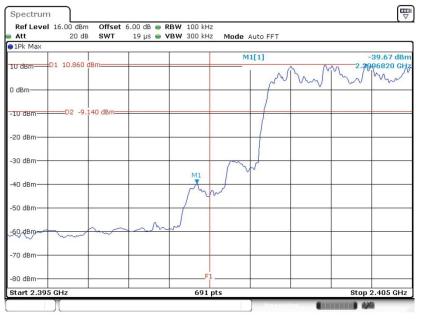


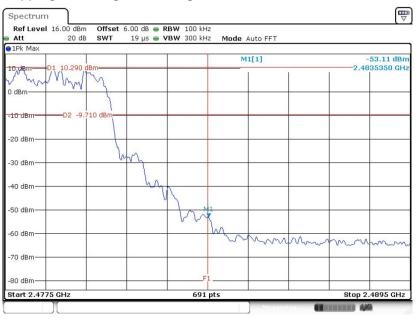
<3Mbps>

Hopping Mode Low Band Edge Plot



Date: 14.MAR.2020 05:48:57

Hopping Mode High Band Edge Plot



Date: 14.MAR.2020 05:49:13



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.

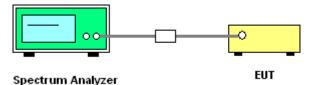
3.7.2 Measuring Instruments

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



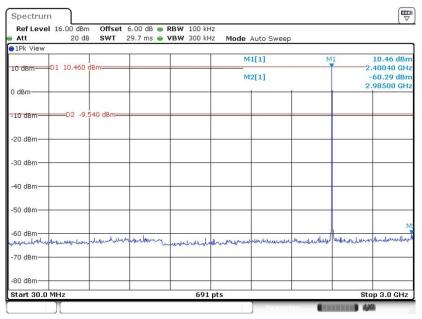
Sporton International (Kunshan) Inc. TEL : +86-512-57900158 FAX : +86-512-57900958 FCC ID: IHDT56YU2



3.7.5 Test Result of Conducted Spurious Emission

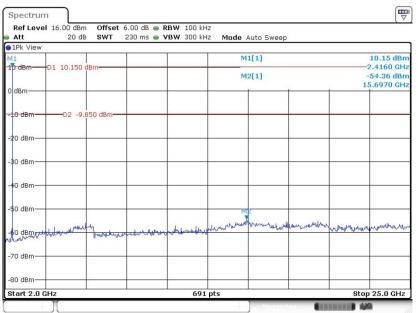
<1Mbps>

CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 14.MAR.2020 06:37:21

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



Date: 14.MAR.2020 06:37:54



Ref Level 16.00 dBm Offse Att 20 dB SWT	t 6.00 dB		3
1Pk View	23.1 115 - 15 1 300 Ki	12 Mode Auto Sweep	
		M1[1]	🚽 11.10 dBn
10 dBm D1 11.100 dBm			M1 2.43910 GH:
		M2[1]	-58.72 dBn 1.75570 GH
0 dBm			
100 C			
-10 dBm D2 -8.900 dBm			
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			
		M2	
-60 dBm	al de la la companya de la companya		
-ou abili	will man white when a work of the	warmen with the reader that	amongol providences and providence
-70 dBm			
-80 dBm			
Start 30.0 MHz		pts	Stop 3.0 GHz

CSE Plot on Ch 39 between 30MHz ~ 3 GHz

Date: 14.MAR.2020 07:18:39

CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

Ref Level	16.00 dBm	Offset	6.00 dB 🕳	RBW 100	kHz				
Att	20 dB	SWT		VBW 300		Auto Sweep			
1Pk View									
T	1 11.020 d	D mo-			M	11[1]			11.02 dBn
10 88m-D	1 11.020 0	DIII.			M	12[1]			2.4490 GH
0 dBm									5.6970 GH
-10 dBm	D2 -8.9	80 dBm <u></u>		_	_				
-20 dBm				-					
-30 dBm									-
-40 dBm									
-50 dBm									
					M				
-60 dBm	How we want	1. Marcuster	A Brown March	Mayname	Multiples	monument	moraney	hubbling	modernal
william .									
-70 dBm									
-80 dBm									+
Start 2.0 GH	Iz			69	91 pts			Stop	25.0 GHz

