

Report No. : FR8N2626A



# FCC RADIO TEST REPORT

FCC ID	: UZ7MC930P
Equipment	: Mobile computer
Brand Name	: Zebra
Model Name	: MC930P
Applicant	: Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742
Manufacturer	: Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742
Standard	: FCC Part 15 Subpart C §15.247

The product was received on Nov. 26, 2018 and testing was started from Dec. 25, 2018 and completed on Mar. 08, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

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

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



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-			

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Appendix E. Setup Photographs



## History of this test report

Report No.	Version	Description	Issued Date
FR8N2626A	01	Initial issue of report	Mar. 13, 2019



## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(1)	Peak Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 3.20 dB at 947.500 MHz
3.9	15.207	AC Conducted Emission	Pass	Under limit 12.59 dB at 0.175 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	Pass	-

### **Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

#### Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Wii Chang** 

**Report Producer: Yimin Ho** 

## **1** General Description

## **1.1 Product Feature of Equipment Under Test**

Product Feature					
Equipment	Mobile computer				
Brand Name	Zebra				
Model Name	MC930P				
FCC ID	UZ7MC930P				
Sample 1	EUT with SKU 3				
Sample 2	EUT with SKU 4				
Sample 3	EUT with SKU 5				
Sample 4	EUT with SKU 6				
Sample 5	EUT with SKU 7				
	NFC				
EUT supports Radios application	WLAN 11a/b/g/n HT20/HT40				
EOT Supports Radios application	WLAN 11ac VHT20/VHT40/VHT80				
	Bluetooth BR/EDR/LE				
HW Version	EV1				
SW Version	01-14-11.00-OG				
MFD	13NOV18				
EUT Stage	Engineering Sample				

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories						
Adapter (5V/2.5A)	Brand Name	Zebra	Part Number	PWR-WUA5V12W0US		
USB-C Adapter	Brand Name	Zebra	Part Number	CBL-MC93-USBCHG-01		
USB-C cable	Brand Name	Zebra	Part Number	CBL-TC2X-USBC-01		
Std Battery	Brand Name	Zebra	Part Number	BT-000370-00		
Fzr Battery	Err Battery         Brand Name         Zebra         Part Number         BT-000371-00					
Holster	Brand Name	Zebra	Part Number	051607-79N1-18		



#### <Sample Information>

Model Name	MC930P				
	SKU3	SKU4	SKU5	SKU6	SKU7
Organization / Function / Group	EV1a-G21	EV1a-G22	EV1a-G23	EV1a-F11	EV1a-F13
nm	G-2S-1D-53k	G-2S-2D-53k	G-2S-LRI-53k	G-1F-1D-53k	G-1F-LRI-53k
Product Number	MC930P-GSBDG 4NA	MC930P-GSDDG 4NA	MC930P-GSFDG 4NA	MC930P-GFADG 4NA	MC930P-GFEDG 4NA
Form factor	Gun	Gun	Gun	Gun	Gun
Package/ Component Category	Pkg2	Pkg2	Pkg2	Pkg1 CS	Pkg 1 CS
NFC	YES	YES	YES	YES	YES
Vib	YES	YES	YES	YES	YES
Camera	YES	YES	YES	NO	NO
NI	NO	NO	NO	NO	NO
Side Trigger	NO	NO	NO	NO	NO
Display + TP Stackup	Option2	Option2	Option2	Option5	Option5
Scanner	SE965	SE4750SR	SE4850	SE965	SE4850
Battery	Std	Std	Std	Fzr	Fzr
Keyboard	53 Key				
Build Date	Oct 2018	Oct 2018	Oct 2018	Nov 2018	Nov 2018

## **1.2 Product Specification of Equipment Under Test**

Standards-related Product Specification				
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz			
Number of Channels	79			
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78			
	Bluetooth BR(1Mbps) : 3.69 dBm (0.0023 W)			
Maximum Output Power to Antenna	Bluetooth EDR (2Mbps) : 2.64 dBm (0.0018 W)			
	Bluetooth EDR (3Mbps) : 2.98 dBm (0.0020 W)			
	Bluetooth BR(1Mbps) : 0.834MHz			
99% Occupied Bandwidth	Bluetooth EDR (2Mbps) : 1.166MHz			
	Bluetooth EDR (3Mbps) : 1.149MHz			
Antenna Type / Gain	Patch Antenna with gain 3.85 dBi			
	Bluetooth BR (1Mbps) : GFSK			
Type of Modulation	Bluetooth EDR (2Mbps) : $\pi$ /4-DQPSK			
	Bluetooth EDR (3Mbps) : 8-DPSK			

## **1.3 Modification of EUT**

No modifications are made to the EUT during all test items.



## **1.4 Testing Location**

Test Site	SPORTON INTERNATIONAL INC.				
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978				
Test Site No. Sporton Site No.					
Test Site NO.	TH05-HY	CO05-HY	03CH07-HY		

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No. TW1190

## 1.5 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- + ANSI C63.10-2013

### Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

#### **Test Configuration of Equipment Under Test** 2

## 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
2400-2483.5 MHz	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-



## 2.2 Test Mode

		Blue	tooth Average Output Po	ower
Channel	Frequency		GFSK / 1Mbps	
		DH1	DH3	DH5
Ch00	2402MHz	1.57 dBm	1.54 dBm	1.55 dBm
Ch39	2441MHz	<mark>3.17</mark> dBm	3.13 dBm	3.13 dBm
Ch78	2480MHz	2.89 dBm	2.85 dBm	2.85 dBm

		Blue	tooth Average Output Po	ower
Channel	Frequency		π/4-DQPSK / 2Mbps	
		2DH1	2DH5	
Ch00	2402MHz	-1.75 dBm	-1.90 dBm	-1.92 dBm
Ch39	2441MHz	<mark>-0.26</mark> dBm	-0.40 dBm	-0.45 dBm
Ch78	2480MHz	-0.29 dBm	-0.44 dBm	-0.50 dBm

		Blue	tooth Average Output Po	ower				
Channel	Frequency	8-DPSK / 3Mbps						
		3DH1	3DH3	3DH5				
Ch00	2402MHz	-1.75 dBm	-1.93 dBm	-1.96 dBm				
Ch39	2441MHz	<mark>-0.24</mark> dBm	-0.42 dBm	-0.47 dBm				
Ch78	2480MHz	-0.27 dBm -0.45 dBm -0.51 dBm						



		Bluetooth Peak Output Power						
Channel	Frequency		GFSK / 1Mbps					
		DH1	DH3	DH5				
Ch00	2402MHz	2.27 dBm	2.25 dBm	2.22 dBm				
Ch39	2441MHz	<mark>3.69</mark> dBm	3.64 dBm	3.62 dBm				
Ch78	2480MHz	3.42 dBm 3.40 dBm 3.38 dBm						

