Audix Technology Corp.
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FCC 15.247& RSS-247
2.4 GHz Test Report

for

LG Electronics Inc.

222, LG-roJinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea

Product Name	**:**	**Notebook Computer**
Model Name	**:**	**(1)17Z90N (2)17ZB90N (3)17ZD90N (4)17ZG90N (5)17ZC90N**
Brand		**LG**
FCC ID	**:**	**BEJNT-17Z90N**
IC	**:**	**2703H-17Z90N**

Prepared by: : AUDIX Technology Corporation, EMC Department

Testing Laboratory
1724

TESTING
NVLAP LAB CODE 200077-0

The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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TABLE OF CONTENTS

Description Page

TEST REPORT CERTIFICATION 4
1. REVISION RECORD OF TEST REPORT 5
2. SUMMARY OF TEST RESULTS 6
3. GENERAL INFORMATION 7
3.1. Description of Application 7
3.2. Description of EUT 8
3.3. Antenna Information 9
3.4. EUT Specifications Assessed in Current Report 12
3.5. Description of Key Components 13
3.6. Test Configuration 15
3.7. Tested Supporting System List 16
3.8. Setup Configuration 16
3.9. Operating Condition of EUT 16
3.10. Description of Test Facility 17
3.11. Measurement Uncertainty 18
4. MEASUREMENT EQUIPMENTLIST 19
4.1. Conducted Emission Measurement 19
4.2. Radiated Emission Measurement 19
4.3. RF Conducted Measurement 20
5. CONDUCTED EMISSION 21
5.1. Block Diagram of Test Setup 21
5.2. Conducted Emission Limit 21
5.3. Test Procedure 21
5.4. Test Results 22
6. RADIATED EMISSION 23
6.1. Block Diagram of Test Setup 23
6.2. Radiated Emission Limits 24
6.3. Test Procedure 25
6.4. Measurement Result Explanation 26
6.5. Test Results 26
7. 20dB BANDWIDTH 27
7.1. Block Diagram of Test Setup 27
7.2. Specification Limits 27
7.3. Test Procedure 27
7.4. Test Results 27
8. CARRIER FREQUENCY SEPARATION 28
8.1. Block Diagram of Test Setup 28
8.2. Specification Limits 28
8.3. Test Procedure 28
8.4. Test Results 28
9. TIME OF OCCUPANCY 29
9.1. Block Diagram of Test Setup 29
9.2. Specification Limits 29

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Fax: +886 2 26099303

9.3. Test Procedure 29
9.4. Test Results 29
10. NUMBER OF HOPPING CHANNELS 30
10.1. Block Diagram of Test Setup 30
10.2. Specification Limits 30
10.3. Test Procedure 30
10.4. Test Results 30
11. MAXIMUM PEAK OUTPUT POWER 31
11.1. Block Diagram of Test Setup 31
11.2. Specification Limits 31
11.3. Test Procedure 31
11.4. Test Results 31
12. EMISSION LIMITATIONS 32
12.1. Block Diagram of Test Setup 32
12.2. Specification Limits 32
12.3. Test Procedure 32
12.4. Test Results 32
13. DEVIATION TO TEST SPECIFICATIONS 33

APPENDIX A TEST DATA AND PLOTS
APPENDIX B TESTPHOTOGRAPHS

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TEST REPORT CERTIFICATION

Applicant	:	LG Electronics Inc.
Manufacturer	:	LG Electronics Inc.
Factory #1	:	LG Electronics Nanjing New Technology Co., Ltd.
Factory #2	:	SEO HEUNG ELECTRONICS CO LTD
EUT Description		
(1) Product	:	Notebook Computer
(2) Model	:	(1)17Z90N (2)17ZB90N (3)17ZD90N (4)17ZG90N (5)17ZC90N
(3) Brand	:	LG
(4) Power Rating	:	DC 19V, 2.53A

Applicable Standards:

47CFRFCC Part 15 Subpart C
RSS-Gen (Issue 5), April 2018
RSS-247 (Issue 2), February 2017
ANSI C63.10:2013

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.
Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2019. 10. 15

Reviewed by: Tina Huang (Tina Huang/Administrator)

Approved by: Johnny Hsueh (Johnny Hsueh/Section Manager)

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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2019. 10. 15	Original Report	EM-F190355

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2. SUMMARY OF TEST RESULTS

Rule		Description	Data Reused	Results
FCC	IC			
15.207	RSS-Gen §8.8	Conducted Emission	No	**PASS**
15.247(d)/15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	No	**PASS**
15.247(a)(1)	RSS-247 §5.1(2)	20dB Bandwidth	No	**PASS**
15.247(a)(1)	RSS-247 §5.1(2)	Carrier Frequency Separation	No	**PASS**
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Time of Occupancy	No	**PASS**
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Number of Hopping Channels	No	**PASS**
15.247(b)(1)	RSS-247 §5.1(2)	Maximum Peak Output Power	SPOT CHECK Note 2	**PASS**
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	No	**PASS**
15.203	RSS-Gen §6.8	Antenna Requirement	---	**Compliance**

Note: 1. The uncertainties value is not used in determining the result.
2. This device embedded with same radio transmitter with FCC ID: BEJNT-15Z90N, IC: 2703H-15Z90N. According to KDB 484596 D01, we did spot check for output power and all output power values keep identical thus we reuse all results.

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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 451-713 Korea.
Manufacturer	LG Electronics Inc. 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 451-713 Korea.
Factory #1	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Factory #2	SEO HEUNG ELECTRONICS CO LTD 55 Asan valley Seo-ro, Dunpo-myeon, Asan-si, Chungcheongnam-do, 31409 Korea
Product	Notebook Computer The product has two colors (Dark Silver and White).
Model	(1)17Z90N (2)17ZB90N (3)17ZD90N (4)17ZG90N (5)17ZC90N The difference between all models is different in the sales customers.
Brand	LG

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3.2. Description of EUT

<table>
<tr><td>Test Model</td><td>17Z90N</td></tr>
<tr><td>Serial Number</td><td>N/A</td></tr>
<tr><td>Power Rating</td><td>DC 19V, 2.53A</td></tr>
<tr><td>Software Version</td><td>N/A</td></tr>
<tr><td>RF Features</td><td>WLAN:802.11 a/b/g/n/ac/ax
Bluetooth: BT and BLE (BT 5.0)</td></tr>
<tr><td>Transmit Type</td><td>
<table>
<tr><th colspan="2">2.4 GHz</th></tr>
<tr><td>802.11b</td><td>1T1R</td></tr>
<tr><td>802.11g</td><td>1T1R</td></tr>
<tr><td>802.11n-HT20</td><td>2T2R</td></tr>
<tr><td>802.11n-HT40</td><td>2T2R</td></tr>
<tr><td>802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>BT/BLE</td><td>1T1R</td></tr>
</table>
<table>
<tr><th colspan="2">UNII Bands</th></tr>
<tr><td>802.11a</td><td>1T1R</td></tr>
<tr><td>802.11n-HT20/802.11ac-VHT20/802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11n-HT40/802.11ac-VHT40/802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT80/802.11ax-HE80</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT160/802.11ax-HE160</td><td>2T2R</td></tr>
</table>
</td></tr>
<tr><td>Sample Status</td><td>Mass production</td></tr>
<tr><td>Date of Receipt</td><td>2019. 09. 16</td></tr>
<tr><td>Date of Test</td><td>2019. 09. 18 ~ 10. 01</td></tr>
<tr><td>Interface Ports of EUT</td><td>• One Micro SD Card Slot
• One Earphone Port
• Three USB 3.0 Ports
• One USB Type C Port
• One HDMI Port
• One DC Input Port</td></tr>
<tr><td>Accessories Supplied</td><td>• AC Adapter
• LAN Gender</td></tr>
</table>

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3.3. Antenna Information

2.4G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1.	WA-P-LBLB-04-068 (Main)	INPAQ	Mono-Pole	2400	2.72
				2410	2.46
				2420	2.58
				2430	2.64
				2440	2.60
				2450	2.90
				2460	3.38
				2470	4.05
				2480	**4.12**
				2490	3.61
				2500	3.14
	WA-P-LBLB-04-068 (AUX)	INPAQ	Mono-Pole	2400	2.04
				2410	2.27
				2420	3.11
				2430	3.57
				2440	3.66
				2450	3.81
				2460	4.00
				2470	4.40
				2480	**4.52**
				2490	4.31
				2500	4.19
2	L1LRF001-CS-H (Main)	LUXSHARE-ICT	Mono-Pole	2400	**4.8**
				2450	4.5
				2500	4.6
	L1LRF001-CS-H (AUX)	LUXSHARE-ICT	Mono-Pole	2400	**4.2**
				2450	4.2
				2500	4.0

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5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1.	WA-P-LBLB-04-068 (Main)	INPAQ	Mono-Pole	5100	2.26
				5150	3.52
				5200	3.18
				5250	3.31
				5300	3.36
				5350	2.15
				5400	2.96
				5450	3.15
				5500	4.67
				5550	4.23
				5600	**4.92**
				5650	4.47
				5700	3.51
				5750	3.74
				5800	2.74
	WA-P-LBLB-04-068 (AUX)	INPAQ	Mono-Pole	5100	2.60
				5150	2.76
				5200	2.96
				5250	2.37
				5300	2.18
				5350	1.90
				5400	3.27
				5450	3.41
				5500	3.18
				5550	3.42
				5600	**3.63**
				5650	3.15
				5700	4.11
				5750	3.13
				5800	2.39

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5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
2	L1LRF001-CS-H (Main)	LUXSHARE-ICT	Mono-Pole	5150	3.9
				5250	4.3
				5350	3.9
				5470	3.7
				5600	4.3
				5725	**4.5**
				5785	3.4
				5800	3.6
				5850	3.9
	L1LRF001-CS-H (AUX)	LUXSHARE-ICT	Mono-Pole	5150	3.2
				5250	3.2
				5350	3.0
				5470	**4.3**
				5600	4.1
				5725	4.1
				5785	4.1
				5800	4.2
				5850	3.3

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3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
Bluetooth	2402-2480	79	FHSS (GFSK, π/4 DQPSK, 8-DPSK)	1/2/3

Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

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3.5. Description of Key Components

3.5.1. For the All Component Lists

Item	Supplier	Model / Type	Character
System	Microsoft	Win10 Home	---
		Win10 Pro	---
Main Board	LG	1XZ90N MAIN B/D PCB	Manufacturer: #1 Hannstar Board Tech (Jiang Yin) Corp., Ltd. #2 Elec & Eltek Company (MCO) Limited.
WLAN SUB Board	LG	17Z90N WLAN SUB B/D	Manufacturer: #1 Hannstar Board Tech (Jiang Yin) Corp., Ltd. #2 Elec & Eltek Company (MCO) Limited.
CPU (Socket: FCBGA1526)	Intel	i5-1035G7	1.2GHz, up to 3.7GHz
	Intel	i7-1065G7	1.3GHz, up to 3.9GHz
17" LCD Panel	LG Display	LP170WQ1(SP)(A1)	Resolution: 2560 x 1600, 60Hz WQXGA IPS (Normal Non touch)
Storage (SSD) (Max. 2 pcs)	Samsung	MZ-VLB5120 (P/N MZVLB512HAJQ-00000)	512GB (M.2)
		MZ-VLB2560 (P/N MZVLB256HAHQ-00000)	256GB (M.2)
Memory (RAM)	Samsung	---	8GB DDR4 3200MHz SODIMM (on Card)
	SK Hynix	---	8GB DDR4 3200MHz SODIMM (on Card)
	Samsung	---	8GB DDR4 (On Board)
Battery Pack	LG	LBV7227E	DC 7.74V, 80Wh, Typ 10336mAh
WLAN Combo Card	Intel	AX201D2W	WLAN and BT, 2x2 CNVi 1216 FCC ID: PD9AX201NG IC: 1000M-AX201NG NCC ID: CCAH18LP3410T5
WLAN Combo Antenna	LG (INPAQ)	WA-P-LBLB-04-068	PCB, Mono-pole Type Main: Black, Aux: Gray
	LG (LUXSHARE-ICT)	L1LRF001-CS-H	PCB, Mono-pole Type Main: Black, Aux: Gray
Keyboard	TIC	KT01-19A6	P/N KT01-19A6BS03USRA000 (White KBD)
		KT01-19A6	P/N KT01-19A6AS03USRA000 (Black KBD)
	LITE ON	SN3890BL	P/N SG-90980-XUA (White KBD)
		SN3890BL	P/N: SG-90970-XUA (Black KBD)
Web Camera	Chicony	CKFIH2821005290LH	With two microphones
		CKFIH28-121005290LH	With One microphone
	Luxvisions	7BF109N2DC	With two microphones
		7BF109N2C	With One microphone

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Item	Supplier	Model / Type	Character
LAN Gender (Type C to LAN)	SUZHOU MEC ELECTRONICS	80-5946-200	(White) 10/100/1000 Megabit Ethernet
		80-5946-210	(Black) 10/100/1000 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.13m		
	SUZHOU MEC ELECTRONICS	80-5946-111	(White) 10/100Megabit Ethernet
		80-5946-101	(Black) 10/100 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
	ARIN TECH CO. LTD	GD-08MF-36-WH-LP10	(White) 10/100Megabit Ethernet
		GD-08MF-36-BK-LP11	(Black) 10/100 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter (48W)	LG (HONOR)	ADS-48MS-19-2 19048E	I/P: AC 100-240V, 50-60Hz, 1.5A, O/P: DC 19V, 2.53A
	DC Power Cord: Non-Shielded, Undetached, 1.5m AC Power Cord: Non-Shielded, Detached, 1.0m (2C) (For Other Countries) AC Power Cord: Non-Shielded, Detached, 1.55m (2C) (For US, Canada, Mexico)		

Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

3.5.2. The EUT collocates with following worst components, which are used to establish a basic configuration of system during test:

SKU		#1	#2
System	Microsoft, Win10 Home	V	V
Main Board	LG, 1XZ90N MAIN B/D PCB	V	V
SUB Board	LG, 17Z90N WLAN SUB B/D	V	V
CPU	Intel, i7-1065G7	V	
	Intel, i5-1035G7		V
17" LCD Panel	LG Display, LP170WQ1(SP)(A1)	V	V
Storage (SSD)	Samsung, 512GB *2	V	
	Samsung, 256GB *1		V
Memory (RAM)	Samsung, 8GB (On Board)	V	V
	Samsung, 8GB (On Card)	V	
	SK Hynix, 8GB (On Card)		V
Battery Pack	LG, LBV7227E	V	V
WLAN Combo Card	Intel, AX201D2W	V	V
WLAN Combo Antenna	LG (INPAQ), WA-P-LBLB-04-068	V	
	LG (LUXSHARE-ICT), L1LRF001-CS-H		V
Keyboard	TIC, KT01-19A6 P/N KT01-19A6BS03USRA000 (White KBD)	V	
	LITE ON, SN3890BL P/N SG-90970-XUA (Black KBD)		V
Web Camera	Chicony, CKFIH2821005290LH	V	
	Luxvisions , 7BF109N2DC		V
LAN Gender (Type C to LAN)	SUZHOU MEC ELECTRONICS, 80-5946-200	V	V
AC Adapter	LG (HONOR), ADS-48MS-19-2 19048E	V	V

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3.6. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Correction Factor (dB)
BT	N/A	2.890	N/A

AC Conduction	
SKU #1	Normal operation
SKU #2	Normal operation

SKU	Item		Modulation	Data Rate	Test Channel
#1	Radiated Test Case	Radiated Band Edge Note1	GFSK	1Mbps	00/78
			8-DPSK	3Mbps	00/78
#1		Radiated Spurious Emission Note1	GFSK	1Mbps	00/39/78
#2			GFSK	1Mbps	39
#1	Conducted Test Case	20dB Bandwidth	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78
		Carrier Frequency Separation	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78
		Time of Occupancy	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78
		Number of Hopping Channels	GFSK	1Mbps	39
			8-DPSK	3Mbps	39
		Maximum Peak Output Power	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78
		Band Edges	GFSK	1Mbps	00/78
			8-DPSK	3Mbps	00/78
		Spurious Emission	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78

Note 1: ☐Mobile Device

■Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ■ Lie ☐ Side☐ Stand

Note 2: Both of the antennas are the same type, and we presented the worst case in the report.
The max-gain condition with SISO (aux port) is SKU #1.

Note 3: We performed testing of the highest and lowest data rate.

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3.7. Tested Supporting System List

3.7.1. Support Peripheral Unit

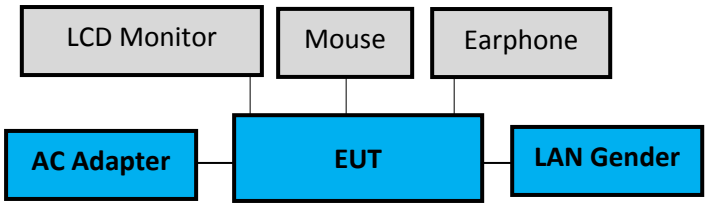
No.	Product	Brand	Model No.	Serial No.	Approval
1.	LCD Monitor	LG	22LK330-DB	N/A	N/A
2.	USB Mouse	acer	MOBVUO	N/A	FCC By DoC
3.	Earphone	APPLE	N/A	N/A	N/A

3.7.2. Cable Lists

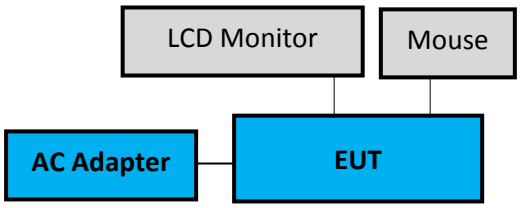
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.8m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Undetachable, 1.8m
3.	Earphone Cable: Unshielded, Undetachable, 0.9m

3.8. Setup Configuration

3.8.1. EUT Configuration for Power Line & Radiated Emission



3.8.2. EUT Configuration for RF Conducted Test Items



3.9. Operating Condition of EUT

Test program “DRTU” is used for enabling EUT BT function under continues transmitting and choosing data rate/ channel.
[Chain 0 is aux port (A Button in DRTU) Chain 1 is main port (B Button in DRTU)].