Date: 14.MAR.2020 07:20:02



Ref Level 16.00 dBm Offset Att 20 dB SWT	6.00 dB RBW 100 kH 29.7 ms VBW 300 kH			
1Pk View				
10 dBm-D1 10.280 dBm		M1[1]	M1	10.28 dBm 2.48210 GHz
10 UBIN D1 10.200 UBIN		M2[1]		-59.99 dBm
0 dBm			<u> </u>	1.75140 GHz
-10 dBm D2 -9.720 dBm				
-20 dBm				
-30 dBm				
-40 dBm				
-50 dBm				
-60 dBm		M2		
-00 UBIII	warrand his our ward	hubble and the shall be a shall b	terburner have been	workerwalk to a show a
-70 dBm				
-80 dBm				
Start 30.0 MHz	691	pts	I	Stop 3.0 GHz

CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 14.MAR.2020 07:27:53

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

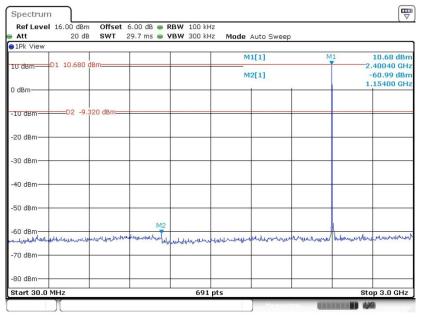
Ref Level Att	16.00 dBm 20 dB	Offset SWT		RBW 100 kH VBW 300 kH		Auto Sweep			
1Pk View	20 UB	3111	230 IIIS 🖷	YDYY 300 K	14 MOUE	auto Sweeb			
M1	D1 9.910 dBr	n			M	1[1]			9.91 dBn 2.4830 GH
					M	2[1]			54.02 dBn
0 dBm								1;	5.7300 GH
-10 dBm	D2 -10.0	090 dBm—	-						
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm					M		-		
-60 dBm	buohander	Luchage	yould and a start of the start	up three hereites	manuerus	vormen	adaption for the second s	manuhan	maltrinitional
-70 dBm									
-80 dBm									
Start 2.0 G	Hz			691	pts			Stor	25.0 GHz

Date: 14.MAR.2020 07:28:27



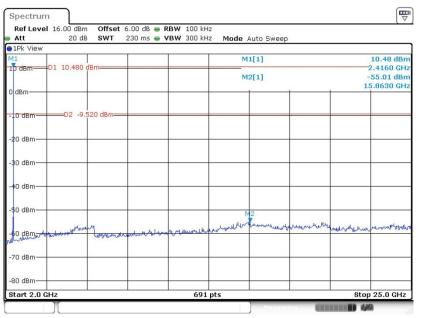
<2Mbps>

CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 14.MAR.2020 06:41:51

CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



Date: 14.MAR.2020 06:42:20



RefLevel 16.00 dBm Of Att 20 dB SV	fset 6.00 dB		Auto Sweep	
1Pk View				
10 dBmD1 11.210 dBm		M	1[1]	11.21 dBm
10 dBm 01 11.210 dBm		M	2[1]	M1 2.43910 GHz -61.23 dBm
			[+]	943.40 MHz
0 dBm				
10 dpm D2 -8.790 dE	m			
-10 dBm 02 -8.790 dE				
-20 dBm				
-20 ubiii				
-30 dBm-				
-50 dbm				
-40 dBm				
-50 dBm-				
-60 dBm	1/12			Δ
-60 dBm	Munichtrachtering	and marked way out to be the	March here have a more thank and the second	d have a support of the second
-70 dBm				
14 - 25 (120) - 19 (12)				
-80 dBm				
Start 30.0 MHz		691 pts		Stop 3.0 GHz