		Bluetooth Peak Output Power							
Channel	Frequency	π/4-DQPSK / 2Mbps							
		2DH1	2DH3	2DH5					
Ch00	2402MHz	1.13 dBm	1.10 dBm	1.09 dBm					
Ch39	2441MHz	<mark>2.64</mark> dBm	2.62 dBm	2.60 dBm					
Ch78	2480MHz	2.59 dBm 2.57 dBm 2.56 dBm							

		Blu	uetooth Peak Output Pov	ver					
Channel	Frequency	8-DPSK / 3Mbps							
		3DH1	3DH3	3DH5					
Ch00	2402MHz	1.59 dBm	1.54 dBm	1.52 dBm					
Ch39	2441MHz	<mark>2.98</mark> dBm	2.97 dBm	2.90 dBm					
Ch78	2480MHz	2.91 dBm 2.87 dBm 2.85 dBm							

Remark: The data rate was set in 1Mbps for all the test items due to the highest RF output power.

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.



	Summary table of Test Cases								
		Data Rate / Modulation							
Test Item	Bluetooth BR 1Mbps	Bluetooth EDR 3Mbps							
	GFSK	$\pi$ /4-DQPSK	8-DPSK						
Conducted	Mode 1: CH00_2402 MHz Mode 4: CH00_2402 MHz Mode 7: CH00_2402 M								
Test Cases	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz						
Test Cases	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz						
		Bluetooth BR 1Mbps GFSK							
		Mode 1: CH00_2402 MHz							
Dedicted		Mode 2: CH39_2441 MHz							
Radiated Test Cases		Mode 3: CH78_2480 MHz							
Radiated	E	Bluetooth BR 3Mbps 8-DPS	K						
Test Cases		Mode 1: CH00_2402 MHz							
		Mode 2: CH39_2441 MHz							
		Mode 3: CH78_2480 MHz							
AC	Mode 1: Bluetooth Link + V	VLAN (2.4GHz) Link + Scan -	+ MP3 Play + Keypad (53) +						
Conducted	Std Battery + US	3-C Adapter + USB-C Cable -	+ Data Link with Notebook						
Emission	(Notebook to SD	Card) for Sample 2							
Remark:									
1. The condu	cted spurious emissions and	conducted band edge measu	rement for other data rates						
were not w	vorse than 1Mbps, and no oth	er significantly frequencies fo	ound in conducted spurious						
emission.									
2. For Radiat	. For Radiated Test Cases, the tests were performed with Std Battery and Sample 1.								

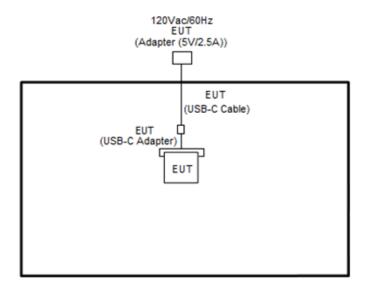
The following summary table is showing all test modes to demonstrate in compliance with the standard.

2. For Radiated Test Cases, the tests were performed with Std Battery and Sample 1.

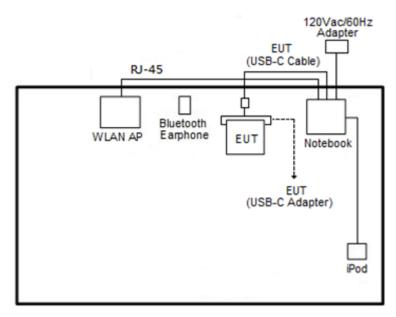


## 2.3 Connection Diagram of Test System

#### <Bluetooth Tx Mode>



#### <AC Conducted Emission Mode>





## 2.4 Support Unit used in test configuration and system

ltem	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
3.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

## 2.5 EUT Operation Test Setup

The RF test items, utility "QRCT" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

## 2.6 Measurement Results Explanation Example

### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)



## 3 Test Result

## 3.1 Number of Channel Measurement

## 3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

## 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

## 3.1.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 7.8.3.
- 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.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings: Span = the frequency band of operation;
   RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
- 6. The number of hopping frequency used is defined as the number of total channel.
- 7. Record the measurement data derived from spectrum analyzer.

## 3.1.4 Test Setup



Spectrum Analyzer

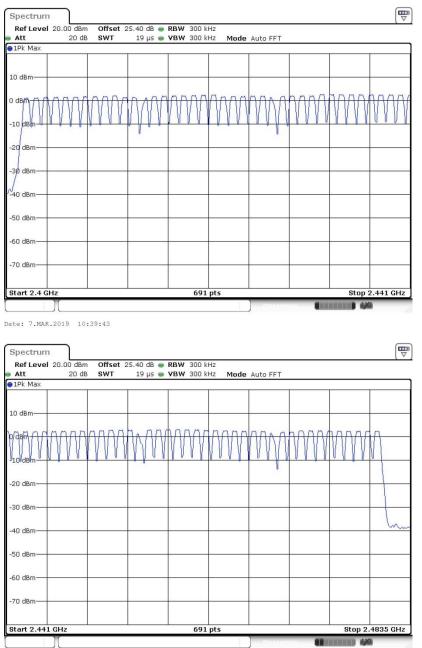
EUT



## 3.1.5 Test Result of Number of Hopping Frequency

Test Engineer :	Howa	rd Lin. Tommy Lee and Kai Liao		•	21~25℃ 51~54%
Number of Hopping (Channel)		Adaptive Frequency Hoppir (Channel)	ng	Limits (Channel)	Pass/Fail
79		20		> 15	Pass

#### Number of Hopping Channel Plot on Channel 00 - 78



Date: 7.MAR.2019 10:41:22



## **3.2 Hopping Channel Separation Measurement**

## 3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

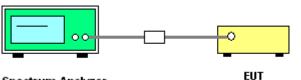
## **3.2.2 Measuring Instruments**

See list of measuring equipment of this test report.

## 3.2.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.2.
- 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.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
- 6. Measure and record the results in the test report.

