

# FCC 47 CFR PART 15 SUBPART C 15.247 TEST REPORT

## FOR

Bluetooth Keyboard

Model : FILCFF03

Trade Name : FILCO

Issued to

**Diatec Corporation** 

4F Kairaku Bldg. (Soto-kanda) 6-5-4, Soto-kanda, Chiyoda-ku, Tokyo, 101-0021, Japan

Issued by

WH Technology Corp.



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### 1. General Information

Applicant	:	Diatec Corporation
Address	:	4F Kairaku Bldg. (Soto-kanda) 6-5-4, Soto-kanda, Chiyoda-ku, Tokyo, 101-0021, Japan
Manufacturer	:	Datacomp Electronics Co., Ltd.
Address	:	No. 38, Sec. 2 Nan-Kan Road, Lu-Chu Village, Taoyuan, Taiwan R.O.C.
EUT	:	Bluetooth Keyboard
Model Name	:	FILCFF03
Model Differences	:	N/A

Is here with confirmed to comply with the requirements set out in the FCC Rules and Regulations Part 15 Subpart C and the measurement procedures were according to ANSI C63.10-2013. The said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.

### FCC part 15 subpart C

Receipt Date : 12/05/2019

Tested By:

 $\sim$ 

May. 12, 2020

Date

Bing Zhang / Engineer

Reviewed by:

May. 12, 2020

Date

Bell W

Final Test Date : 05/12/2020

Bell Wei / Manager Designation Number: TW2954



## 2. Report of Measurements and Examinations

### 2.1 List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.203	Antenna Requirement	Pass
15.207	Conducted Emission	Pass
15.209	Radiated Emission	Pass
15.247(a)(1)	Channel Carrier Frequencies Separation	Pass
15.247(a)(1)	20dB Bandwidth Measurement	Pass
15.247(a)(1)	Dwell Time	Pass
15.247(b)	Number of Hopping Channels	Pass
15.247(b)	Peak Output Power Measurement Data	Pass
15.247(d)	Band Edges Measurement Data	Pass



## 3. Test Configuration of Equipment under Test

## 3.1 Description of the Tested Samples

EUT Name	:	Bluetooth Keyboard	
Model Number	:	FILCFF03	
FCC ID	:	XS8-MINILA-R	
Receipt Date	:	12/05/2019	
8		DC 5V from PC DC 3V from AA Batteries*2	
Operate Frequency		Refer to the channel list as described below (2402 ~ 2480 MHz)	
Modulation Technique	:	GFSK, π/4-DQPSK, 8DPSK	
Number of Channels	:	79	
Channel Spacing	:	1 MHz	
Operating Mode	:	□ Simplex ☑ Duplex	
Antenna Type	:	PCB Antenna	
Antenna Gain	:	2.78 dBi	



### 3.2 Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	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		

### 3.3 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10-2013.
- b. The complete test system included Notebook and EUT for RF test.
- c. An executive "BLUETEST3" under WIN8 was executed to keep transmitting and receiving data via Wireless.
- d. The following test modes were performed for test:
  - GFSK: CH00: 2402MHz, CH39: 2441MHz, CH78: 2480MHz
  - π/4-DQPSK: CH00: 2402MHz, CH39: 2441MHz, CH78: 2480MHz
  - 8DPSK: CH 00: 2402MHz, CH 39: 2441MHz, CH 78: 2480MHz.



### 3.4 Test Methodology & General Test Procedures

All testing as described bellowed were performed in accordance with ANSI C63.10-2013 and FCC CFR 47 Part 15 Subpart C.

### **Conducted Emissions**

The EUT is placed on a wood table, which is at 0.8 m above ground plane acceding to clause 15.207 and requirements of ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz are using CISPR Quasi-Peak / Average detectors.

### **Radiated Emissions**

The EUT is a placed on a turn table, which is 0.8 m above ground plane. The turntable was rotated through 360 degrees to determine the position of maximum emission level. The EUT is placed at 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

- 1) Putting the EUT on the platform and turning on the EUT (on/off button on the bottom of the EUT).
- 2) Setting test channel described as "Channel setting and operating condition", and testing channel by channel.
- 3) For the spurious emission test based on ANSI(2013), at the frequency where below 1GHz used quasi-peak detector mode; where above 1GHz used the peak and average detector mode. IF the peak value may be under average limit, the average mode will not be performed.



### 3.5 Measurement Uncertainty

Measurement Item	Uncertainty
Radiated emission	±4.11dB
Peak Output Power (Conducted)	±1.38dB
Peak Output Power (Radiated)	±1.70dB
Power Spectral Density	±1.39dB
Radiated emission (3m)	±4.11dB
Radiated emission (10m)	±3.89dB

### 3.6 Description of the Support Equipments

### Setup Diagram

See test photographs attached in appendix for the actual connections between EUT and support equipment.

### Support Equipment

Peripherals Devices:

	OUTSIDE SUPPORT EQUIPMENT						
No.	Equipment	Model	Serial No.	FCC ID/ BSMI ID	Trade name	Data Cable	Power Cord
1.	PC	D19M	CYY7Y A00 DC4	R33002	DELL	N/A	Unshielded 1.8m
2.	Monitor	BL2420-T	EJ35J00797019	R33037	BENQ	Shielded 1.8m	Unshielded 1.8m
3.	Printer	D4360	N/A	R33001	HP	Shielded 1.8m / USB	Unshielded 1.8m
4.	USB 3.0	TAD-SDCZS0	NA	D31490	SanDisk	Shielded 1m / USB	N/A
5.	Mouse	MS111-L	CN-09RRC7- 48729-43M-070D	T41126	DELL	Shielded 1.8m / USB	N/A
6.	Notebook	N16P7	NXVGKTA001751 042C17200	R33142	Acer	N/A	Unshielded 1.8m

**Note:** (1) All the above equipment /cable were placed in worse case position to maximize emission signals during emission test.

(2) Grounding was in accordance with the manufacturer's requirement and conditions for the intended use.



## 4. Test and Measurement Equipment

### 4.1 Calibration

The measuring equipment utilized to perform the tests documented in the report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2 Equipment

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective.



### TABLELIST OF TEST AND MEASUREMENT EQUIPMENT

Conducted emission					
Instrument	Manufacturer	Model No.	Serial No.	Cali Due Date	
EMI Test Receiver	R&S	ESHS30	838550/003	2020/08/12	
Spectrum Analyzer	R&S	FSP7	830180/009	2020/08/14	
Two-Line V-Network	EMCO	3810/2NM	9801-1849	2020/08/07	
Test Cable	EMCI	EMCCFD300- BM-BM-3000	180618	2020/08/11	
Measurement Software	AUDIX	e3	V9.160707	N/A	
	Radiated	d emission Below 1GF	łz		
Instrument	Manufacturer	Model No.	Serial No.	Cali Due Date	
Bilog antenna	Chase	CBL6111A	1546	2020/07/30	
LOOP Antenna	EMCO	6507	9301-1298	2021/01/08	
Pre-amplifier	Anritsu	MH648A	M15180	2020/08/11	
Cable	EMCI	EMCCFD400-NM- NM-7000	180617	2020/08/11	
Cable	Marvelous Microwave	260260.F141	120A	2020/08/11	
Receiver	R&S	ESCI3	101131	2020/09/08	
Measurement Software	AUDIX	e3	V9.160707	N/A	
Radiated emission Above 1GHz					
Instrument	Manufacturer	Model No.	Serial No.	Cali Due Date	
Horn antenna	ETS LINDGREN	3117	00114397	2021/04/08	
Horn antenna	com-power	AH-826	81000	2020/09/16	
Horn antenna	Schwarzbeck	BBHA9170	#687	2020/06/11	
Pre-amplifier	EMCI	EMC051845	980108	2020/12/19	
Pre-amplifier	MITEQ	JS4-18002600-30- 5A	808329	2020/09/04	
Pre-amplifier	EMC INSTRUMENT	EMC264035SE	980288	2021/04/18	
RF CABLE	SUCOFLEX	104PEA	27348/4PEA	2020/06/10	
RF CABLE	AGILENT	EMC102-KM-KM- 3000	160101	2020/08/18	
RF CABLE	AGILENT	EMC102-KM-KM- 600	160102	2020/08/18	
Spectrum Analyzer	R&S	FSP7	830180/006	2021/04/23	
Spectrum Analyzer	ADVANTEST	R3182	150900201	2021/01/17	
Measurement Software	AUDIX	e3	V9.160707	N/A	

\*CALIBRATION INTERVAL OF INSTRUMENTS LISTED ABOVE IS ONE YEAR.