CSE Plot on Ch 39 between $30MHz \sim 3 GHz$

Date: 14.MAR.2020 06:57:41

CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

Spectrum								
RefLevel 16.00 Att 2	dBm Offset 0 dB SWT	6.00 dB 👄 RI 230 ms 👄 VI			Auto Sweep			
1Pk View	0 00 3441	200 ms 🚽 📢	044 000 KH	2 Moue /	auto Sweep			
M1	570 dBm			M	1[1]			10.57 dBm 2.4490 GHz
10 dbiir				м	2[1]			-54.61 dBm 4.8790 GHz
0 dBm								
-10 dBmD2	-9.430 dBm							
-20 dBm								
-30 dBm	_							
-40 dBm	_							
-50 dBm	_			0.07		10 64		
-60 dBm the along	manife	the second stands and the second stand stands and the second stand stands and the second stand	y July de la Marchar	wanter	ununun	manunan	haddanda	nybookbouch
-70 dBm								
-80 dBm								
Start 2.0 GHz		· ·	691	pts			Stop	25.0 GHz
) Measuri			

Date: 14.MAR.2020 06:58:11



Ref Level 16.00 dBm Off Att 20 dB SW	set 6.00 dB		
1Pk View		nous nate sheep	
D1 10.700 dBm=		M1[1]	M1 10.70 dBm
10 dBm D1 10.700 dBm		M2[1]	2.47780 GH: -60.51 dBn
0 dBm			1.67830 GH
-10 dBm D2 -9.300 dB	m		
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			
		M2	
-60 dBm	roburn marken male make	understander and the	untertaily the branched and man
-70 dBm			
-80 dBm			
Start 30.0 MHz	69	1 pts	Stop 3.0 GHz

CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 14.MAR.2020 07:30:49

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

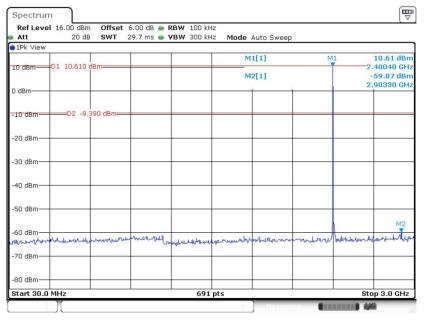
Att	16.00 dBm 20 dB	SWT	6.00 dB 👄 🖡 230 ms 👄 🛛			Auto Sweep			
1Pk View									
M1 10 dBm					M	1[1]			9.66 dBn 2.4830 GH
o asm	D1 9.660 dB	m			м	2[1]			-54.71 dBr
dBm								1	6.5960 GH
10 d8m-	D2 -10	340 dBm-							
20 dBm									
30 dBm									
40 dBm									
50 dBm						M2			
eo deman	note free believe	www	manter	and the second de	arreyhouten	mburkerweato	mound	unortholan	haldenhaugan
70 dBm									
80 dBm									
Start 2.0 G	Hz			691	pts			Stor	25.0 GHz

Date: 14.MAR.2020 07:32:05



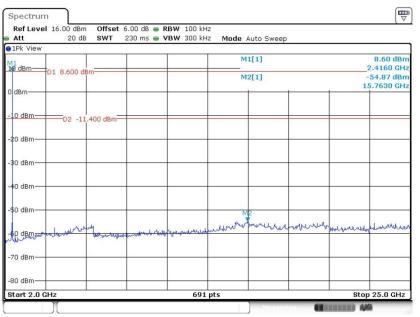
<3Mbps>

CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 14.MAR.2020 06:48:38

CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



Date: 14.MAR.2020 06:49:15



Ref Level 16.00 dBm Offse Att 20 dB SWT	t 6.00 dB		
1Pk View			
10 dBmD1 11.210 dBm		M1[1]	11.21 dBn M1 2.43910 GH
		M2[1]	-61.08 dBn
0 dBm			2.98500 GH
-10 dBmD2 -8.790 dBm_			
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			
-60 dBm			A N
wandwwellallanthappenson	matrowhile any public me	whole our manual and a human whe	get walken bernarber how the
-70 dBm			
-80 dBm			