## 3.2.4 Test Setup



Spectrum Analyzer



Test Eng	ngineer : Howard Lin, Tommy Lee and Kai Liao Relative H				Test Engineer :			21~25℃ 51~54%	
Mod.	Data Rate	Νтх	CH.	Freq. (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping ( Separa Measure Limit (I	ation ement	Pass/Fail	
DH	1Mbps	1	0	2402	1.025	0.58	27	Pass	
DH	1Mbps	1	39	2441	1.003	0.58	27	Pass	
DH	1Mbps	1	78	2480	1.003	0.58	27	Pass	
2DH	2Mbps	1	0	2402	1.003	0.83	65	Pass	
2DH	2Mbps	1	39	2441	1.003	0.83	36	Pass	
2DH	2Mbps	1	78	2480	1.012	0.83	65	Pass	
3DH	3Mbps	1	0	2402	1.007	0.82	78	Pass	
3DH	3Mbps	1	39	2441	1.003	0.82	78	Pass	
3DH	3Mbps	1	78	2480	1.003	0.82	78	Pass	

## 3.2.5 Test Result of Hopping Channel Separation

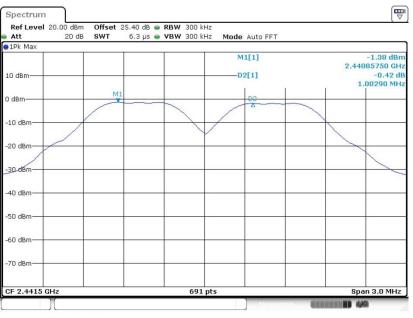
#### <1Mbps>

### Channel Separation Plot on Channel 00 - 01



Date: 7.MAR.2019 09:10:58

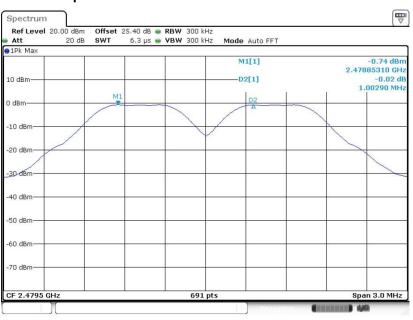




### Channel Separation Plot on Channel 39 - 40

Date: 7.MAR.2019 09:20:57

#### **Channel Separation Plot on Channel 77 - 78**

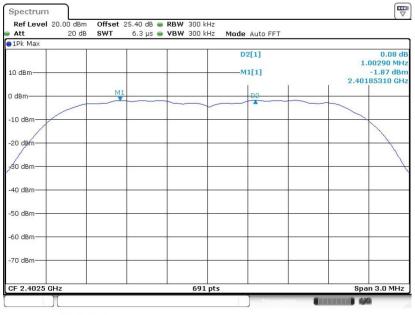


Date: 7.MAR.2019 09:36:56



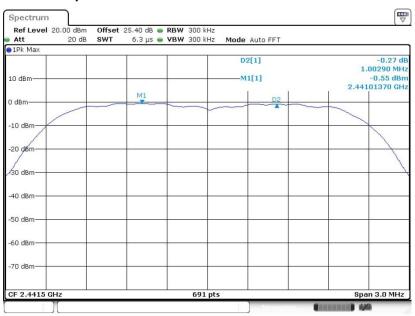
#### <2Mbps>

#### **Channel Separation Plot on Channel 00 - 01**



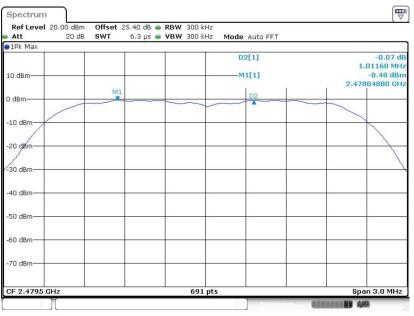
Date: 7.MAR.2019 10:55:27

#### **Channel Separation Plot on Channel 39 - 40**



Date: 7.MAR.2019 11:13:39



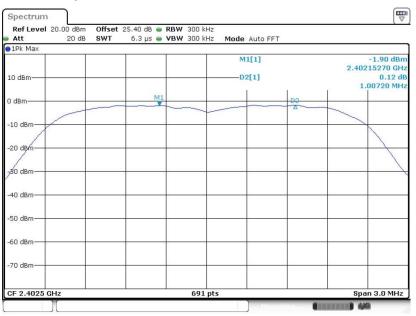


### Channel Separation Plot on Channel 77 - 78

Date: 7.MAR.2019 11:36:25

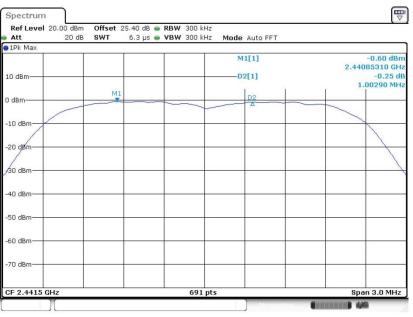
#### <3Mbps>

#### **Channel Separation Plot on Channel 00 - 01**



Date: 7.MAR.2019 12:24:29

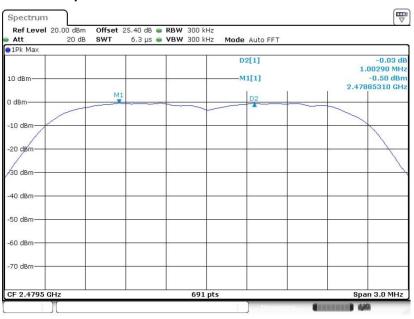




### Channel Separation Plot on Channel 39 - 40

Date: 7.MAR.2019 12:22:15

#### **Channel Separation Plot on Channel 77 - 78**



Date: 7.MAR.2019 12:00:32



## 3.3 Dwell Time Measurement

## 3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

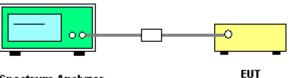
## 3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

## 3.3.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.4.
- 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.
- 4. Enable the EUT hopping function.
- 5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
- 6. Measure and record the results in the test report.

## 3.3.4 Test Setup

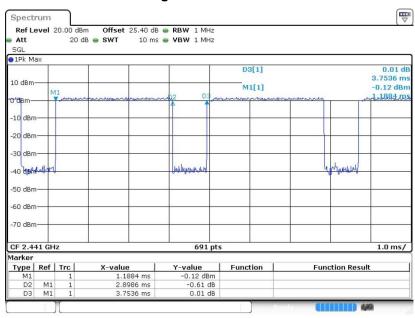


Spectrum Analyzer



### 3.3.5 Test Result of Dwell Time

Test Eng	<b>jineer</b> : Howa	rd Lin, Tommy Le	Temperature : Relative Humidity :		21~25℃ 51~54%		
Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec) (MHz)	Dwell Time (sec)		.imits (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



#### Package Transfer Time Plot

Date: 5.MAR.2019 17:38:07

#### Remark:

**1.** In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit  $(0.4 \times 79)$  (s),Hops Over Occupancy Time comes to  $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$  hops.