## 5. Antenna Requirements

### 5.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 5.2 Antenna Construction and Directional Gain

Antenna Type: PCB Antenna Antenna Gain: 2.78 dBi



#### 6. Test of Conducted Emission

### 6.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 kHz on the 120 VAC power and return leads of the EUT according to the methods defined in ANSI C63.10-2013 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 2.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dBµV)	Average (dBµV)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\*Decreases with the logarithm of the frequency.

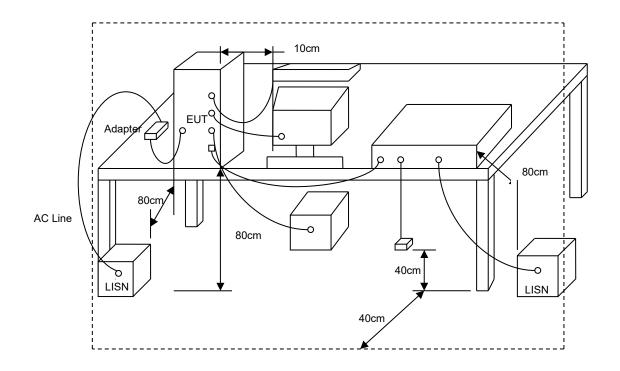
### 6.2 Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



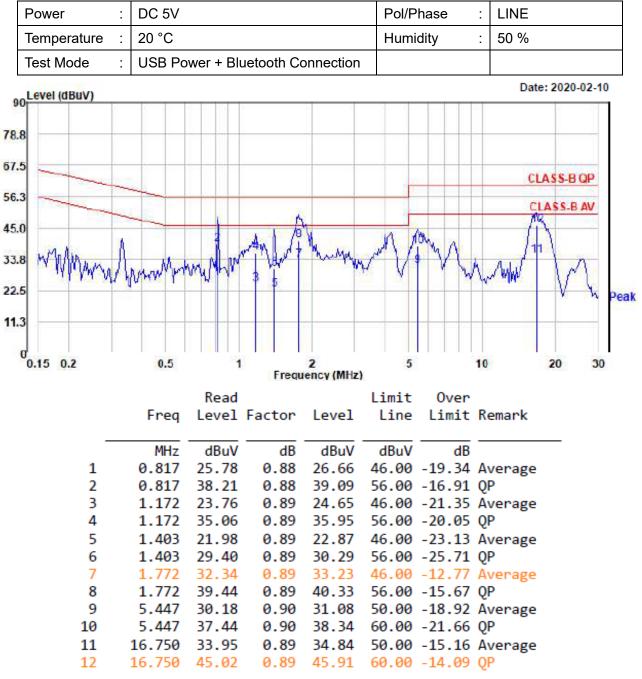
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### 6.3 Typical Test Setup



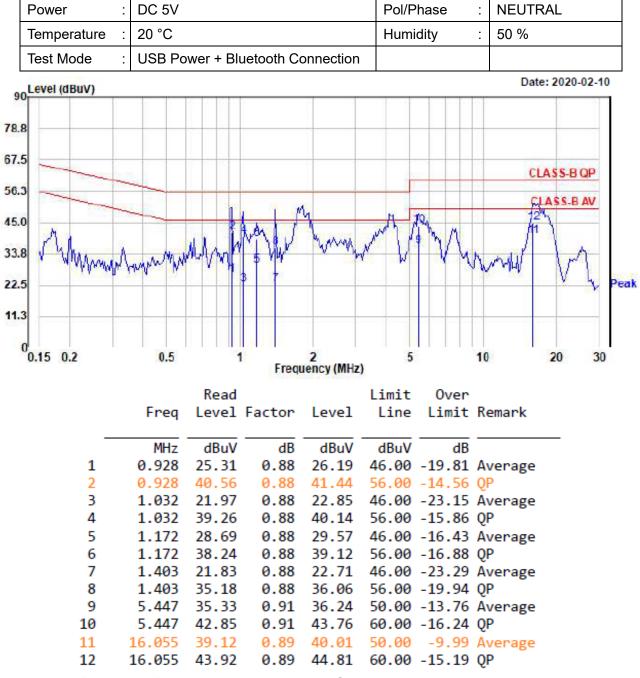


### 6.4 Test Result and Data



Remarks: Factor = Insertion Loss + Cable Loss





Remarks: Factor = Insertion Loss + Cable Loss



## 7. Test of Radiated Emission

### 7.1 Test Limit

In any 100 kHz 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 100 kHz 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 measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/meter)	Measurement Distance (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



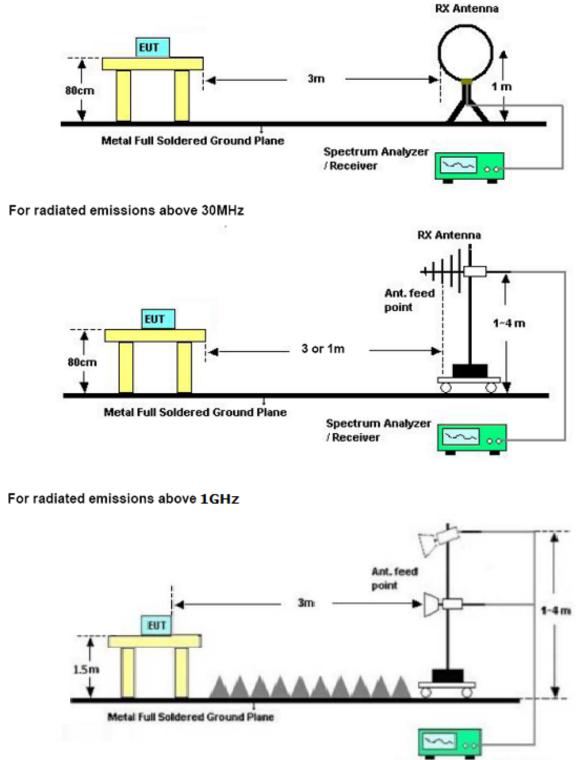
### 7.2 Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- i. "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.