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3.10.Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.8 Shielded Room (2) No.1 3m Semi Anechoic Chamber (3) Fully Anechoic Chamber

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3.11.Measurement Uncertainty

Test Items/Facilities		Frequency Range	Uncertainty
Conduction Test		150kHz~30MHz	±3.50dB
Radiation Test	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
		200MHz-1000MHz, 3m, Horizontal	±4.3dB
		30MHz-200MHz, 3m, Vertical	±4.5dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
		1GHz-6GHz, 3m	±5.1dB
		6GHz-18GHz, 3m	±5.5dB
	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.7dB
		200MHz-1000MHz, 3m, Horizontal	±4.5dB
		30MHz-200MHz, 3m, Vertical	±4.3dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
		200MHz-1000MHz, 3m, Horizontal	±4.4dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±5.0dB
		1GHz-6GHz, 3m	±4.4dB
		6GHz-18GHz, 3m	±4.1dB
	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
		200MHz-1000MHz, 3m, Horizontal	±4.0dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±4.4dB
		1GHz-6GHz, 3m	±4.3dB
		6GHz-18GHz, 3m	±4.6dB
	Fully Anechoic Chamber	30MHz~1000MHz	±4.7dB
		1GHz~18GHz	±5.3dB

Remark：Uncertainty = $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	±0.2kHz
Carrier Frequency Separation	±0.2kHz
Time of Occupancy	±0.03sec
Maximum peak Output power	± 0.52dB
Conducted Emission Limitations	± 0.13dB

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4. MEASUREMENT EQUIPMENTLIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2019. 01. 23	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2018. 11. 14	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2018. 12. 19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2019. 01. 12	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2019. 04. 20	1 Year
6.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2019. 09. 11	1 Year
2.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2019.05.06	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2019. 06. 12	1 Year
4.	Amplifier	HP	8447D	2944A06305	2019. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2019. 03. 07	1 Year
6.	Amplifier	Keysight	83051A	MY53010042	2019. 08. 08	1 Year
7.	Bilog Antenna	TESEQ	CBL6112D	33821	2019. 01. 19	1 Year
8.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017.12. 18	2 Years
9	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2019. 03. 13	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2019 .05. 14	1 Year
11.	2.4GHz Notch Filter	K&L	7NSL10-2441.5/E130.5-O/O	1	2019. 07. 24	1 Year
12.	3GHz Notch Filter	Microwave	H3G018G1	484796	2019. 08. 21	1 Year
13.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2019. 02. 01	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	RF CABLE-01	2019. 09. 20	1 Year
15.	Coaxial Cable	HUBER+ SUHNER	SUCOFLEX 102	No.1 18-40GHz Cable	2019.09.20	1 Year
16.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2019. 04. 20	1 Year
17.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2019. 04. 20	1 Year
18.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.
19.	Test Software	Audix	e3	V6.110601	N.C.R.	N.C.R.

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4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9020B-544	MY57120357	2019. 01. 17	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2018. 11. 07	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2018. 11. 07	1 Year
4.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2019. 04. 20	1 Year

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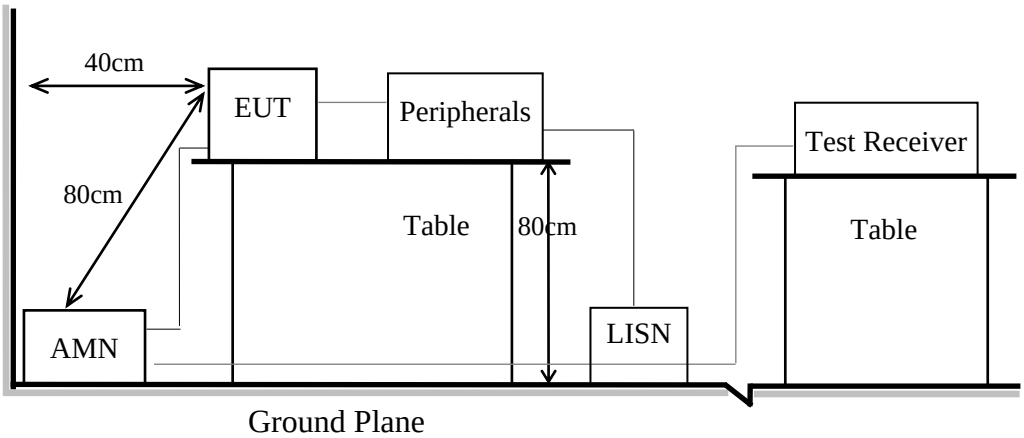
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.8

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dBμV	56 ~ 46 dBμV
500kHz ~ 5MHz	56 dBμV	46 dBμV
5MHz ~ 30MHz	60 dBμV	50 dBμV

Remark1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.
2.: The lower limit applies to the band edges.

5.3. Test Procedure

5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.

5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).

5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)

5.3.4. Checking frequency range from 150kHz to 30 MHz and record the emission which does not have 20 dB below limit.

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5.4. Test Results

Please refer to Appendix A.

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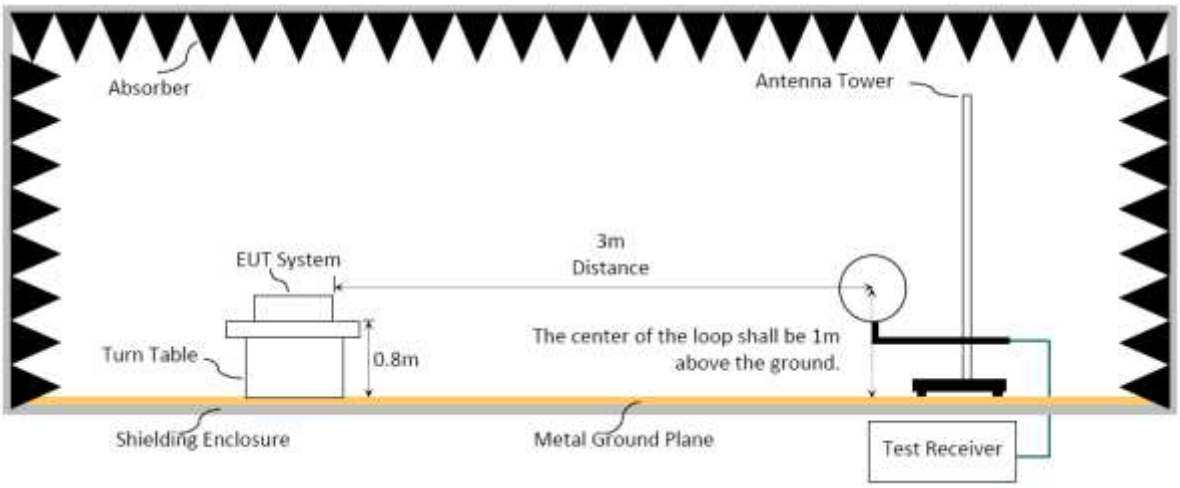
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

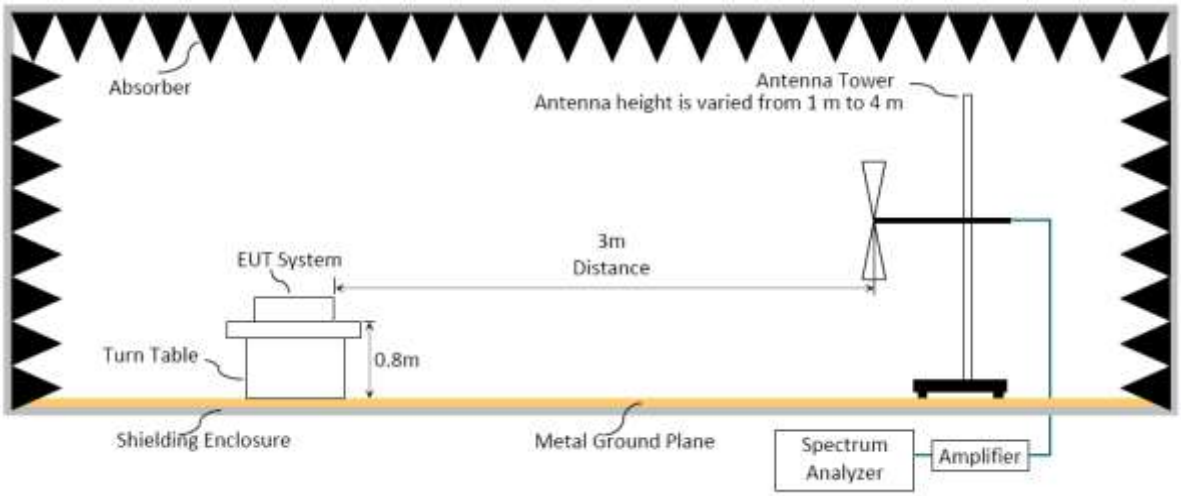
6.1.1. Block Diagram of EUT

Indicated as section 3.8

6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



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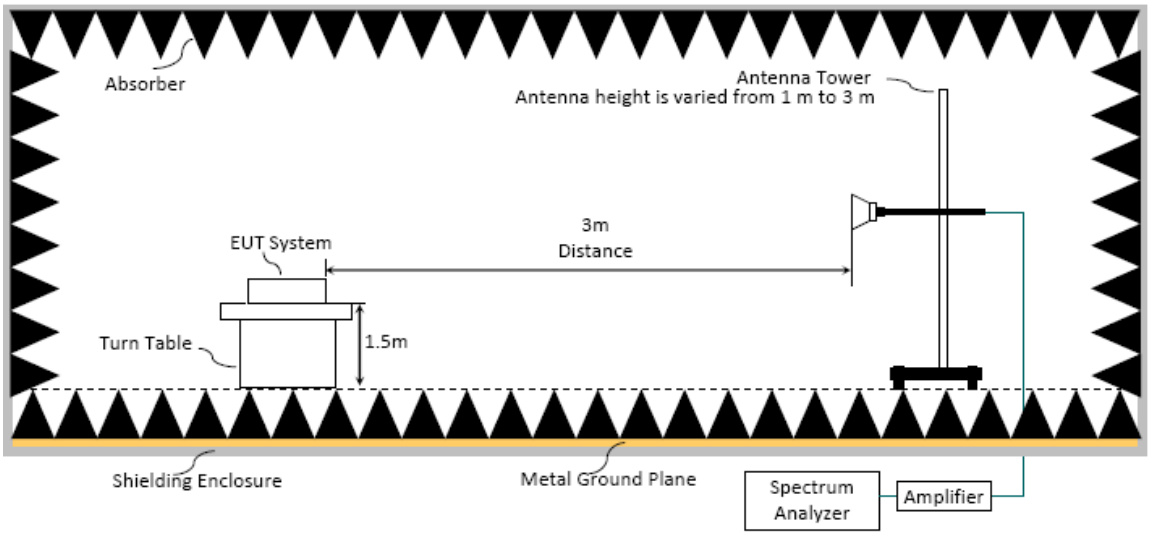
6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark：(1) dBμV/m = 20 log (μV/m)
(2) The tighter limit applies to the edge between two frequency bands.
(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
(4) Fundamental and emission fall within operation band are exempted from this section.
(5) Pursuant to ANSI C63.10: 6.6.4.3,if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

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6.3. Test Procedure

Frequency Range 9kHz~30MHz:
The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level.
In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013regulation.

(1) RBW = 9kHz with peak and average detector.
(2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 25GHz:
The EUT setup on the turn table which has 80 cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m (for 30-1000MHz) or antenna varied from 1 m to 3 m (for above 1GHz) to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013regulation.

Frequency below 1GHz:
Spectrum Analyzer is used for pre-testing with following setting:
(1)RBW = 120KHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note 1: When peak-detected value is lower than limit that the measurement using theQ.P. detector is not required, otherwise using Q.P. for final measurement.
Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic(up to 25 GHz):
Peak Detector:
(1)RBW = 1MHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

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Average Detector:

■**Option 1:**

(1)RBW = 1MHz
(2)VBW ≥ 1/ T.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.

□**Option 2:**

Average Emission Level= Peak Emission Level+ D.C.C.F.

6.4. Measurement Result Explanation

■Peak Emission Level=Antenna Factor + Cable Loss + Meter Reading (including Preamp factor if test used)

■Average Emission Level l=Antenna Factor + Cable Loss + Meter Reading (including Preamp factor if test used)

□Average Emission Level= Peak Emission Level+ DCCF
Duty Cycle Correction Factor (DCCF)= 20log(TX_{on}/TX_{on+off}) presented in section 3.6

□ERP= Peak Emission Level-95.2dB-2.14dB

6.5. Test Results

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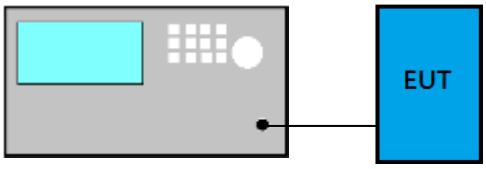
7. 20dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

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

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Set RBW close to1% to 5% of OBW.
(2) Set VBW≥3xRBW.
(3) Detector = Peak.
(4) Trace mode = Max hold.
(5) Sweep = Auto couple.
(6) Allow the trace to stabilize.
(7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

7.4. Test Results

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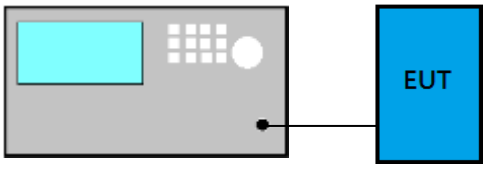
8. CARRIER FREQUENCY SEPARATION

8.1. Block Diagram of Test Setup



8.2. Specification Limits

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output no greater than 125mW.

8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span = Wide enough to capture the peaks of two adjacent channels
(2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
(3) VBW≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold
(7) Allow the trace to stabilize.

8.4. Test Results

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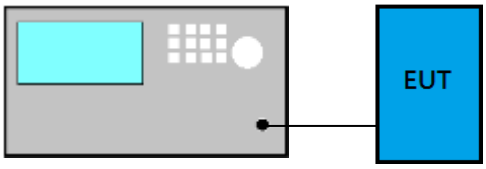
9. TIME OF OCCUPANCY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency hopping systems in the 2400-2483.5MHz shall use at least 15 non-overlapping channels. 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 number of hopping channels employed.

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: Zero span, centered on a hopping channel.
(2) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel.
(3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
(4) Detector function = Peak
(5) Trace = Max hold

9.4. Test Results

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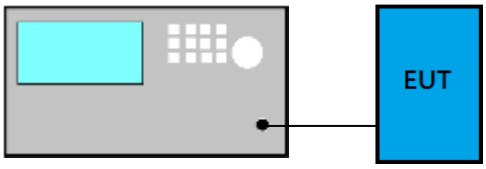
10. NUMBER OF HOPPING CHANNELS

10.1. Block Diagram of Test Setup



10.2. Specification Limits

Frequency hopping systems which use fewer than 20 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
(2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = m=Max hold
(7) Allow the trace to stabilize.

10.4. Test Results

Please refer to Appendix A

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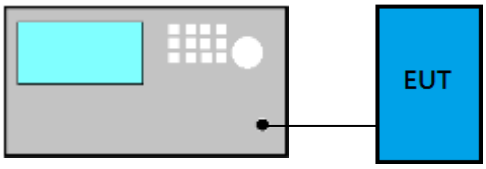
11. MAXIMUM PEAK OUTPUT POWER

11.1. Block Diagram of Test Setup



11.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

11.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(a) Use the following spectrum analyzer settings

(1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
(2) RBW > 20 dB bandwidth of the emission being measured.
(3) VBW ≥ RBW
(4) Sweep: Auto
(5) Detector function: Peak
(6) Trace: Max hold

(b) Allow trace to stabilize.

(c) Use the marker-to-peak function to set the marker to the peak of the emission.

11.4. Test Results

Please refer to Appendix A

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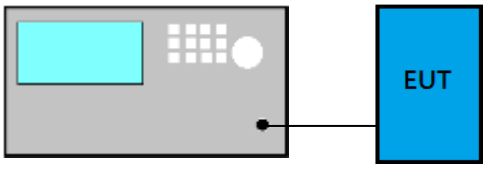
12. EMISSION LIMITATIONS

12.1. Block Diagram of Test Setup



12.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a)/RSS-Gen Section 8.9table 4is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6,, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 (See Section 15.205(c)).

12.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Set span wide enough to capture the peak level of the in-band emission and all spurious emissions; up to 10th harmonic.
(2) RBW = 100 kHz
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold

12.4. Test Results

Please refer to Appendix A

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13. DEVIATION TO TEST SPECIFICATIONS

【NONE】

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APPDNDIX A

TEST DATA AND PLOTS

(Model: 17Z90N)

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TABLE OF CONTENTS

A.1 CONDUCTED EMISSION 2
A.2 RADIATED EMISSION 6
A.2.1 Emissions within Restricted Frequency Bands 6
A.2.2 Emissions outside the frequency band: 16
A.2.3 Emissions in Non-restricted Frequency Bands: 17
A.3 20dB BANDWIDTH 18
A.3.1 6dB Bandwidth Result 18
A.3.2 Measurement Plots 19
A.4 CARRIER FREQUENCY SEPARATION 20
A.5 TIME OF OCCUPANCY 22
A.5.1 Time of Occupancy 22
A.6 NUMBER OF HOPPING CHANNELS 32
A.7 MAXIMUM PEAK OUTPUT POWER 33
A.7.1 Maximum Peak Output Power 33
A.7.2 Measurement Plots 34
A.8 EMISSION LIMITATIONS MEASUREMENT 35
A.8.1 Band Edge 35
A.8.2 Spurious Emission 37

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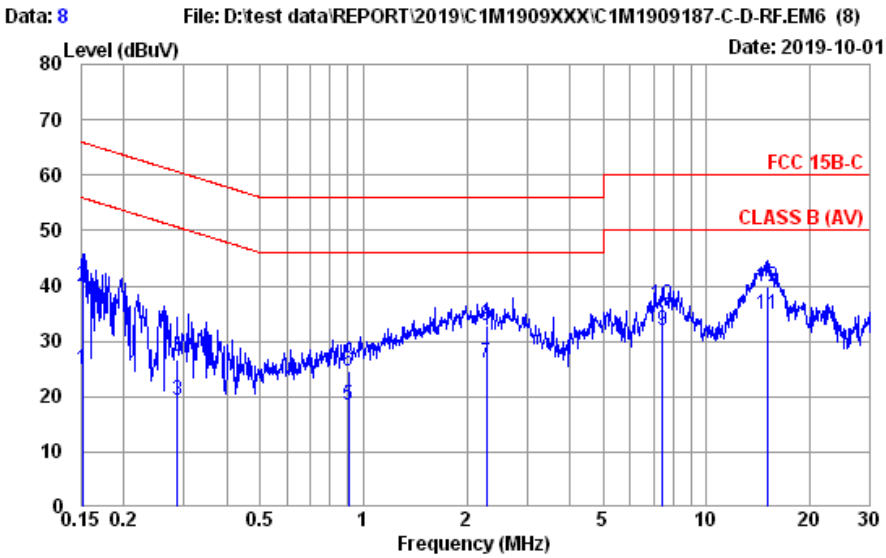
A.1 CONDUCTED EMISSION

Test Date	2019/10/01	Temp./Hum.	24℃/60%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #1	Test Model	17Z90N




```
Site no.      : No.8 Shielded Room          Data no.    : 8
Condition     : ENV4200 100169              LISN Phase  : NEUTRAL
Limit         : FCC 15B-C
Env. / Ins.   : 24°C / 57% ESR3 (1774)      Engineer    : Chucky Chiu
EUT           : 17Z90N
Power Rating  : 120Vac/60Hz
Test Mode     : Operating
```