**2.** In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit  $(0.4 \times 20)$  (s), Hops Over Occupancy Time comes to  $(800 / 6 / 20) \times (0.4 \times 20) = 53.33$  hops.

3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time



## 3.4 20dB and 99% Bandwidth Measurement

## 3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

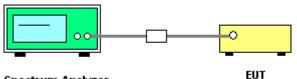
## 3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

## 3.4.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
- 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.
- Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
  Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
  RBW ≥ 1-5% of the OBW; VBW ≥ RBW; Sweep = auto; Detector function = peak;
  Trace = max hold.
- Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 \* RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
- 6. Measure and record the results in the test report.

## 3.4.4 Test Setup



Spectrum Analyzer



Test Engir	Test Engineer :       Howard Lin, Tommy Lee and Kai Liao									
	Relative Humidity : 51~54%									
Mod.	Data Rate	Νтх	CH.	Freq. (MHz)	20db BW (MHz	) Pass/Fail				
DH	1Mbps	1	0	2402	0.874	Pass				
DH	1Mbps	1	39	2441	0.874	Pass				
DH	1Mbps	1	78	2480	0.874	Pass				
2DH	2Mbps	1	0	2402	1.255	Pass				
2DH	2Mbps	1	39	2441	1.250	Pass				
2DH	2Mbps	1	78	2480	1.255	Pass				
3DH	3Mbps	1	0	2402	1.242	Pass				
3DH	3Mbps	1	39	2441	1.242	Pass				
3DH	3Mbps	1	78	2480	1.242	Pass				

## 3.4.5 Test Result of 20dB Bandwidth

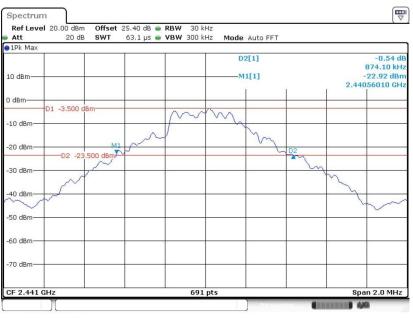
#### <1Mbps>

#### 20 dB Bandwidth Plot on Channel 00



Date: 7.MAR.2019 09:02:49

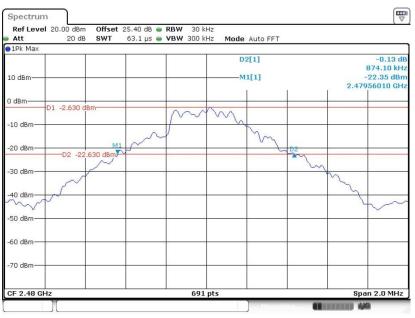




#### 20 dB Bandwidth Plot on Channel 39

Date: 7.MAR.2019 09:16:45

#### 20 dB Bandwidth Plot on Channel 78

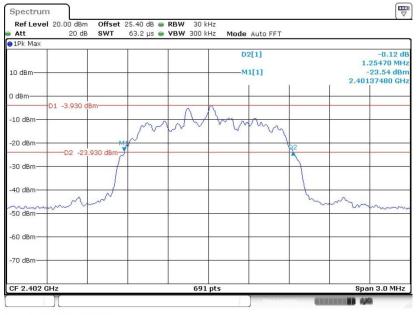


Date: 7.MAR.2019 09:26:00



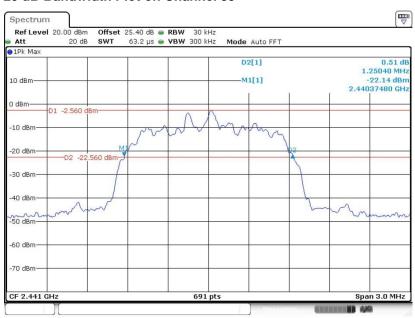
#### <2Mbps>

#### 20 dB Bandwidth Plot on Channel 00



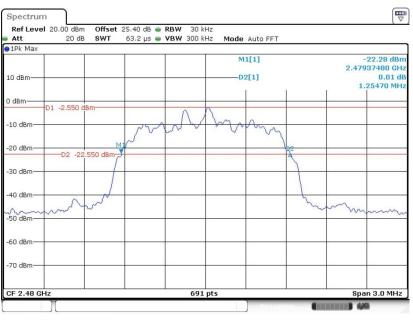
Date: 7.MAR.2019 10:58:42

#### 20 dB Bandwidth Plot on Channel 39



Date: 7.MAR.2019 11:18:40



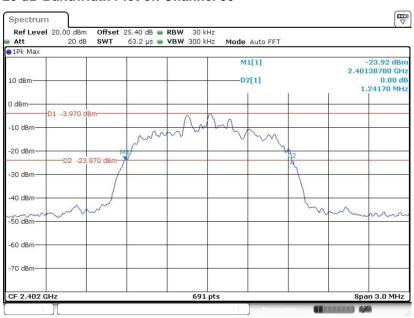


#### 20 dB Bandwidth Plot on Channel 78

Date: 7.MAR.2019 11:47:28

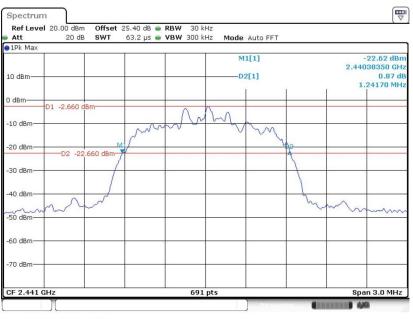
#### <3Mbps>

#### 20 dB Bandwidth Plot on Channel 00



Date: 7.MAR.2019 12:27:26

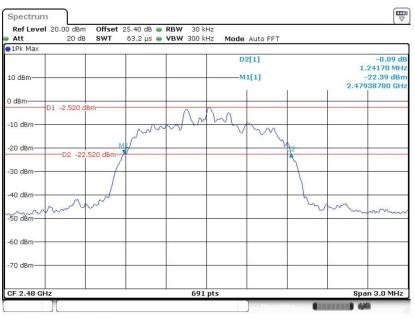




#### 20 dB Bandwidth Plot on Channel 39

Date: 7.MAR.2019 12:21:05

#### 20 dB Bandwidth Plot on Channel 78



Date: 7.MAR.2019 12:10:38

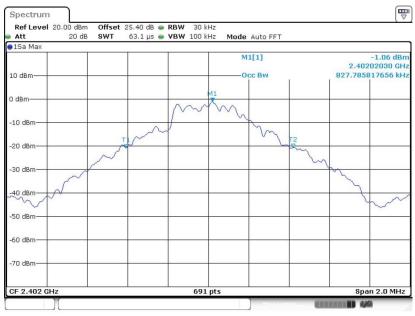


Test Engir	Test Engineer :       Howard Lin, Tommy Lee and Kai Liao       Temperature :       21~25         Relative Humidity :       51~54								
Mod.	Data Rate	Νтх	CH.	Freq. (MHz)	99% Bandwidth (MHz)	Pass/Fail			
DH	1Mbps	1	0	2402	0.828	Pass			
DH	1Mbps	1	39	2441	0.834	Pass			
DH	1Mbps	1	78	2480	0.834	Pass			
2DH	2Mbps	1	0	2402	1.166	Pass			
2DH	2Mbps	1	39	2441	1.166	Pass			
2DH	2Mbps	1	78	2480	1.166	Pass			
3DH	3Mbps	1	0	2402	1.149	Pass			
3DH	3Mbps	1	39	2441	1.149	Pass			
3DH	3Mbps	1	78	2480	1.149	Pass			

