



# FCC RADIO TEST REPORT

FCC ID	: UZ7RFD8500
Equipment	: RFD8500 UHF RFID READER
Brand Name	: ZEBRA
Model Name	: RFD8500
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 Jul. 07, 2022 and testing was performed from Jul. 28, 2022 to Aug. 13, 2022. 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 test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu Sporton International Inc. EMC & Wireless Communications Laboratory No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



## **Table of Contents**

His	tory o	f this test report	3
Sur	nmary	/ of Test Result	4
1	Gene	ral Description	5
	1.1	Product Feature of Equipment Under Test	5
	1.2	Product Specification of Equipment Under Test	5
	1.3	Modification of EUT	5
	1.4	Testing Location	6
	1.5	Applicable Standards	6
2	Test	Configuration of Equipment Under Test	7
	2.1	Carrier Frequency Channel	7
	2.2	Test Mode	8
	2.3	Connection Diagram of Test System	9
	2.4	Support Unit used in test configuration and system	9
	2.5	EUT Operation Test Setup	9
	2.6	Measurement Results Explanation Example	.10
3	Test	Result	.11
	3.1	Number of Channel Measurement	.11
	3.2	Hopping Channel Separation Measurement	.13
	3.3	Dwell Time Measurement	.18
	3.4	20dB and 99% Bandwidth Measurement	.21
	3.5	Output Power Measurement	. 30
	3.6	Conducted Band Edges Measurement	.32
	3.7	Conducted Spurious Emission Measurement	.37
	3.8	Radiated Band Edges and Spurious Emission Measurement	.44
	3.9	Antenna Requirements	.48
4	List o	of Measuring Equipment	.49
5	Unce	rtainty of Evaluation	.50
Арр	oendix	A. Radiated Spurious Emission	
Арр	oendix	B. Radiated Spurious Emission Plots	
Арр	oendix	c C. Duty Cycle Plots	

Appendix D. Setup Photographs



## History of this test report

Version	Description	Issue Date
01	Initial issue of report	Aug. 19, 2022
02	Revise typo	Sep. 01, 2022
	01	01 Initial issue of report



## 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	8.51 dB under the limit at 204.960 MHz
3.9	15.203 & 15.247(b)	Antenna Requirement	Pass	-

#### Declaration of Conformity:

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

It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.

2. The measurement uncertainty please refer to report "Uncertainty of Evaluation".

#### Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

#### Reviewed by: Wei Chen

Report Producer: Lucy Wu

## **1** General Description

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

Product Feature				
Equipment	RFD8500 UHF RFID READER			
Brand Name	ZEBRA			
Model Name	RFD8500			
FCC ID	UZ7RFD8500			
EUT supports Radios application	UHF RFID			
EOT Supports Radios application	Bluetooth BR/EDR/LE			
HW Version	EV1			
SW Version	PAACPS00-008-N02D0			
MFD 28JUN22				
EUT Stage Identical Prototype				

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

Specification of Accessories						
Battery	Battery Brand Name symbol Part Number 82-172087-01					
Micro USB Cable	Brand Name	ZEBRA	Part Number	25-MCXUSB-01R		
Supported Unit used in test configuration and system						
AC Adapter	Brand Name	ZEBRA	Part Number	PWR-WUA5V6W0WHT		
Terminal	Brand Name	Zebra	Model Name	TC26BK		

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

Product Specification is subject to this standard			
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): 1.30 dBm / 0.0013 W		
Maximum Output Power to Antenna	Bluetooth EDR (2Mbps): 3.35 dBm / 0.0022 W		
-	Bluetooth EDR (3Mbps): 3.98 dBm / 0.0025 W		
	Bluetooth BR (1Mbps): 0.842MHz		
99% Occupied Bandwidth	Bluetooth EDR (2Mbps): 1.187MHz		
	Bluetooth EDR (3Mbps): 1.172MHz		
Antenna Type / Gain	PIFA and PCB chip Antenna type with gain 2.6 dBi		
	Bluetooth BR (1Mbps) : GFSK		
Type of Modulation	Bluetooth EDR (2Mbps) :π/4-DQPSK		
	Bluetooth EDR (3Mbps) : 8-DPSK		

**Remark:** The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

## **1.3 Modification of EUT**

No modifications made to the EUT during the testing.



## **1.4 Testing Location**

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory		
Test Site LocationNo.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978			
Test Site No.	Sporton Site No. 03CH07-HY		

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

Test Site	Sporton International Inc. Wensan Laboratory		
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855		
Test Site No.	Sporton Site No.		
Test Sile NO.	TH05-HY (TAF Code: 3786)		
Remark         The Conducted test item subcontracted to Sporton International Laboratory.			

FCC designation No.: TW1190 and TW3786

## 1.5 Applicable Standards

According to the specifications declared by 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 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

### Remark:

- 1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
- 2. The TAF code is not including all the FCC KDB listed without accreditation.
- 3. 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

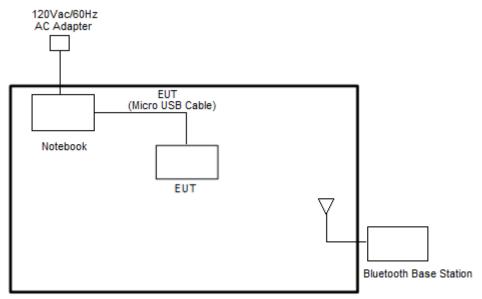
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Y plane with Notebook as worst plane, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.

	Summary table of Test Cases				
Test Item	Data Rate / Modulation				
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi$ /4-DQPSK	Bluetooth EDR 3Mbps 8-DPSK		
Conducted	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz		
Test Cases	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz		
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz		
	Bluetooth EDR 3Mbps 8-DPSK				
Radiated Mode 1: CH00_2402 MHz					
Test Cases	Mode 2: CH39_2441 MHz				
	Mode 3: CH78_2480 MHz				
<b>Remark:</b> For Radiated Test Cases, the worst mode data rate 3Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 3Mbps, and no other significantly frequencies found in conducted spurious emission.					



## 2.3 Connection Diagram of Test System

#### <Bluetooth Tx Mode>



## 2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m

## 2.5 EUT Operation Test Setup

The RF test items, utility "BT Regulatory Test App - 1.2" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to contact with base station 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 10 dB 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

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings: Span = the frequency band of operation;
   RBW = 300 kHz; 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



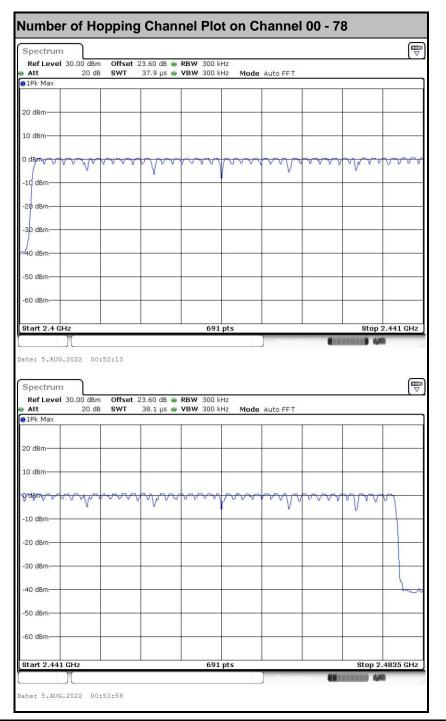
Spectrum Analyzer

EUT



## 3.1.5 Test Result of Number of Hopping Frequency

Test Engineer :	Shiming Li	J	•	21~25℃ 51~54 %
Number of Ho (Channel		Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79		20	> 15	Pass



: 12 of 50 Page Number Issue Date Report Version : 02



## **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**

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to 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 = 300 kHz; 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



EUT

Spectrum Analyzer

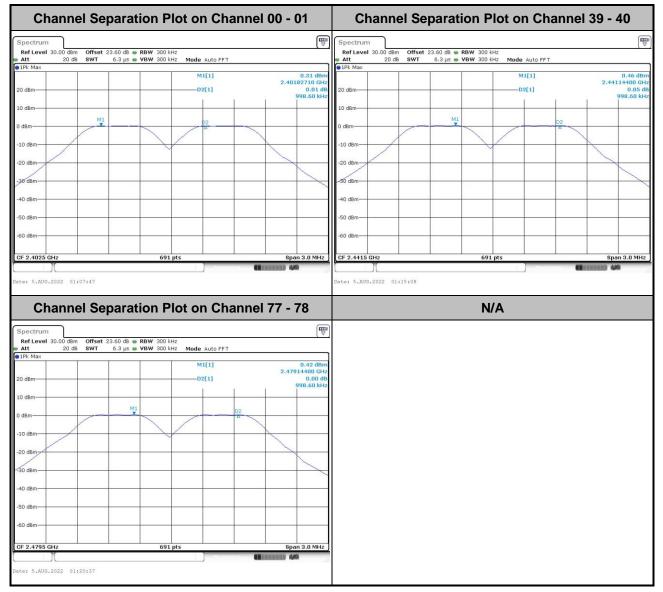


## 3.2.5 Test Result of Hopping Channel Separation

Test Eng	jineer :	Shim	ing Liu			Temperature : Relative Humidity :		21~25℃ 51~54 %	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Hopping Chan Separation Measuremer (MHz)	nel	Hopping Char Separatior Measureme Limit (MHz	nnel n nt	Pass/Fail
DH	1Mbps	1	0	2402	0.999		0.6213		Pass
DH	1Mbps	1	39	2441	0.999		0.6213		Pass
DH	1Mbps	1	78	2480	0.999		0.6213		Pass
2DH	2Mbps	1	0	2402	1.003		0.8828		Pass
2DH	2Mbps	1	39	2441	0.990		0.8828		Pass
2DH	2Mbps	1	78	2480	1.320		0.8828		Pass
3DH	3Mbps	1	0	2402	0.999		0.8567		Pass
3DH	3Mbps	1	39	2441	0.999		0.8712		Pass
3DH	3Mbps	1	78	2480	0.999		0.8741		Pass



