	54	-	-	-	-	150	258	А	V
		7323	43.89	-30.11	74	50.14	36.4	11.88	54.53	152	309	Р	V
		7323	19.1	-34.9	54	-	-	-	-	152	309	А	V
		4960	38.12	-35.88	74	51.13	31.37	9.93	54.31	110	182	Р	н
		4960	13.33	-40.67	54	-	-	-	-	110	182	А	н
		7440	43.65	-30.35	74	49.77	36.5	12.03	54.65	167	255	Р	н
BT		7440	18.86	-35.14	54	-	-	-	-	167	255	А	н
CH 78 2480MHz		4960	38.71	-35.29	74	51.72	31.37	9.93	54.31	118	289	Р	V
2400111172		4960	13.92	-40.08	54	-	-	-	-	118	289	А	V
		7440	44.37	-29.63	74	50.49	36.5	12.03	54.65	158	273	Р	V
		7440	19.58	-34.42	54	-	-	-	-	158	273	А	V



#### Emission below 1GHz

#### 2.4GHz BT (LF)

вт	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	( dB )	( cm )	(deg)	(P/A)	(H/V)
		33.88	22.82	-17.18	40	31.58	22.92	0.62	32.3	-	-	Ρ	н
		80.44	23.2	-16.8	40	41.07	13.4	0.93	32.2	-	-	Р	н
		133.79	24.29	-19.21	43.5	37.52	17.47	1.2	31.9	-	-	Р	Н
		240.49	26.25	-19.75	46	38.79	17.64	1.62	31.8	-	-	Р	н
		469.41	27.33	-18.67	46	33.37	23.25	2.31	31.6	-	-	Р	Н
2.4GHz BT		884.57	32.55	-13.45	46	31.47	28.92	3.28	31.12	163	202	Р	Н
LF		30	28.55	-11.45	40	34.49	24.8	0.56	31.3	182	34	Р	V
LF		73.65	22.15	-17.85	40	39.98	12.89	0.88	31.6	-	-	Р	V
		126.03	27.75	-15.75	43.5	40.66	17.43	1.16	31.5	-	-	Р	V
		430.61	25.01	-20.99	46	31.81	22.45	2.21	31.46	-	-	Р	V
		521.79	27.19	-18.81	46	31.68	24.31	2.45	31.25	-	-	Р	V
		941.8	29.72	-16.28	46	28.01	29.67	3.38	31.34	-	-	Р	V
Remark		lo other spurio Il results are F		mit line.									



## Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any
	unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	Peak or Average
H/V	Horizontal or Vertical



## A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	н

1. Level(dBµV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBµV/m) – Limit Line(dBµV/m)

### For Peak Limit @ 2390MHz:

1. Level(dBµV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

- = 32.22(dB/m) + 4.58(dB) + 54.51(dBµV) 35.86 (dB)
- = 55.45 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- = 32.22(dB/m) + 4.58(dB) + 42.6(dBµV) 35.86 (dB)
- = 43.54 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

#### Both peak and average measured complies with the limit line, so test result is "PASS".

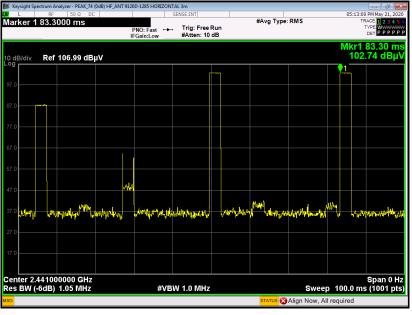


# Appendix D. Duty Cycle Plots

Keysight Spectrum Analyzer - PEAK_74 (0df		and I		
L RF 50 Ω DC larker 3 4.67000 ms		: Free Run en: 10 dB	#Avg Type: RMS	05:10:21 PM May 21, 202 TRACE 1 2 3 4 5 TYPE W
0 dB/div Ref 106.99 dBµV	/			Mkr3 4.670 m 102.48 dBµ
og ¥ <mark>1∆2</mark>	¥2Δ3	3		
7.0				
7.0				
7.0				
7.0	Long Parton			n haddala
7.0				
enter 2.441000000 GHz es BW (-6dB) 1.05 MHz	#VBW 1.0	MHz	Swe	Span 0 H ep 10.00 ms (1001 pt
KR         MODE         TRC         SCL         X           1         Δ2         1         t         (Δ)	-2.880 ms (Δ) -0.08 dB	FUNCTION FI	JNCTION WIDTH	FUNCTION VALUE
2 Δ3 1 t (Δ) 3 N 1 t	-870.0 μs (Δ) 0.07 dB 4.670 ms 102.48 dBμV			
5				
7				
0 1				
G		m	STATUS 🔀 Align Now	· · · · ·

## 3DH5 on time (One Pulse) Plot on Channel 39





#### Note:

- 1. Worst case Duty cycle = on time/100 milliseconds = 2 \* 2.88 / 100 = 5.76 %
- 2. Worst case Duty cycle correction factor = 20\*log(Duty cycle) = -24.79 dB
- 3. 3DH5 has the highest duty cycle worst case and is reported.