## 3.4.6 Test Result of 99% Occupied Bandwidth

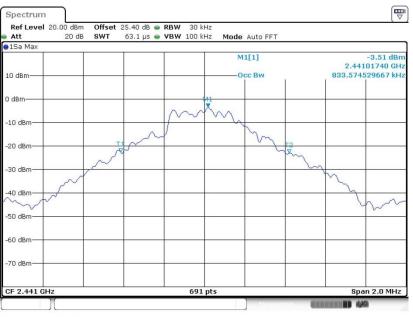
### <1Mbps>

#### 99% Occupied Bandwidth Plot on Channel 00



Date: 7.MAR.2019 08:54:43





## 99% Occupied Bandwidth Plot on Channel 39

Date: 7.MAR.2019 09:13:40



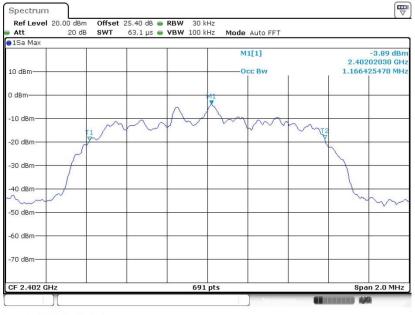


Date: 7.MAR.2019 09:23:05



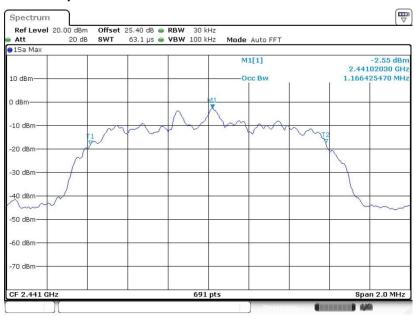
#### <2Mbps>

#### 99% Occupied Bandwidth Plot on Channel 00



Date: 7.MAR.2019 11:00:16

#### 99% Occupied Bandwidth Plot on Channel 39



Date: 7.MAR.2019 11:19:20





### 99% Occupied Bandwidth Plot on Channel 78

Date: 7.MAR.2019 11:49:50

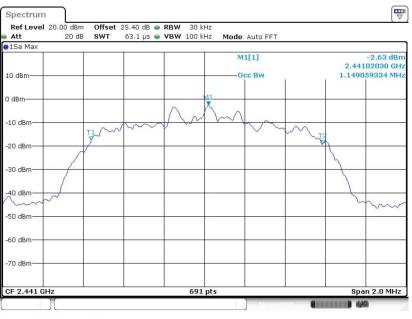
#### <3Mbps>

#### 99% Occupied Bandwidth Plot on Channel 00



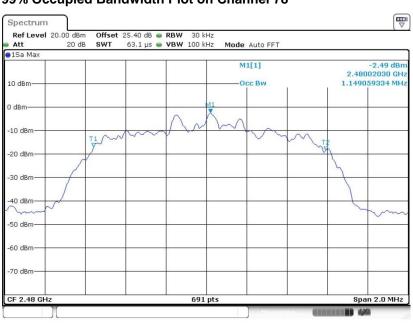
Date: 7.MAR.2019 12:28:28





## 99% Occupied Bandwidth Plot on Channel 39

Date: 7.MAR.2019 12:17:05



### 99% Occupied Bandwidth Plot on Channel 78

Date: 7.MAR.2019 12:12:18

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



## 3.5 Output Power Measurement

## 3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

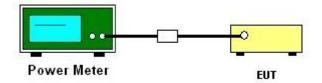
## 3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

## 3.5.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.5.
- 2. The RF output of EUT was connected to the power meter 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.
- 4. Measure the conducted output power with cable loss and record the results in the test report.
- 5. Measure and record the results in the test report.

## 3.5.4 Test Setup





Test Engine	er · Ho	ward Lip T	ommy Lee and Kai Liao	Temperature :	<b>21~25</b> ℃
rest Engine				Relative Humidity :	51~54%
DH	CH.	Νтх	Peak Power (dBm)	Power Limit (dBm)	Test Result
	0	1	2.27	20.97	Pass
DH1	39	1	3.69	20.97	Pass
	78	1	3.42	20.97	Pass
2DH	CH.	Νтх	Peak Power (dBm)	Power Limit (dBm)	Test Result
	0	1	1.13	20.97	Pass
2DH1	39	1	2.64	20.97	Pass
	78	1	2.59	20.97	Pass
3DH	CH.	Νтх	Peak Power (dBm)	Power Limit (dBm)	Test Result
	0	1	1.59	20.97	Pass
3DH1	39	1	2.98	20.97	Pass
	78	1	2.91	20.97	Pass

## 3.5.5 Test Result of Peak Output Power

## 3.5.6 Test Result of Average Output Power (Reporting Only)

Test Engineer :		Howard Lin, Tommy Lee and Kai Liao		
		Relative F		Humidity : 51~54%
DH	CH.	Ντχ	Average Power (dBm)	Duty Factor (dB)
DH1	0	1	1.57	5.19
	39	1	3.17	5.19
	78	1	2.89	5.19
2DH	CH.	Ντχ	Average Power (dBm)	Duty Factor (dB)
2DH1	0	1	-1.75	5.11
	39	1	-0.26	5.11
	78	1	-0.29	5.11
3DH	CH.	Ντχ	Average Power (dBm)	Duty Factor (dB)
3DH1	0	1	-1.75	5.11
	39	1	-0.24	5.11
	78	1	-0.27	5.11



# 3.6 Conducted Band Edges Measurement

# 3.6.1 Limit of Band Edges

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.