### 7.3 Typical Test Setup

For radiated emissions below 30MHz



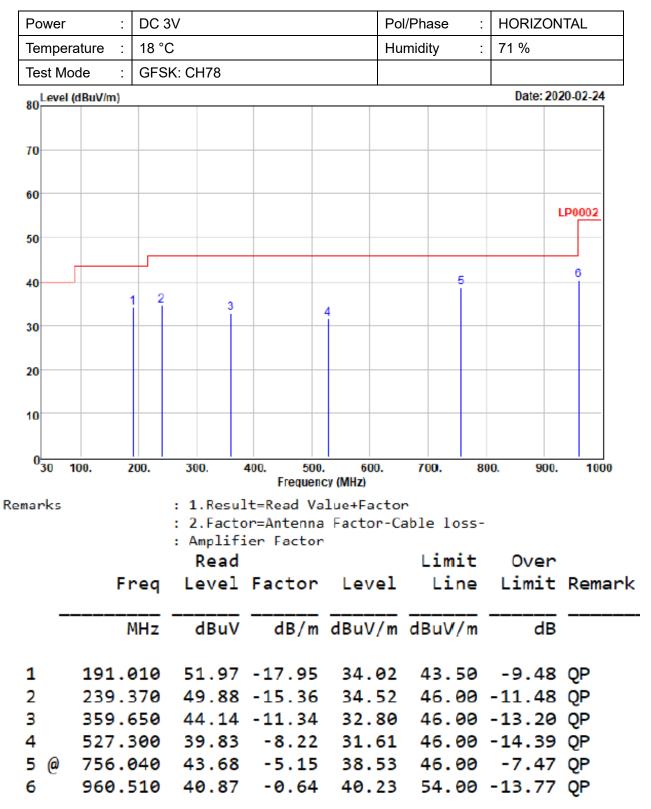
Spectrum Analyzer / Receiver



### 7.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

### 7.5 Test Result and Data (30MHz ~ 1GHz, worst emissions found)





Tomper		DC 3	3V					Pol/l	Phase	VE	RTICAL	-
remper	rature :	18 °(	С					Hum	nidity	71	%	
Test Mo	ode :	GFS	K: CH	178								
80 Level	l (dBuV/m)										Date: 20	20-02-24
70		_										
60												LP0002
50												
			1									
40		1 1										
									4		5	6
30						3			Ī			
20												
20												
10												
1												
0	100.	200.	30	0.	400.	500	. 600	).	700.	800.	900.	1000
0 <mark>30</mark>	100.	200.			Fre	equen	cy (MHz)			800.	900.	1000
	100.	200.	: 1.	Resul	Fre lt=Read	equen d Va	cy(MHz) lue+Fac	tor			900.	1000
	100.	200.	: 1. : 2.	Resul Facto	Fre lt=Read	equen d Va enna	c <b>y (MHz</b> ) lue+Fac Factor	tor	ble loss		900.	1000
			: 1. : 2. : Am R	Resul Facto plif: C <b>ead</b>	Fre lt=Read or=Ante ier Fac	equen d Va enna tor	cy (MHz) lue+Fac Factor	tor -Ca	ble loss Limit	C	)ver	
			: 1. : 2. : Am R	Resul Facto plif: C <b>ead</b>	Fre lt=Read or=Ante ier Fac	equen d Va enna tor	cy (MHz) lue+Fac Factor	tor -Ca	ble loss	C	)ver	1000 Remar
	Fr	req	: 1. : 2. : Am R Le	Resul Facto plif: <b>ead</b> vel	Fre lt=Read or=Ante ier Fac <b>Fact</b>	equen d Va enna ctor	cy(MHz) lue+Fac Factor Leve	tor -Cal	ble loss Limit Line	C Li	)ver .mit	
	Fr		: 1. : 2. : Am R Le	Resul Facto plif: C <b>ead</b>	Fre lt=Read or=Ante ier Fac <b>Fact</b>	equen d Va enna ctor	cy(MHz) lue+Fac Factor Leve	tor -Cal	ble loss Limit	C Li	)ver	
emarks —	F ı	req MHz	: 1. : 2. : Am R Le	Resul Facto plif: ead vel BuV	Free or=Ante ier Fac Fact dB	or	cy (MHz) lue+Fac Factor Leve dBuV/	el /m	ble loss Limit Line dBuV/m	C Li	over .mit  dB	Remar
	Fr 191.8	req MHz 840	: 1. : 2. : Am Le 	Resul Facto plifi ead vel BuV	Free or=Ante ier Fac Fact  dB -17.	or 91 91 91	cy (MHz) lue+Fac Factor Leve dBuV/ 39.6	el /m	ble loss Limit Line	- 4	Over .mit dB	Remar
	Fr 191.8 239.9	req MHz 840	: 1. : 2. : Am Le  d 56 56	Resul Facto plif: ead vel BuV	Free or=Ante ier Fac Fact -17. -15.	or 91 33	cy (MHz) lue+Fac Factor Leve dBuV/ 39.6 41.5	≥1 /m 02	ble loss Limit Line dBuV/m 43.50	-4 -4	0ver .mit dB .48	Reman  QP QP
	Fr 191.8 239.9 480.2 709.2	req MHz 840 920 210 150	: 1. : 2. : Am Le 56 56 35 35	Resul Facto plifi ead vel BuV 5.93 5.85 5.06 5.63	Free It=Read Dr=Ante ier Fac Fact -17. -15. -8. -5.	91 33 63	cy (MHz) lue+Fac Factor Leve dBuV/ 39.6 41.9 26.6 30.6	=1 /m 52 88 90	ble loss Limit Line dBuV/m 43.50 46.00 46.00 46.00	-4 -4 -19 -16	over .mit dB .48 .48 .92 5.00	Reman QP QP QP QP QP
	Fr 191.8 239.9 480.2 709.2 861.6	req MHz 840 920 210 150 530	: 1. : 2. : Am Le 56 35 35 34	Resul Factor Plif: ead vel .93 .85 .06 .63 .94	Free or=Ante ier Fact -17. -15. -8. -2.	91 33 65	cy (MHz) lue+Fac Factor Leve dBuV/ 39.6 41.9 26.6 30.6 32.2	≥1 /m 52 58 80 29	Limit Line dBuV/m 43.50 46.00 46.00	-4 -4 -19 -16 -13	over .mit dB .48 .48 .92 .00 .71	Remar QP QP QP QP QP QP QP



Power	:	DC 3	SV		Po	l/Phase			
Temperatu	ure :	18 °C			Hu	imidity	: 71 %		
Test Mode		π/4-[	DQPSK: C	H78					
80 Level (dB	βuV/m)						Date: 20	20-02-24	
70									
60								LP0002	
50									
40						- 5		6	
	1	1 2	:	3	4				
30									
20									
20									
10									
030 100	). 2	200.	300.	400. 500	. 600.	700.	B00. 900.	1000	
				Frequen	cy (MHz)				
marks				ult=Read Va			_		
marks			: 2.Fac	ult=Read Va tor=Antenna fier Factor	a Factor-C		-		
marks			: 2.Fac	tor=Antenna fier Factor	a Factor-C				
marks	Fr	req	: 2.Fac : Ampli Read	tor=Antenna fier Factor	a Factor-C	able loss L <b>imit</b>	Over	Remar	
marks 			: 2.Fac : Ampli Read Leve	tor=Antenna fier Factor d l Factor	Level	able loss Limit Line	Over Limit		
marks 		req MHz	: 2.Fac : Ampli Read Leve	tor=Antenna fier Factor d	Level	able loss Limit Line	Over Limit		
		MHz	: 2.Fac : Ampli Read Leve	tor=Antenna fier Factor d l Factor / dB/m	Level	able loss Limit Line dBuV/m	Over Limit dB		
	N 188.2	 MHz 240	: 2.Fac : Ampli Read Leve dBu	tor=Antenna fier Factor d Factor V dB/m 4 -18.09	Level dBuV/m 33.75	able loss Limit Line dBuV/m 43.50	Over Limit dB -9.75	QP	
 1 1 2 2	N 188.2 243.6	MHz 240	: 2.Fac : Ampli Read Leve: dBu 51.84 49.20	tor=Antenna fier Factor d l Factor / dB/m	Level dBuV/m 33.75 34.07	able loss Limit Line dBuV/m 43.50 46.00	Over Limit 	QP QP	
1 1 2 2 3 3	N 188.2 243.6 365.8	MHz 240 510 800	: 2.Fac : Ampli Read Leve dBu 51.84 49.20 43.02	tor=Antenna fier Factor d Factor V dB/m 4 -18.09 0 -15.13	Level dBuV/m 33.75 34.07 31.89	able loss Limit Line dBuV/m 43.50 46.00 46.00	Over Limit 	QP QP QP	
1 1 2 2 3 3 4 5	N 188.2 243.6 365.8 533.2	MHz 240 510 300 190 470	: 2.Fac : Ampli Read Leve: dBu 51.84 49.20 43.03 39.53 43.09	tor=Antenna fier Factor d Factor / dB/m 4 -18.09 0 -15.13 1 -11.12	Level dBuV/m 33.75 34.07 31.89 31.38 37.90	able loss Limit Line dBuV/m 43.50 46.00 46.00 46.00 46.00	Over Limit 	QP QP QP QP QP QP	