#### <1Mbps>





#### <2Mbps>

Channel Sep	paration Plot on C	hannel 00 - 01	Channel Sepa	aration Plot on Cha	nnel 39 - 40
Spectrum			Spectrum		
Att 20 dB SWT	3.60 dB <b>B RBW</b> 300 kHz 6.3 µs <b>B VBW</b> 300 kHz Mode Auto B	FFT	Att 20 dB SWT 6	60 dB ● RBW 300 kHz 5.3 µs ● VBW 300 kHz Mode Auto FFT	
20 dBm	M1[1] D2[1]	0.53 dBm 2.40214490 GHz 0.03 dB	20 dBm-	M1[1]	0.67 dBm 2.44114830 GHz 0.04 dB
	52[1]	1.00290 MHz			989.90 kHz
10 dBm	M1	D2	10 dBm	M1	02
0 dBm			0 dBm		
-10 dBm			-10 dBm		
20 dBm			-20 dBm-		
30 dBm			-30 dBm-		
40 dBm			-40 dBm-		
50 dBm			-50 dBm		
-60 dBm			-60 dBm		
CF 2.4025 GHz	691 pts	Span 3.0 MHz	CF 2.4415 GHz	691 pts	Span 3.0 MHz
Ate: 5.AUG.2022 01:29:10	×		Date: 5.AUG.2022 01:34:05		(111111))) 4/A
ate: 5.AUG.2022 01:29:10 Channel Sep	paration Plot on C			N/A	(11111) <b>()</b> 44
Channel Sep		thannel 77 - 78		Maxage/	44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 22 Att 20 dB SWT	Daration Plot on C			Maxage/	unanan <b>in</b> 44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 Att 20 dB SWT	3.60 dB 🖷 <b>RBW</b> 300 kHz	(₩) FFT 0.63 dBm 2.47892270 GHz 0.00 dB		Maxage/	449
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dB WT 1Pk: Max	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(♥) FFT 0.63 dBm 2.47882270 GHz		Maxauere	44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 Att 20 dB SWT 20 dBm 0 00 dBm 0 10 dBm 0 11	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) FFT 0.63 dBm 2.47892270 GHz 0.00 dB		Maxauere	44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 22 20 dB SWT 20 dBm I Offset 21 20 dBm I Offset 22 20 dBm I Offset 21 20 dBm I Offset 21 2	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	ummil 44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dB Offset 23 20 dB Offset 23 0 dBm Offset 23 0 dBm Mail 10 dBm Mail	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	URININ 44
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dBm Offset 23 10 dBm Max 10 dBm M1 0 dBm M1 20 dBm M1 10 dBm M1	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dB WWT 20 dBm M1 0 dBm M1	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dB WWT 10 HBM Max 20 dBm MI 10 dBm MI 30 dBm MI 40 dBm Offset 23 20 dB WWT 10 dBm MI 10 d	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	
Channel Sep           Spectrum         0.0 dBm         Offset 23           Att         20 dB         SWT           JIPK Max         0         0           00 dBm         0         0           10 dBm         M1         0           20 dBm         0         0           10 dBm         0         0           50 dBm         0         0	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	
Channel Sep Spectrum Ref Level 30.00 dBm Offset 23 20 dB WT 20 dBm 0 10 dBm 0 10 dBm 0 20 dBm 0 20 dBm 0 10 dBm 0 20 dBm 0 10 dBm 0 20	3.60 dB ● RBW 300 kHz 6.3 µs ● VBW 300 kHz Mode Auto I M1[1]	(₩) 2,47882270 GHz 0.63 dBm 2,47882270 GHz 0.00 dB 1.31980 NHz		Maxauere	



#### <3Mbps>

Channel S	-													
pectrum Ref Level 30.00 dBm Offs	set 23.60 dB 🖷 RBW	W 300 kHz				Spectrum Ref Level 30.	0 dBm Offse	t 23.60 dB 🖷	RBW 3001	(Hz				T T
Att 20 dB SW1 1Pk Max			e Auto FFT			Att 1Pk Max	20 dB SWT		VBW 300		Auto FFT			
0 dBm			M1[1] D2[1]		0.51 dBm 198340 GHz 0.01 dB 998.55 kHz	20 dBm					41[1] 02[1]			0.68 dB 97900 GH 0.04 d 998.60 kH
0 dBm	M1					10 dBm		M1						
dBm			D2			0 dBm					D2			
0 dBm						-10 dBm								
dBm						-20 dBm								/
) dBm						-30 dBm								
I dBm-						-40 dBm								
dBm						-50 dBm								
dBm						-60 dBm-								
2.4025 GHz														
2.1020 012		691 pts	Mexicolog	Spa	an 3.0 MHz	CF 2.4415 GHz			691	pts			Spa	_
	 }	691 pts	Mexicina			CF 2.4415 GHz	2 20:23:03	-	691	pts	) Messault	000		_
: 5.AUG.2022 20:05:57			n Chan	() V	•		2 20:23:03	1		/A				_
Channel S			n Chan	() V	78		2 20:23:03			1				_
Channel S Channel S rectrum ef Level 30.00 dBm Offs		on Plot o		() V	•		2 20;23:03			1				_
channel S ectrum t t 20 db soft		w 300 kHz w 300 kHz Mode	e Auto FFT	() V	78		2 20:23:03			1	]	nu (111		_
Channel S ectrum t v 20 dB ww K Max		w 300 kHz w 300 kHz Mode		nel 77 - 5	78		2 20;23;03			1	]			_
5.AUG.2022 20:05:37 Channel S actrum filevel 30.00 dBm Offs t 20 dB SWT Max Bm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
S.AUG.2022 20:05:57      Channel S      sctrum     20 dB swi      Max      Bm     Bm		w 300 kHz w 300 kHz Mode	e Auto FFT M1[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
t \$,AUG.2022 20:05:37      Channel S      octrum     ofteel 30.00 dBm Offs     t 20 dB SWr      k Max      Bm     am	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
ectrum of Level 30.00 dBm Offst k Max dBm dBm dBm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
Channel S Channel S sectrum of Level 30.00 dBm Offs t 20 dB SWT t Max Bm dBm dBm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
ectrum t 5.AUG.2022 20:05:57 Channel S ectrum et Level 30.00 dBm Offs t 20 dB SWT k Max dBm dBm dBm dBm dBm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1		CERT		_
5.AUG.2022 20:05:87 Channel S sctrum f Level 30.00 dBm Offs 20 dB SW Max Bm dBm dBm dBm dBm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
S.AUG.2022 20:05:57 Channel S Sctrum CMax Max Bm dBm dBm dBm dBm dBm dBm	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	nel 77 - 5	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				_
Channel S ectrum ef Level 30.00 dBm offs	Separatio	w 300 kHz w 300 kHz Mode	e Auto FFT M1[1] D2[1]	2.478	0.61 dBm 998770 GHz 0.02 dB		2 20:23:03			1				n 3.0 MH



## 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

Please refer to the measuring equipment list in this test report.

### 3.3.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.4.
- 2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to 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



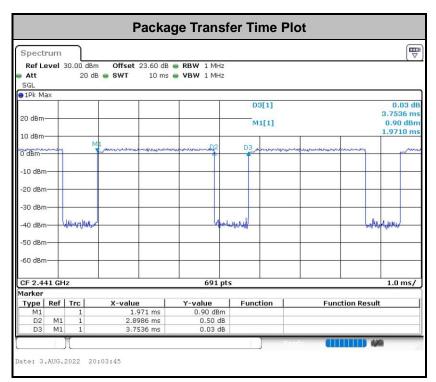
Spectrum Analyzer



## 3.3.5 Test Result of Dwell Time

Test Eng	gineer : Shiming	g Liu	Temperature : Relative Humidity :		21~25℃ 51~54 %		
Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)		nits ec)	Pass/Fail
Normal	79	106.670	2.90	0.31	0	.4	Pass
AFH	20	53.330	2.90	0.15	0	.4	Pass





#### 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

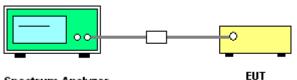
## 3.4.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- Use the following spectrum analyzer settings for 20 dB Bandwidth measurement.
  Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
  RBW ≥ 1% of the 20 dB bandwidth; 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

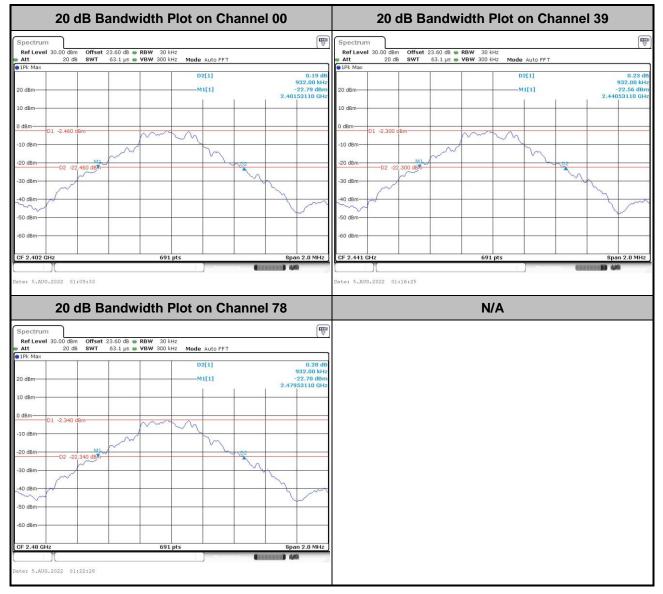


## 3.4.5 Test Result of 20dB Bandwidth

Test Enginee	r: Shiming	a Liu		٦	lemperature :	21~25°C		
		y Liu		F	Relative Humidity :	51~54 %		
Mod.	Data Rate	NTX	СН.	Freq. (MHz)	20db BW (MHz)	Pass/Fail		
DH	1Mbps	1	0	2402	0.932	Pass		
DH	1Mbps	1	39	2441	0.932	Pass		
DH	1Mbps	1	78	2480	0.932	Pass		
2DH	2Mbps	1	0	2402	1.324	Pass		
2DH	2Mbps	1	39	2441	1.324	Pass		
2DH	2Mbps	1	78	2480	1.324	Pass		
3DH	3Mbps	1	0	2402	1.285	Pass		
3DH	3Mbps	1	39	2441	1.307	Pass		
3DH	3Mbps	1	78	2480	1.311	Pass		