CSE Plot on Ch 39 between $30MHz \sim 3 GHz$

Date: 14.MAR.2020 06:52:46

CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

	16.00 dBm		6.00 dB 👄 🖡						
Att	20 dB	SWT	230 ms 🖷 🕻	/BW 300 kH	z Mode /	Auto Sweep			
1Pk View M1					M	1[1]			10.44 dBm
10 dBm	D1 10.440 di	3m				2[1]			2.4490 GH
0 dBm						2[1]			4.8790 GH
-10 d8m-	D2 -9.5	50 dBm—							
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm	M2								
-60 dBm	whenever	Underson	glywyddiau fan drefen	hy man m	Number	Widdung	mpromitionen	hundryn	whateen
-70 dBm									
-80 dBm									
Start 2.0 G	Hz			691	pts	1		Stor	25.0 GHz

Date: 14.MAR.2020 06:53:15



Ref Level 16.00 dBm Att 20 dB		6.00 dB 👄			Auto Sweep			
1Pk View				in indus				
тт dвm D1 10.690 с	10 m			М	1[1]		M1	10.69 dBm
10 dBm D1 10.690 d	ibin-			M	2[1]			-61.14 dBm
0 dBm				-				2.85600 GHz
-10 dBm D2 -9.3	10 dBm===							
-20 dBm							_	
-30 dBm								
40 dBm							-	
-50 dBm								
-60 dBm							1	M2
man hall and a superior of the second second	identication and the second	matherenweither	manumban	hunderhaleven	enterternout	Hundrenwan	rl huke	mounter
-70 dBm								
-80 dBm								
Start 30.0 MHz			69	1 pts				Stop 3.0 GHz

CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 14.MAR.2020 07:36:32

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

1 8.660 dBm 2.4830 (2000) 0 0 M2[1] -54.23 (2000) -20 dBm -20 dBm -20 (2000) -20 dBm -20 (2000) -20 (2000) -20 dBm -20 (2000) -20 (2000) -20 dBm -20 (2000) -20 (2000) -30 dBm -20 (2000) -20 (2000) -20 dBm -20 (2000) -20 (2000) -30 dBm -20 (2000) -20 (2000) -40 dBm	Spectrum									
IPk View M1[1] 8.66 d M1[1] 2.4830 d 0 dBm M2[1] -54.23 d 19 dBm 02 -11.340 dBm 19.5250 d -20 dBm -02 -11.340 dBm -02 -11.340 dBm -20 dBm -0 -0 -0 -20 dBm							Auto Sween			
2.4830 0 dBm -10 0 -20 -10 -20 -11.340 -20		20 00	0.111	200 110		in mode	Adto Direop			
0 dBm 19.5250 (-10 dBm 02 -11.340 dBm -20 dBm	M1 19 dBm	D1 8.660 dB	m							8.66 dBm 2.4830 GHz
20 dBm 20 dBm 30 dBm 20 dBm 40 dBm 20 dBm 50 dBm 20 dBm 60 dBm 20 dBm 80 dBm 20 dBm 80 dBm 20 dBm	D dBm					M	2[1]	-		-54.23 dBm 9.5250 GHz
-30 dBm	-10 dBm	D2 -11.	340 dBm-							
40 dBm	-20 dBm									
SO dBm	-30 dBm									
EO dBman when when when the second and the second a	-40 dBm									
-70 dBm	-50 dBm							1712		
80 dBm-	GO dBm	unandun	hours	and the second	urun	Apple and the second	and and a second second	under	Hurmbrury	report the de
	-70 dBm									
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0										
Start 2.0 GHz 691 pts Stop 25.0 G	Start 2.0 G	Hz			691	pts			Stop	25.0 GHz

Date: 14.MAR.2020 07:37:00



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

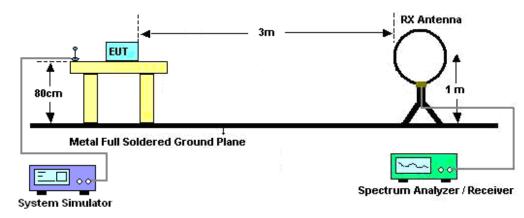
- 1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. For each suspected 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 = N₁*L₁+N₂*L₂+...+N_{n-1}*LN_{n-1}+N_n*L_n Where N₁ is number of type 1 pulses, L₁ 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 (-24.79 dB) 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.