Power	:	DC 3	V				Po	l/Phase	; ;	VER	TICA	L
Temperature	:	18 °C	)				Hu	midity	:	71 %		
Test Mode	:	π/4-0	DQPSK:	CH	78							
80 Level (dBuV/n	n)									Dat	e: 202	20-02-24
70												
60												<b>BAAAA</b>
											1	.P0002
50												
40		1 2										
40											_	6
30					3			4			5	
20												
10												
0			200		400. 5	500.	600					1000
<sup>0</sup> 30 100.	2	00.	300.				600.	700.	80	0.	900.	1000
	2	00.			Frequ	iency (	(MHZ)		80	10.	900.	1000
0 <mark>30 100.</mark> marks	Z	00.	: 1.Re	esu]	Frequ t=Read	ency( Valu		r		10.	900.	1000
	2	00.	: 1.Re : 2.Fa : Ampl	esul acto lifi	Frequ t=Read	ency( Valu na F	MHz) 1e+Facto	r able ]	loss-	10.	900.	1000
	2	00.	: 1.Re : 2.Fa : Ampl Rea	esul acto lifi <b>ad</b>	Frequ lt=Read or=Anten ier Fact	Valu Valu na F or	MHz) 1e+Facto actor-C	r able 1 L <b>i</b> r	loss- nit	Ov	ver	
		°eq	: 1.Re : 2.Fa : Ampl Rea	esul acto lifi <b>ad</b>	Frequ lt=Read or=Anten ier Fact	Valu Valu na F or	MHz) 1e+Facto	r able 1 L <b>i</b> r	loss- nit	Ov	ver	Remar
	Fr		: 1.Re : 2.Fa : Ampl Rea Leve	acto lifi ad el	Frequ lt=Read or=Anten ier Fact Facto	valu Valu na F or	MHz) 1e+Facto actor-C	r able l Lir L:	nit ine	Ov	ver	
marks	Fr	°eq 1Hz	: 1.Re : 2.Fa : Ampl Rea Leve	acto acto ad el  uV	Frequ lt=Read or=Anten ier Fact Facto  dB/	valu valu na F or <b>r</b> m d	MHz) ie+Factor actor-C Level BuV/m	r Lir L: dBu\	nit ine //m	Ov Lim	ver nit dB	Remar
marks  1 @ 192	Fr  2.6	req 1Hz	: 1.Re : 2.Fa : Ampl Rea Leve dBu	acto lifi ad el uV 58	Frequ lt=Read or=Anten ier Fact Facto  dB/ -17.9	iency ( Valu ina F cor pr  m d	MHz) Ie+Factor Cactor-C Level IBuV/m 38.67	r Lir Li dBu 43	nit ine //m	Ov Lim -4.	ver nit dB 83	Remar  QP
1 @ 192 2 242	Fr N 2.6	req 1Hz 900	: 1.Re : 2.Fa : Ampl Rea Leve dBu 56. 55.	acto acto ad el uV 58 38	Frequent It=Read Freat Facto dB/ -17.9 -15.1	valu valu ona F or m d 1	MHz) Ie+Factor actor-C Level IBuV/m 38.67 40.21	r Lir L: dBu 43 46	nit ine //m .50	Ov Lim -4. -5.	ver nit dB 83 79	Remar  QP QP
1 @ 192 2 242 3 484	Fr 2.6	req 1Hz 900 930	: 1.Re : 2.Fa : Ampl Rea Levo dBo 56. 55. 35.	acto acto ad el uV 58 38 97	Frequent It=Read Facto Facto  dB/ -17.9 -15.1 -8.9	iency ( Valu ina F or m d 1 .7	MHz) Ie+Factor Cactor-C Level IBuV/m 38.67	r Lir L: dBu 43 46 46	nit ine //m .50 .00	Ov Lim -4. -5. -18.	ver nit dB 83 79 95	Remar  QP QP QP
marks 1 @ 192 2 242 3 484 4 721	Fr 2.6 2.9 4.6	req 1Hz 900 930 940	: 1.Re : 2.Fa : Ampl Rea Leve dBu 56. 55. 35. 34.	esul acto lifi ad el uV 58 38 97 93	Frequent It=Read Factor Factor -17.9 -15.1 -8.9 -5.5	iency ( Valu ina F ior m d 1 7 2 2	MHz) Ie+Factor actor-C Level IBuV/m 38.67 40.21 27.05	r Lir Li dBu 43 46 46	nit ine //m .50 .00	Ov Lim -4. -5. -18. -16.	ver nit dB 83 79 95 59	Remar  QP QP QP QP QP



	:	DC :	3V			Po	ol/Phase	:	HOR	IZON	ITAL	
Temper	rature :	18 °	С			Hu	umidity	:	71 %	I		
Test Mo	ode :	8DP	SK: CH	H78								
80	(dBuV/m)								Da	ite: 20	20-02-24	
70												
60											LP0002	
50												
40		2					4					
	1			3					:	5	6	
30		_										
20												
10												
0	100	200	200		400 500	600	700			000	100	
0	100.	200.	300	).	400. 500 Frequer	). 600. cy (MHz)	700.	8	00.	900.	100	)
0 <sub>30</sub> marks	100.	200.	: 1.	Resul	Frequer lt=Read Va	cy(MHz) lue+Facto	r		00.	900.	1000	)
	100.	200.	: 1. : 2.	Resul Facto	Frequer lt=Read Va pr=Antenna	cy (MHz) lue+Facto Factor-C	r		00.	900.	1000	)
	100.	200.	: 1. : 2. : Am	Resul Facto plifi	Frequer lt=Read Va	cy (MHz) lue+Facto Factor-C	r able l	oss-			1000	)
			: 1. : 2. : Am R	Resul Facto plifi <b>ead</b>	Frequer lt=Read Va pr=Antenna	cy (MHz) lue+Facto Factor-C	r able 1 Lin		0\	/er	1000	
			: 1. : 2. : Am R	Resul Facto plifi <b>ead</b>	Frequer It=Read Va or=Antenna ier Factor	cy (MHz) lue+Facto Factor-C	r able 1 Lin	.oss- nit	0\	/er		
	F		: 1. : 2. : Am R Le	Resul Facto plif: ead vel	Frequer It=Read Va or=Antenna ier Factor	cy (MHz) alue+Facto Factor-C Level	r able 1 Lin Li	nit ine	0\	/er	Rema	
	F	req MHz	: 1. : 2. : Am R Le	Resul Facto plif: ead vel BuV	Frequer lt=Read Va pr=Antenna ier Factor Factor	Level	r Lin Li dBu\	nit ine //m	O\ Lin	/er nit dB	Rema	
narks — 1 2	F 163.0	req MHz 040	: 1. : 2. : Am R Le d	Resul Facto plif: ead vel  BuV	Frequer lt=Read Va pr=Antenna ier Factor Factor dB/m	Level dBuV/m 31.86	dBu\	nit ine //m	0\ Lin -11.	ver nit dB	Rema 	
1 2 3	F 163. 239. 344.	req MHz 040 560 730	: 1. : 2. : Am R Le d 48 52 45	Resul Facto plif: ead vel .61 .87 .09	Frequer lt=Read Va pr=Antenna ier Factor Factor dB/m -16.75 -15.35 -11.81	cy (MHz) elue+Facto Factor-C Level dBuV/m 31.86 37.52 33.28	or Lin Li dBu\ 43. 46. 46.	.oss- nit ine //m .50 .00	Ov Lin -11. -8. -12.	/er dB .64 .48 .72	Rema QP QP QP	
1 2 4 @	F 163. 239. 344. 720.	req MHz 040 560 730 310	: 1. : 2. : Am R Le d 48 52 45 43	Resul Facto plif: ead vel .61 .87 .09 .16	Frequer lt=Read Va pr=Antenna ier Factor Factor  dB/m -16.75 -15.35 -11.81 -5.52	cy (MHz) elue+Factor Factor-C Level dBuV/m 31.86 37.52 33.28 37.64	dBu\ 43. 46. 46.	.50 .00	Ov Lin -11. -8. -12. -8.	/er dB 64 48 72 36	Rema QP QP QP QP QP	
1 2 3	F 163. 239. 344. 720. 875.	req MHz 040 560 730 310 660	: 1. : 2. : Am R Le d 48 52 45 43 37	Resul Facto plif: ead vel .61 .87 .09 .16 .39	Frequer lt=Read Va pr=Antenna ier Factor Factor dB/m -16.75 -15.35 -11.81	cy (MHz) elue+Factor Factor-C Level dBuV/m 31.86 37.52 33.28 37.64 34.84	or Lin Li dBu\ 43. 46. 46. 46. 46.	.055- nit ine //m .50 .00 .00	O\ Lin -11. -8. -12. -8. -11.	/er dB 64 48 72 36 16	Rema QP QP QP QP QP QP	