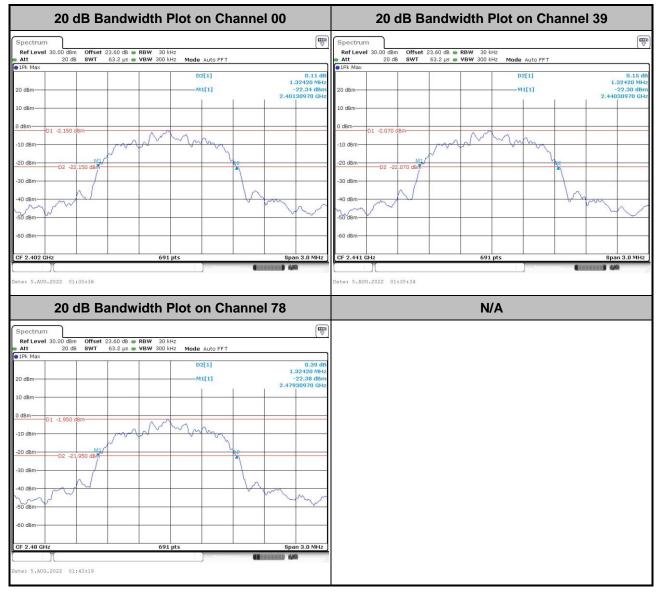


#### <1Mbps>



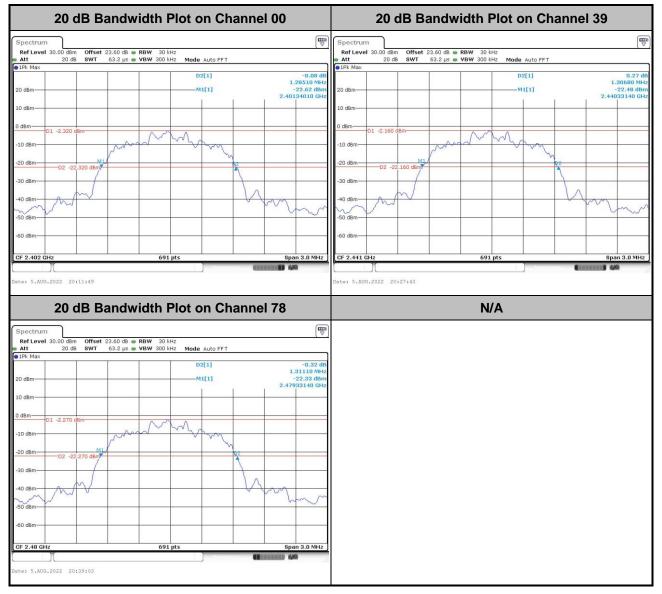


#### <2Mbps>





#### <3Mbps>



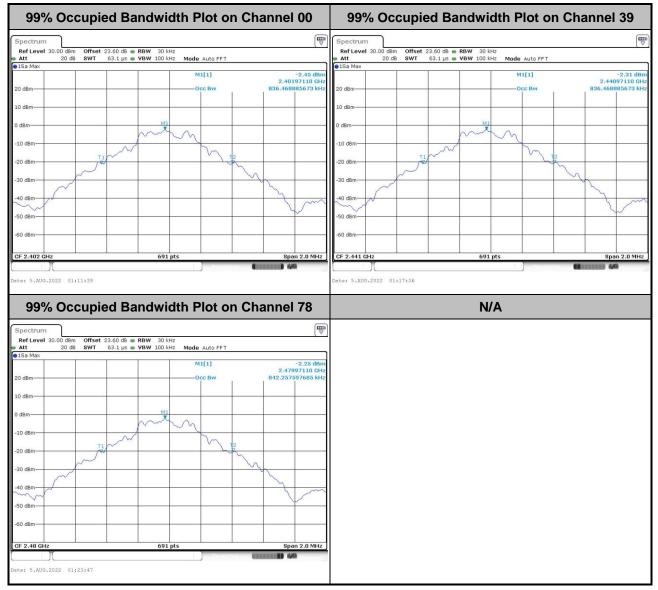


## 3.4.6 Test Result of 99% Occupied Bandwidth

Test Engine	or : Shimi	ing Liu			Temperature :	21~25℃
Test Engine		ing Liu			Relative Humidity :	51~54 %
Mod.	Data Rate	NTX	CH.	Freq.	99% Bandwidth	Pass/Fail
	Rate			(MHz)	(MHz)	
DH	1Mbps	1	0	2402	0.836	Pass
DH	1Mbps	1	39	2441	0.836	Pass
DH	1Mbps	1	78	2480	0.842	Pass
2DH	2Mbps	1	0	2402	1.184	Pass
2DH	2Mbps	1	39	2441	1.187	Pass
2DH	2Mbps	1	78	2480	1.184	Pass
3DH	3Mbps	1	0	2402	1.169	Pass
3DH	3Mbps	1	39	2441	1.169	Pass
3DH	3Mbps	1	78	2480	1.172	Pass



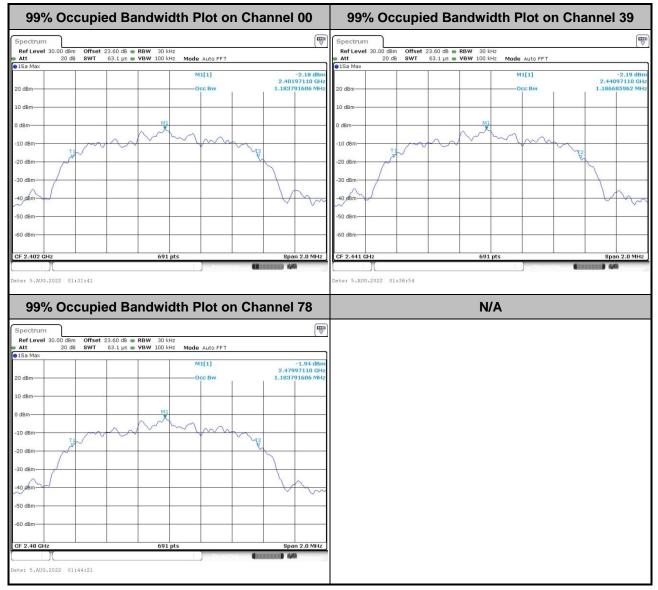
#### <1Mbps>



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



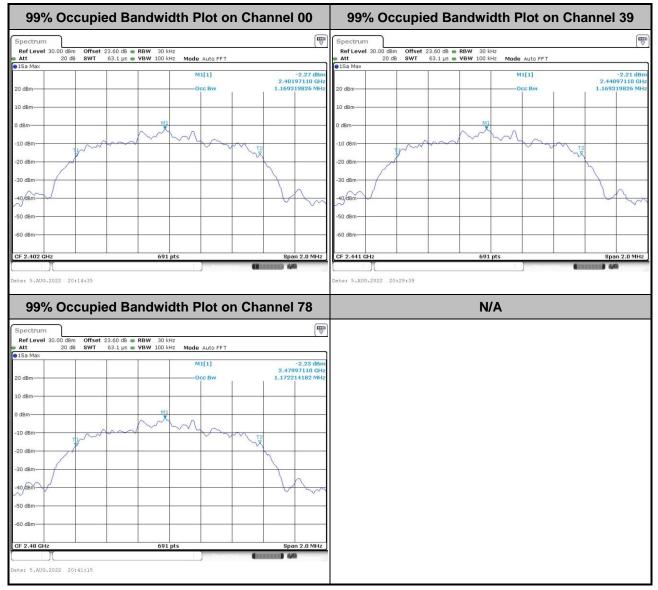
#### <2Mbps>



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



#### <3Mbps>



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: 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.

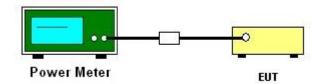
## 3.5.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to 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





## 3.5.5 Test Result of Peak Output Power

Test Engine	Shir	ning Liu		Temperature :	21~25°C
rest Engine				Relative Humidity :	51~54 %
DH	CH.	NTX	Peak Power	Power Limit (dBm)	Test
DII	011.		(dBm)		Result
	0	1	1.01	30.00	Pass
DH5	39	1	1.30	30.00	Pass
	78	1	1.03	30.00	Pass
	0	1	3.28	20.97	Pass
2DH5	39	1	3.35	20.97	Pass
	78	1	3.32	20.97	Pass
	0	1	3.78	20.97	Pass
3DH5	39	1	3.98	20.97	Pass
	78	1	3.84	20.97	Pass

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

Test Engineer :	Shiming Liu	Temperature :	21~25°C
rest Engineer .		Relative Humidity :	51~54 %

DH	СН.	NTX	Average Power (dBm)	Duty Factor (dB)
	0	1	0.32	5.12
DH5	39	1	0.47	5.12
	78	1	0.37	5.12
	0	1	0.45	5.05
2DH5	39	1	0.55	5.05
	78	1	0.50	5.05
	0	1	0.55	5.05
3DH3	39	1	0.59	5.05
	78	1	0.56	5.05



## 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.

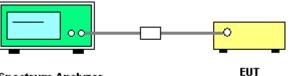
## 3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.6.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.6.
- 2. Set the maximum power setting and enable the EUT to transmit continuously.
- 3. Set RBW = 100 kHz, VBW = 300 kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz 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



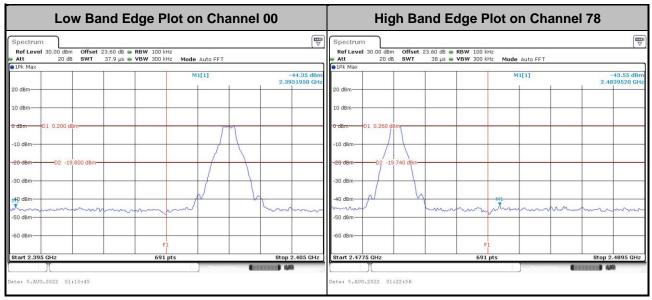
Spectrum Analyzer



## 3.6.5 Test Result of Conducted Band Edges

Test Engineer :	Shiming Liu	Temperature :	21~25°C
rest Engineer .		Relative Humidity :	51~54 %

#### <1Mbps>



#### <2Mbps>

Low Band Edge Plot on Channel 00				High Band Edge Plot on Channel 78					
Spectrum Ref Level 30.00 dBm Offset 23.60 dB • F	RBW 100 kHz		Spectrum Ref Level 30.	O dBm Offset	23.60 dB 👄 RBW 10	0 kHz			
👄 Att 20 dB SWT 37.9 μs 🖷 ۷	/BW 300 kHz Mode Auto FFT		Att     IPk Max	20 dB SWT	38 µs 🖷 VBW 30	0 kHz Mode Auto FFT			
1Pk Max	M1[1]	-44.59 dBm 2.3996380 GHz				M1[1]	-43.95 dBm 2.4884490 GHz		
20 dBm-			20 dBm						
10 dBm			10 dBm						
0 dBm-01 0.490 dBm-	- m		0 d8m 01	).530 dBm					
-10 dBm			-10 dBm	$f \rightarrow$					
-20 dBm D2 -19.510 dBm			-20 dBm	D2 -19.470 dBm-					
-30 dBm	<i>,</i>	5	-30 dBm	$ \downarrow $					
-40 dBm	-MI - M	hhuman	-40 dBm		mun	munun	mmann mi		
-60 dBm			-60 dBm-						
	F1					F1			
Start 2.395 GHz	691 pts	Stop 2.405 GHz	Start 2.4775 G	Hz	6	91 pts	Stop 2.4895 GHz		
L	Stewaueing	(Ennen) 4/9	ll			Stersauer	<b>G</b> (1111) 4/9		
Date: 5.AUG.2022 01:31:01			Date: 5.AUG.20	22 01:43:39					



#### <3Mbps>

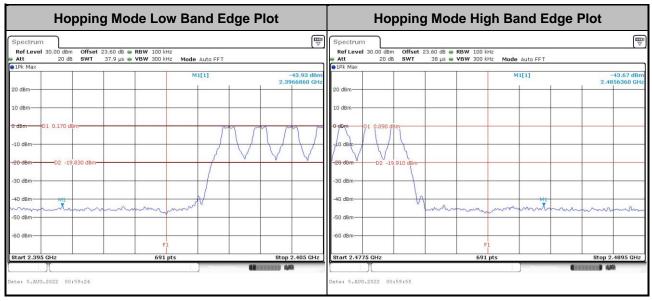
Low Band Edge F	High Band Edge Plot on Channel 78						
Spectrum Reflevel 30.00 dBm Offset 23.60 dB ● RBW 100 ● Att 20 dB SWT 37.9 μs ● VBW 300 G IPF Max				Offset 23.60 d8 ● RBW 100 k SWT 38 µs ● VBW 300 k			
20 dBm-	M1[1]	-43.23 dBm 2.3978000 GHz	20 dBm		M1[1]	-44, 2,48619	.61 dBm 920 GHz
10 dBm			10 dBm-01 0.490 dBm				
-10 dBm			-10 dBm	10 dBm			
-30 dBm		2	-30 dBm				
-40 dBm	~~~~	Jum	-40 dBm	Munum		MI	m
	1		-60 dBm	F	Î		
Start 2.395 GHz 69:	pts Misseletino	Stop 2.405 GHz	Start 2.4775 GHz	<b>691</b> 0:17	pts	Stop 2.489	95 GHZ