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.152	10.70	0.03	9.86	4.44	25.03	55.91	30.88	Average
2	0.152	10.70	0.03	9.86	19.34	39.93	65.91	25.98	QP
3	0.286	10.55	0.04	9.86	-1.20	19.25	50.63	31.38	Average
4	0.286	10.55	0.04	9.86	6.24	26.69	60.63	33.94	QP
5	0.904	10.47	0.06	9.86	-1.93	18.46	46.00	27.54	Average
6	0.904	10.47	0.06	9.86	4.26	24.65	56.00	31.35	QP
7	2.285	10.53	0.09	9.86	5.63	26.11	46.00	19.89	Average
8	2.285	10.53	0.09	9.86	12.22	32.70	56.00	23.30	QP
9	7.446	11.13	0.16	9.88	10.79	31.96	50.00	18.04	Average
10	7.446	11.13	0.16	9.88	15.41	36.58	60.00	23.42	QP
11	14.986	12.65	0.23	9.92	12.17	34.97	50.00	15.03	Average
12	14.986	12.65	0.23	9.92	17.17	39.97	60.00	20.03	QP

```
Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
         2. If the average limit is met when useing a quasi-peak detector,
            the EUT shall be deemed to meet both limits and measurement
            with average detector is unnecessary.
```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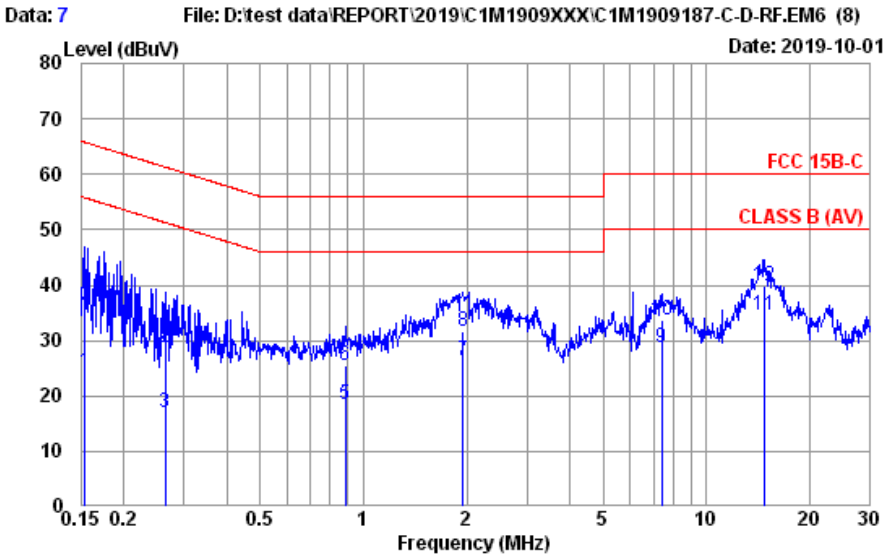
Test Date	2019/10/01	Temp./Hum.	24℃/60%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #1	Test Model	17Z90N



Site no. : No.8 Shielded Room
Data no. : 7
Condition : ENV4200 100169
LISN Phase : LINE
Limit : FCC 15B-C
Env. / Ins. : 24°C / 57% ESR3 (1774)
Engineer : Chucky Chiu
EUT : 17Z90N
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.154	10.61	0.03	9.86	3.89	24.39	55.78	31.39	Average
2	0.154	10.61	0.03	9.86	15.93	36.43	65.78	29.35	QP
3	0.264	10.50	0.03	9.86	-3.40	16.99	51.29	34.30	Average
4	0.264	10.50	0.03	9.86	7.75	28.14	61.29	33.15	QP
5	0.885	10.42	0.06	9.86	-1.93	18.41	46.00	27.59	Average
6	0.885	10.42	0.06	9.86	5.03	25.37	56.00	30.63	QP
7	1.949	10.45	0.08	9.86	5.88	26.27	46.00	19.73	Average
8	1.949	10.45	0.08	9.86	11.30	31.69	56.00	24.31	QP
9	7.407	10.95	0.16	9.88	7.85	28.84	50.00	21.16	Average
10	7.407	10.95	0.16	9.88	12.56	33.55	60.00	26.45	QP
11	14.750	12.25	0.23	9.92	12.28	34.68	50.00	15.32	Average
12	14.750	12.25	0.23	9.92	17.53	39.93	60.00	20.07	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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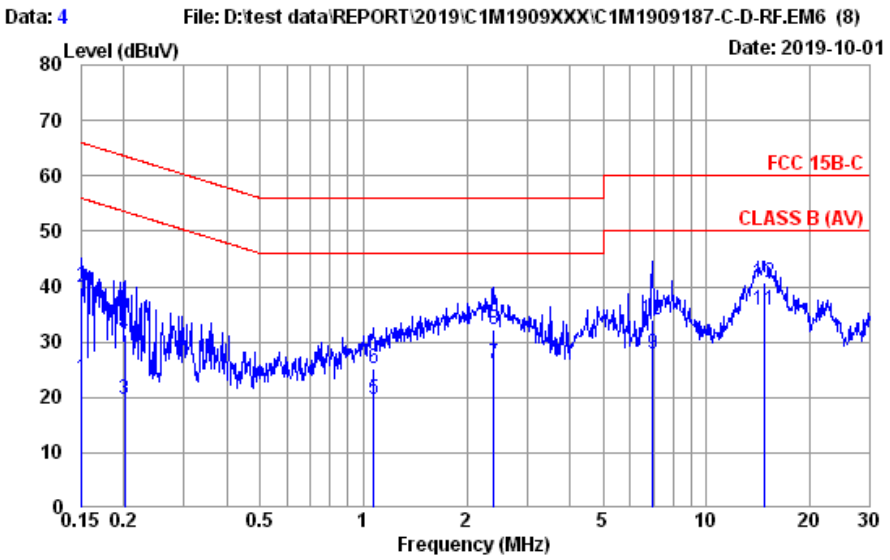
Test Date	2019/10/01	Temp./Hum.	24℃/60%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #2	Test Model	17Z90N



Site no. : No.8 Shielded Room
Condition : ENV4200 100169
Limit : FCC 15B-C
Env. / Ins. : 24°C / 57% ESR3 (1774)
EUT : 17Z90N
Power Rating : 120Vac/60Hz
Test Mode : Operating

Data no. : 4
LISN Phase : NEUTRAL
Engineer : Chucky Chiu

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.70	0.03	9.86	2.78	23.37	55.96	32.59	Average
2	0.151	10.70	0.03	9.86	19.35	39.94	65.96	26.02	QP
3	0.202	10.62	0.03	9.86	-0.92	19.59	53.54	33.95	Average
4	0.202	10.62	0.03	9.86	10.90	31.41	63.54	32.13	QP
5	1.071	10.47	0.06	9.86	-0.74	19.65	46.00	26.35	Average
6	1.071	10.47	0.06	9.86	4.94	25.33	56.00	30.67	QP
7	2.396	10.54	0.09	9.86	5.69	26.18	46.00	19.82	Average
8	2.396	10.54	0.09	9.86	11.70	32.19	56.00	23.81	QP
9	6.988	11.08	0.16	9.88	6.70	27.82	50.00	22.18	Average
10	6.988	11.08	0.16	9.88	12.84	33.96	60.00	26.04	QP
11	14.750	12.60	0.23	9.92	12.87	35.62	50.00	14.38	Average
12	14.750	12.60	0.23	9.92	18.10	40.85	60.00	19.15	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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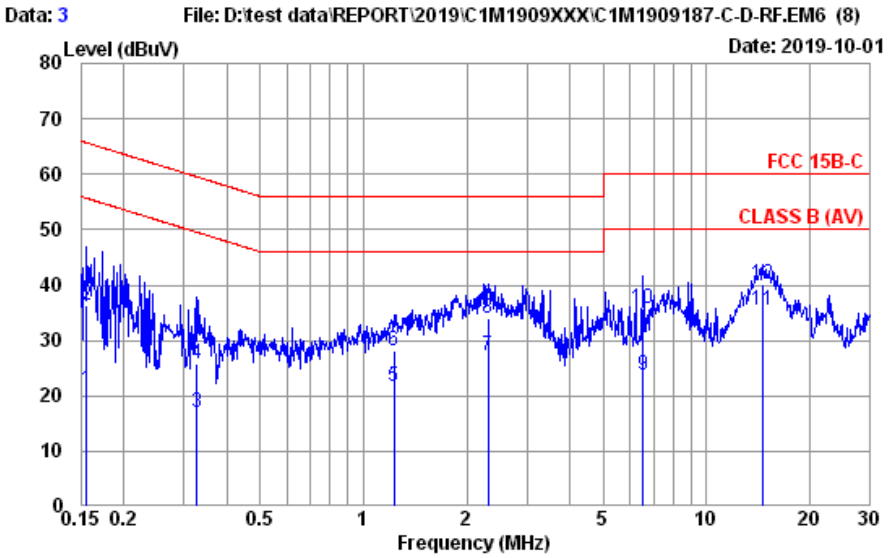
Test Date	2019/10/01	Temp./Hum.	24℃/60%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #2	Test Model	17Z90N



Site no. : No.8 Shielded Room
Data no. : 3
Condition : ENV4200 100169
LISN Phase : LINE
Limit : FCC 15B-C
Env. / Ins. : 24*C / 57% ESR3 (1774)
Engineer : Chucky Chiu
EUT : 17Z90N
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.156	10.61	0.03	9.86	0.52	21.02	55.69	34.67	Average
2	0.156	10.61	0.03	9.86	15.94	36.44	65.69	29.25	QP
3	0.327	10.48	0.04	9.86	-3.38	17.00	49.53	32.53	Average
4	0.327	10.48	0.04	9.86	5.30	25.68	59.53	33.85	QP
5	1.229	10.43	0.06	9.86	1.45	21.80	46.00	24.20	Average
6	1.229	10.43	0.06	9.86	7.81	28.16	56.00	27.84	QP
7	2.309	10.47	0.09	9.86	6.76	27.18	46.00	18.82	Average
8	2.309	10.47	0.09	9.86	13.72	34.14	56.00	21.86	QP
9	6.546	10.87	0.15	9.88	2.80	23.70	50.00	26.30	Average
10	6.546	10.87	0.15	9.88	14.95	35.85	60.00	24.15	QP
11	14.517	12.21	0.23	9.92	13.03	35.39	50.00	14.61	Average
12	14.517	12.21	0.23	9.92	17.88	40.24	60.00	19.76	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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A.2 RADIATED EMISSION

Test Date	2019/09/20 ~ 10/01	Temp./Hum.	23 ~ 25℃/53 ~ 56%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Kuper Hsu
		Test Model	17Z90N

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1 GHz

Test SKU: SKU #1

Mode	GFSK	Frequency	TX 2441MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
36.79	21.37	1.33	10.85	33.55	40.00	6.45	Peak
169.68	15.95	3.11	19.78	38.84	43.50	4.66	Peak
254.07	18.89	3.98	21.45	44.32	46.00	1.68	Peak
339.43	20.86	5.00	14.93	40.79	46.00	5.21	Peak
697.36	25.42	7.35	8.71	41.48	46.00	4.52	Peak
870.99	27.09	8.29	8.34	43.72	46.00	2.28	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
79.47	13.44	2.03	18.89	34.36	40.00	5.64	Peak
113.42	18.26	2.45	20.92	41.63	43.50	1.87	Peak
254.07	18.89	3.98	19.04	41.91	46.00	4.09	Peak
505.30	23.76	6.76	5.86	36.38	46.00	9.62	Peak
697.36	25.42	7.35	5.34	38.11	46.00	7.89	Peak
795.33	26.45	7.87	2.94	37.26	46.00	8.74	Peak

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Test SKU: SKU #2

Mode	GFSK	Frequency	TX 2441MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
37.76	20.81	1.35	13.01	35.17	40.00	4.83	Peak
169.68	15.95	3.11	19.07	38.13	43.50	5.37	Peak
244.37	18.54	3.88	21.91	44.33	46.00	1.67	Peak
395.69	22.30	5.81	11.39	39.50	46.00	6.50	Peak
697.36	25.42	7.35	6.99	39.76	46.00	6.24	Peak
962.17	27.79	8.82	2.43	39.04	54.00	14.96	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
79.47	13.44	2.03	18.90	34.37	40.00	5.63	Peak
113.42	18.26	2.45	20.60	41.31	43.50	2.19	Peak
152.22	16.90	2.92	18.79	38.61	43.50	4.89	Peak
243.40	18.50	3.87	21.06	43.43	46.00	2.57	Peak
697.36	25.42	7.35	6.39	39.16	46.00	6.84	Peak
877.78	27.14	8.33	3.77	39.24	46.00	6.76	Peak

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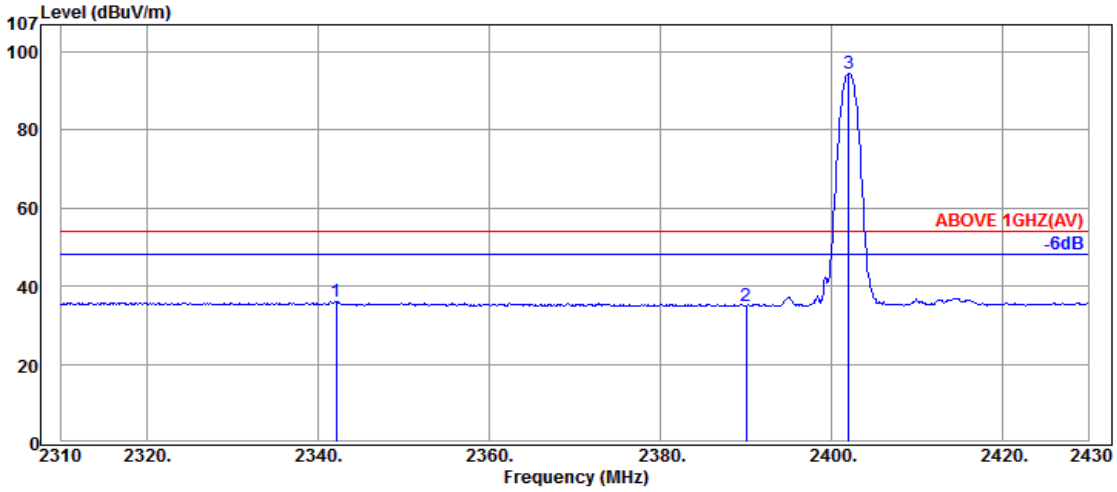
A.2.1.3 Frequency Above 1 GHz to 10th harmonics

Test SKU: SKU #1

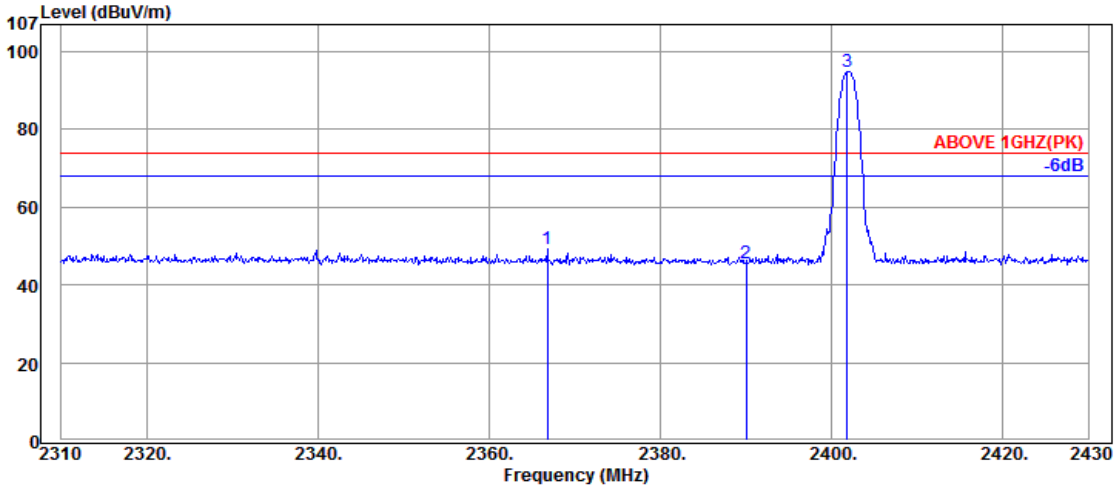
Band Edge:

Mode	GFSK	Frequency	TX 2402MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2342.16	32.00	8.16	-4.20	35.96	74.00	38.04	Peak
	2390.04	32.00	8.17	-5.06	35.11	74.00	38.89	Peak
@	2402.04	32.00	8.17	54.49	94.66	---	---	Peak



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2366.76	32.00	8.16	8.93	49.09	54.00	4.91	Average
	2390.04	32.00	8.17	5.58	45.75	54.00	8.25	Average
@	2401.80	32.00	8.17	54.57	94.74	---	---	Average

Remark: The "@" means fundamental frequency, it is ignored in this section.

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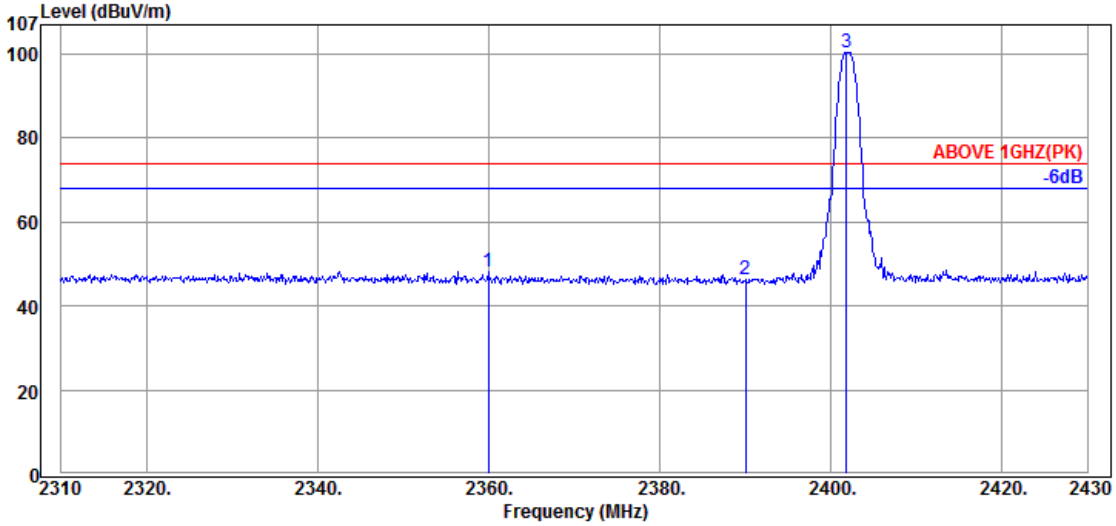
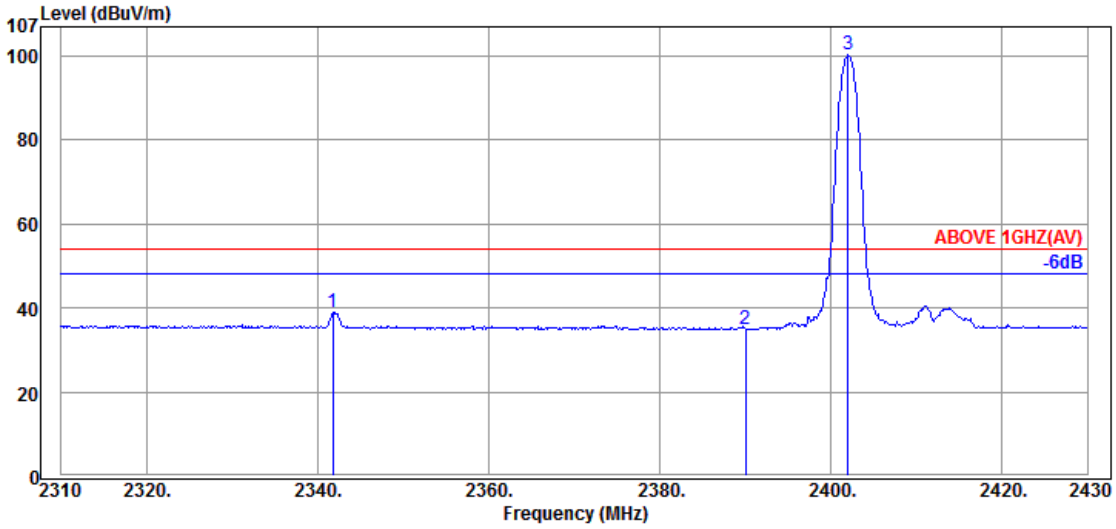
Mode	GFSK	Frequency	TX 2402MHz