Power	:	DC	3V			Po	l/Phase :	VERTICAL		
Temper	rature :	18 °	С			Hu	imidity :	71 %		
Test Mo	ode :	8DP	SK: CH7	8						
80 Level	(dBuV/m)							Date: 20	20-02-24	
70										
60	_								LP0002	
50										
40		2 3	4			6				
		Ιĭ		5						
30										
20										
20										
10										
0 30	100.	200.	300.	<u> </u>	400. 500.	600.	700. 8	300. 900.	1000	
	100.	200.	300.		400. 500. Frequenc	cy (MHz)		300. 900.	1000	
0 <mark>⊣</mark> marks	100.	200.	: 1.Re	esul	Frequent t=Read Va	cy(MHz) lue+Facto	r		1000	
	100.	200.	: 1.Re : 2.Fa	esul	Frequen t=Read Va r=Antenna	ry (MHz) lue+Facto Factor-C			1000	
	100.	200.	: 1.Re : 2.Fa	esul acto lifi	Frequent t=Read Va	ry (MHz) lue+Facto Factor-C	r		1000	
			: 1.Re : 2.Fa : Amp] Rea	esul acto Lifi <b>ad</b>	Frequent t=Read Va or=Antenna er Factor	ry (MHz) lue+Facto Factor-C	r able loss-	Over	1000 Remar	
	F	req	: 1.Re : 2.Fa : Amp] Rea Leva	esul acto lifi ad el	Frequent t=Read Va or=Antenna er Factor Factor	Level	r able loss Limit Line	Over Limit	Remar	
	F		: 1.Re : 2.Fa : Amp] Rea Leva	esul acto lifi ad el	Frequent t=Read Va or=Antenna er Factor Factor	Level	r able loss L <b>imit</b>	Over Limit	Remar	
	F	req MHz	: 1.Re : 2.Fa : Amp] Rea Leve	esul acto lifi ad el  uV	Frequent t=Read Va or=Antenna er Factor Factor  dB/m	Level dBuV/m	r able loss Limit Line	Over Limit dB	Remar	
marks —	F 163.	req MHz 110	: 1.Re : 2.Fa : Ampl Rea Leva dB	esul acto lifi ad el uV 25	Frequent t=Read Va or=Antenna er Factor Factor dB/m -16.76	Level dBuV/m 34.49	r able loss Limit Line dBuV/m	Over Limit dB -9.01	Remar	
1 (0 1 2 (0 3	F 163. 195.	req  MHz 110 490	: 1.Re : 2.Fa : Ampl Rea Leva dB 51 53	esul acto ad el uV 25 74	Frequent t=Read Va or=Antenna er Factor Factor dB/m -16.76 -17.77	Level dBuV/m 34.49 35.97	r able loss Limit Line dBuV/m 43.50	Over Limit dB -9.01 -7.53	Reman QP QP	
1	F 163. 195. 225. 284.	req MHz 110 490 520	: 1.Re : 2.Fa : Ampl Rea Leve dB 51. 53. 51. 49.	esul acto lifi ad el uV 25 74 25 37	Frequent t=Read Va or=Antenna er Factor Factor dB/m -16.76 -17.77 -16.31 -13.23	Level 34.49 34.94 36.14	r able loss Limit Line dBuV/m 43.50 43.50 46.00 46.00	Over Limit dB -9.01 -7.53 -11.06 -9.86	Reman QP QP QP QP QP	
1	F 163. 195. 225. 284. 344.	req MHz 110 520 520 040	: 1.Re : 2.Fa : Amp] Re: Leve dB 51. 53. 51. 49. 44.	esul acto lifi ad el uV 25 74 25 37 11	Frequent t=Read Va pr=Antenna er Factor Factor dB/m -16.76 -17.77 -16.31 -13.23 -11.83	Level 4.49 34.49 35.97 34.94 36.14 32.28	r Limit Line dBuV/m 43.50 43.50 46.00	Over Limit dB -9.01 -7.53 -11.06 -9.86 -13.72	Remar QP QP QP QP QP QP QP	



### 7.6 Test Result and Data (Above 1GHz)

Power :	DC 3V		F	Pol/Phase : HORIZONTAI			
Temperature :	18 °C		ŀ	Humidity	: 71 %		
Test Mode :	GFSK: CH00, 0	CH39, CH78					
80 Level (dBuV/m)					Dat	e: 2020-02-24	
						CLASS-B	
70							
60							
60					CL	ASS-B (AVG)	
50	3						
40							
30							
20							
10							
0 <mark>1000 4000.</mark>	6000. 8000. 1	0000. 12000.	14000 1600	0. 18000. 200	00 22000	24000 26000	
1000 4000.	0000. 0000. 1		ency (MHz)	0. 10000. 200	22000.	24000.20000	
	Read			Limit	Ove		
Fre	eq Level	Factor	Level	Line	Limi	t Remark	
M	Hz dBuV	dB/m		dBuV/m	d		
PIL		<b>u</b> b/ iii		abav/m	u		
4804.00	90 54.57	-5.44	49.13	74.00	-24.8	7 Peak	
4882.00				74.00			
@ 4960.00	90 54.30	-4.86	49.44	74.00	-24.5	6 Peak	

Note:

1. Emission level = Reading level + Correction factor

2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.

- 3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.
- 4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.
- 5. Peak detector measurement data will represent the worst case results.
- 6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
- 7. The other emission levels were 20dB below the limit.



Power :	DC	3V		F	Pol/Phase	:	VERTIC	AL
Temperature :	18	°C		ŀ	Humidity	:	71 %	
Test Mode :	GF	SK: CH00, 0	CH39, CH78					
80 Level (dBuV/m)							Date: 2	020-02-24
								CLASS-B
70								
60								
50	12						CLAS	<u>S-B (AVG)</u>
40								
30								
30								
20								
10								
0 <mark></mark>	600	00. 8000. 1		14000. 1600 ency (MHz)	0. 18000. 200	00.	22000. 24	4000. 26000
		Read			Limit		Over	
Fr	eq	Level	Factor	Level	Line	I	Limit	Remark
N	IHz	dBuV	dB/m	dBuV/m	dBuV/m		dB	
					74.00			
					74.00			
3 @ 4960.0	00	54.00	-4.86	49.14	74.00	- 3	24.86	Peak

1. Emission level = Reading level + Correction factor

2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.