## **3.6.6 Test Result of Conducted Hopping Mode Band Edges**

Test Engineer :	Shiming Liu	Temperature :	21~25℃
		Relative Humidity :	51~54 %

#### <1Mbps>



#### <2Mbps>

Hopping Mode Low Band Edge Plot				Hopping Mode High Band Edge Plot					
Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB           Att         20 dB         SWT         37.9 us	RBW 100 kHz VBW 300 kHz Mode Auto FFT		Spectrum Ref Level 3	20 dB SWT	23.60 dB   RBW 10				
1Pk Max	YOW SOURH2 Mode Auto FFT		1Pk Max	20 00 3 00 1	20 h2 🖷 APM 201	0 kHz Mode Auto FFT			
20 dBm	M1[1]	-44.44 dBm 2.3950800 GHz	20 dBm			M1[1]	-43.63 dBm 2.4859140 GHz		
10 dBm									
			10 dBm	0.490 dBm					
	m	Januar	mound	mar hy					
-10 dBm			-10 dBm						
-20 dBm D2 -19.570 dBm			-20 dBm	-02 -19.510 dBm					
-30 dBm-			-30 dBm	4					
H40 dBm	mmm		-40 dBm	¥	mmm	mmm	the man man		
-50 dBm			-50 dBm						
-60 dBm-	F1		-60 dBm			F1			
Start 2.395 GHz	691 pts	Stop 2.405 GHz	Start 2.4775	GHz	6	91 pts	Stop 2.4895 GHz		
T T	Stewarting	(mmmm) 4/9				Mercure	(manual) 4/4		
Date: 5.AUG.2022 00:57:14			Date: 5.AUG.2	022 00:58:10					



#### <3Mbps>

Hopping Mode Low Band Edge Plot				Hopping Mode High Band Edge Plot					
Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB         RBW           Att         20 dB         SWT         37.9 µs         VBW			Spectrum Ref Level 30.00 ( Att 20		RBW 100 kHz VBW 300 kHz Mode Au	to FFT			
1Pk Max     20 dBm	M1[1]	-43.22 dBm 2.3991900 GHz	1Pk Max     20 dBm		M1[1				
10 dBm			10 dBm						
-10 dBm	man	munder	-10 dBm	- Marina					
-20 dBm-D2 -19,540 dBm-			-20 dBm D2	-19.490 dBm					
-40 dBm	m min		-40 dBm	how	man mitan	mmmmmmm			
-50 dBm			-50 dBm						
Start 2.395 GHz	F1 691 pts	Stop 2.405 GHz	Start 2.4775 GHz		691 pts	Stop 2.4895 GHz			
Date: 5.AUG.2022 00:55:21			Date: 5.AUG.2022	00:55:51					

## 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.

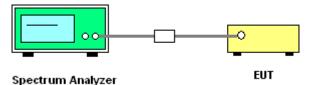
## 3.7.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurious 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

Test Engineer :	Shiming Liu	Temperature :	21~25°C
Test Engineer .		Relative Humidity :	51~54 %

#### <1Mbps>

Spectrum			Spectrum		~		
Ref Level         30.00 dBm         Offset         23.60 dB           Att         20 dB         SWT         29.7 ms	RBW 100 kHz VBW 300 kHz Mode Auto Sweep		RefLevel 30.00 dBm Off Att 20 dB SW	set 23.60 dB  RBW 10	0 kHz 0 kHz <b>Mode</b> Auto Sweep	0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1Pk View			• 1Pk View	1 1	23		
	M1[1]	0.04 dBm 2.40040 GHz	2220.00		M1[1]		-0.51 dBm 2.4160 GHz
20 dBm	M2[1]	-42.44 dBm 2.61530 GHz	20 dBm		M2[1]		-38.89 dBn 6.9430 GH
10 dBm			10 dBm				
0-dBm D1 0.040 dBm		MI	M1				
01 0.040 dbm			-07d8m-01 -0.510 d8m				
10 dBm-			-10 dBm				-
20 dBm D2 -19.960 dBm				3m			_
30 dBm			-30 dBm				
-40 dBm		M2	-40 dBm	and the second second	Muthan mark Marken Mark	Normon and	harmohn
where the second and the second secon	ware a set of the server the server	monoreduction	-50 dBm	rande row more and and	vien en		
60 dBm			-60 dBm-				
				6	91 pts	St	op 25.0 GHz
start 20.0 MHz	691 nts						op zoio driz
te: 5.AUG.2022 01:12:21	39 between 30 MF	stop 3.0 GHz	Stort 2.0 GHz Date: 5.AUG.2022 01:12:50 CSE Plot		etween 2 Gl	Hz ~ 25 G	) Hz
Spectrum Ref Level 30.00 dBm Offset 23.60 dB	<b>39 between 30 MF</b>	(Entra) 4/2	CSE Plot ( Spectrum RefLevel 30.00 dBm Off	on CH 39 bo	etween 2 GI		¥A GHz (₹
CSE Plot on CH Spectrum Ref Level 30.00 dBm Offset 23.60 dB swr Att 20 dB swr 29.7 ms	39 between 30 M⊦	Hz ~ 3 GHz	CSE Plot (	on CH 39 bo	etween 2 GI		
te: 5.AU9.2022 01:12:21 CSE Plot on CH Spectrum RefLevel 30.00 dBm Offset 23.60 dB swT 29.7 ms	39 between 30 MH	4z ~ 3 GHz ⊕ 0.13 dbm	CSE Plot ( Spectrum RefLevel 30.00 d8m Off Att 20 d8 sw	on CH 39 bo	etween 2 GI		
ter 5,AU9.2022         01:12:21           CSE Plot on CH           Spectrum         0ffset 23.60 db at           Att         20 db         SWT         29.7 ms at           IPk View         0         100 db at         100 db at	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep	1z ~ 3 GHz ⊕ 0.13 dBm 2.43910 GHz -42.94 dBm	CSE Plot ( Spectrum RefLevel 30.00 d8m Off Att 20 d8 sw	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn
Ite: 5.AU0.2022 01:12:21           CSE Plot on CH           Spectrum           Ref Level 30.00 dBm           Att           20 dB           SWT           29.7 ms           SIPK View           20 dBm	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	4 ~ 3 GHz +z ~ 3 GHz (♥) 0.13 dBm 2.43910 GHz	Date: 5.AU9.2022 01:12:50 CSE Plot ( Spectrum Ref Level 30.00 dbm Off att 20 db SW PIPk View	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
Ate:         5.AU0.2022         01:12:21           CSE Plot on CH           Spectrum         Offset 23:60 db #           Ref Level 30.00 dbm         Offset 23:60 db #           20 db         SWT         29.7 ms #           21Pk View         0         0           20 dbm         0         0	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	1z ~ 3 GHz ⊕ 0.13 dBm 2.43910 GHz -42.94 dBm	Date: \$.AUG.2022 01:12:50	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
CSE Plot on CH     CSE Plot on CH     Spectrum     Code Swr     20.00 dbm     Offset 23.60 db     Swr     29.7 ms     20 db     Swr     29.7 ms	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date: \$,AU9,2022         01:12:50           CSE Plot           Spectrum         RefLevel 30:00 dBm           RefLevel 30:00 dBm         Off           e1Pk View         20 dBm           10 dBm         10 dBm	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
te: 5.AU9.2022         01:12:21           CSE Plot on CH           Spectrum         0 dBm           Att         20 dB           19k View         0 dBm           00 dBm         01 0.130 dBm	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date: \$.AUG.2022 01:12:50	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
te: 5.AUG.2022 01:12:21  CSE Plot on CH  Spectrum Att 20 dB WT 29.7 ms  IPk View  0 dBm 01 0.130 dBm 10 dBm	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date:         \$.AUG,2022         01:12:50           CSE Plot           Spectrum         Ref Level 30.00 dBm Off           Att         20 dB w           10 dBm         01 0.130 dBm	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn
te: 5.AU0.2022 01:12:21 CSE Plot on CH Spectrum Att 20 dB Offset 23.60 dB 1 10 dBm 01 0.130 dBm 10 dBm	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date: 5.AU9.2022         01:12:50           CSE Plot           Spectrum         20 db           Ref Lovel 30.00 dbm         Off           • 1Pk View         20 db           10 dbm         01 0.130 dbm	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
te:         5.AU0.2022         01:12:21           CSE Plot on CH           Spectrum           Ref Level         30.00 dBm         Offset         23.60 dB           10 dBm         01         0.130 dBm         00           10 dBm         02         -19.870 dBm         02	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date:         \$.AUG,2022         01:12:50           CSE Plot           Spectrum         Ref Level 30.00 dBm Off           Att         20 dB w           10 dBm         01 0.130 dBm	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH: -39.28 dBn
Ate:         5.AU06.2022         01:12:21           CSE Plot on CH           Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB e           JIPK View         20 dB         Swr           20 dBm         01 0.130 dBm         01 0.130 dBm	39 between 30 MH RBW 100 kHz VBW 300 kHz Mode Auto Sweep M1[1]	• • • • • • • • • • • • • • • • •	Date:         \$.AUG.2022         01:12:50           CSE Plot           Spectrum         Spectrum           RefLevel 30.00 dBm         Off           #Att         20 dB           20 dBm         10 dBm           #0         01 0.130 dBm           #0 dBm         02 -19.870 d           40 dBm         02 -19.870 d	on CH 39 bu	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn 15.8300 GH
CESE Plot on CH           Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB e           20 dB         SWT         29.7 ms           IPk View         0 dBm         0           0 dBm         01 0.130 dBm         0           10 dBm         02 -19.870 dBm         0           30 dBm         02 -19.870 dBm         10	39 between 30 MH *BBW 100 kH2 *VBW 300 kH2 Mode Auto Sweep M1[1] M2[1] M2[1] M2[1] M2[1]	• • • • • • • • • • • • • • • • •	Date:         \$.AUG,2022         01:12:50           CSE Plot           Spectrum         Colspan="2">Colspan="2"           Colspan="2">Colspan="2"           Colspan="2"           Colspan="2"	on CH 39 bo	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn 15.8300 GH
tee:         5.AU0.2022         01:12:21           CSE Plot on CH           Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB e           SWT 29.7 ms e           IPK View           20 dB SWT 29.7 ms e           IPK View	39 between 30 MH * RBW 100 kH2 * VBW 300 kH2 Mode Auto Sweep M1[1] M2[1] M	the second	Date:         \$.AUG.2022         01:12:50           CSE Plot           Spectrum         Spectrum           RefLevel 30.00 dBm         Off           #Att         20 dB           20 dBm         10 dBm           #0         01 0.130 dBm           #0 dBm         02 -19.870 d           40 dBm         02 -19.870 d	on CH 39 bu	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn 15.8300 GH
Ate: 5.AUG.2022 01:12:21           CSE Plot on CH           Spectrum           Ref Level 30.00 dBm         Offset 23.60 dB e           10 dBm         01 0.130 dBm           10 dBm         02 -19.870 dBm           -30 dBm         02 -19.870 dBm	39 between 30 MH * RBW 100 kH2 * VBW 300 kH2 Mode Auto Sweep M1[1] M2[1] M	the second	Date:         \$.AUG,2022         01:12:50           CSE Plot           Spectrum         Colspan="2">Colspan="2"           Colspan="2">Colspan="2"           Colspan="2"           Colspan="2"	on CH 39 bu	etween 2 GI		0.13 dBn 2.4490 GH -39.28 dBn 15.8300 GH
CSE Plot on CH           Spectrum           Ref Level 30.00 dBm           20 dB           SWT           29.7 ms           1Pk View           0 dBm           10 dBm           20 dB           20 dB           20 dB           90 dBm           10 dBm           20 dBm           10 dBm	39 between 30 MH * RBW 100 kH2 * VBW 300 kH2 Mode Auto Sweep M1[1] M2[1] M	the second	Date: 5.AUG.2022 01:12:50 CSE Plot ( Spectrum Ref Level 30.00 dbm off Att 20 db sw 9 1Pk View 20 dbm 10 dbm -10 dbm -0 dbm -0 dbm -0 dbm -0 dbm -0 dbm	on CH 39 bu	etween 2 GI	p	0.13 dBn 2.4490 GH -39.28 dBn 15.8300 GH