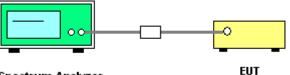
## 3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

## 3.6.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.6.
- 2. Set to the maximum power setting and enable the EUT transmit continuously.
- 3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
- 4. Enable hopping function of the EUT and then repeat step 2. and 3.
- 5. Measure and record the results in the test report.

# 3.6.4 Test Setup



Spectrum Analyzer

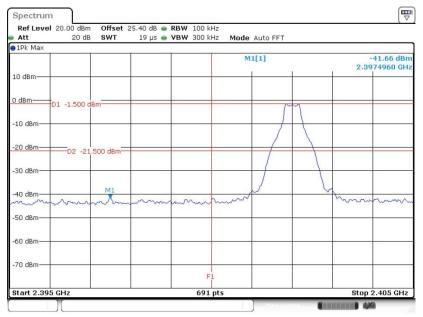


## 3.6.5 Test Result of Conducted Band Edges

Teet Engineer :			<b>21~25</b> ℃
Test Engineer :	Howard Lin, Tommy Lee and Kai Liao	Relative Humidity :	51~54%

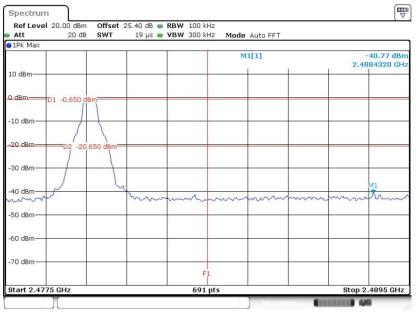
### <1Mbps>

### Low Band Edge Plot on Channel 00



Date: 7.MAR.2019 09:07:27

### High Band Edge Plot on Channel 78

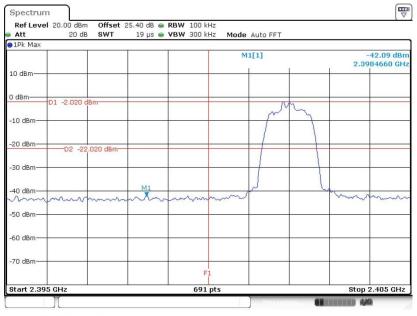


Date: 7.MAR.2019 09:29:53



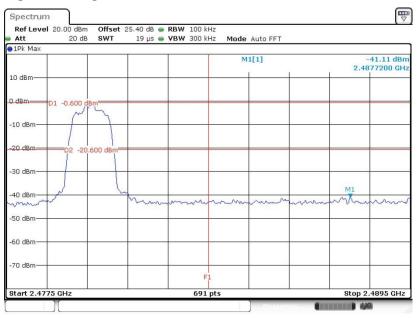
#### <2Mbps>

### Low Band Edge Plot on Channel 00



Date: 7.MAR.2019 10:59:10

### High Band Edge Plot on Channel 78

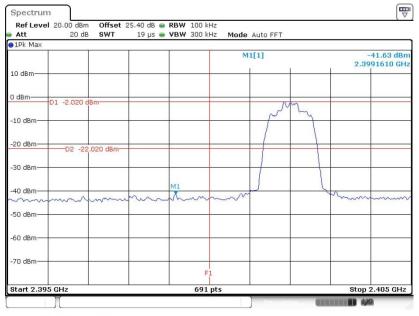


Date: 7.MAR.2019 11:49:06



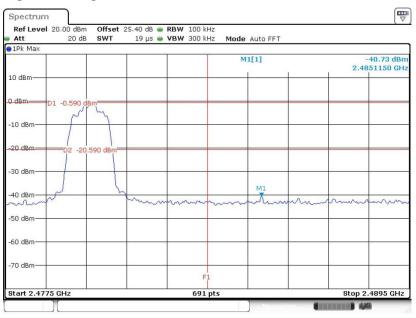
#### <3Mbps>

### Low Band Edge Plot on Channel 00



Date: 7.MAR.2019 12:27:47

### High Band Edge Plot on Channel 78

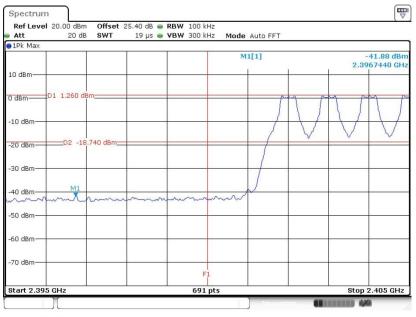


Date: 7.MAR.2019 12:11:06

# 3.6.6 Test Result of Conducted Hopping Mode Band Edges

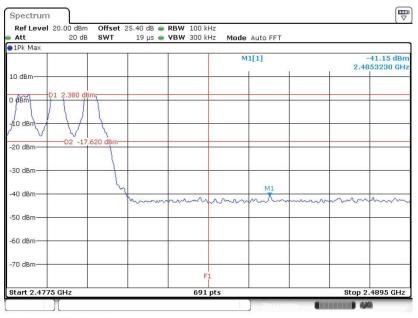
#### <1Mbps>

### Hopping Mode Low Band Edge Plot



Date: 7.MAR.2019 10:34:43

### Hopping Mode High Band Edge Plot

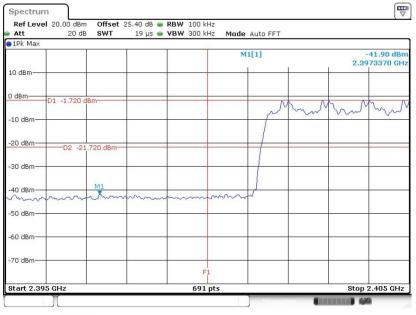


Date: 7.MAR.2019 10:35:40



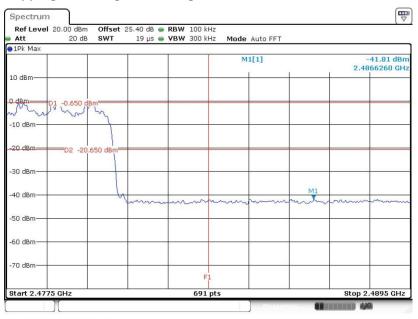
#### <2Mbps>

### Hopping Mode Low Band Edge Plot



Date: 7.MAR.2019 11:55:24

### Hopping Mode High Band Edge Plot

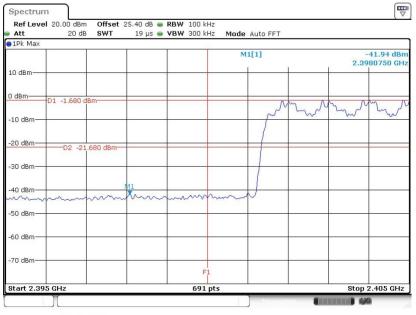


Date: 7.MAR.2019 11:54:40



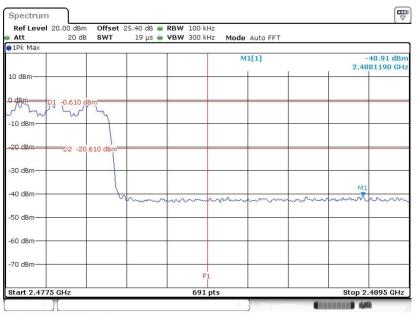
#### <3Mbps>

### Hopping Mode Low Band Edge Plot



Date: 7.MAR.2019 11:56:46

### Hopping Mode High Band Edge Plot



Date: 7.MAR.2019 11:57:52

# 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.

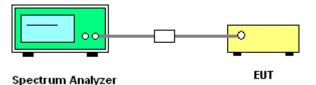
## 3.7.2 Measuring Instruments

See list of measuring equipment 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