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2359.92	32.00	8.16	8.01	48.17	74.00	25.83	Peak
	2390.04	32.00	8.17	6.17	46.34	74.00	27.66	Peak
@	2401.80	32.00	8.17	60.23	100.40	---	---	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2341.80	32.00	8.16	-1.13	39.03	54.00	14.97	Average
	2390.04	32.00	8.17	-5.23	34.94	54.00	19.06	Average
@	2402.04	32.00	8.17	60.04	100.21	---	---	Average

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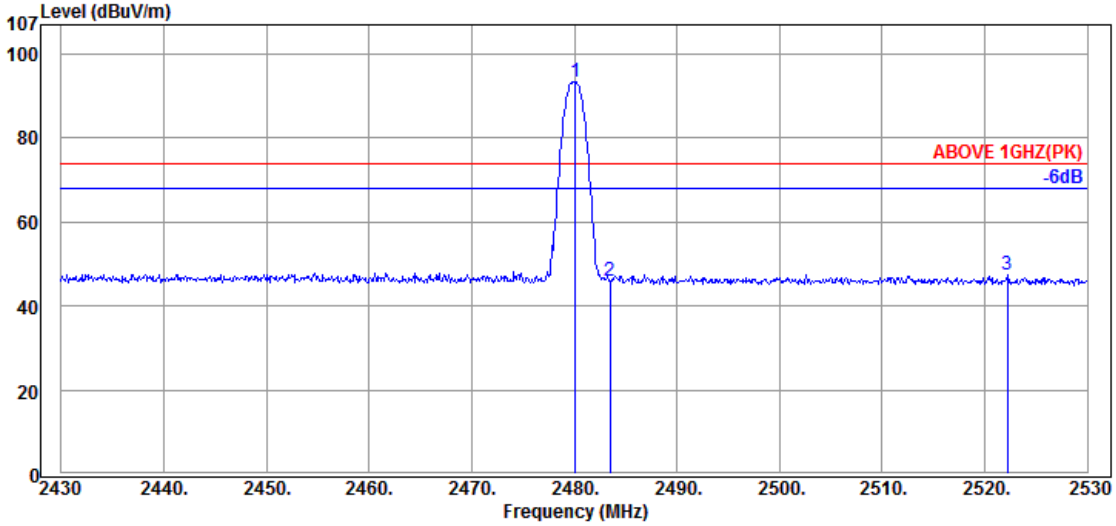
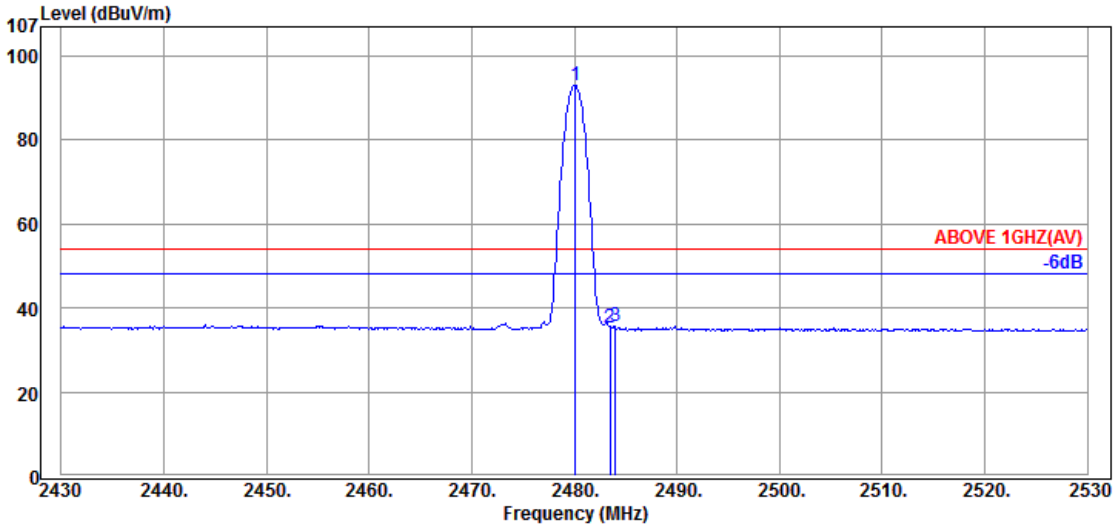
Mode	GFSK	Frequency	TX 2480MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.10	32.57	8.20	52.51	93.28	---	---	Peak
	2483.50	32.57	8.20	5.35	46.12	74.00	27.88	Peak
	2522.20	32.10	8.24	7.12	47.46	74.00	26.54	Peak



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.10	32.57	8.20	52.35	93.12	---	---	Average
	2483.50	32.57	8.20	-5.38	35.39	54.00	18.61	Average
	2484.00	32.57	8.20	-5.07	35.70	54.00	18.30	Average

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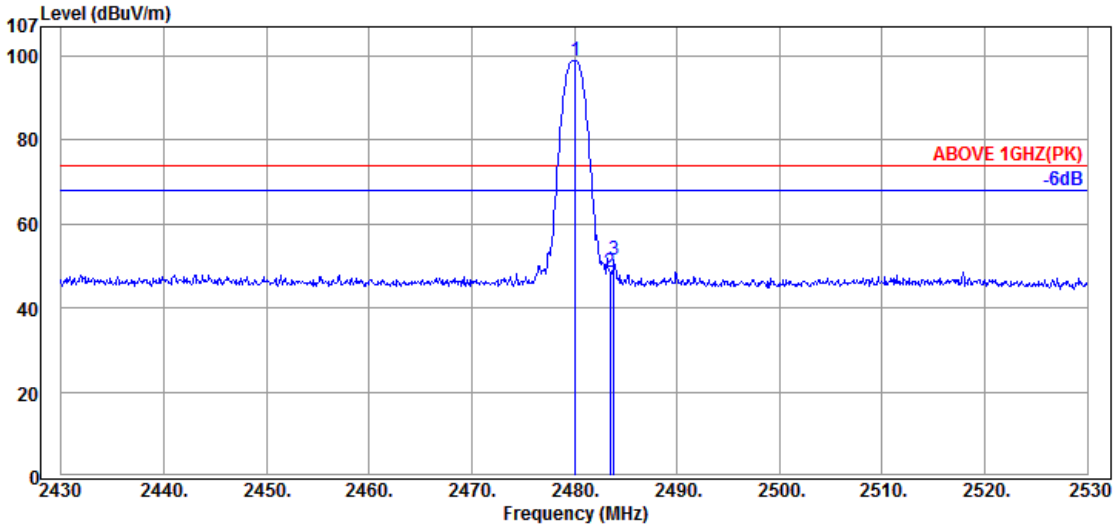
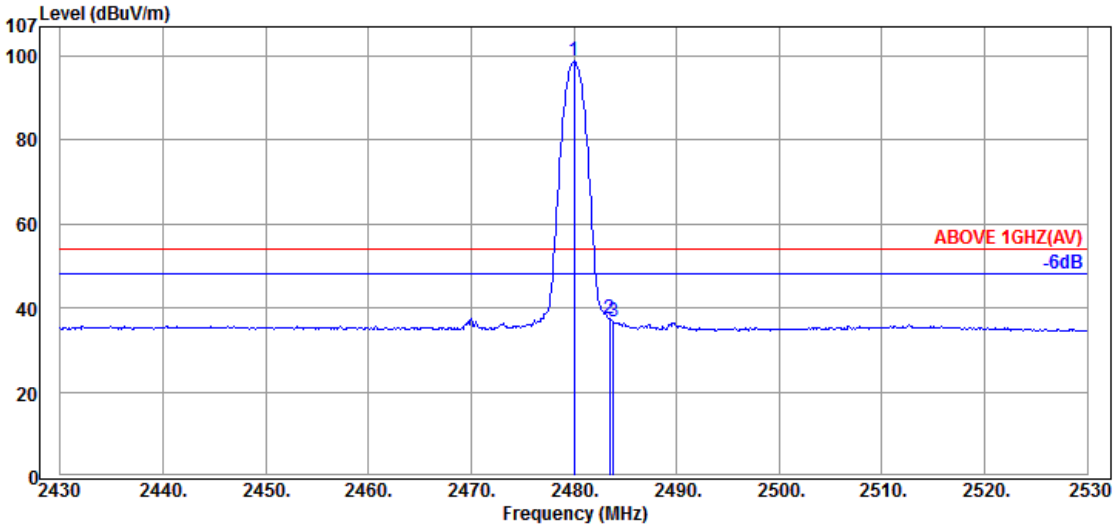
Mode	GFSK	Frequency	TX 2480MHz



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.10	32.57	8.20	58.26	99.03	---	---	Peak
	2483.50	32.57	8.20	7.77	48.54	74.00	25.46	Peak
	2483.90	32.57	8.20	10.87	51.64	74.00	22.36	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.00	32.57	8.20	58.00	98.77	---	---	Average
	2483.50	32.57	8.20	-3.44	37.33	54.00	16.67	Average
	2483.90	32.57	8.20	-3.83	36.94	54.00	17.06	Average

Remark: The "@" means fundamental frequency, it is ignored in this section.

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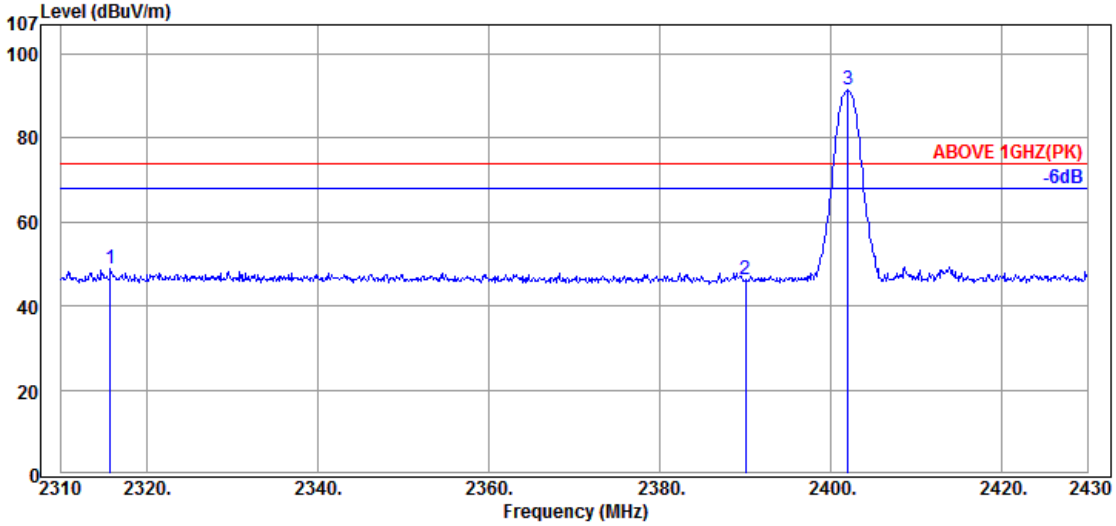
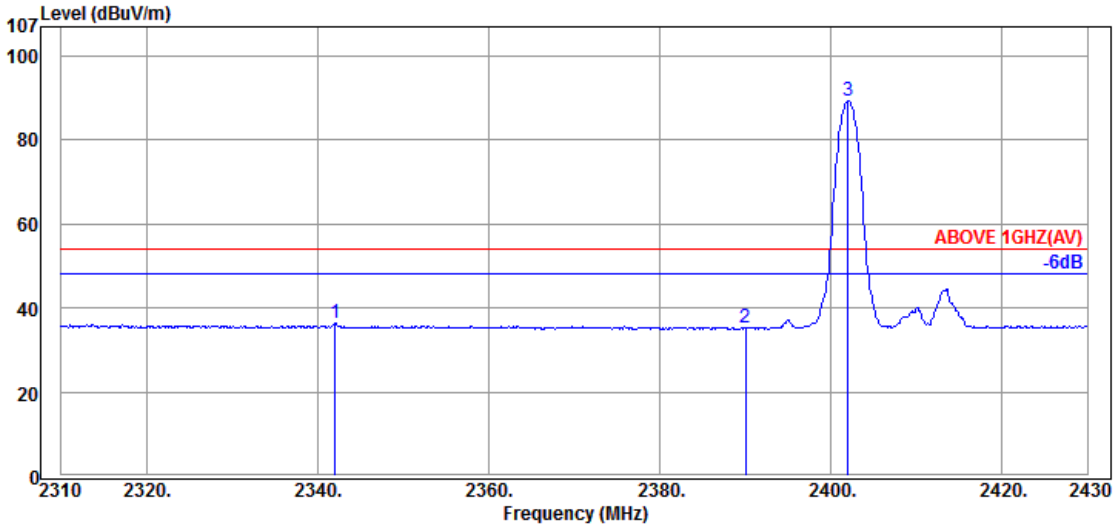
Mode	8-DPSK	Frequency	TX 2402MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2315.76	32.00	8.15	8.57	48.72	74.00	25.28	Peak
	2390.04	32.00	8.17	6.23	46.40	74.00	27.60	Peak
@	2402.04	32.00	8.17	51.45	91.62	---	---	Peak



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2342.04	32.00	8.16	-3.66	36.50	54.00	17.50	Average
	2390.04	32.00	8.17	-4.97	35.20	54.00	18.80	Average
@	2402.04	32.00	8.17	49.12	89.29	---	---	Average

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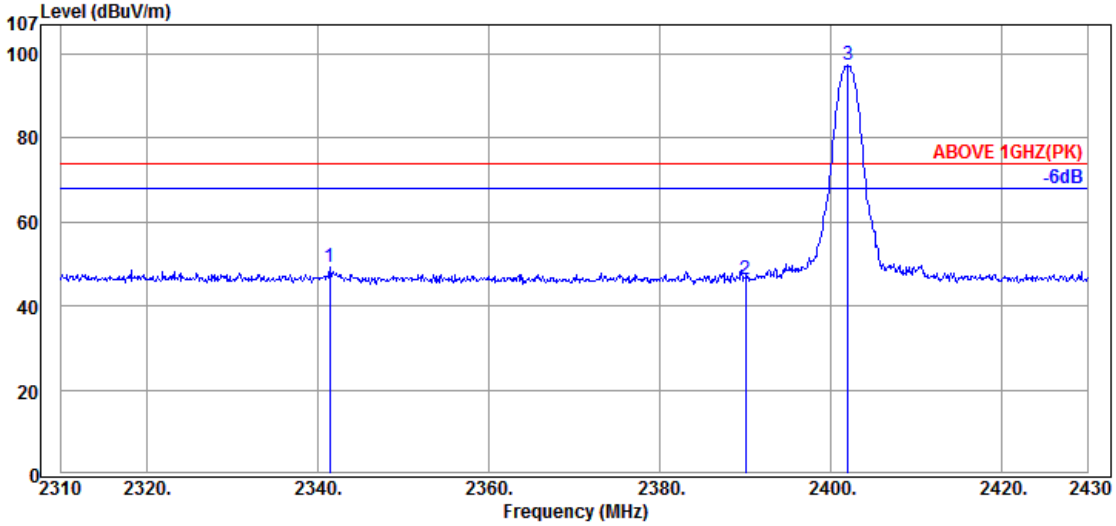
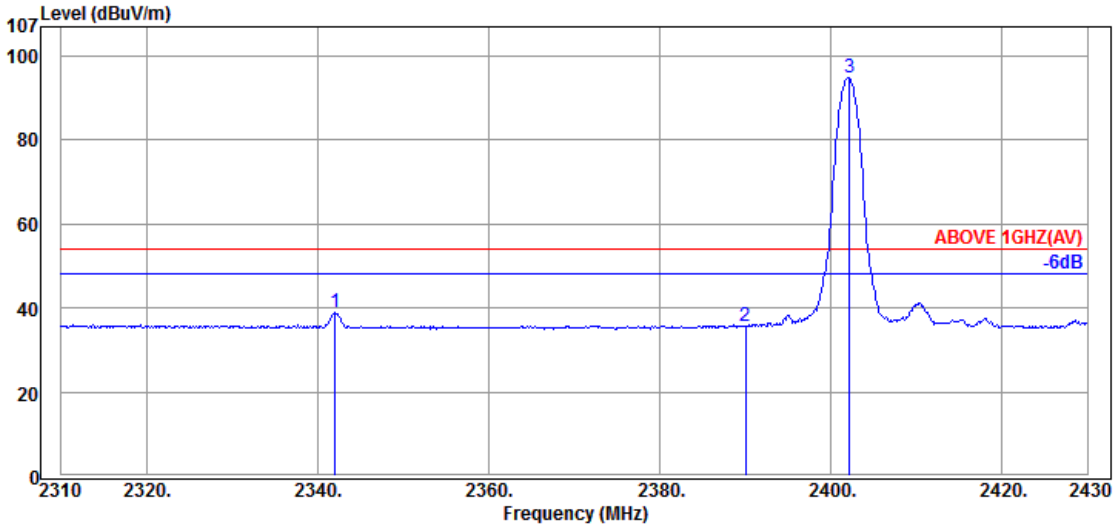
Mode	8-DPSK	Frequency	TX 2402MHz



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2341.44	32.00	8.16	9.21	49.37	74.00	24.63	Peak
	2390.04	32.00	8.17	6.29	46.46	74.00	27.54	Peak
@	2402.04	32.00	8.17	57.18	97.35	---	---	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	2342.04	32.00	8.16	-1.34	38.82	54.00	15.18	Average
	2390.04	32.00	8.17	-4.34	35.83	54.00	18.17	Average
@	2402.16	32.00	8.17	54.76	94.93	---	---	Average

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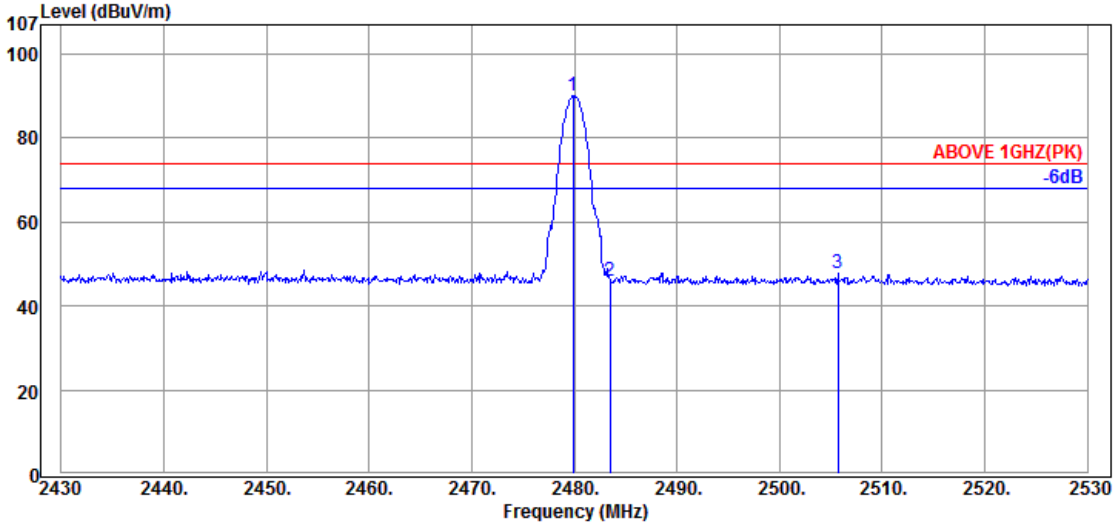
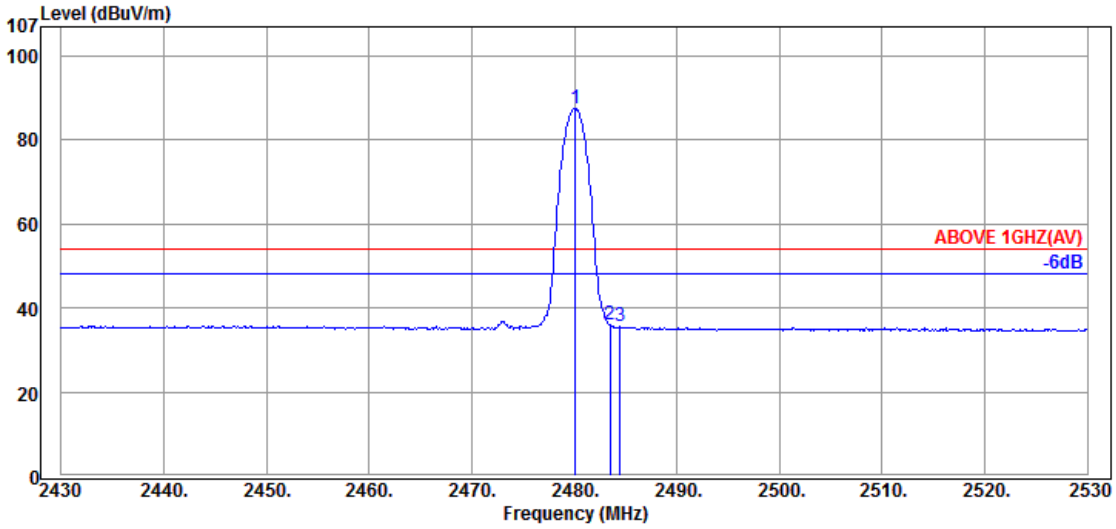
Mode	8-DPSK	Frequency	TX 2480MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2479.90	32.57	8.20	49.34	90.11	---	---	Peak
	2483.50	32.57	8.20	5.25	46.02	74.00	27.98	Peak
	2505.70	32.30	8.22	7.33	47.85	74.00	26.15	Peak