CSE Plot on C	CH 78 between 30 M	Hz ~ 3 GHz	CSE Plot	on CH 78 b	etween 2 GH	lz ~ 25 GHz
Spectrum			Spectrum			
Att 20 dB SWT 29.7	0 dB 🖷 RBW 100 kHz 7 ms 🖶 VBW 300 kHz 🛛 Mode Auto Sweep		Att 20 dB S	ffset 23.60 dB ● RBW 10 WT 230 ms ● VBW 30		
1Pk View			1Pk View			
20 dBm	M1[1] M2[1]	0.32 dBm 2.47780 GHz -42.65 dBm 2.59380 GHz	20 dBm		M1[1] M2[1]	-0.24 dBn 2.4830 GH -38.34 dBn 15.7970 GH
10 dBm			10 dBm			
0 d8m-01 0.320 d8m-		M1	01 -0.240 dBm			
-10 dBm			-10 dBm			
-20 dBm-D2 -19.680 dBm-			-20-dBm	dBm		
-30 dBm			-30 dBm		Mp	
-40 dBm	mulalunter and how many and and	M2	-40 dBm	march alle and some has	moundation	montesturentere
-50 dBm			-50 dBm			
-60 dBm			-60 dBm			
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	6	91 pts	Stop 25.0 GHz
Date: 5.AUG.2022 01:24:23	Steeninfog	(	Date: 5.AUG.2022 01:24:	52	Messuring	44



#### <2Mbps>

CSE Plot on C	H 00 between 30 MH	lz ~ 3 GHz	CSE Plot o	on CH 00 betwee	en 2 GHz ~	25 GHz
Spectrum			Spectrum			
	0 dB 🖷 RBW 100 kHz 7 ms 🖶 VBW 300 kHz 🛛 Mode Auto Sweep		Ref Level 30.00 dBm Offs Att 20 dB SWT	et 23.60 dB 👄 RBW 100 kHz 230 ms 🖶 VBW 300 kHz Mod	e Auto Sweep	
19k View     20 dBm	M1[1] M2[1]	0.17 dBm 2.40040 GHz	20 dBm		M1[1] M2[1]	0,18 dBm 2.4160 GHz -38.83 dBm
10 dBm		2.27150 GHz	10 dBm		+ +	16.1300 GHz
-10 dBm		M	M1 0 dBm-01 0.180 dBm			
-20 dBm-D2 -19.830 dBm-			-20 dBm	m		
-30 dBm		M2	-30 dBm-		M2	
-50 dBm	with the manufacture and the second s	dere permiter the gladestation of	-90 dBm	mut and when a strange which	Monary Marian	word and the test
-60 dBm	691 pts	Stop 3.0 GHz	-60 dBm	691 pts		Stop 25.0 GHz
Date: 5.AUG.2022 01:32:14	) - Michielaa	(	ate: 5.AUG.2022 01:32:44	091 pts	Merendina 机	
CSE Plot on C	H 39 between 30 MH	lz ~ 3 GHz	CSE Plot o	on CH 39 betwee	en 2 GHz ~	25 GHz
Spectrum			Spectrum			
Att 20 dB SWT 29.7	0 dB 🖷 RBW 100 kHz 7 ms 🖶 VBW 300 kHz 🛛 Mode Auto Sweep		Att 20 dB SWT	et 23.60 dB 🖷 RBW 100 kHz 230 ms 🖷 VBW 300 kHz Mod	e Auto Sweep	
1Pk View	M1[1]	0.34 dBm	1Pk View		M1[1]	0.46 dBm
20 dBm	M2[1]	2.43910 GHz -42.93 dBm 2.27150 GHz	20 dBm		M2[1]	2.4490 GHz -39.42 dBm 22.2210 GHz
10 dBm-01 0.340 dBm-		M1	10 dBm M1 0 dBm 01 0.460 dBm			
-10 dBm			-10 dBm			
-20 dBm D2 -19.660 dBm			-20 dBm D2 -19.540 dBr -30 dBm	m		
		N2 Mary all an and a farmer of		upprover the way of a service	monuter and the second	M2 minum the land and
-50 dBm			-50 dBm			
-60 dBm					1 1	
	601 pts			601 ptr		Stop 25.0 CH2
-60 dBm	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Mexand ()	Stop 25.0 GHz

CSE Plot on Cl	H 78 between 30 M⊦	lz ~ 3 GHz	CSE Plot	on CH 78 betw	ween 2 GHz	~ 25 GHz
Att 20 dB SWT 29.7 m	B <b>● RBW</b> 100 kHz Is <b>● VBW</b> 300 kHz <b>Mode</b> Auto Sweep		Att 20 dB \$	Offset 23.60 d8 ● RBW 100 kHz SWT 230 ms ● VBW 300 kHz		
e IPk View 20 dBm	M1[1] M2[1]	0,51 dBm 2,48210 GHz -40,52 dBm 2,27150 GHz	20 dBm		M1[1] M2[1]	-1.35 dBn 2.4830 GH; -38.19 dBn 4.9460 GH;
10 dBm-01 0.510 dBm-		M1	10 dBm 01 -1.350 dBm			
-30 dBm			-20 dBm-D2 -21.350	) dBm		
-40 dBm- 	han har an	M2 Warander Worw (Annuscopielle	-40 dBm	when merer and a start of the	unan menter war	on the controlled and a second
-60 dBm			-60 dBm			
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Date: 5.AUG.2022 01:45:	691 pt	S Measuring	Stop 25.0 GHz