TEL : 886-3-327-3456 FAX : 886-3-328-4978 Report Template No.: BU5-FR15CBT Version 2.4

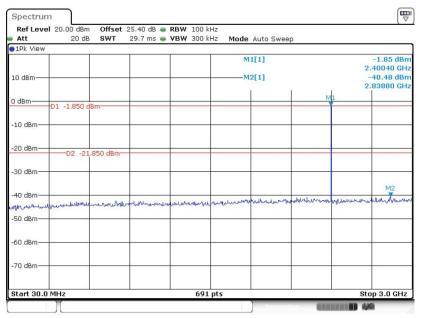


## 3.7.5 Test Result of Conducted Spurious Emission

Teet Engineer :			<b>21~25</b> ℃
Test Engineer :	Howard Lin, Tommy Lee and Kai Liao	Relative Humidity :	51~54%

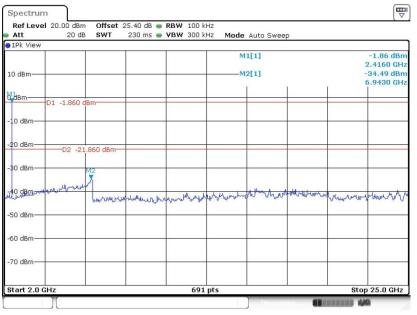
### <1Mbps>

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



Date: 7.MAR.2019 09:05:26

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



Date: 7.MAR.2019 09:06:01



Att	20 dB	SWT	29.7 ms 👄	<b>VBW</b> 300	kHz Mode	Auto Sweep			
1Pk View									
					M	1[1]			2.08 dBn
10 dBm					M	2[1]			3910 GH: 1.11 dBn
						2[1]			6350 GH
0 dBm							M	1	
J UBIII-	D1 -1.990 d	8m							
-10 dBm									
-10 uBm									
-20 dBm									
-20 UBIII-	D2 -21	.990 dBm-							
-30 dBm									
-50 0011									
-40 dBm									M
-to abili	L. L. L. A. MALAR	autouto	AND LOUISING	and A MANDAN	mapphonent	whichthered	no public house	and approximation of	withursouth
-50 dBm	humo an a								
-50 abiii									
-60 dBm									
oo abiii									
-70 dBm									
, o abiii									
					L pts				3.0 GHz
Start 30.0									

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

Date: 7.MAR.2019 09:18:15

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

Ref Level 20.0 Att	0 dBm Offset 2 20 dB SWT	5.40 dB 👄 RBW 230 ms 👄 VBW		Auto Sweep			
1Pk View							
10 dBm				11[1] 12[1]		-2.63 2.4490 -33.65 6.9760	0 GH i dBr
D1 -2	.630 dBm						
-10 dBm							
-20 dBm	2 -22.630 dBm						
-30 dBm	under W						
Lower Carlow and	whyme	when we we had	withour with	Mutotwant	Mannah	uphraduran	47
50 dBm							
-60 dBm							
-70 dBm							
Start 2.0 GHz			691 pts			Stop 25.0	GHz

Date: 7.MAR.2019 09:18:49



Att 🛛	20 dB	SWT	29.7 ms 🧉	VBW 30	00 kHz M	ode Auto Sv	weep			
1Pk View			- <u>r</u>							
						M1[1]				-0.84 dBn 47780 GH
10 dBm				-	_	M2[1]				40.41 dBn
						I	Ĩ	M		59810 GH
0.dBm	D1 -0.840 dB	m <del></del>			_	_		-	-	
-10 dBm										
-20 dBm										
-211 0Bm	D2 -20.8	40 dBm-								
-30 dBm										
-40 dBm-				_	_		AL. A.A.		M2	
mound	www.hunder	whitehous	anomentation	regulation work	neuronalismet	androwender	monthermore	Marganet Col	C. Warder and	and the second
-50 dBm										
-60 dBm							_	-		
70.10										
-70 dBm										
Start 30.0	MHZ				591 pts				Sto	p 3.0 GHz

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

Date: 7.MAR.2019 09:33:47

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

Ref Level 20.0 Att	20 dB SWT	25.40 dB 👄 230 ms 👄	VBW 300 k		Auto Swee	þ		
1Pk View								
10 dBm					1[1]		-	-1.14 dBr 2.4830 GH -34.45 dBr 6.9760 GH
DI -1	.140 dBm							0.9700 GH
-10 dBm								
-20 dBm0	2 -21.140 dBm							
-30 dBm	. M2							
49 dBarner un	burney	whenthever	nduartent	entrement	maturantheor	ntr (ntrans	hourselwa	handling
-50 dBm								
-60 dBm								
-70 dBm								
Start 2.0 GHz			691	nts			Stor	25.0 GHz

Date: 7.MAR.2019 09:34:31



### <2Mbps>

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

Ref Level	20.00 dBm 20 dB		25.40 dB 👄 29.7 ms 👄			Auto Sweep		
1Pk View	20 00	3111	29.7 113	1011 300	KITZ HOUE	Auto Sweet		
10 dBm						11[1]		-2.31 dBn 2.40040 GH -40.75 dBn 2.98500 GH
0 dBm	D1 -2.310 d	Bm					MI	
-10 dBm		1999						
-20 dBm		.310 dBm—						
-30 dBm								
-40 dBm	multiple	an man	- and the second se	anterior	nantalanan	the second	humanitation	n naturalitetterenterenterenterenterenterenterent
-60 dBm						-		
-70 dBm								
Start 30.0	MH2			60	1 pts			Stop 3.0 GHz