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.10	32.57	8.20	46.79	87.56	---	---	Average
	2483.50	32.57	8.20	-4.84	35.93	54.00	18.07	Average
	2484.50	32.57	8.20	-5.17	35.60	54.00	18.40	Average

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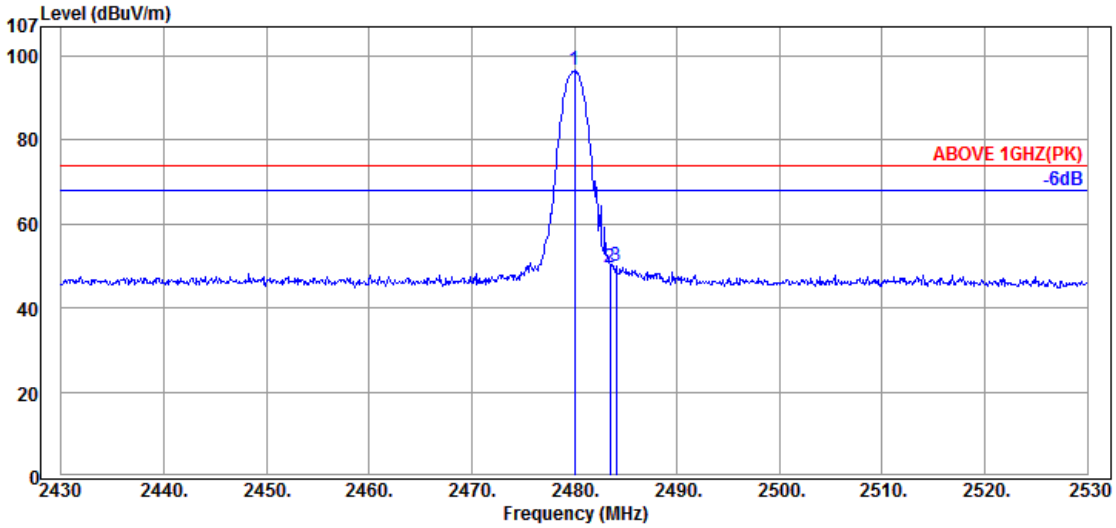
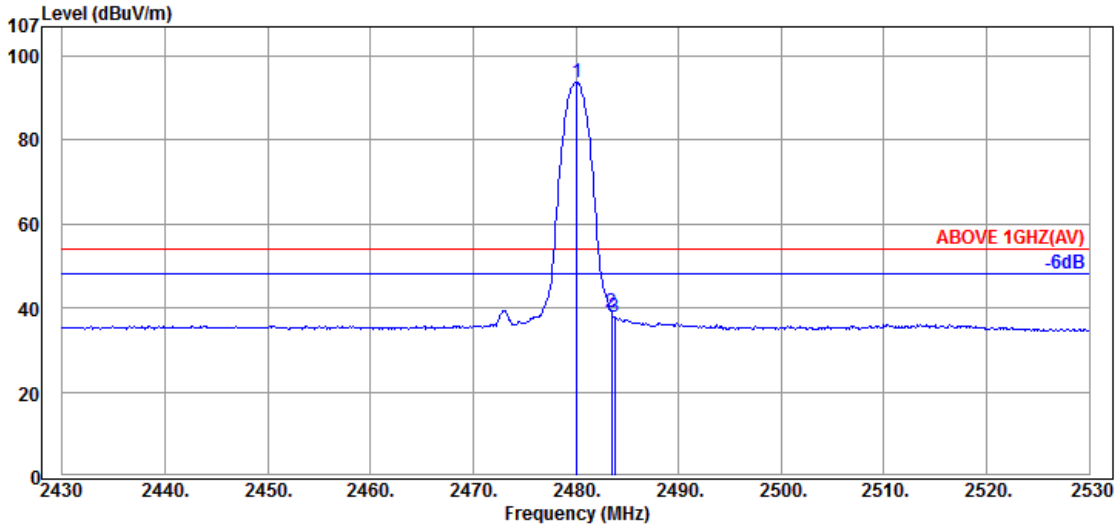
Mode	8-DPSK	Frequency	TX 2480MHz



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.00	32.57	8.20	55.92	96.69	---	---	Peak
	2483.50	32.57	8.20	8.75	49.52	74.00	24.48	Peak
	2484.10	32.57	8.20	9.19	49.96	74.00	24.04	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	2480.10	32.57	8.20	53.15	93.92	---	---	Average
	2483.50	32.57	8.20	-1.71	39.06	54.00	14.94	Average
	2483.80	32.57	8.20	-2.94	37.83	54.00	16.17	Average

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A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Test SKU: SKU #1

Mode	GFSK	Frequency	TX 2402MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4804.00	33.90	10.32	-2.91	41.31	54.00	12.69	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4804.00	33.90	10.32	-2.51	41.71	54.00	12.29	Peak

Mode	GFSK	Frequency	TX 2441MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.00	34.37	10.38	-3.54	41.21	54.00	12.79	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.00	34.37	10.38	-3.38	41.37	54.00	12.63	Peak

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Mode	GFSK	Frequency	TX 2480MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.27	10.46	-3.10	41.63	54.00	12.37	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.27	10.46	-3.07	41.66	54.00	12.34	Peak

Test SKU: SKU #2

Mode	GFSK	Frequency	TX 2441MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.00	34.37	10.38	-2.01	42.74	54.00	11.26	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.00	34.37	10.38	-3.44	41.31	54.00	12.69	Peak

A.2.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

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A.3 20dB BANDWIDTH

Test Date	2019/09/18	Temp./Hum.	25℃/51%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

A.3.1 6dB Bandwidth Result

Mode	Centre Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz) (Reference only)	2/3 (20dB Bandwidth)
GFSK	2402	0.9217	0.86410	0.614
	2441	0.9232	0.86892	0.615
	2480	0.9220	0.86466	0.615
8-DPSK	2402	1.386	1.3581	0.924
	2441	1.386	1.3566	0.924
	2480	1.389	1.3547	0.926

Remark: The maximum two-thirds of the 20dB bandwidth is the limit for carrier frequency separation presented.

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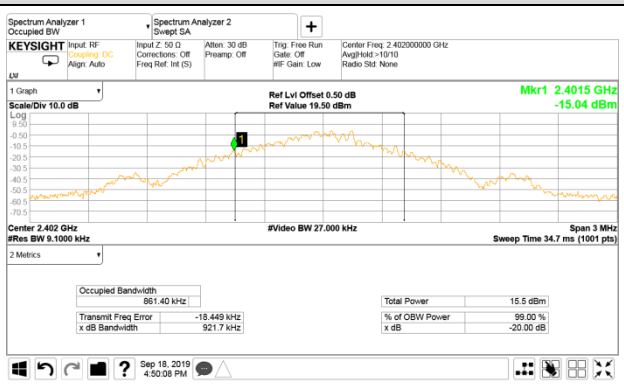
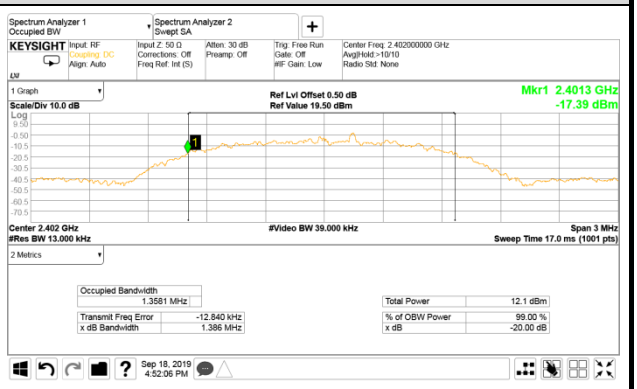
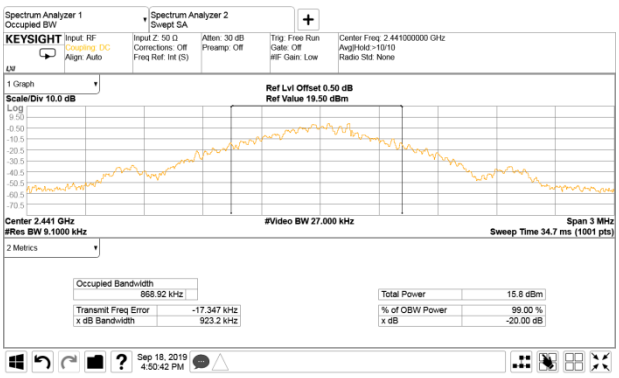
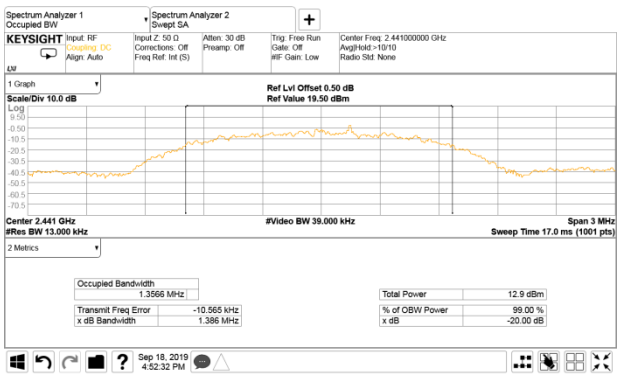
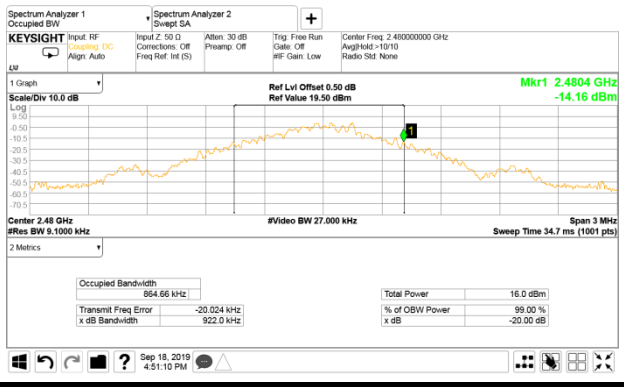
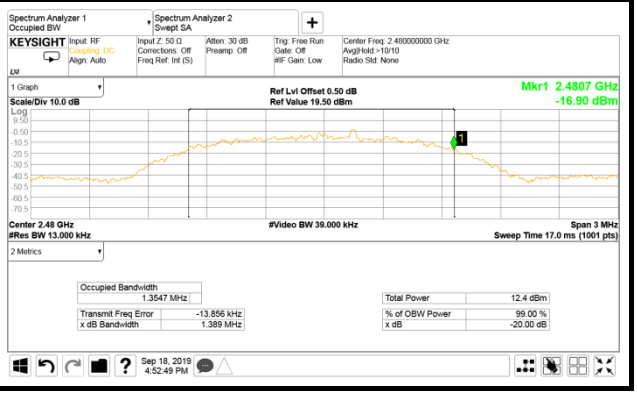
A.3.2 Measurement Plots

GFSK	8-DPSK
	
	
	

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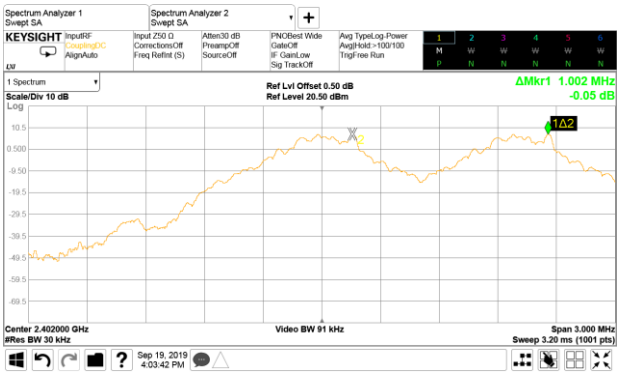
A.4 CARRIER FREQUENCY SEPARATION

Test Date	2019/09/19	Temp./Hum.	25℃/54%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

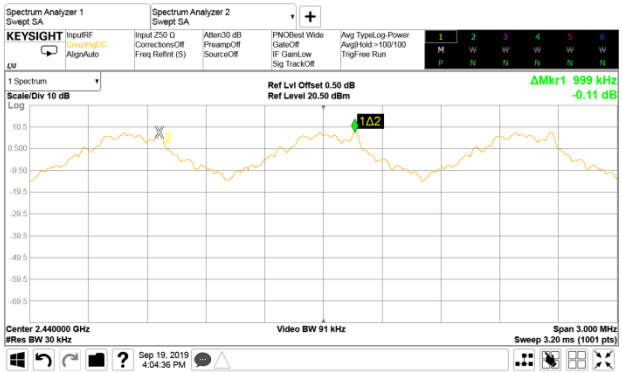
GFSK

2402MHz



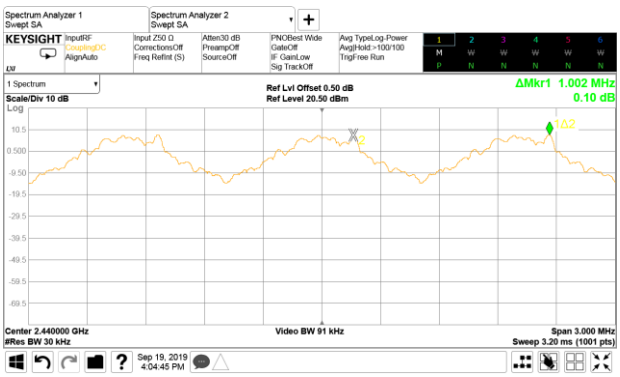
2441MHz

adjacent channel of left carrier frequency

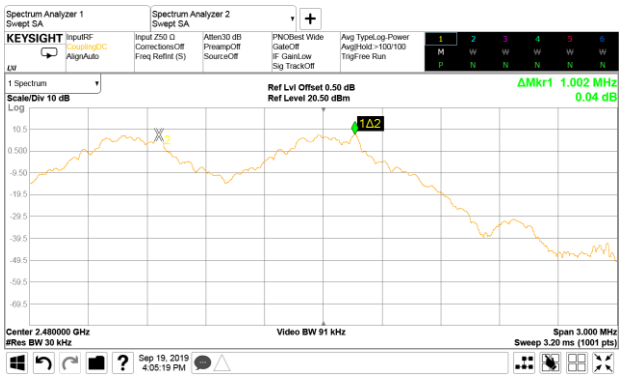


2441MHz

adjacent channel of right carrier frequency



2480MHz



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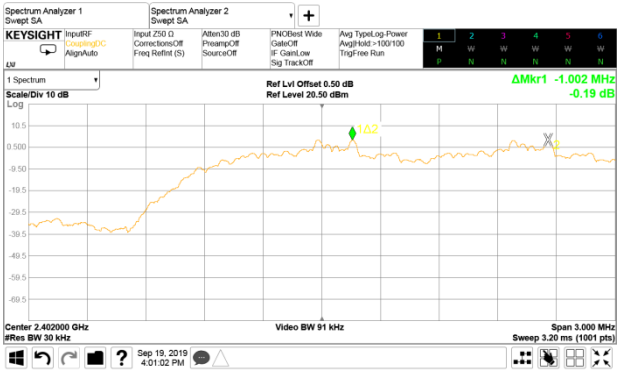
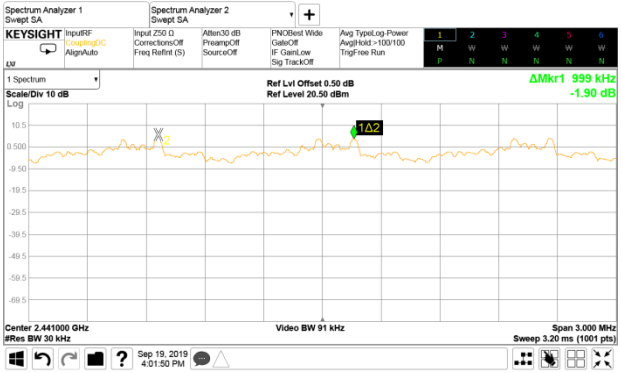
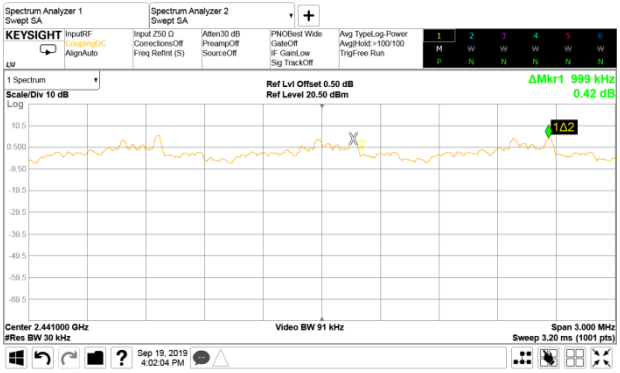
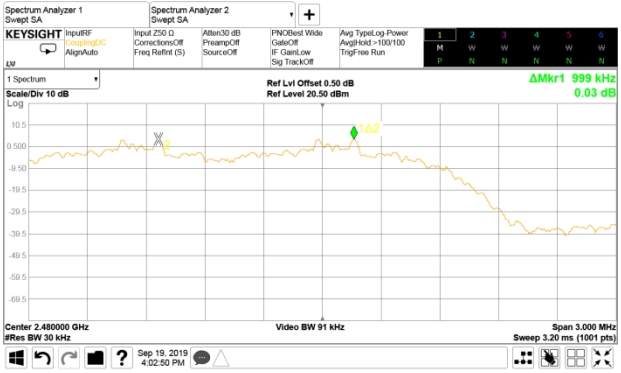
8-DPSK	
2402MHz	2441MHz adjacent channel of left carrier frequency
	