#### <3Mbps>

Spectrum			Spectrum				
	dB 🖷 RBW 100 kHz ms 🖷 VBW 300 kHz 🛛 Mode Auto Sweep	(-)		ffset 23.60 dB - RBW 1 WT 230 ms - VBW 3	100 kHz 300 kHz <b>Mode</b> Auto Swee		( '
1Pk View	ms 🖶 VBW 300 kHz Mode Auto Sweep		Att 20 08 St     IPk View	W1 250 ms - VBW 3	SUU KHZ MODE AUTO SWEE	2p	
	M1[1]	0.08 dBm 2.40040 GHz			M1[1]		0.15 dBn 2.4160 GH
20 dBm	M2[1]	-42.66 dBm 2.48640 GHz	20 dBm		M2[1]		-39.11 dBn 15.8300 GH
10 dBm		2.46040 GHZ	10 dBm			I	13.8300 GH2
		NIT	M1				
9-dBm D1 0.080 dBm		10 L	0 dBm 01 0.150 dBm				
-10 dBm			-10 dBm				
-10 0Bm			-10 0Bm				
20 dBm D2 -19.920 dBm			-20 dBm-D2 -19.850	dBm			-
00 IB							
30 dBm			-30 dBm		Mo		
40 dBm		the up allow the second	-10 dBm		may restructure and	many men	waterward
	allow home we all able munder of all water	desided the shine was an		mulpopulation	mph mar	Just Mar	- Carolinea
-50 dBm-			-50 dBm				
60 dBm			-60 dBm				_
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	1 1	691 pts	St	op 25.0 GHz
	Meseuvino	(IIIIII) 4/9			210-010		iya .
	H 39 between 30 Mł		CSE Plot		oetween 2 G	Hz ~ 25 G	iHz
Spectrum			CSE Plot	on CH 39 b		Hz ~ 25 G	
CSE Plot on C	dB 🖷 RBW 100 kHz	Hz ~ 3 GHz	CSE Plot Spectrum Ref Level 30.00 dBm O	on CH 39 b			
CSE Plot on C	d8 <b>⊕ RBW</b> 100 kHz ns <b>⊕ VBW</b> 300 kHz. <b>Mode</b> Auto Sweep	Hz ~ 3 GHz	CSE Plot Spectrum Ref Level 30.00 dBm O	on CH 39 b	100 kHz 300 kHz <b>Mode</b> Auto Swee		(₩
CSE Plot on C	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz	CSE Plot	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBm 2.4490 GH
CSE Plot on C	d8 <b>⊕ RBW</b> 100 kHz ns <b>⊕ VBW</b> 300 kHz. <b>Mode</b> Auto Sweep	Hz ~ 3 GHz	CSE Plot	on CH 39 b	100 kHz 300 kHz <b>Mode</b> Auto Swee		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBm
CSE Plot on C	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C           Spectrum           Ref Level 30.00 dBm         Offset 23.60.           10k View         0           20 dBm         0           10 dBm         0	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C           Spectrum           Ref Level 30.00 dBm         Offset 23.60           20 dB         SWT 29.7 r           1Pk View         20 dBm           0 dBm         0 dBm           0 dBm         0 1 0.170 dBm	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBm 2.4490 GHz -39.48 dBm
CSE Plot on C           Spectrum           Ref Level 30.00 dBm           20 dB           WT           0 dBm           0 dBm           0 dBm           10 dBm	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot           Spectrum           Ref Level 30.00 dBm_0 Ol           20 dB           10 dBm_0           10 dBm_0           10 dBm_0           10 dBm_0           10 dBm_0	on CH 39 b	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot           Spectrum           Ref Level 30.00 dBm_0 Ol           20 dB           10 dBm_0           10 dBm_0           10 dBm_0           10 dBm_0           10 dBm_0	on CH 39 k	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C           Spectrum           Ref Level 30.00 dBm         Offset 23.60.           20 dB         SWT         29.7 f           1Pk View         20 dBm         0           20 dBm         0         0           0 dBm         01 0.170 dBm         0           10 dBm         01 0.170 dBm         0           20 dBm         02 -19.830 dBm         0	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot           Spectrum           Ref Level 30.00 dBm         Of           20 dB         Of           10 dBm         01           41         Ofdem           10 dBm         D1           -10 dBm         D2           -20.080         CBm	on CH 39 k	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBn 2.4490 GH: -39.48 dBn
CSE Plot on C           Spectrum           Ref Level 30.00 dBm         Offset 23.60.           20 dB         SWT         29.7 f           21/k View         20         But         20           20 dBm         0         0         0           10 dBm         01 0.170 dBm         0         0           20 dBm         02 -19.830 dBm         0         0	dB • RBW 100 kHz ns • VBW 300 kHz Mode Auto Sweep M1[1]	Hz ~ 3 GHz 	CSE Plot           Spectrum           Ref Level 30.00 dBm_0 or           Att           20 dBm_0           10 dBm_0           Mil           Offdem_01_0.080 dBm_0	on CH 39 k	100 kHz 300 kHz Mode Auto Swee M1[1]		-0.08 dBm 2.4490 GHz -39.48 dBm
OCSE Plot on C           RefLevel 30.00 dBm         Offset 23.60           Att         20 db         SWT         29.7 ft           19k View         20 db         SWT         29.7 ft           10 dBm         01 0.170 dBm         0         0           10 dBm         02 - 19.830 dBm         0         0           30 dBm         02 - 19.830 dBm         0         0	dB • RBW 100 kHz:           ns • VBW 300 kHz:           Mode Auto Sweep             M1[1]           M2[1]	1z ~ 3 GHz	Spectrum           Ref Level 30.00 dBm         00           Att         20 dB         St           10 dBm         01         -0.080 dBm           -10 dBm         -02         -20.080           -30 dBm         -02         -20.080	On CH 39 k	100 kHz Mode Auto Swee M1[1] M2[1] M2[1] M2[1]	P	-0.08 dBn 2.4490 GH -39.48 dBn 15.8300 GH
Spectrum         Offset 23.60           Ref Level 30.00 dBm         Offset 23.60           10 dBm         20 dB           10 dBm         01 0.170 dBm           10 dBm         02 -19.830 dBm           -10 dBm         02 -19.830 dBm           -30 dBm         -02 -19.830 dBm	dB • RBW 100 kHz:           ns • VBW 300 kHz:           Mode Auto Sweep             M1[1]           M2[1]	Hz ~ 3 GHz 	CSE Plot           Spectrum           Ref Level 30.00 dBm0 right           0 dBm	On CH 39 k	100 kHz 300 kHz Mode Auto Swee M1[1]	P	-0.08 dBn 2.4490 GH -39.48 dBn 15.8300 GH
OCSE Plot on C           Ref Level 30.00 dBm         Offset 23.60           Att         20 dB         SWT         29.7 r           19/k View         20 dB         Offset 23.60         NWT         29.7 r           10 kBm         0         0         0.170 dBm         0         0         0           10 dBm         01         0.170 dBm         0         0         0         0         0           10 dBm         02         -19.830 dBm         0	dB • RBW 100 kHz:           ns • VBW 300 kHz:           Mode Auto Sweep             M1[1]           M2[1]	1z ~ 3 GHz	Spectrum           Ref Level 30.00 dBm         00           Att         20 dB         St           10 dBm         01         -0.080 dBm           -10 dBm         -02         -20.080           -30 dBm         -02         -20.080	On CH 39 k	100 kHz 100 kHz Mode Auto Swee M1[1] M2[1] M2[1] M2[1]	P	-0.08 dBm 2.4490 GH -39.48 dBm 15.8300 GH;
OCSE Plot on C           Spectrum           Ref Lavel 30.00 dBm         Offset 23.60           Att         20 dB         SWT         29.7 ft           SIPK View         20 dB         SWT         29.7 ft           SIPK View         00 dBm         01 0.170 dBm         01 0.170 dBm           10 dBm         01 0.170 dBm         01 0.170 dBm         01 0.170 dBm           10 dBm         02 -19.830 dBm         01 0.170 dBm         01 0.170 dBm	dB • RBW 100 kHz:           ns • VBW 300 kHz:           Mode Auto Sweep             M1[1]           M2[1]	1z ~ 3 GHz	CSE Plot           Spectrum           Ref Level 30.00 dBm0 right           0 dBm	On CH 39 k	100 kHz 100 kHz Mode Auto Swee M1[1] M2[1] M2[1] M2[1]	P	-0.08 dBm 2.4490 GHz -39.48 dBm 15.8300 GHz
Offset         23.60           Spectrum         20.88         Offset         23.60           Att         20.80         SWT         29.7 r           1Pk View         90.88         SWT         29.7 r           10 dBm         00         00.170 dBm         00           10 dBm         01         0.170 dBm         00           10 dBm         02         19.830 dBm         00           30 dBm         02         19.830 dBm         00           50 dBm         02         19.830 dBm         00           60 dBm         00         00         00         00	dB • RBW 100 kHz rs • VBW 300 kHz Made Auto Sweep M1[1] M2[1]	1z ~ 3 GHz	CSE Plot           Spectrum           Ref Level 30.00 dBm         Of           10 dBm         Of           10 dBm         Of           10 dBm         D1 -0.080 dBm           10 dBm         D2 -20.080           -30 dBm         O1 -0.080 dBm           -0 dBm         D2 -20.080           -30 dBm         -60 dBm	On CH 39 k	100 kHz 100 kHz M1[1] M2[1] M2[1] M2 M2 M2 M2 M2 M2 M2 M2		-0.08 dBm 2.4490 GHz -39.48 dBm 15.8300 GHz
OCSE Plot on C           Spectrum           Ref Level 30.00 dBm           20 dB           SWT           20 dB           0 dBm           0 dBm           01 0.170 dBm           10 dBm           20 dB           20 dB           20 dB           20 dBm           02 -19,830 dBm           30 dBm           40 dBm           40 dBm	dB • RBW 100 kHz:           ns • VBW 300 kHz:           Mode Auto Sweep             M1[1]           M2[1]	1z ~ 3 GHz	CSE Plot           Spectrum           Ref Level 30.00 dBm           Att           20 dBm           10 dBm           10 dBm           40	On CH 39 k	100 kHz 100 kHz Mode Auto Swee M1[1] M2[1] M2[1] M2[1]		-0.08 dBi 2.4490 GF -39.48 dBi 15.8300 GF

CSE Plot on CH	78 between 30 MHz	2 ~ 3 GHz	CSE Plo	t on CH 78 b	etween 2 G	Hz ~ 25 GH	lz
Spectrum Ref Level 30.00 dBm Offset 23.60 dB				Offset 23.60 dB . RBW 100			
Att 20 dB SWT 29.7 ms	VBW 300 kHz Mode Auto Sweep		Att 20 dB	SWT 230 ms  VBW 300	0 kHz Mode Auto Swee	p	
20 dBm	M1[1] M2[1]	-0.38 dBm 2.48210 GHz -43.11 dBm 2.27150 GHz	20 dBm		M1[1] M2[1]	2.	0.37 dBm 4830 GHz 7.70 dBm 9460 GHz
10 dBm		M1	10 dBm 01 -0.370 dBm				
-10 dBm			-10 dBm	'0 dBm			
-30 d8m			-30 dBm				
-40 dBm while-twenderender-twenty-twenty-the- -50 dBm		and a superior and a superior	-50 dBm	mounderstations	ph mark to have a second	and the second	terestated is
-60 dBm			-60 dBm				
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	6	91 pts	Stop :	25.0 GHz
Date: 5.AUG.2022 20:41:52	Heasing	(111111) 44 <b>4</b>	Date: 5.AUG.2022 20:42	:25	. Sporth	<b>(1</b>	

## 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

Please refer to the measuring equipment list in this test report.



## 3.8.3 Test Procedures

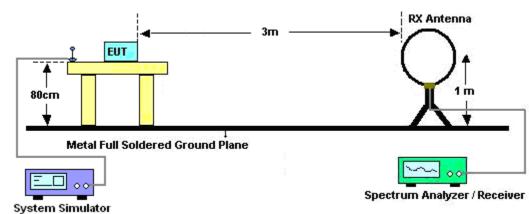
- 1. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
- 2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
- 3. For each suspected emission, the EUT is 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 the maximum power setting and enable the EUT to 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 = 1 MHz for f>1 GHz ; 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. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
- 8. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

Note: The average levels are calculated from the peak level corrected with duty cycle correction factor (-24.76dB) 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.

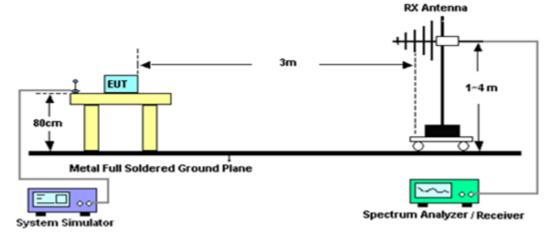


## 3.8.4 Test Setup

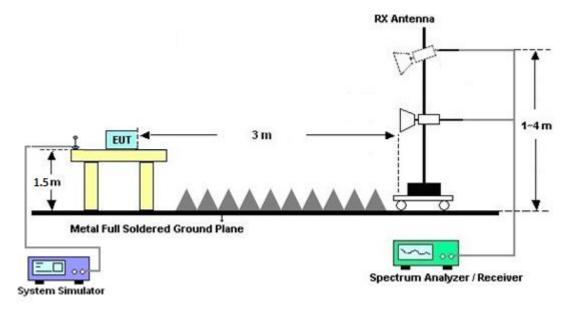
For radiated test below 30MHz



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

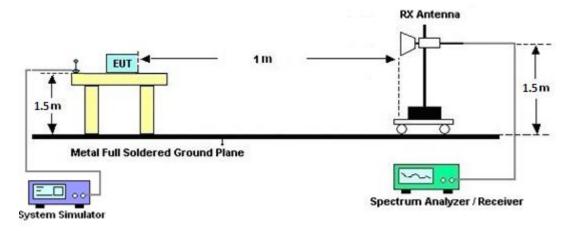








#### For radiated test above 18GHz



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

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

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

## 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

## 3.8.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.



## 3.9 Antenna Requirements

## 3.9.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. 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.

## 3.9.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

## 3.9.3 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	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N- 06	35419 & 03	30MHz~1GHz	Apr. 24, 2022	Aug. 08, 2022~ Aug. 13, 2022	Apr. 23, 2023	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	Aug. 08, 2022~ Aug. 13, 2022	Dec. 02, 2022	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Aug. 08, 2022~ Aug. 13, 2022	Jan. 06, 2023	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101 800-30-10P	1590075	1GHz~18GHz	Apr. 21, 2022	Aug. 08, 2022~ Aug. 13, 2022	Apr. 20, 2023	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 04, 2021	Aug. 08, 2022~ Aug. 13, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 04, 2021	Aug. 08, 2022~ Aug. 13, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 21, 2022	Aug. 08, 2022~ Aug. 13, 2022	Jul. 20, 2023	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2022	Aug. 08, 2022~ Aug. 13, 2022	Jul. 21, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 23, 2022	Aug. 08, 2022~ Aug. 13, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 23, 2022	Aug. 08, 2022~ Aug. 13, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 23, 2022	Aug. 08, 2022~ Aug. 13, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 17, 2021	Aug. 08, 2022~ Aug. 13, 2022	Sep. 16, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 23, 2022	Aug. 08, 2022~ Aug. 13, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 14, 2022	Aug. 08, 2022~ Aug. 13, 2022	Apr. 13, 2023	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Aug. 08, 2022~ Aug. 13, 2022	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Aug. 08, 2022~ Aug. 13, 2022	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Aug. 08, 2022~ Aug. 13, 2022	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Aug. 08, 2022~ Aug. 13, 2022	N/A	Radiation (03CH07-HY)
Attenuator	HONOVA	5910 SMA-50-005-19 -NE	ATT-36	N/A	Oct. 30, 2021	Aug. 08, 2022~ Aug. 13, 2022	Oct. 29, 2022	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Aug. 08, 2022~ Aug. 13, 2022	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 07, 2022	Aug. 08, 2022~ Aug. 13, 2022	Mar. 06, 2023	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 30, 2021	Aug. 08, 2022~ Aug. 13, 2022	Nov. 29, 2022	Radiation (03CH07-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Jul. 28, 2022~ Aug. 05, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 30, 2021	Jul. 28, 2022~ Aug. 05, 2022	Sep. 29, 2022	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Sep. 30, 2021	Jul. 28, 2022~ Aug. 05, 2022	Sep. 29, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Jul. 28, 2022~ Aug. 05, 2022	Aug. 29, 2022	Conducted (TH05-HY)
BT Base Station (Measure)	Rohde & Schwarz	СВТ	101136	BT 3.0	Oct. 17, 2021	Jul. 28, 2022~ Aug. 05, 2022	Oct. 16, 2022	Conducted (TH05-HY)