3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.

4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.

5. Peak detector measurement data will represent the worst case results.

6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

7. The other emission levels were 20dB below the limit.



Power :	DC 3V		F	Pol/Phase	: H	ORIZO	NTAL
Temperature :	18 °C		F	lumidity	: 7	1 %	
Test Mode :	π/4-DQPSK: C	H00, CH39, C	CH78				
80 Level (dBuV/m)						Date: 2	2020-02-24
							CLASS-B
70							
60							
50 2	8						<u>S-B (AVG)</u>
40							
30							
20							
10							
0 <mark></mark>	<u>6000.</u> 8000. 1		14000. 16000 ency (MHz)	0. 18000. 200	00. 22	2000. 24	4000. 26000
	Read			Limit	C	ver	
Fre	eq Level	Factor	Level	Line	Li	mit	Remark
M	Hz dBuV	dB/m	dBuV/m	dBuV/m		dB	
	00 54.53						
	00 54.40 00 54.27						

1. Emission level = Reading level + Correction factor

2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.

3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.

4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.

- 5. Peak detector measurement data will represent the worst case results.
- 6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
- 7. The other emission levels were 20dB below the limit.



Power		:	DC	C 3V					Ρ	ol/Phase	:	VERTICA	۸L
Tempe	rature	:	18	°C					Н	umidity	:	71 %	
Test Mo	ode	:	π/4	4-DQP	SK: CH	100, CH	39, C	CH78					
80	(dBuV/	m)										Date: 2	020-02-24
													LASS-B
70													
60													
50		1	3									CLASS	-B (AVG)
40													
30													
20													
10													
0 <mark></mark>	40	00.	60(	00. 8 <b>0</b>	00. 10			14000. 16 ncy (MHz)	6000	. 18000. 200	000.	22000. 24	000. 26000
				R	ead					Limit		Over	
	I	Fr	eq	Le	vel	Fact	or	Leve	1	Line	I	Limit	Remark
		М	Hz	d	BuV	dB	/ m	dBuV/	'n	dBuV/m	_	dB	
										74.00			
										74.00			
3@4	960	.0	99	53	.97	-4.	86	49.1	.1	74.00	- 7	24.89	Реак

1. Emission level = Reading level + Correction factor

2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.

3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.

4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.

5. Peak detector measurement data will represent the worst case results.

6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

7. The other emission levels were 20dB below the limit.



Power :	DC 3V	,			Pol/Phase		HORIZO	ΝΤΔΙ
Temperature :	18 °C				Humidity	•	71 %	
Test Mode :		<- CH00	CH39, CH78		Turniaity	•	7170	
		<u>. 01100,</u>		,			Date: 2	020-02-24
80 Level (dBuV/m)								
								CLASS-B
70								
60								
60							CLAS	S-B (AVG)
50	3							
40								
30								
20								
10								
10								
0								
0 <mark>1000 4000.</mark>	6000.	8000. 10		14000. 16000 ancy (MHz)	0. 18000. 200	00.	22000. 24	4000. 26000
		Read			Limit		Over	
Fr	ea l		Factor	level				Remark
			1 40 201					itemaria
M	Hz —	dBuV	dB/m	dBuV/m	dBuV/m	_	dB	
1 4804.0	00 S	54.47	-5.44	49.03	74.00	-	24.97	Peak
2 4882.0	00 S	54.36	-5.15	49.21	74.00	-	24.79	Peak
3 @ 4960.0	00 S	54.20	-4.86	49.34	74.00	-	24.66	Peak

- 1. Emission level = Reading level + Correction factor
- 2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.
- 3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.
- 4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.
- 5. Peak detector measurement data will represent the worst case results.
- 6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
- 7. The other emission levels were 20dB below the limit.



Power	: DC	C 3V		F	Pol/Phase	:	VERTIC	AL
Temperature	: 18	°C		ŀ	Humidity	:	71 %	
Test Mode	: 80	PSK: CH00,	CH39, CH78	3				
80 Level (dBuV/m	)						Date: 2	020-02-24
								CLASS-B
70								
60							CLAS	
50	12							<u>S-B (AVG)</u>
40	_							
30	_							
20								
10	-							
0 <mark>1000 4000</mark>	). 60	00. 8000. 1		14000. 1600 ency (MHz)	0. 18000. 200	00.	22000. 24	4000. 26000
		Read			Limit		Over	
F	req	Level	Factor	Level	Line	I	Limit	Remark
I	MHz	dBuV	dB/m	dBuV/m	dBuV/m		dB	
					74.00			
2 4882.0					74.00			
3 @ 4960.0	999	55.69	-4.86	49.03	/4.00	- 1	24.9/	Реак

1. Emission level = Reading level + Correction factor

2. Correction factor: Antenna factor, Cable loss, Pre-Amp, etc.

3. Measurements above 1000 MHz, Peak detector setting: 1 MHz RBW with 1 MHz VBW.

4. Measurements above 1000 MHz, Average detector setting: 1 MHz RBW with 10Hz VBW.

- 5. Peak detector measurement data will represent the worst case results.
- 6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

7. The other emission levels were 20dB below the limit.



WH Technology Corp.

## 8. 20dB Bandwidth Measurement Data

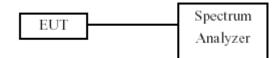
### 8.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

### 8.2 Test Procedures

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 30 kHz and VBW to 100 kHz.
- c. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

### 8.3 Test Setup Layout

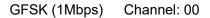


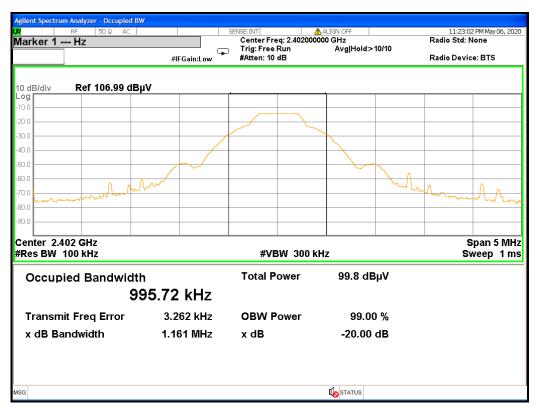
### 8.4 Test Result and Data

Test Date: 2020.05.06	Temperature: 23°C
Atmospheric pressure: 1012 hPa	Humidity: 57%

Modulation Standard	Channel	Frequency (MHz)	20dB Bandwidth (MHz)
	00	2402	1.161
GFSK (1Mbps)	39	2441	1.147
(Thisps)	78	2480	1.145
	00	2402	1.161
π/4-DQPSK (2Mbps)	39	2441	1.160
	78	2480	1.157
	00	2402	1.154
8DPSK (3Mbps)	39	2441	1.155
	78	2480	1.145







### GFSK (1Mbps) Channel: 39

<mark>gilent Spectrum Analyzer - Occupied BW</mark>			ALIGN OFF	11:29:12 PM May 06, 20
Center Freq 2.441000000 GHz		Center Freq: 2.441000 Trig: Free Run	Radio Std: None	
	#IFGain:Low	#Atten: 10 dB	Avg Hold:>10/10	Radio Device: BTS
) dB/div Ref 106.99 dB	IV	·		
0.0				
.0		m		
.0				
0				
.0	-0			
0 marge your	ww			
.0			WW	wwwwwwwwww
.0				
1.0				
enter 2.441 GHz				Span 5 Mi
Res BW 100 kHz		#VBW 300 k	Sweep 1 n	
Occupied Bandwidth	ו	Total Power	95.8 dBµV	
	97.19 kHz			
Transmit Freq Error	2.884 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.147 MHz	x dB	-20.00 dB	
3			STATUS	