2441MHz adjacent channel of right carrier frequency	2480MHz
	

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A.5 TIME OF OCCUPANCY

Test Date	2019/09/19	Temp./Hum.	25℃/54%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

A.5.1 Time of Occupancy

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2402	DH1	10	0.380	120.080	<400
		DH3	5	1.635	258.330	<400
		DH5	3	2.880	273.024	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.380** ms= **120.080** ms (<400ms)

DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.880** ms= **273.024** ms (<400ms)

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2440	DH1	10	0.380	120.080	<400
		DH3	5	1.635	258.330	<400
		DH5	3	2.880	273.024	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.380** ms= **120.080** ms (<400ms)

DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.880** ms= **273.024** ms (<400ms)

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Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2480	DH1	10	0.380	120.080	<400
		DH3	5	1.635	258.330	<400
		DH5	3	2.880	273.024	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.380** ms= **120.080** ms (<400ms)

DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.880** ms= **273.024** ms (<400ms)

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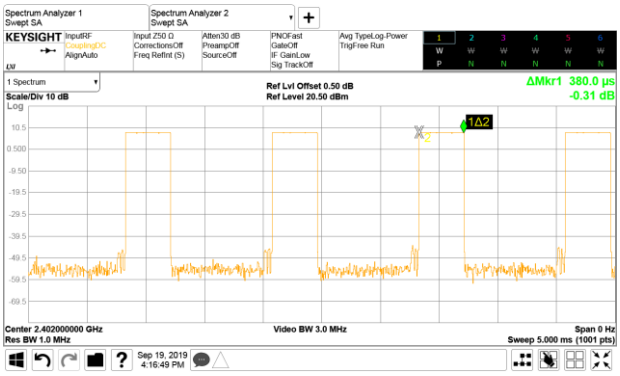
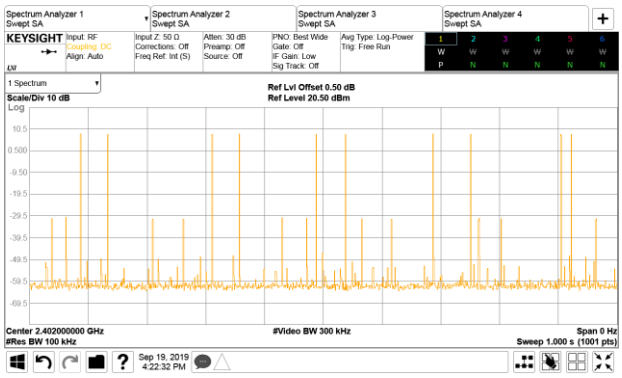
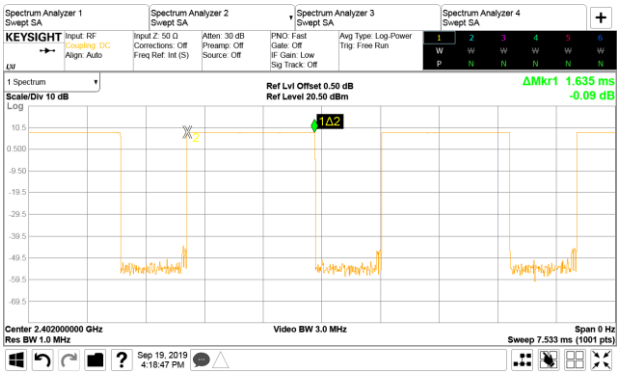
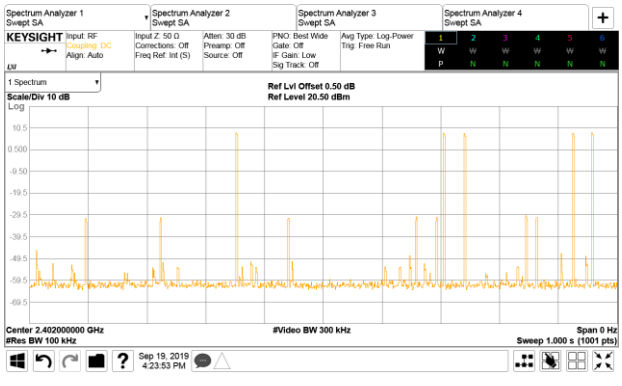
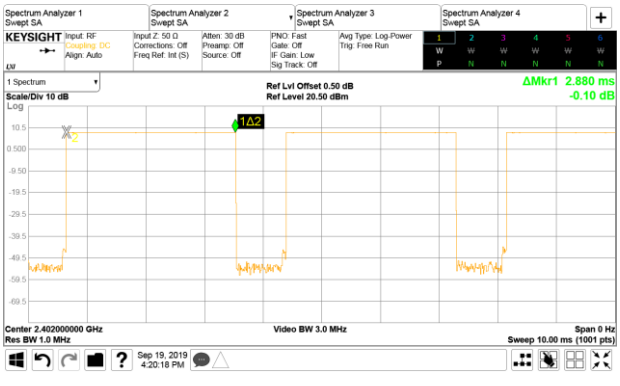
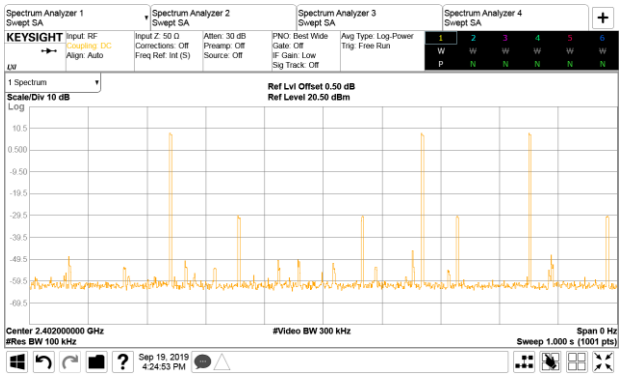
- Measurement Plots

GFSK	
2402MHz	
DH1	
	
DH3	
	
DH5	
	

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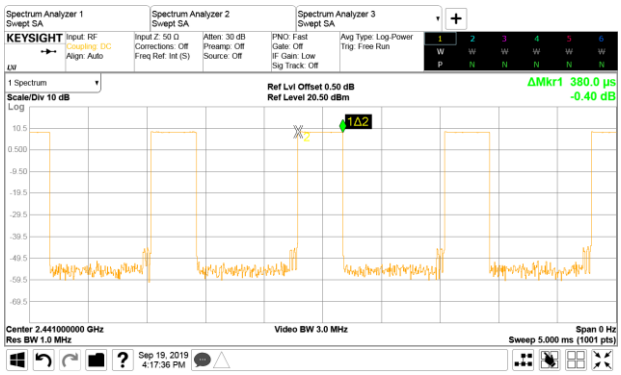
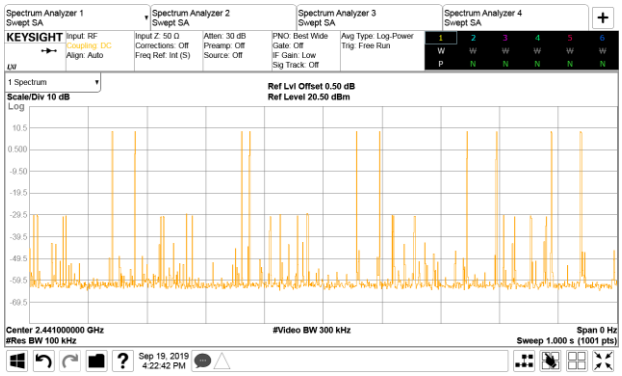
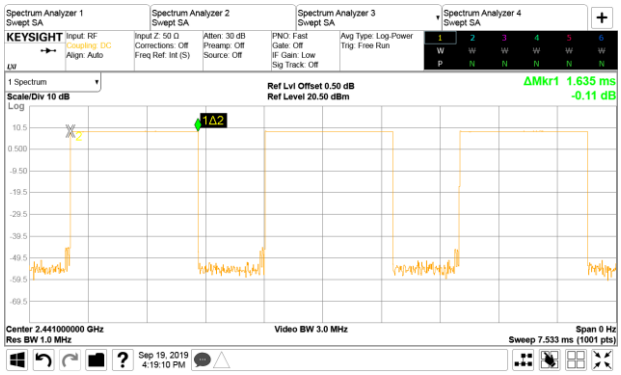
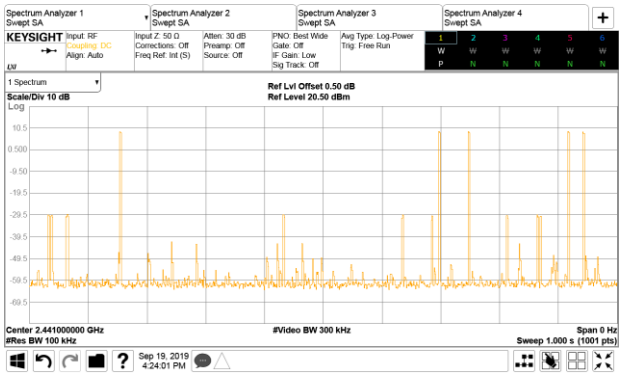
GFSK
2441MHz
DH1



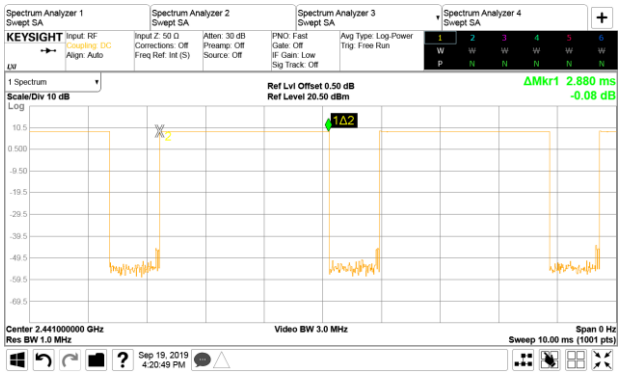


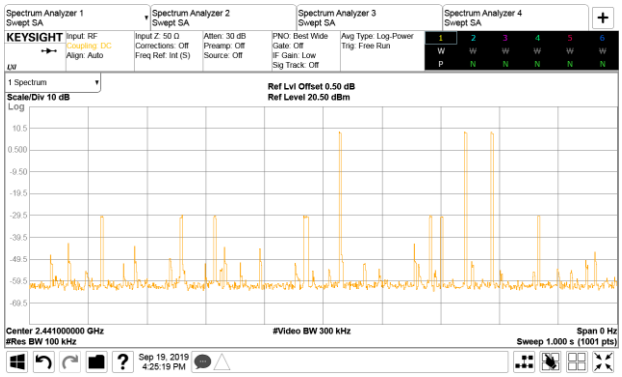
DH3





DH5





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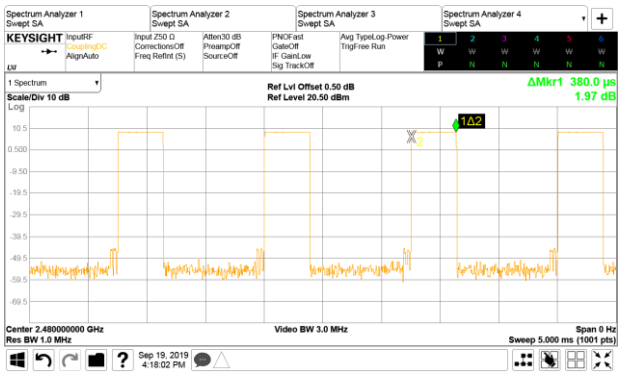
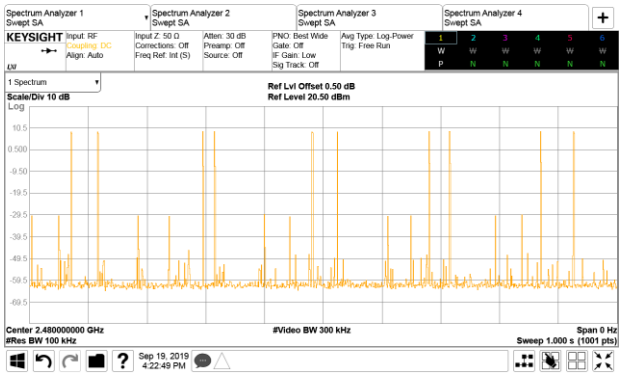
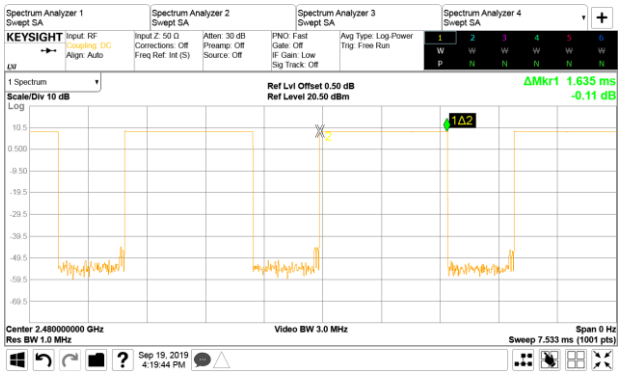
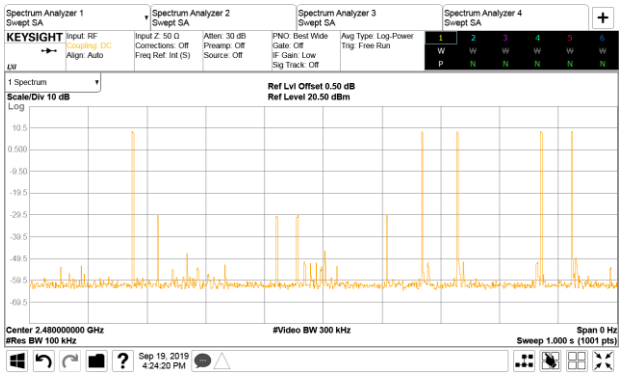
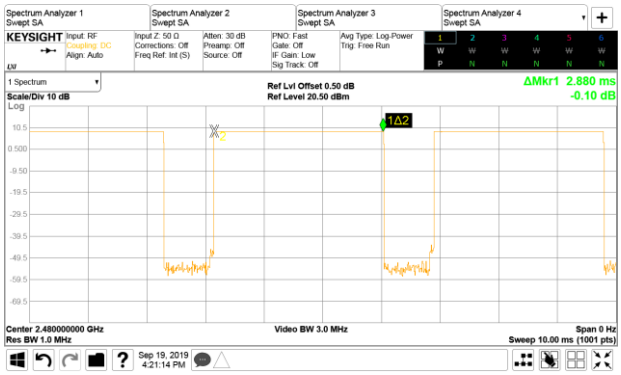
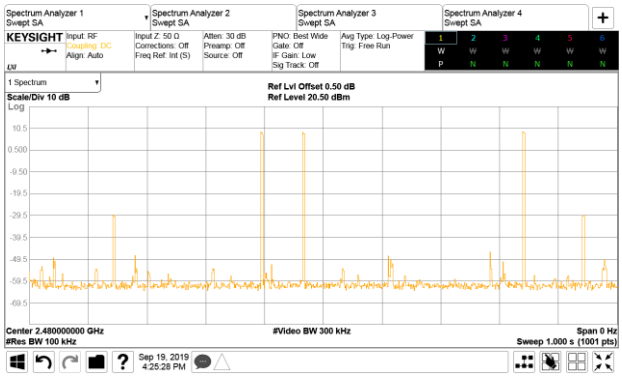
GFSK	
2480MHz	
DH1	
	
DH3	
	
DH5	
	

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Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2402	3DH1	10	0.390	123.240	<400
		3DH3	5	1.635	258.330	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

3DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.390** ms= **123.240** ms (<400ms)

3DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

3DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.890** ms= **273.972** ms (<400ms)

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2441	3DH1	10	0.390	123.240	<400
		3DH3	5	1.635	258.330	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

3DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.390** ms= **123.240** ms (<400ms)

3DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

3DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.890** ms= **273.972** ms (<400ms)

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Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2480	3DH1	10	0.390	123.240	<400
		3DH3	5	1.635	258.330	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* **0.4** seconds= **31.6** seconds

3DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.390** ms= **123.240** ms (<400ms)

3DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.635** ms= **258.330** ms (<400ms)

3DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.890** ms= **273.972** ms (<400ms)

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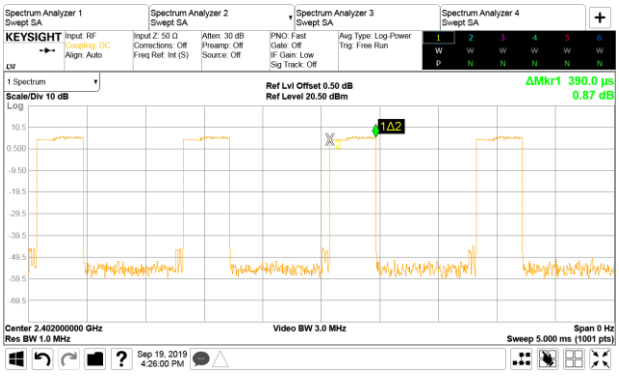
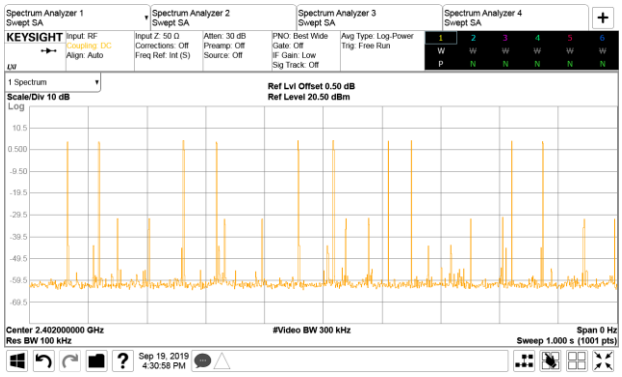
- Measurement Plots

8-DPSK	
2402MHz	
3DH1	
	
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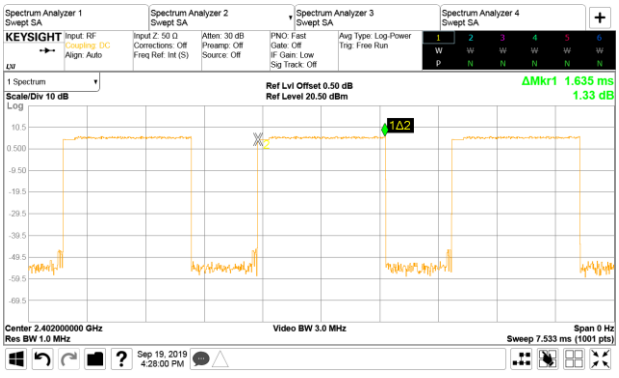	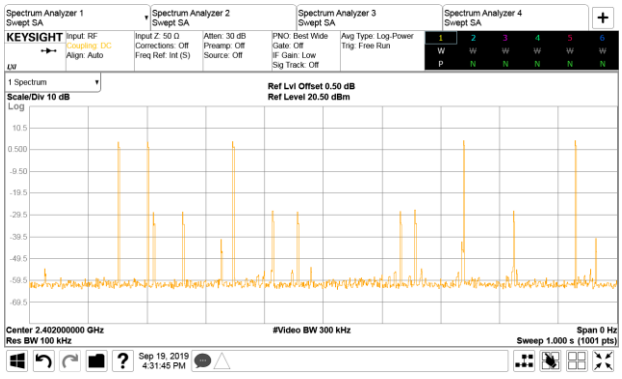
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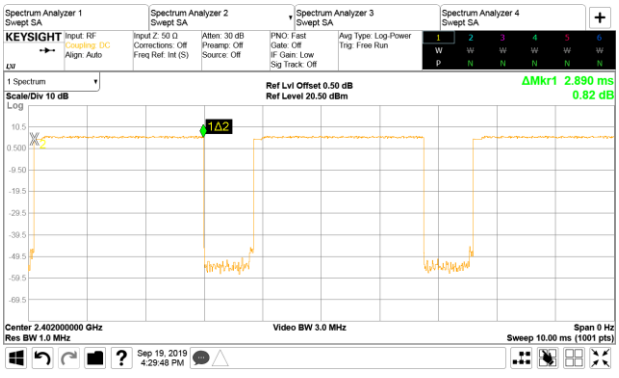	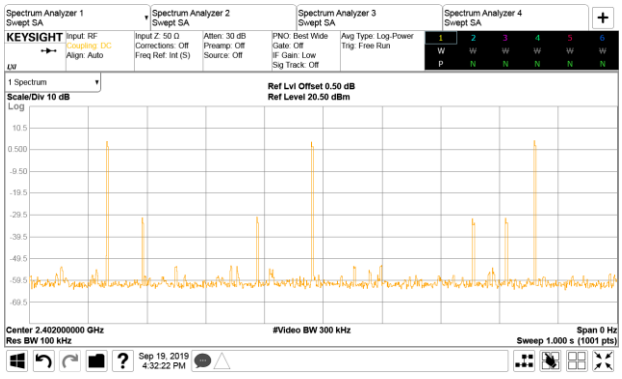