Page Number: 4Issue Date: 5Report Version: 0

: 49 of 50

: Sep. 01, 2022 : 02



## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence	5.1 dB
of 95% (U = 2Uc(y))	5.1 dB

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

Measuring Uncertainty for a Level of Confidence	5.8 dB
of 95% (U = 2Uc(y))	5.0 UD

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

Measuring Uncertainty for a Level of Confidence	4.0 dB
of 95% (U = 2Uc(y))	4.0 ab



# Appendix A. Radiated Spurious Emission

Test Engineer :	Jees Wang	Temperature :	24~26°C
rest Engineer.		Relative Humidity :	55~65%

#### 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					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)
		2386.335	57.99	-16.01	74	53.62	31.4	8.38	35.41	202	19	Р	Н
		2386.335	33.23	-20.77	54	-	-	-	-	-	-	А	Н
	*	2402	101.03	-	-	96.62	31.42	8.41	35.42	202	19	Р	Н
	*	2402	76.27	-	-	-	-	-	-	-	-	A	Н
вт													н
СН00												_	Н
2402MHz		2386.545	50.83	-23.17	74	46.46	31.4	8.38	35.41	107	344	Р	V
		2386.545	26.07	-27.93	54	-	-	-	-	-	-	Α	V
	*	2402	92.87	-	-	88.46	31.42	8.41	35.42	107	344	Ρ	V
	*	2402	68.11	-	-	-	-	-	-	-	-	А	V
													V
													V
		2365.86	44.32	-29.68	74	40	31.4	8.33	35.41	234	22	Ρ	Н
		2365.86	19.56	-34.44	54	-	-	-	-	-	-	А	Н
	*	2441	98.46	-	-	93.67	31.73	8.5	35.44	234	22	Ρ	Н
	*	2441	73.7	-	-	-	-	-	-	-	-	А	Н
		2483.97	44.92	-29.08	74	39.71	32.07	8.59	35.45	234	22	Ρ	Н
ВТ СН 39		2483.97	20.16	-33.84	54	-	-	-	-	-	-	А	Н
сп зэ 2441MHz		2319.52	43.66	-30.34	74	39.31	31.52	8.22	35.39	112	331	Ρ	V
2441101612		2319.52	18.9	-35.1	54	-	-	-	-	-	-	А	V
	*	2441	91.89	-	-	87.1	31.73	8.5	35.44	112	331	Р	V
	*	2441	67.13	-	-	-	-	I	-	-	-	А	V
		2488.1	44.99	-29.01	74	39.74	32.1	8.6	35.45	112	331	Р	V
		2488.1	20.23	-33.77	54	-	-	-	-	-	-	А	V

Page Number : A1 of A8



	*	2480	98.11	-	-	92.93	32.04	8.59	35.45	221	26	Р	Н
	*	2480	73.35	-	-	-	-	-	-	-	-	А	Н
		2496.64	44.78	-29.22	74	39.45	32.17	8.62	35.46	221	26	Р	Н
		2496.64	20.02	-33.98	54	-	-	-	-	-	-	А	Н
57													Н
ВТ СН 78													Н
СП 78 2480MHz	*	2480	91.68	-	-	86.5	32.04	8.59	35.45	130	320	Р	V
240010112	*	2480	66.92	-	-	-	-	-	-	-	-	А	V
		2499.28	45.01	-28.99	74	39.65	32.19	8.63	35.46	130	320	Ρ	V
		2499.28	20.25	-33.75	54	-	-	-	-	-	-	А	V
													V
													V
Remark		o other spurious I results are PA		Peak and	Average lir	nit line.							



#### 2.4GHz 2400~2483.5MHz

		-		ſ	ы (пarmo	-	-	-	<b></b>			[	<b>F</b>
BT	Note	Frequency	Level	Margin		Read	Antenna	Path	Preamp	Ant		Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)		( dBµV/m )		( dB/m )	( dB )	(dB)	( cm )	(deg)		
		4804	60.66	-13.34	74	72.95	34.01	12.7	59	203	61	Р	Н
		4804	35.9	-18.1	54	-	-	-	-	-	-	Α	Н
													Н
													Н
													Н
													Н
													Н
													Н
													Н
													Н
													Н
ВТ													Н
CH 00 2402MHz		4804	57.21	-16.79	74	69.5	34.01	12.7	59	358	107	Р	V
240210112		4804	32.45	-21.55	54	-	-	-	-	-	-	А	V
													V
													V
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													V

## BT (Harmonic @ 3m)



BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		(MHz)			Line ( dBµV/m )	Level (dBµV)	Factor ( dB/m )	Loss (dB)	Factor (dB)	Pos (cm)	Pos ( deg )	Avg. (P/A)	(H/V)
		4882	56.62	-17.38	74	68.67	34.04	12.76	58.85	100	65	Р	Н
		4882	31.86	-22.14	54	-	-	-	-	-	-	А	н
		7323	58.2	-15.8	74	64.99	35.69	15.03	57.51	260	259	Ρ	Н
		7323	33.44	-20.56	54	-	-	-	-	-	-	А	Н
													Н
													Н
													Н
													Н
													Н
													Н
BT													Н
CH 39													Н
2441MHz		4882	53.84	-20.16	74	65.89	34.04	12.76	58.85	235	57	Ρ	V
		4882	29.08	-24.92	54	-	-	-	-	-	-	А	V
		7323	53.8	-20.2	74	60.59	35.69	15.03	57.51	100	243	Р	V
		7323	29.04	-24.96	54	-	-	-	-	-	-	А	V
													V
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													V
													V
													V
													V



вт	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos		Avg.	
		(MHz)	(dBµV/m)			(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)		
		4960	54.3	-19.7	74	66.09	34.1	12.82	58.71	100	66	Р	Н
		4960	29.54	-24.46	54	-	-	-	-	-	-	Α	Н
		7440	54.76	-19.24	74	61.5	35.82	15.03	57.59	317	259	Р	Н
		7440	30	-24	54	-	-	-	-	-	-	А	н
													н
													н
													Н
													н
													Н
													н
													н
BT													н
CH 78		4960	52.71	-21.29	74	64.5	34.1	12.82	58.71	220	57	Р	V
2480MHz		4960	27.95	-26.05	54	-	-	-	-	-	-	А	V
		7440	52.28	-21.72	74	59.02	35.82	15.03	57.59	100	243	Р	V
		7440	27.52	-26.48	54	-	-	-	-	-	-	А	V
													V
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													V
				I		<u> </u>							<u> </u>
Remark		o other spurious											
	2. All	l results are PA	SS against F	Peak and	Average lim	it line.							



## Emission below 1GHz

BT	Note	Frequency	Level	Margin		Read	Antenna	Path	Preamp	Ant	Table	Poak	Pol
		Trequency	Level	margin	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	( dBµV/m )		( dB/m )	(dB)	(dB)	( cm )	(deg)		
		55.38	23.99	-16.01	40	40.33	12.45	1.24	30.03	-	-	Ρ	Н
		174.18	24.86	-18.64	43.5	36.98	15.36	2.38	29.86	-	-	Ρ	Н
		204.96	34.99	-8.51	43.5	47.22	15.06	2.53	29.82	-	-	Р	Н
		796.3	30.34	-15.66	46	26.78	27.81	5.01	29.26	-	-	Р	Н
		855.8	32.41	-13.59	46	27.45	28.82	5.17	29.03	-	-	Р	Н
		947.5	33.17	-12.83	46	26.19	30.1	5.54	28.66	-	-	Р	Н
													Н
													Н
													Н
													Н
2.4GHz													Н
BT													Н
LF		30	31.47	-8.53	40	36	24.57	1.01	30.11	-	-	Р	V
		201.45	33.68	-9.82	43.5	46.03	14.97	2.51	29.83	-	-	Р	V
		230.61	32.94	-13.06	46	43.89	16.22	2.61	29.78	-	-	Р	V
		790.7	33.03	-12.97	46	29.54	27.8	4.97	29.28	-	-	Р	V
		887.3	34.66	-11.34	46	29.49	28.66	5.38	28.87	-	-	Р	V
		941.2	34.28	-11.72	46	27.64	29.78	5.54	28.68	-	-	Р	V
													V
													V
													V
													V
													V
													V
		o other spurious											
Remark		l results are PA											
		e emission pos				pected em	nission foun	d and em	ission leve	el has a	t least 60	iB mai	rgin
	ag	ainst limit or er	nission is no	se tioor	oniy.								

## 2.4GHz BT (LF)



## 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:

ВТ	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					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)
вт		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 00													
2402MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	Н

- 1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
- 2. Level(dB $\mu$ V/m) =

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

3. Margin(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Path 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. Margin(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

Peak measured complies with the limit line, so test result is "PASS".