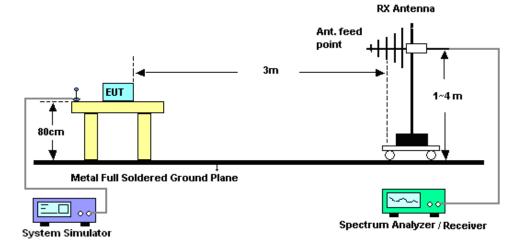


3.8.4 Test Setup

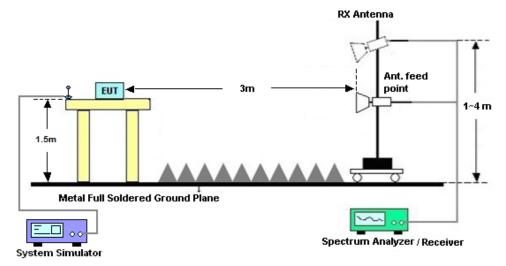
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



Sporton International (Kunshan) Inc. TEL : +86-512-57900158 FAX : +86-512-57900958 FCC ID: IHDT56YU2



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 ~ 10th 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

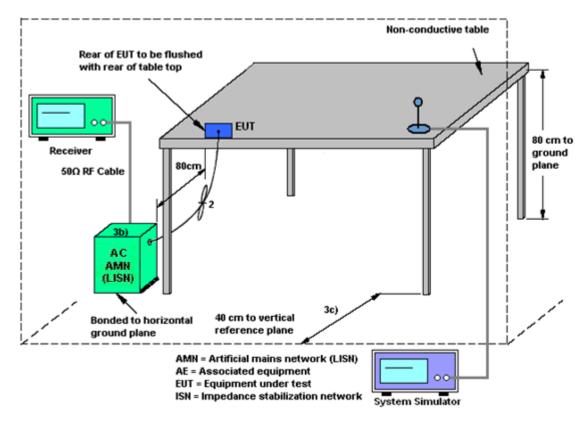
The measuring equipment is listed in the section 4 of this test report.

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	101040	10Hz~40GHz	Nov. 02, 2019	Mar. 14, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 13, 2020	Mar. 14, 2020	Jan. 12, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 13, 2020	Mar. 14, 2020	Jan. 12, 2021	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY572901 57	3Hz~8.5GHz;M ax 30dBm	Jul. 18, 2019	Feb. 26, 2020	Jul. 17, 2020	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 08	10Hz-44GHz	Apr. 16, 2019	Feb. 26, 2020	Apr. 15, 2020	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 10, 2019	Feb. 26, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 30, 2019	Feb. 26, 2020	May 29, 2020	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2019	Feb. 26, 2020	Apr. 26, 2020	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2019	Feb. 26, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Aug. 06, 2019	Feb. 26, 2020	Aug. 05, 2020	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 08, 2020	Feb. 26, 2020	Jan. 07, 2021	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Aug. 16, 2019	Feb. 26, 2020	Aug. 15, 2020	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY532702 03	500MHz~26.5G Hz	Apr. 15, 2019	Feb. 26, 2020	Apr. 14, 2020	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 16, 2019	Mar. 07, 2020	Apr. 15, 2020	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 18, 2019	Mar. 07, 2020	Oct. 17, 2020	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 28, 2019	Mar. 07, 2020	Oct. 27, 2020	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 18, 2019	Mar. 07, 2020	Oct. 17, 2020	Conduction (CO01-KS)

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	2.9 dB
of 95% (U = 2Uc(y))	2:9 dB

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

Measuring Uncertainty for a Level of Confidence	E 0 dP
of 95% (U = 2Uc(y))	5.0 dB