GFSK (1Mbps) Channel: 78

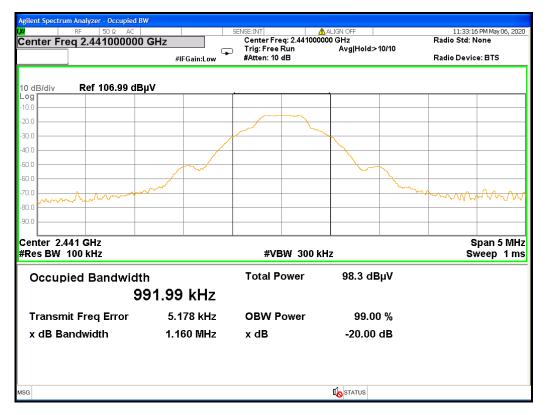
Agilent Spectrum Analyzer -								
Zenter Freq 2.480		9	ENSE:INT	4q: 2.48000000	LIGN OFF		11:30:55 Radio Std: N	5 PM May 06, 2020 Ione
			Trig: Free Run Avg Hold:>10/10 #Atten: 10 dB			Radio Device: BTS		
10 dB/div         Ref 10           Log	06.99 dBµV							
-70.0 -80.0 -90.0	Amman						ma	hand
Center 2.48 GHz #Res BW 100 kHz			#VE	3W 300 kH;	Z			pan 5 MHz veep 1 ms
Occupied Bar	ndwidth 986.88	8 kHz	Total P	ower	95.9 dE	βµV		
Transmit Freq E	Frror 9.9	90 kHz	OBW P	ower	99.0	0%		
x dB Bandwidth	1.1	45 MHz	x dB		-20.00	dB		
MSG					<b>I</b> STATUS			

### π/4-DQPSK (2Mbps) Channel: 00

RF 50Ω AC			ALIGN OFF	11:31:53 PM May 06, 20
enter Freq 2.40200000	GHz	Center Freq: 2.402000 Trig: Free Run	000 GHz Avg Hold:>10/10	Radio Std: None
	#IFGain:Low	#Atten: 10 dB		Radio Device: BTS
) dB/div Ref 106.99 dBµ	V		- <b>h</b>	
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0.0				
0.0				
0.0	/			
0.0				
0.0			~ \	
D.O A D OWN	www.		- Marine Marine	A A
).0 m l l m m m l l -				and more
0.0				
enter 2.402 GHz				Span 5 Mi
Res BW 100 kHz		#VBW 300 k	Hz	Sweep 1 n
Occupied Bandwidth	1	Total Power	98.3 dBµV	
	9.57 kHz			
Transmit Freq Error	3.830 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.161 MHz	x dB	-20.00 dB	



π/4-DQPSK (2Mbps) Channel: 39

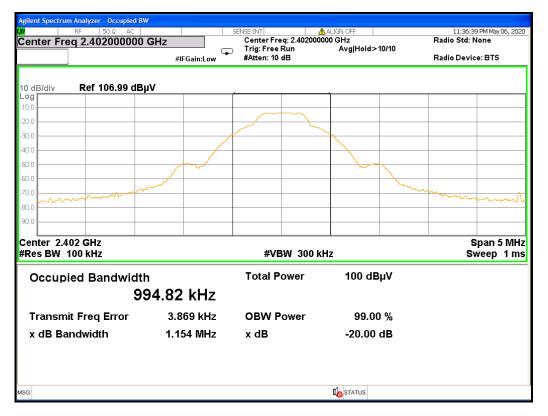


### π/4-DQPSK (2Mbps) Channel: 78

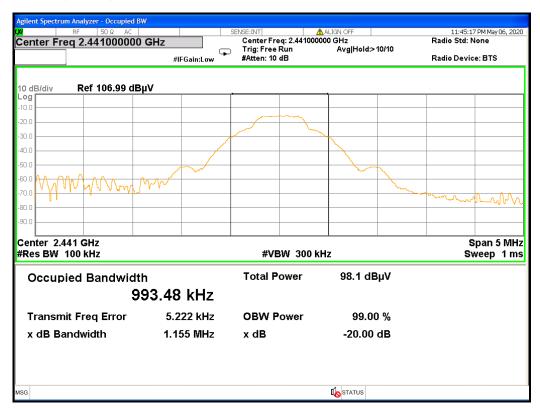
Agilent Spectrum Analyzer - Occupied BV X/ RF 50 Ω AC			ALIGN OFF	11:35:26 PM May 06, 20
Center Freq 2.480000000 GHz		Center Freq: 2.480000 Trig: Free Run	000 GHz Avg Hold:>10/10	Radio Std: None
	#IFGain:Low	#Atten: 10 dB	Avgineia.> ione	Radio Device: BTS
dB/div Ref 106.99 dB	١V			
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0.0			~ ~	
0.0	man and a second s			man A
).0				and the
0.0				
enter 2.48 GHz				Span 5 Mi
Res BW 100 kHz		#VBW 300 k	Hz	Sweep 1 n
Occupied Bandwidth	ו	Total Power	98.1 dBµV	
	97.08 kHz		-	
	9.758 kHz	OBW Power	00.00.0/	
Transmit Freq Error			99.00 %	
x dB Bandwidth	1.157 MHz	x dB	-20.00 dB	
			4	
SG				



8DPSK (3Mbps) Channel: 00

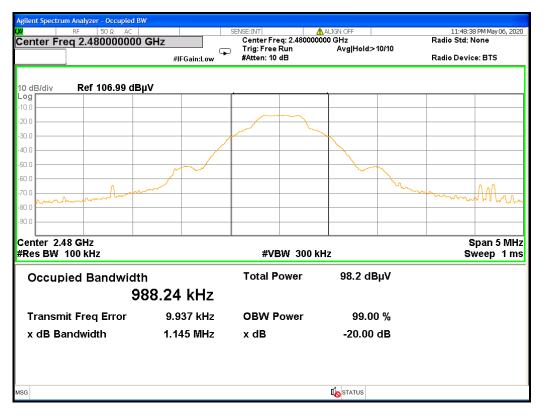


### 8DPSK (3Mbps) Channel: 39





8DPSK (3Mbps) Channel: 78





## 9. Frequencies Separation

## 9.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

## 9.2 Test Procedures

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 100 kHz and VBW to 100 kHz.
- c. By using the MaxHold function record the separation of two adjacent channels.
- d. Measure the frequency difference of these two adjacent channels.

## 9.3 Test Setup Layout



### 9.4 Test Result and Data

Test Date: 2020.05.07 Atmospheric pressure: 1012 hPa Temperature: 23°C

Humidity: 57%

Modulation Standard	Channel	Frequency (MHz)	Frequency Sepration (MHz)
	00	2402	1.000
GFSK (1Mbps)	39	2441	1.000
(100000)	78	2480	1.000
	00	2402	1.000
π/4-DQPSK (2Mbps)	39	2441	1.000
(200000)	78	2480	1.000
	00	2402	1.000
8DPSK (3Mbps)	39	2441	1.000
(0600)	78	2480	1.000