# Appendix B. Radiated Spurious Emission Plots

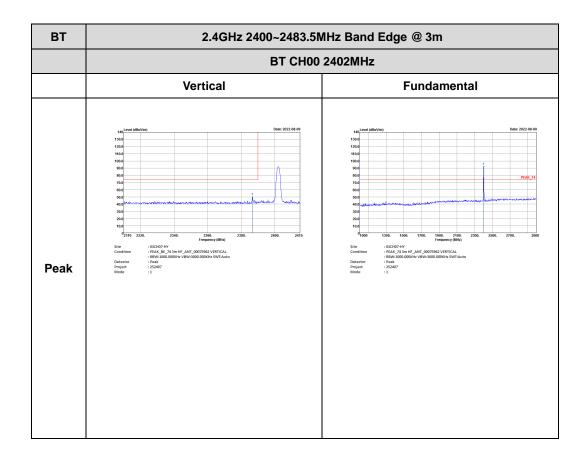
Test Engineer :	Jees Wang	Temperature :	24~26°C
rest Engineer .		Relative Humidity :	55~65%

#### 2.4GHz 2400~2483.5MHz

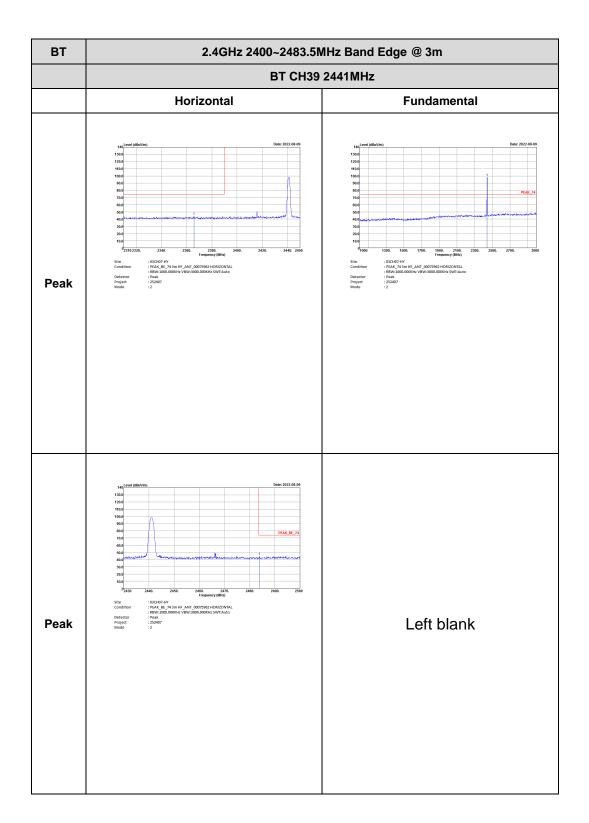
## BT (Band Edge @ 3m)

ВТ	2.4GHz 2400~2483.5MHz Band Edge @ 3m											
	BT CH00 2402MHz											
	Horizontal	Fundamental										
Peak	<text></text>	<text></text>										

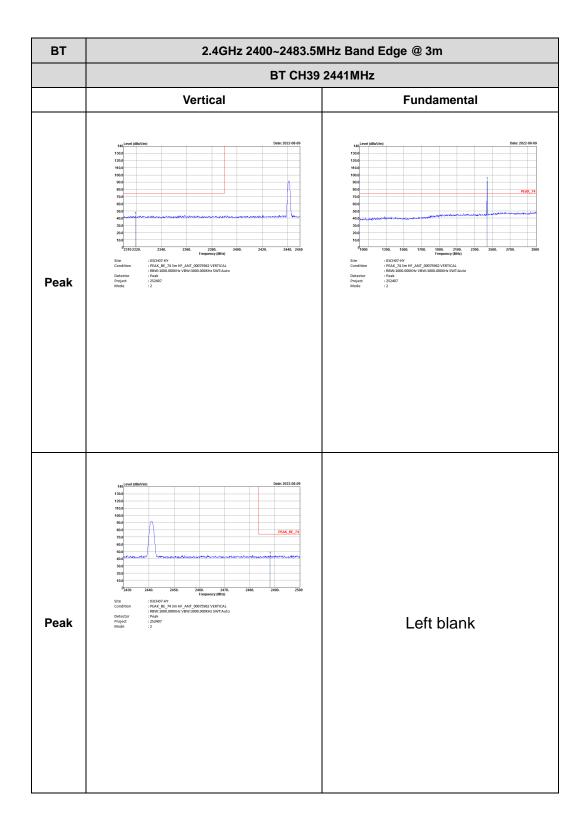




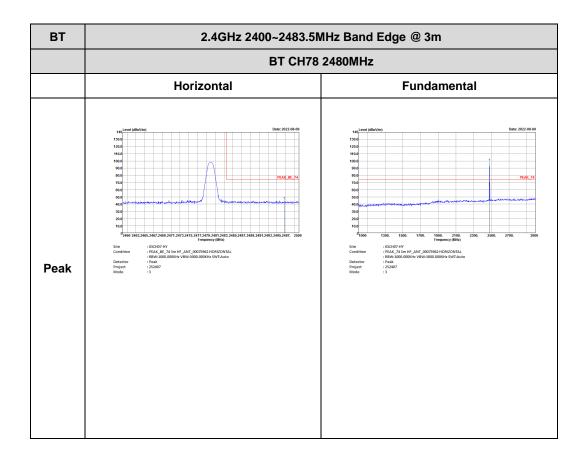




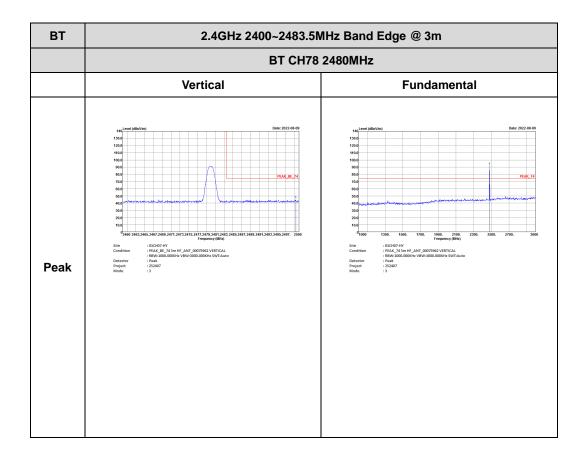








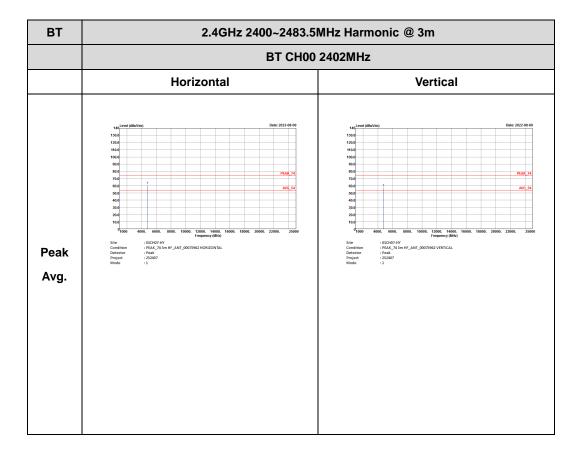




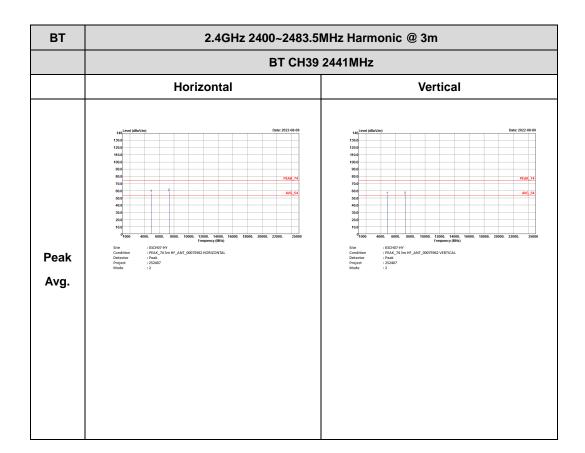


#### 2.4GHz 2400~2483.5MHz

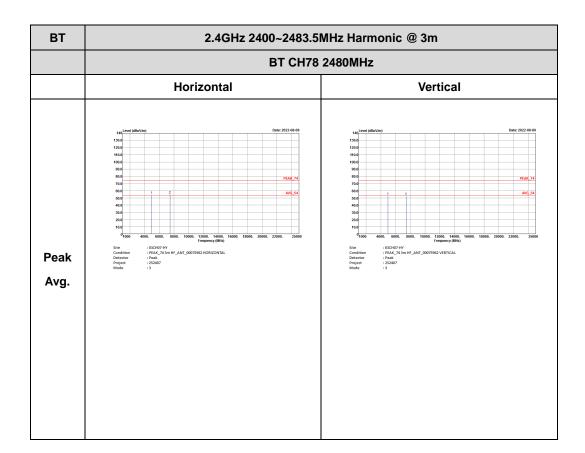
## BT (Harmonic @ 3m)







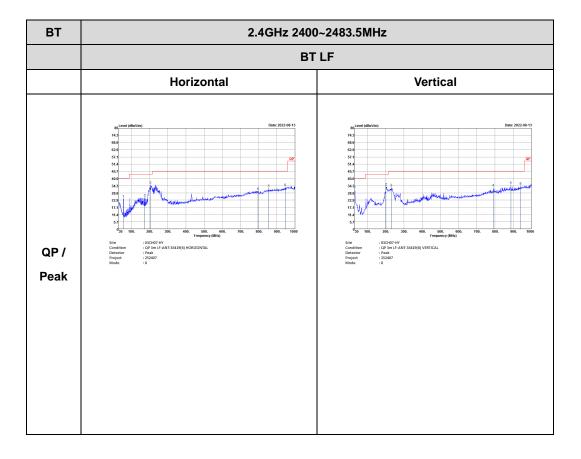






## Emission below 1GHz

## 2.4GHz BT (LF)





# Appendix C. Duty Cycle Plots

3DH5 on time (One Pulse) Plot on (	Channel 39	on time (Count Pulses) Plot on Channel 39
Marker 4 1.42000 ms #Avg Type: RMS Type: RMS	TAM Aug 09, 2022 RACE 11 2 3 4 5 6 Trace/Detector TYPE MWWWWW DET P P P P P P	Alternt Spectman Analyzer         Sergit SA           III 8L         FF         ISO IS IC         ESIZE INT         ALIGNATIO         01019121974 Aug09, 2022         Trace/Detector           RBW 1 MHz         FR0: Wide         Trig: Free Run IF Graintow         Avg Type: RMS Rem: 20 dB         Ward [1:3:8:5 G Rem: 20 dB         Trace/Detector
10 dB/div Ref 126.99 dBμV 93.2	1.420 ms 257 dBµV	10 dB/div Ref 126.99 dBµV 93.205 dBµV
	Clear Write	117 Clear Write
	Trace Average	
50 60 50 50 50 50 50 50 50 50 50 5	Max Hold	01         1
Res BW (CISPR)         1.0 MHz         #VBW         1.0 MHz         Sweep         10.00 ms           WMRI MUDEL         Y         FUNCTION         FUNCTION         FUNCTION         FUNCTION	Span 0 Hz s (1001 pts) Min Hold	
1 Δ2 1 t (Δ) 2.890 ms (Δ) 0.769 dB 2 N t 1.420 ms 3257 dBµ/v 3 Δ4 1 t (Δ) 3.750 ms (Δ) 0.018 dB 5 N t t 1.420 ms 93.257 dBµ/v 6	View Blank Trace On	10 Louiser frank and with a first and a second
7 8 9 10 11 11	More 1 of 3	B 0         More           Center 2.44 1000000 GHz         Span 0 Hz           Res BW (CISPR) 1.0 MHz         #VBW 1.0 MHz           Sweep 100.0 ms (1001 pts)

#### Note:

- 1. Worst case Duty cycle = on time/100 milliseconds = 2 \* 2.89 / 100 = 5.78 %
- 2. Worst case Duty cycle correction factor = 20\*log(Duty cycle) = -24.76 dB
- 3. 3DH5 has the highest duty cycle worst case and is reported.

#### Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

#### 2.89 ms x 20 channels = 57.8 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.8 ms ] = 2 hops Thus, the maximum possible ON time:

#### 2.89 ms x 2 = 5.78 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

 $20 \times \log(5.78 \text{ ms}/100 \text{ ms}) = -24.76 \text{ dB}$