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

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

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

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



Appendix A. Conducted Test Results

Report Number : FR010812A

Bluetooth

Test Engineer:	Asa Cheng	Temperature:	20~26	°C
Test Date:	2020/3/14	Relative Humidity:	40~51	%

<u>TEST RESULTS DATA</u> 20dB and 99% Occupied Bandwidth and Hopping Channel Separation									
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	0.935	0.828	998.600	0.6233	Pass
DH	1Mbps	1	39	2441	0.935	0.828	998.600	0.6233	Pass
DH	1Mbps	1	78	2480	0.935	0.828	1002.900	0.6233	Pass
2DH	2Mbps	1	0	2402	1.255	1.164	1306.800	0.8365	Pass
2DH	2Mbps	1	39	2441	1.255	1.166	1007.200	0.8365	Pass
2DH	2Mbps	1	78	2480	1.263	1.166	1002.900	0.8423	Pass
3DH	3Mbps	1	0	2402	1.229	1.149	1002.900	0.8191	Pass
3DH	3Mbps	1	39	2441	1.229	1.149	998.600	0.8191	Pass
3DH	3Mbps	1	78	2480	1.229	1.155	1007.200	0.8191	Pass

			<u>TES</u>	ST RESULTS Dwell Time		
Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec) (MHz)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.90	0.31	0.4	Pass
AFH	20	53.33	2.90	0.15	0.4	Pass

					S <u>T RESUL</u> Peak Powe
DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
	0	1	11.42	20.97	Pass
DH1	39	1	12.09	20.97	Pass
	78	1	11.39	20.97	Pass
2DH	CH.	NTX	Peak Power	Power Limit	Test
2011	011.	NIX	(dBm)	(dBm)	Result
	0	1	12.79	20.97	Pass
2DH1	39	1	13.28	20.97	Pass
	78	1	12.23	20.97	Pass
					-
3DH	CH.	NTX	Peak Power	Power Limit	Test
5011			(dBm)	(dBm)	Result
	0	1	13.07	20.97	Pass
3DH1	39	1	13.52	20.97	Pass
	78	1	12.44	20.97	Pass

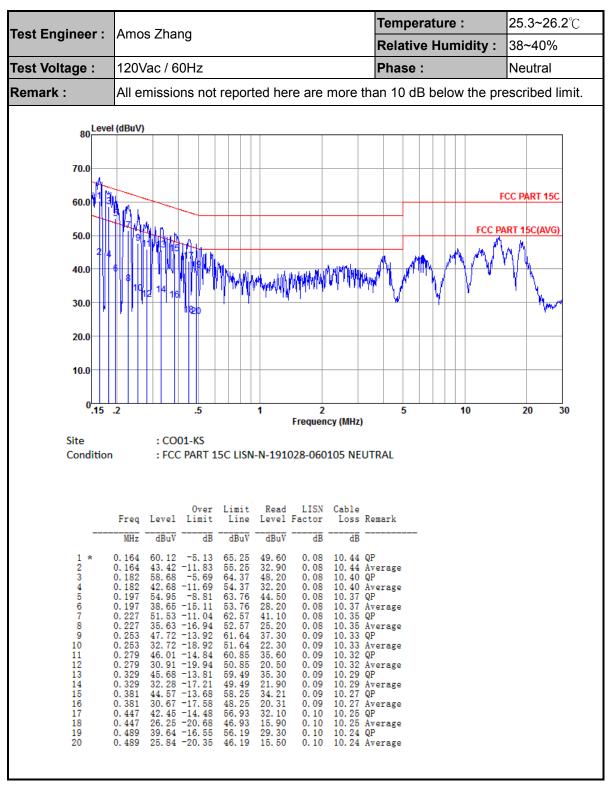
		<u>TEST RES</u> Number of Ho		
Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail	
79	79	> 15	Pass	