Date: 7.MAR.2019 11:02:04

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

1Pk View	20 dB SWT	230 ms 🖷 V	DW JUU KI	12 MOUE	Auto Swee	þ		
10 dBm					1[1] 2[1]	6		-2.99 dBn 2.4160 GH -35.04 dBn 7.0090 GH
0 dBm	.990 dBm							
-10 dBm								
20 dBmD	2 -22.990 dBm-				×			
-30 dBm	M2							
49 dBarter hours	we have here here here here here here here he	theman which which	newtoneth	warman	nonthe	untrajutrai	mublim	month
50 dBm								
-60 dBm								
70 dBm								
-70 dBm								
) GHz	-		691	pts			Sto	25.0 GHz

Date: 7.MAR.2019 11:09:36



		SWT	29.7 1115	VBW 30	UKHZ MOC	le Auto Swe	ер		
0 dBm						M1[1] M2[1]			-0.86 dBr 2.43910 GH -40.80 dBr 2.89900 GH
	D1 -0.860 de	3m <del></del>						M1	
10 dBm						_			
20 dBm	D2 -20.	860 dBm=		_					
30 dBm						2			
40 dBm						allocation to the second	a a Albertanda	1.4.0	M2
lithonnad 50 dBm	burkerthat	numphan	matchlonen	e allow and			un un un un un	Landon of Arrand	b-harden werther
60 dBm			-		_	_			
70 dBm-									

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

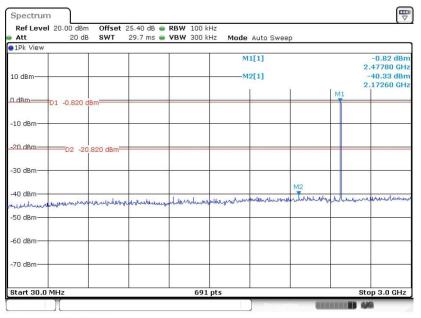
Date: 7.MAR.2019 11:20:39

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

Att 20.00	O dB SWT	25.40 dB 👄 I 230 ms 👄 1			Auto Swee	р		
1Pk View								
10 dBm					1[1] 2[1]			-1.28 dBr 2.4490 GH -35.09 dBr
						Ĩ		6.9760 GH
D1 -1.2	280 dBm							
-10 dBm								
20 dBmD2	2 -21.280 dBm							
30 dBm	M2							-
40. ABRON - LANDA	hunder	Muhrmunduren	umput	abythrough	monthe	hours	Municip	uturn
-50 dBm								
60 dBm								2
-70 dBm								
			691					p 25.0 GHz

Date: 7.MAR.2019 11:21:18





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

Date: 7.MAR.2019 11:51:13

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

Ref Level 20 Att	20 dB SW1	et 25.40 dB 👄 I	/BW 300 kHz		Auto Sweep			
1Pk View	20 08 3991	230 113 🖷	BW 300 KH2	Moue	auto Sweet	,		
10 dBm				M1				-1.00 dBn 2.4830 GH 35.11 dBn
				-1112	[1]			5.9430 GH
DI D1	-1.000 dBm							
-10 dBm								
20 dBm	=D2 -21.000 dB	m						
30 dBm	M2							
49. gpm+ car	within turning	an much when the ment	menterate	a same	man for the	whentout	mound	mart
50 dBm								
60 dBm								
70 dBm								
Start 2.0 GHz			691 p					25.0 GHz

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### <3Mbps>

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

	el 20.00 dBm		25.40 dB 👄						
Att	20 dE	3 SWT	29.7 ms 🖷	<b>VBW</b> 300	i kHz Mode	Auto Sweep	0		
1Pk View					T				
					M	11[1]			-2.27 dBn 40040 GH:
10 dBm					N	2[1]			40.57 dBr
10 0011			v.						92480 GH
0 dBm							MI		
u asm	D1 -2.270 d	dBm							
-10 dBm—									
-20 dBm	D2 -22	2.270 dBm-				-			
-30 dBm					-				
									M2
-40 dBm-	and the second		a constant and	-		Acres	, manager all and	and the second	
wanghunan	shubberthe	myndeline	www.	monthema	nununundun	an mereralised	L0	maller	
-50 dBm—									
-60 dBm—									
-70 dBm—									
Start 30.0	) MHz			69	91 pts			Sto	p 3.0 GHz

Date: 7.MAR.2019 12:29:04

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

Att	20 dB	SWT 2	30 ms 🖷	<b>VBW</b> 300 k	Hz Mode	Auto Swee	р			
1Pk View					M	1[1]			-2.34 dBm	
					M1[1]			2.4160 GH		
10 dBm					M2[1]			-34.90 dBn 6.9430 GH		
44						Ĩ.		r i	5.9430 GH	
dBm-D	1 -2.340 dBm									
-10 dBm										
10 ubiii										
-20 dBm										
	-D2 -22.34	J dBm								
-30 dBm	M2			3				-		
	- MANAMANA AND									
P dBm + Anno		Mountain	etunate	mound	and the south	montin	with human	Munary	muunt	
-50 dBm										
-60 dBm			2	2				· · · · · ·		
-70 dBm										
Start 2.0 GH	z			691	pts			Stop	25.0 GHz	

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Att	20 dB SW	T 29.7 ms 🖷	VBW 300	Hz Mode	Auto Sweep	)			
1Pk View				T					
				M1[1]			-0.92 dBr 2.43910 GH		
10 dBm				M2[1]			-40.46 dBr		
					5 B			2.99360 GH	
	-0.920 dBm						M1	_	
-10 dBm									
-20 dBm	-D2 -20.920 di	3m							
-30 dBm			20						
-40 dBm								1	
auraprover the	mourmathrees	montheman	uponweather	manhamm	endertherest	Andrewin	whitedgem	anormaliant	
-50 dBm			-					_	
-60 dBm			-		-				
-70 dBm					2			-	
Start 30.0 MH	-		601	pts			-	top 3.0 GHz	

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

Date: 7.MAR.2019 12:14:38

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

Ref Level 20.0 Att	20 dB SWT	25.40 dB 👄 1 230 ms 👄 1			Auto Swee	р			
1Pk View									
							-1.84 dBn 2.4490 GH		
10 dBm		-		M2[1]			-34.54 dBr		
					1	ĩ	ř.	6.9760 GH	
dBm	.840 dBm								
01-1							5		
-10 dBm									
-20 dBm	)2 -21.840 dBm-								
-30 dBm-									
	M2							8	
-40 dBarana	and letter				u hora 1 .	Martin Line			
dhow	hours	malebauneen	understeh	hand through	has a contra	an allaran alla	ranno	home of	
-50 dBm									
-60 dBm								-	
-70 dBm									
Start 2.0 GHz			691	pts	-		Sto	p 25.0 GHz	

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