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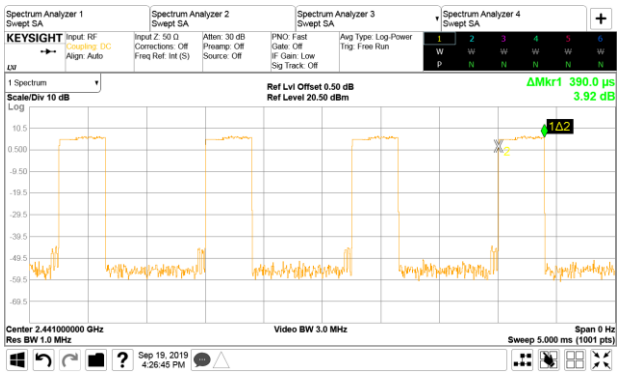
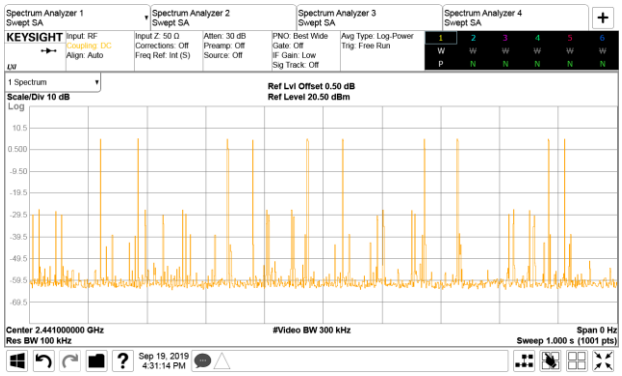
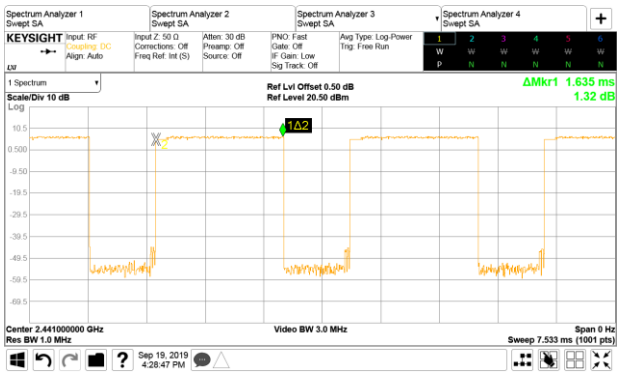
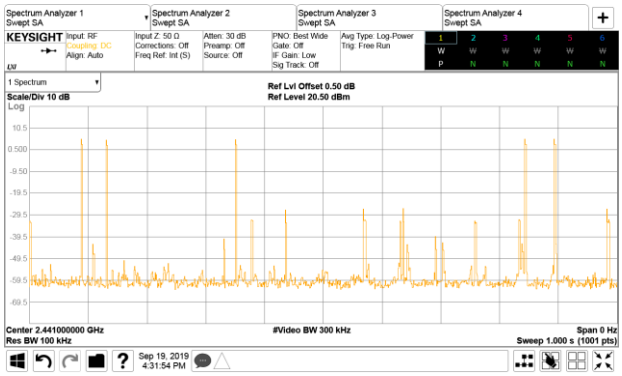
8-DPSK	
2441MHz	
3DH1	
	
3DH3	
	
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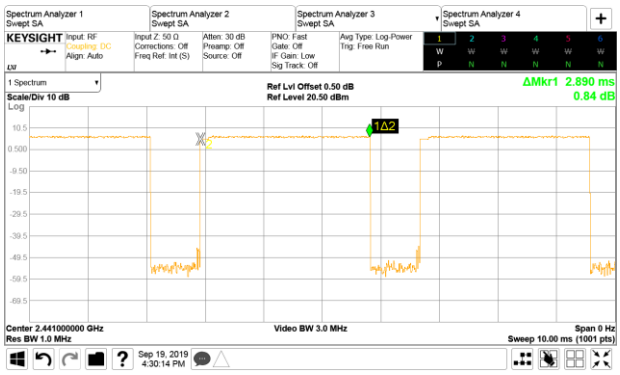	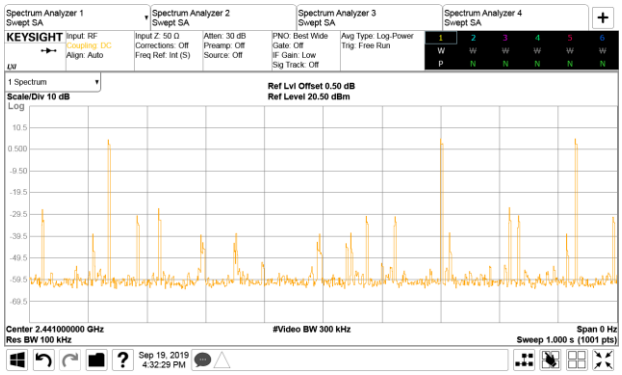

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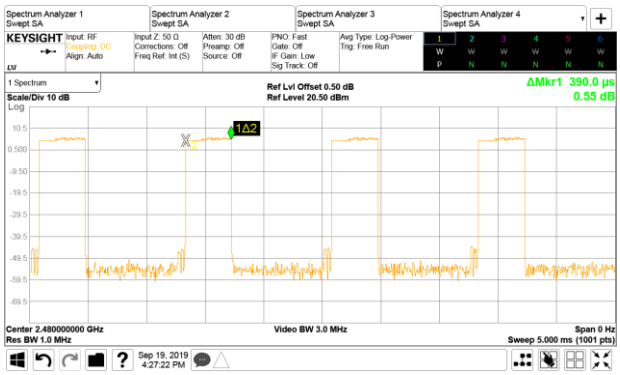
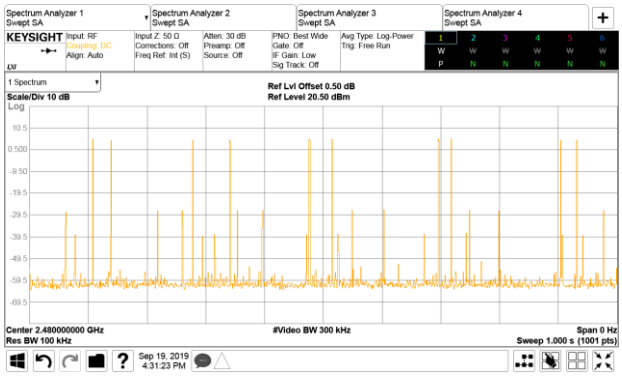
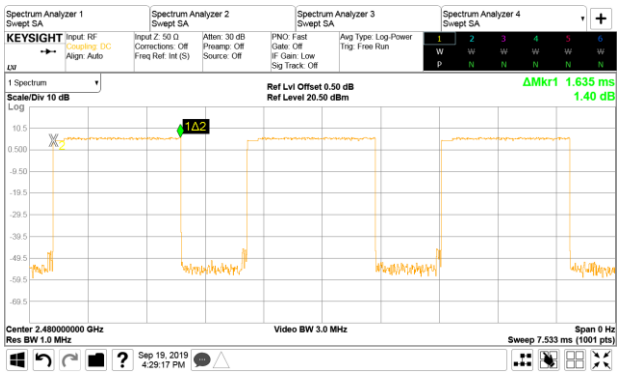
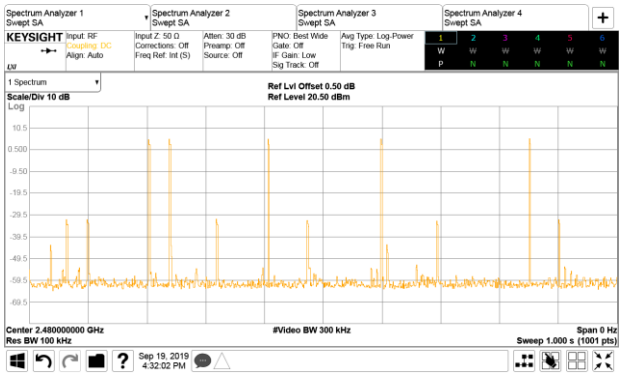
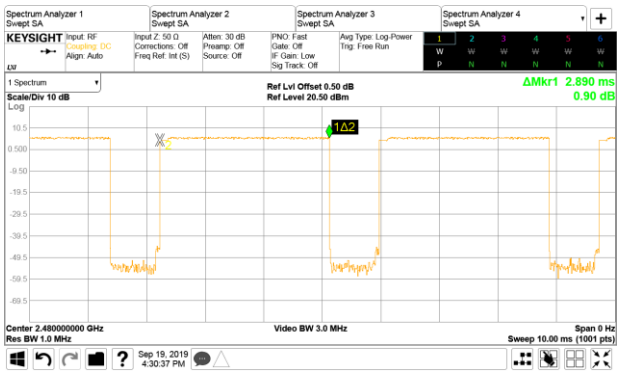
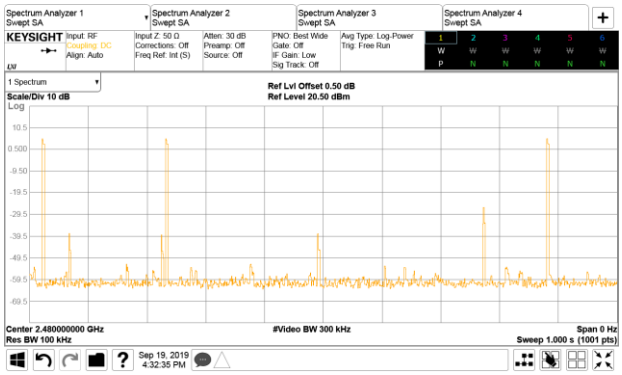
8-DPSK	
2480MHz	
3DH1	
	
3DH3	
	
3DH5	
	

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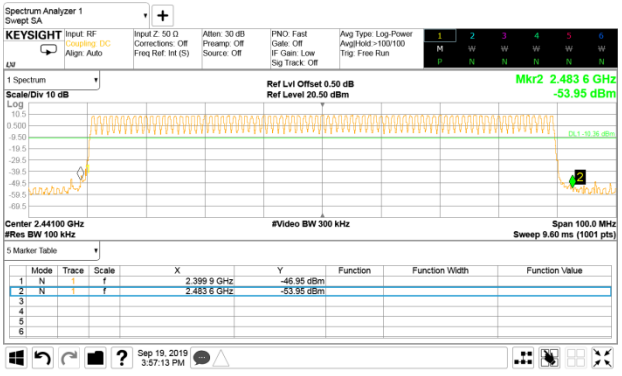
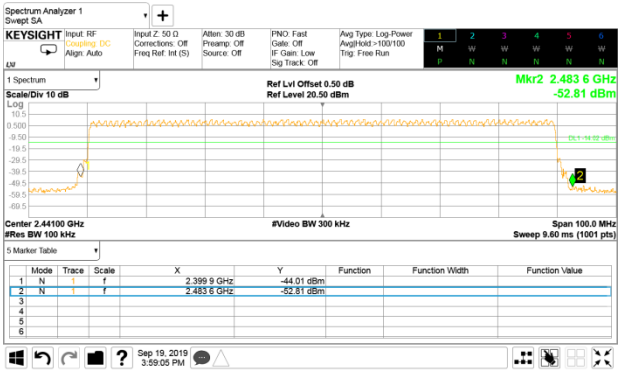
A.6 NUMBER OF HOPPING CHANNELS

Test Date	2019/09/19	Temp./Hum.	25℃/54%
Cable Loss	0.50dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

Mode: GFSK	Mode: 8-DPSK
	
The number hopping channel is 79.	The number hopping channel is 79.

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A.7 MAXIMUM PEAK OUTPUT POWER

Test Date	2019/09/18	Temp./Hum.	25℃/51%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

A.7.1 Maximum Peak Output Power

Mode	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
GFSK	2402	9.14	0.008	21dBm (0.125W)
	2441	9.59	0.009	
	2480	9.48	0.009	
8-DPSK	2402	6.89	0.005	
	2441	7.55	0.006	
	2480	7.00	0.005	

SPOT CHECK

Mode	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
GFSK	2402	9.12	0.008	21dBm (0.125W)
	2441	9.62	0.009	
	2480	9.50	0.009	
8-DPSK	2402	6.94	0.005	
	2441	7.56	0.006	
	2480	6.96	0.005	

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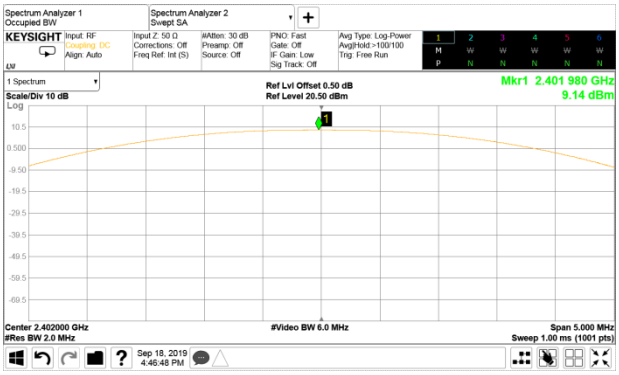
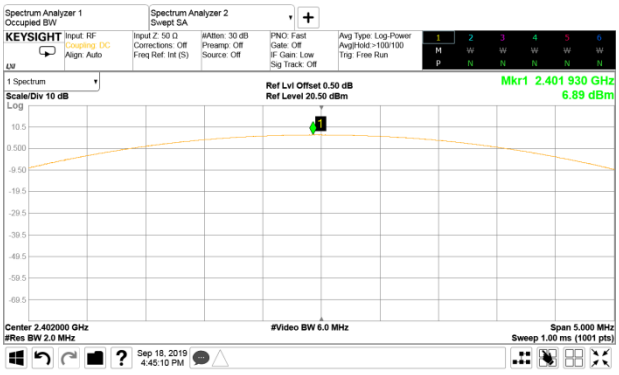
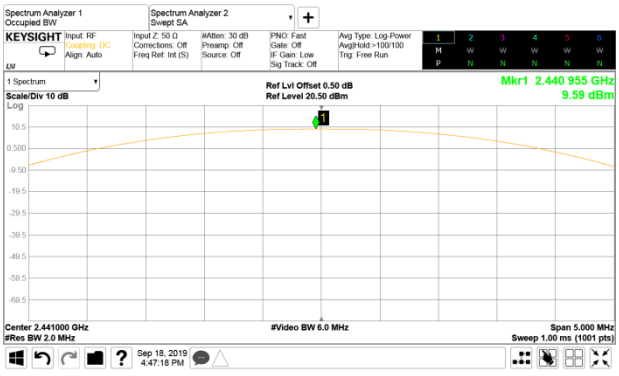
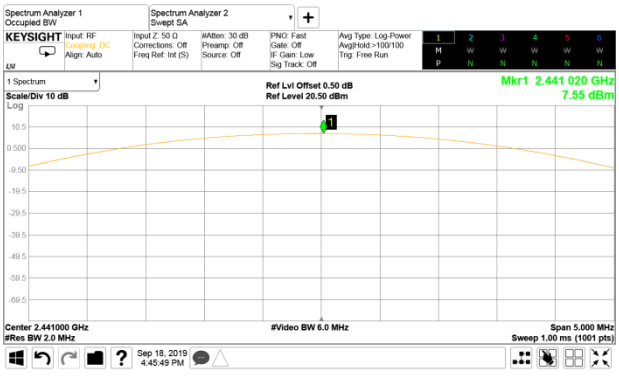
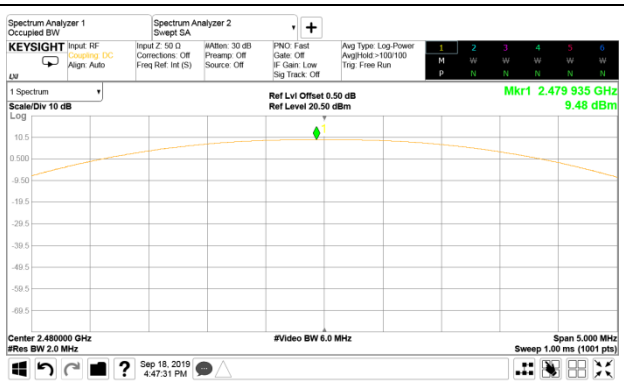
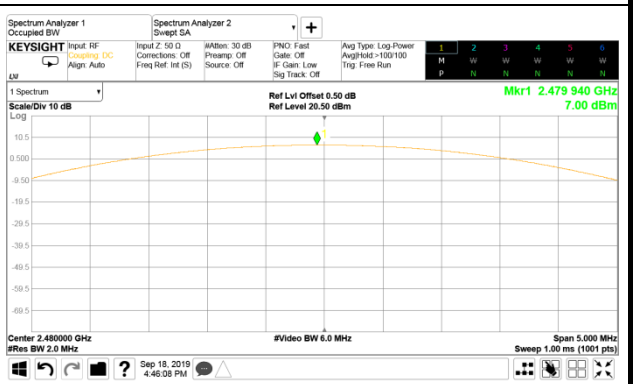
A.7.2 Measurement Plots

GFSK	8-DPSK
	
	
	

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A.8 EMISSION LIMITATIONS MEASUREMENT

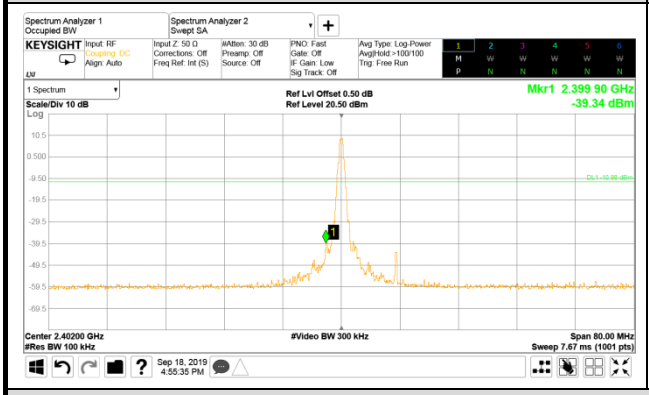
Test Date	2019/09/18 ~ 19	Temp./Hum.	25℃/51 ~ 54%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