Appendix B. AC Conducted Emission Test Results

Teet Freineen	Amon Zhang	Temperature :	25.3~26.2℃	
Test Engineer :	Amos Zhang	Relative Humidity :	38~40%	
Test Voltage :	120Vac / 60Hz	Phase :	Line	
Remark :	All emissions not reported here are more that	an 10 dB below the pr	escribed limit.	
80 Ferminal K 1 80 10.0 10.0 10.0 10.0 15 Site Condition	(dBuV) (dBuV	F	CC PART 15C ART 15C(AVG)	
2 3 5 6 7 8 9 10 11 12	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	erage erage erage erage erage erage		
14 15 16 17 18 19	0. 276 46. 97 -13. 97 60. 94 36. 60 0. 05 10. 32 QP 0. 276 30. 97 -19. 97 50. 94 20. 60 0. 05 10. 32 Av. 0. 317 45. 85 -13. 95 59. 80 35. 50 0. 05 10. 30 Av. 0. 317 29. 55 -20. 25 49. 80 19. 20 0. 05 10. 30 Av. 0. 400 43. 52 -14. 34 57. 86 33. 19 0. 06 10. 27 QP 0. 400 26. 22 -21. 64 47. 86 15. 89 0. 06 10. 27 Av. 0. 481 41. 50 -14. 82 56. 32 31. 20 0. 06 10. 24 QP 0. 481 24. 50 -21. 82 46. 32 14. 20 0. 06 10. 24 Av.	erage erage erage		





Note:

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

2. Over Limit(dB) = Level(dB μ V) – Limit Line(dB μ V)



Appendix C. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	(110)
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	
		2333.01	53.01	-20.99	74	47.62	31.16	6.92	32.69	306	132	Р	Н
		2333.01	28.22	-25.78	54	-	-	-	-	-	-	Α	Н
БТ	*	2402	101.05	-	-	95.43	31.2	7.04	32.62	306	132	Р	Н
ВТ СН00		2402	76.26	-	-	-	-	-	-	-	-	А	Н
2402MHz		2376.3	53.59	-20.41	74	48.04	31.19	7.01	32.65	149	115	Ρ	V
240210112		2376.3	28.8	-25.2	54	-	-	-	-	-	-	А	V
	*	2402	101.06	-	-	95.44	31.2	7.04	32.62	149	115	Ρ	V
		2402	76.27	-	-	-	-	-	-	-	-	А	V
		2485.12	54.63	-19.37	74	48.3	31.77	7.16	32.6	315	132	Ρ	Н
		2485.12	29.84	-24.16	54	-	-	-	-	-	-	А	Н
DT	*	2480	100.87	-	-	94.54	31.77	7.16	32.6	315	132	Ρ	Н
ВТ СН 78		2480	76.08	-	-	-	-	-	-	-	-	А	н
2480MHz		2483.5	55.11	-18.89	74	48.78	31.77	7.16	32.6	120	115	Ρ	V
240010112		2483.5	30.32	-23.68	54	-	-	-	-	-	-	А	V
	*	2480	101.98	-	-	95.65	31.77	7.16	32.6	120	115	Ρ	V
		2480	77.19	-	-	-	-	-	-	-	-	А	V
Remark		o other spuric I results are F		st Peak	and Averag	je limit lin	e.		1	1	1	<u> </u>	1

BT (Band Edge @ 3m)



_				I	BT (Harmo	onic @ 3	8m)						_
BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Pos	Peak Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
ВТ СН 00		4806	39.52	-34.48	74	58.57	33.7	9.81	62.56	150	360	Р	Н
2402MHz		4806	39.1	-34.9	74	58.15	33.7	9.81	62.56	150	360	Ρ	V
		4884	38.91	-35.09	74	57.73	33.77	9.95	62.54	100	360	Р	Н
BT		7320	40.84	-33.16	74	55.96	35.89	12.64	63.65	100	360	Р	Н
CH 39 2441MHz		4884	37.83	-36.17	74	56.65	33.77	9.95	62.54	100	360	Ρ	V
244 111112		7320	41.05	-32.95	74	56.17	35.89	12.64	63.65	100	360	Р	V
		4962	38.62	-35.38	74	57.15	33.85	10.13	62.51	150	360	Р	Н
BT		7440	38.63	-35.37	74	54.45	36.11	12.84	64.77	150	360	Р	Н
CH 78 2480MHz		4962	37.93	-36.07	74	56.46	33.85	10.13	62.51	150	360	Р	V
240010172		7440	38.53	-35.47	74	54.35	36.11	12.84	64.77	150	360	Р	V
Remark		o other spurio I results are P		st Peak	and Averag	je limit lin	е.						