A.8.1 Band Edge

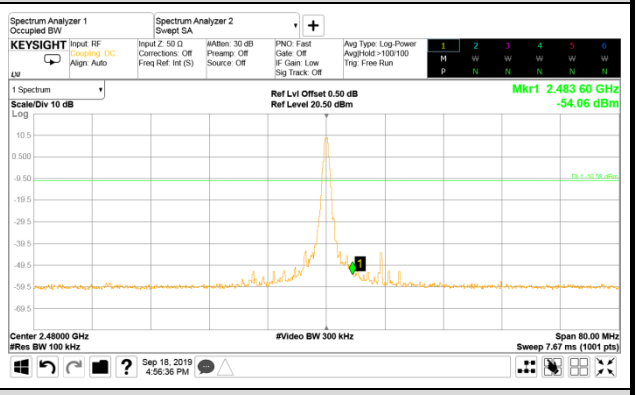
GFSK

Single Channel

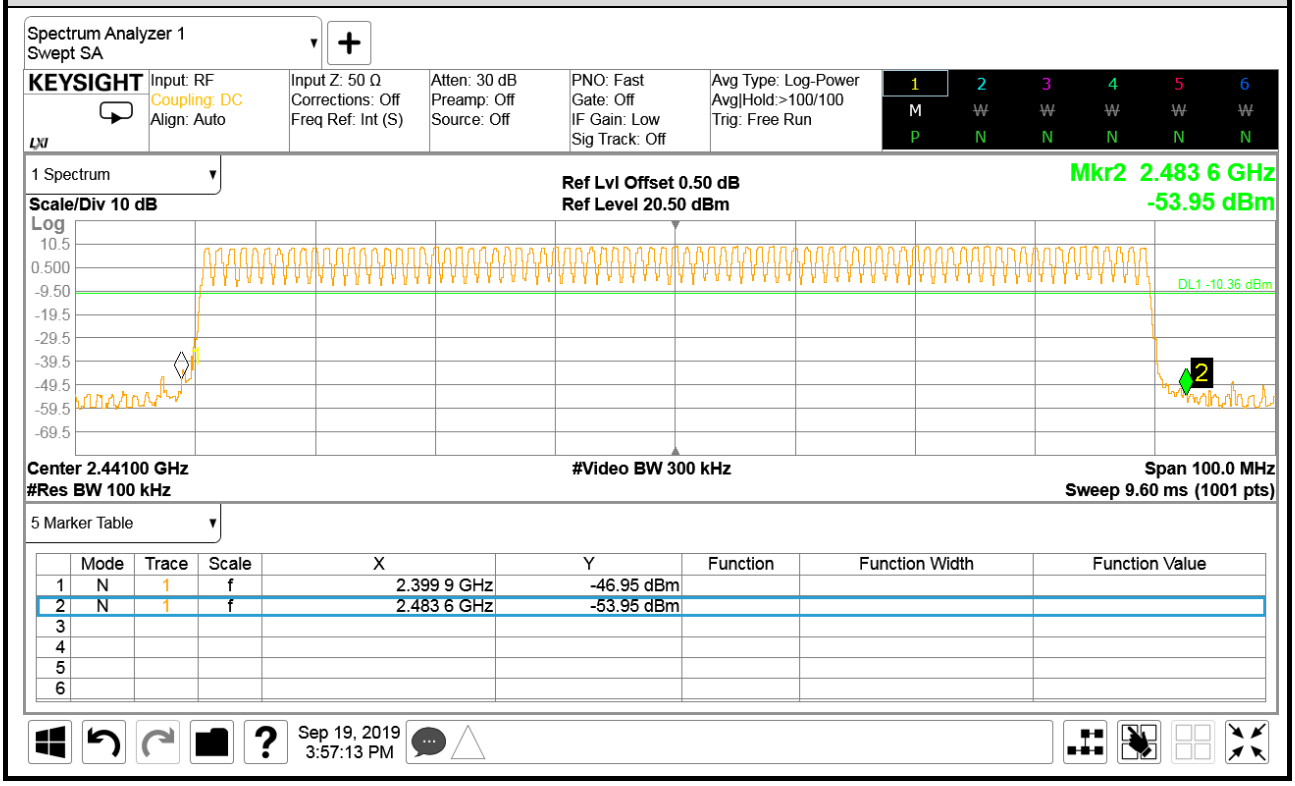
Low channel



High channel



Hopping Mode



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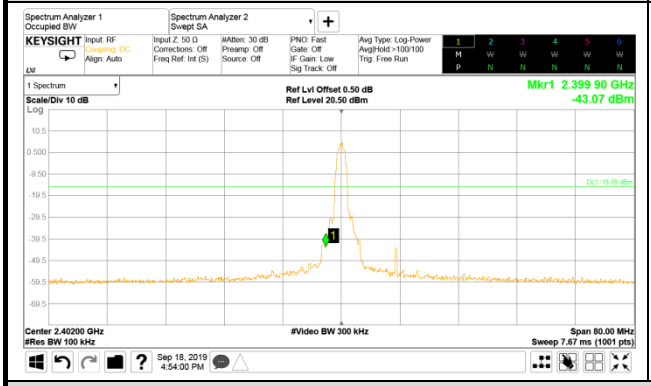
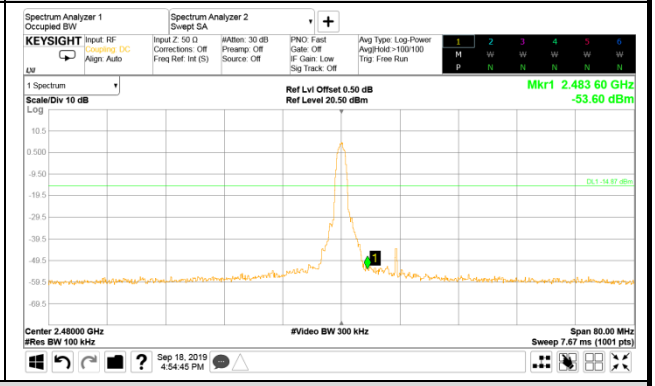
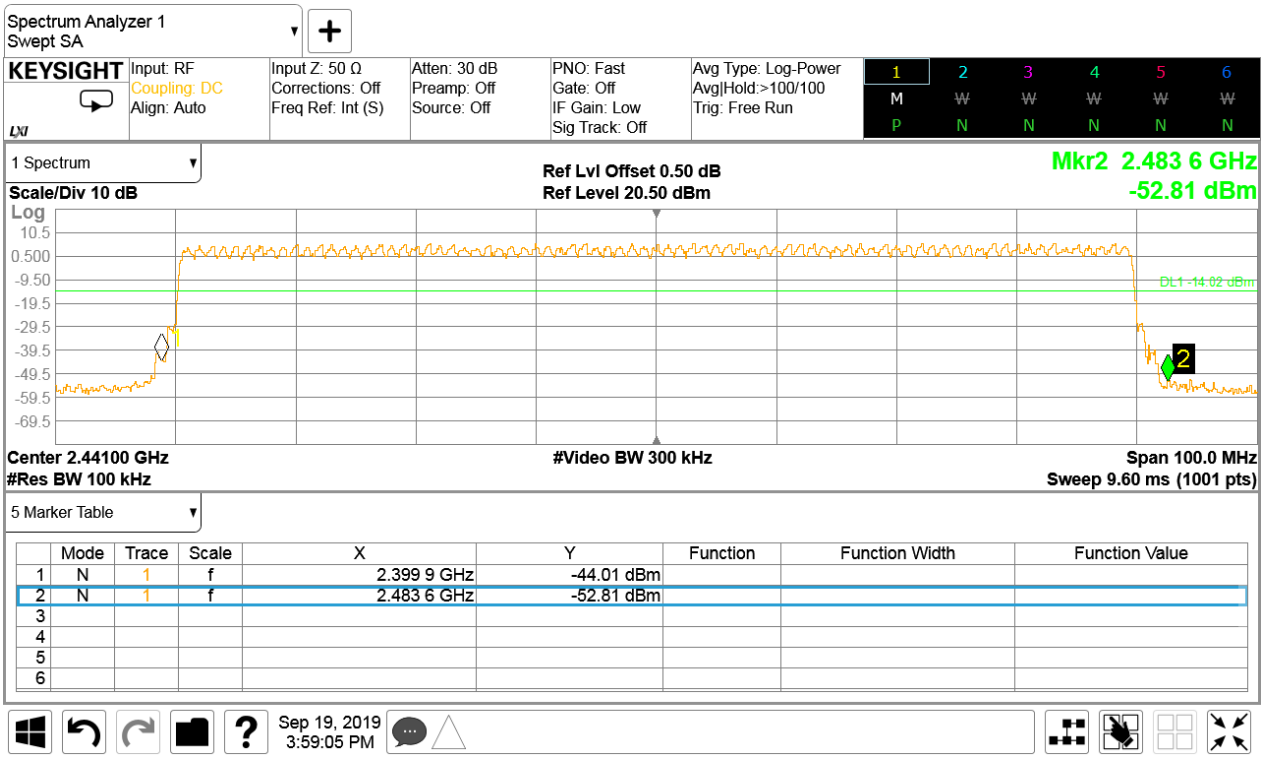
8-DPSK

Single Channel

Low channel	High channel
	

Hopping Mode



	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.399 9 GHz	-44.01 dBm			
2	N	1	f	2.483 6 GHz	-52.81 dBm			
3								
4								
5								
6								

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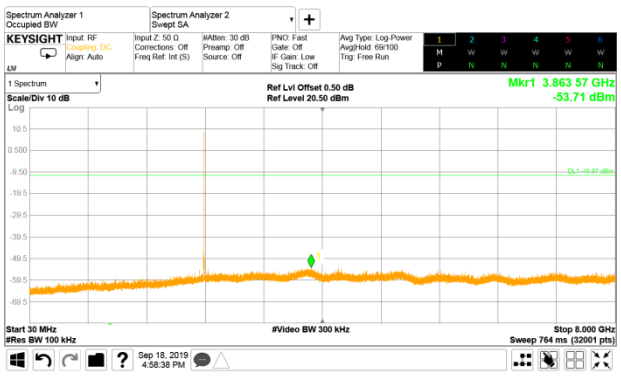
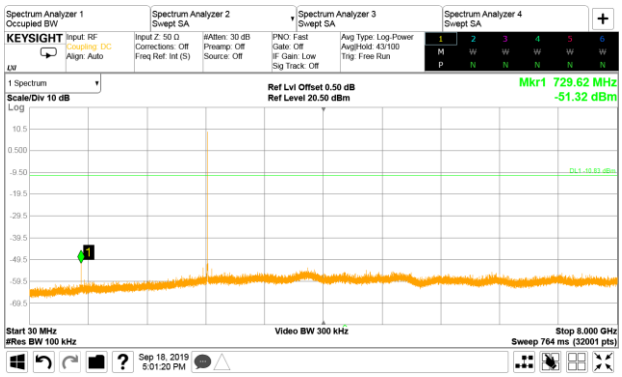
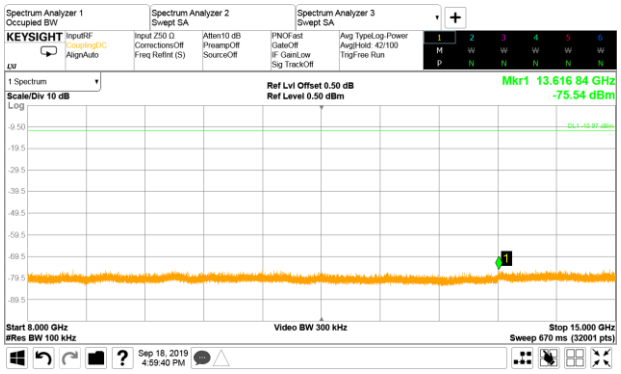
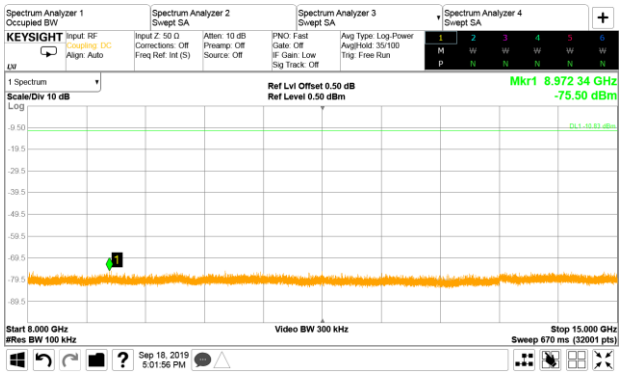
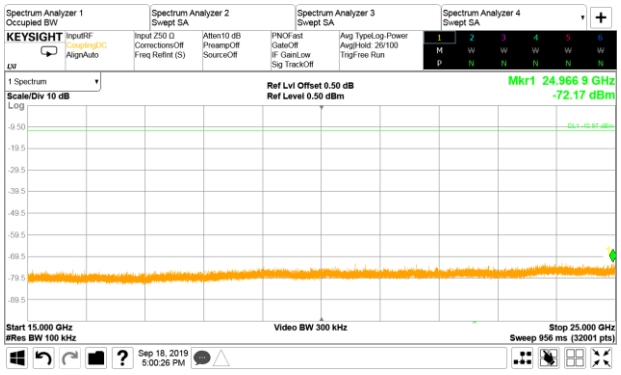
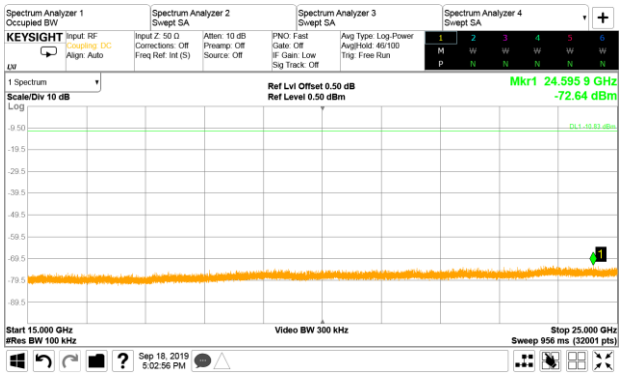
A.8.2 Spurious Emission

Test Date	2019/09/18	Temp./Hum.	25℃/51%
Cable Loss	0.50dB	Tested By	Martin Chen
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Test Model	17Z90N

GFSK	
2402MHz	2441MHz
30MHz –8GHz	30MHz –8GHz
	
8GHz –15GHz	8GHz –15GHz
	
15GHz – 25GHz	15GHz – 25GHz
	

Note: All results have been included cable loss.

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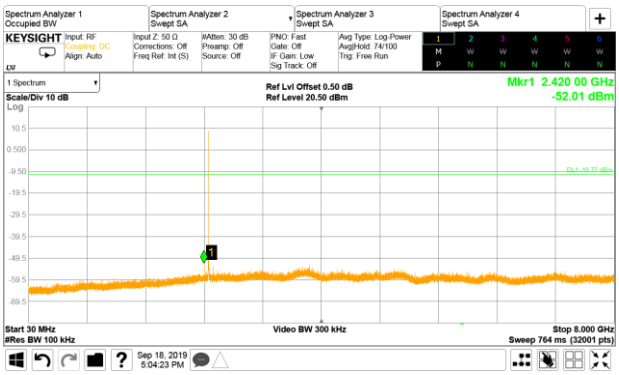
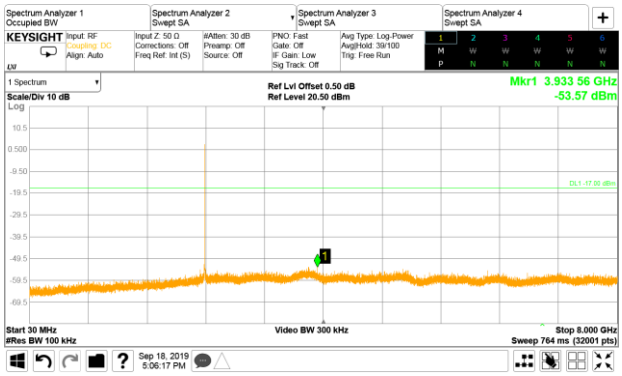
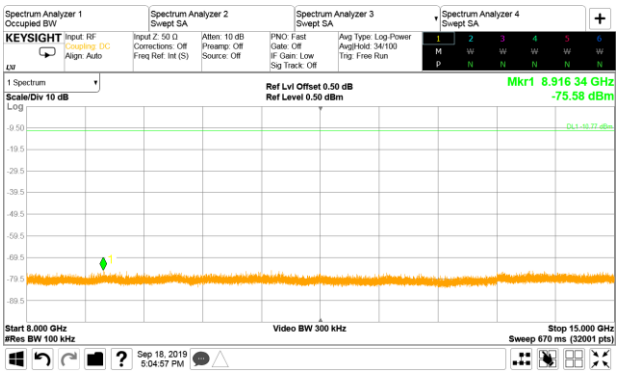
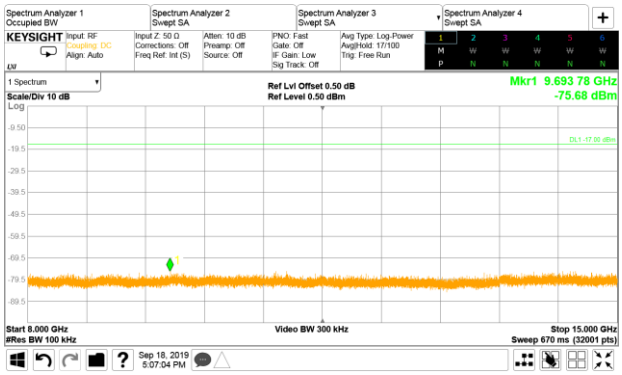
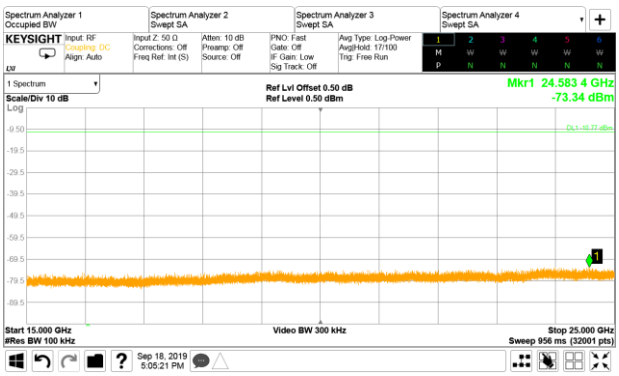
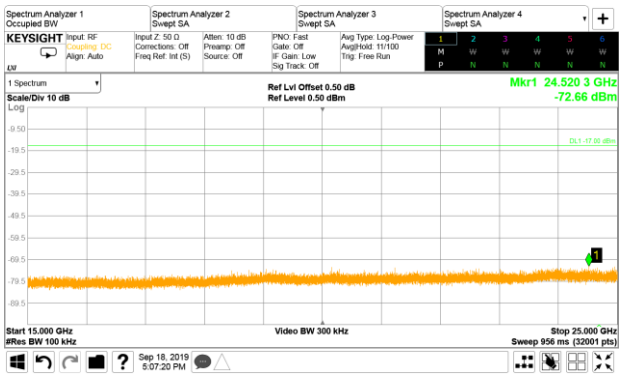
GFSK	8-DPSK
2480MHz	2402MHz
30MHz –8GHz	30MHz –8GHz
	
8GHz –15GHz	8GHz –15GHz
	
15GHz – 25GHz	15GHz – 25GHz
	

Note: All results have been included cable loss.

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 17Z90N)

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