2.4GHz 2400~2483.5MHz



Emission below 1GHz

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)
		37.76	16.71	-23.29	40	27.3	20.66	0.71	31.96	-	-	Р	Н
		128.94	16.2	-27.3	43.5	30.08	16.78	1.28	31.94	-	-	Р	Н
		157.07	18.2	-25.3	43.5	31.75	16.91	1.47	31.93	-	-	Р	Н
		186.17	15.07	-28.43	43.5	29.73	15.68	1.57	31.91	-	-	Р	Н
2.4011-		855.47	26.56	-19.44	46	25.66	29.29	3.36	31.75	-	-	Р	Н
2.4GHz BT		925.31	28.81	-17.19	46	26.46	30.07	3.5	31.22	100	0	Р	Н
LF		31.94	17.31	-22.69	40	26.8	21.8	0.68	31.97	-	-	Р	V
		138.64	13.65	-29.85	43.5	27.33	16.97	1.29	31.94	-	-	Р	V
		165.8	13.64	-29.86	43.5	27.52	16.54	1.51	31.93	-	-	Р	V
		875.84	27.15	-18.85	46	26.12	29.25	3.4	31.62	-	-	Р	V
		936.95	28.9	-17.1	46	26.02	30.47	3.52	31.11	100	0	Р	V
		985.45	28.79	-25.21	54	25.25	30.62	3.58	30.66	-	-	Р	V
Remark	1. No	o other spurio	us found.										
	2. Al	I results are P	ASS agains	st limit li	ne.								



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 over limit 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)

- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- = 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".

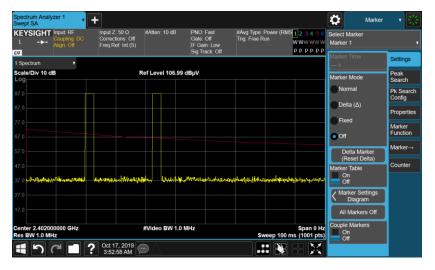


Appendix D. Duty Cycle Plots

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

Spectrum Analyzer Swept SA		+					Marker	- * 法
	ut: RF upling: DC jn: Off	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 10 dB	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Powe Trig: Free Run	er (RMS <mark>123456</mark> WWWWWW PPPPPP	Select Marker Marker 3	
1 Spectrum	•				ΔΜ	lkr3 3.750 ms	Marker ∆ Time 3.75000 ms	Settings
Scale/Div 10 dB	01		Ref Level 106.99	dBµV ∲3∆1		0.00 dB	Marker Mode	Peak Search
97.0 87.0			······································	3Δ1			Normal	Pk Search Config
77.0 67.0							Delta (Δ)	Properties
57.0 47.0							Fixed	Marker
37.0 44 ⁴ 27.0	hundrycay		whether			www.man	or	Function
17.0 Center 2.4020000							Delta Marker (Reset Delta)	Marker→
Res BW 1.0 MHz	JU GHZ		#Video BW 1.0 I	WHZ	Sweep	Span 0 Hz 10.0 ms (1001 pts)	Marker Table	Counter
5 Marker Table	•						On Off	
Mode Trans 1 N 1 2 Δ1 1	t	X 1.660 ms (Δ) 2.880 ms	Υ 96.94 dBµV (Δ)0.003675 dB	Function Fi	unction Width	Function Value	Marker Settings Diagram	
3 ∆1 1 4 5	t	(Δ) 3.750 ms	(Δ)0.004410 dB				All Markers Off Couple Markers	
		Oct 17, 2019					On Off	
	اللل	3:51:59 AM						

3DH5 on time (Count Pulses) Plot on Channel 39



Note:

- 1. Worst case Duty cycle = on time/100 milliseconds = $2 \times 2.88 / 100 = 5.76 \%$
- 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.