GFSK (1Mbps) Channel: 00



GFSK (1Mbps) Channel: 39

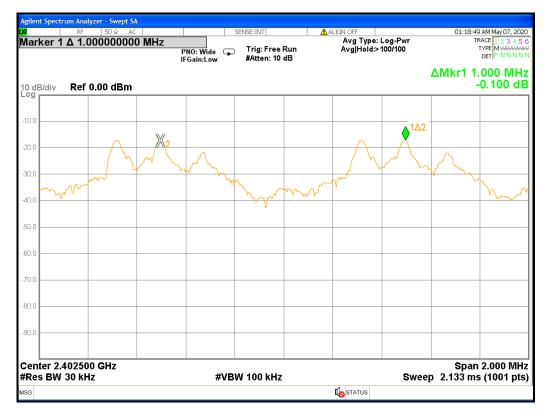




GFSK (1Mbps) Channel: 78



π/4-DQPSK (2Mbps) Channel: 00





π/4-DQPSK (2Mbps) Channel: 39

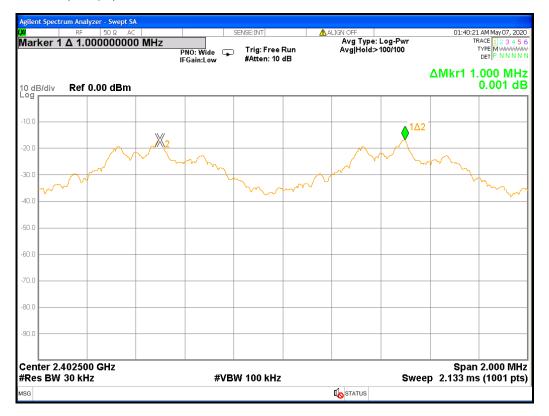


π/4-DQPSK (2Mbps) Channel: 78





8DPSK (3Mbps) Channel: 00



8DPSK (3Mbps) Channel: 39





8DPSK (3Mbps) Channel: 78





## 10. Dwell Time on each channel

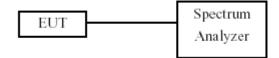
### 10.1 Test Limit

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.

#### **10.2 Test Procedures**

- a. The transmitter output was connected to the spectrum analyzer.
- b. Adjust the center frequency to measure frequency, then set zero span mode.
- c. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
- d. Measure the time duration of one transmission on the measured frequency.

#### 10.3 Test Setup Layout





WH Technology Corp.

#### 10.4 Test Result and Data

Test Date: 2020.05.12

Atmospheric pressure: 1012 hPa

Temperature: 23°C

Humidity: 57%

Modulation Standard	Channel	Frequency (MHz)	Reading Data (ms)	Dwell Time (ms)
	00	2402	0.420	134.4
GFSK DH1	39	2441	0.410	131.2
Biii	78	2480	0.410	134.4
	00	2402	1.680	268.8
GFSK DH3	39	2441	1.670	267.2
Brio	78	2480	1.670	267.2
	00	2402	2.930	312.5
GFSK DH5	39	2441	2.910	310.4
Dilo	78	2480	2.930	312.5
	00	2402	0.420	134.4
π/4-DQPSK 2DH1	39	2441	0.410	131.2
20111	78	2480	0.430	137.6
	00	2402	1.680	268.8
π/4-DQPSK 2DH3	39	2441	1.670	267.2
20110	78	2480	1.660	265.6
	00	2402	2.940	313.6
π/4-DQPSK 2DH5	39	2441	2.930	312.5
20110	78	2480	2.920	311.5
	00	2402	0.430	137.6
8DPSK 3DH1	39	2441	0.410	131.2
0D111	78	2480	0.430	137.6
	00	2402	1.680	268.8
8DPSK 3DH3	39	2441	1.680	268.8
	78	2480	1.680	268.8
	00	2402	2.910	310.4
8DPSK 3DH5	39	2441	2.940	313.6
	78	2480	2.930	312.5

Test period: 0.4(second/ channel) x 79 channel= 31.6 second

Example:

CH00,DH1 mode =  $0.420 \text{ (ms)}^{(1600/2)/79}^{31.6} = 134.4 \text{ (ms)}$ CH00,DH3 mode =  $1.680 \text{ (ms)}^{((1600/4)/79)}^{31.6} = 268.8 \text{ (ms)}$ CH00,DH5 mode =  $2.930 \text{ (ms)}^{((1600/6)/79)}^{31.6} = 312.5 \text{ (ms)}$ 



nt Spectrum Analyzer - Swept SA 01:02:14 AM May 12, 2020 TRACE 1 2 3 4 5 1 TYPE WWWWWWW DET N N N N N \Lambda ALI Marker 1 Δ 420.000 μs Avg Type: Log-Pwr Trig: Free Run #Atten: 10 dB PNO: Fast 😱 IFGain:Low ∆Mkr1 420.0 µs 0.60 dB 10 dB/div Log Ref 0.00 dBm <mark>⊘</mark>1∆2 -10.0 ¥2 -20.0 -30.0 40.0 -50.0 -60.0 70.0 JU. ومل الدور ի հա τu a. 1994 1100 M -80.0 -90.0 11111 π n in t pin n aan Dia Span 0 Hz Sweep 10.00 ms (1001 pts) Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz UNCTION FUNCTION WIDTH FUNCTION VALUE 420.0 μs (Δ) 3.160 ms 0.60 dB -11.86 dBm > **I**STATUS ISG

#### GFSK (1Mbps) Rate: DH1 Channel: 00

GFSK (1Mbps) Rate: DH1 Channel: 39

Agilent Spectrum Analyzer - Swe							
μα Marker 1 Δ 410.000	- F	PNO: Fast	<sup>SE:INT</sup> Trig: Free Run #Atten: 10 dB	ALIGN OFF	「ype: Log-Pwr	TR	AM May 12, 2020 ACE 1 2 3 4 5 6 TYPE WWWWWW DET N N N N N
10 dB/div Ref 0.00 di	Bm					ΔMkr1	410.0 μs -0.04 dB
-10.0		₩ <u>2</u> _'	1Δ2				
-20.0							
-30.0							
-50.0							
-60.0							
-70.0 7	Trading to 1	al a shine	TESTIN	Malarta	The state	Mala Tre	and the second
-90.0		, , , , , , , , , , , , , , , , , , ,	(iiid) (i)	adalaki, ji	init min	<b>U</b> A BARA	ahija jita
Center 2.441000000 C Res BW 1.0 MHz	GHz	#VBW	1.0 MHz		Swe	ep 10.00 ms	Span 0 Hz (1001 pts)
MKR         MODE         TRC         SCL           1         Δ2         1         t         (Δ)           2         F         1         t         3           4         5         6         6         7           8         8         8         8         8	х 410.0 µs 3.880 ms	Y (∆) -0.04 c -9.29 dB		FUNCTION WIDTH	<b>↓</b>	FUNCTION VALUE	
8 9 10 11							~
MSG				I STATU	s		



nt Spectrum Analyzer - Swept SA 01:03:39 AM May 12, 2020 TRACE 1 2 3 4 5 1 TYPE WWWWWW DET N N N N N 🔥 ALI) Marker 1 Δ 410.000 μs Avg Type: Log-Pwr Trig: Free Run #Atten: 10 dB PNO: Fast 😱 IFGain:Low ∆Mkr1 410.0 µs -0.07 dB 10 dB/div Ref 0.00 dBm Δ1Δ2 -10.0 ₩2 -20.0 -30.0 -40.0 -50.0 -60.0 -70.0 de la tra **A** Her al att . Lol. o h fla -80.0 -90.0 thirp, s 1 WARD n i film A PLAN A Span 0 Hz Sweep 10.00 ms (1001 pts) Center 2.480000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz FUNCTION VALUE FUNCTION WIDTH INCTION 410.0 μs (Δ) 2.690 ms -0.07 dB -11.23 dBm > **I**STATUS ISG

#### GFSK (1Mbps) Rate: DH1 Channel: 78

GFSK (1Mbps) Rate: DH3 Channel: 00

Marker 1 Δ 1.68000 ms         PN0: Fast IFGain:Low         Trig: Free Run #Atten: 10 dB         Avg Type: Log-Pwr         TRAC           PN0: Fast IFGain:Low         Trig: Free Run #Atten: 10 dB         Trig: Free Run #Atten: 10 dB         D         D           10 dB/div         Ref 0.00 dBm         1Δ2         1         1         1           -200         1Δ2         1         1         1         1         1           -300         2         1	AM May 12, 20	01:06:25		ALIGN OFF		T	SENSE:		AC	50Ω.	RF			
0 dB/div         Ref 0.00 dBm           00         1Δ2           00         22           00         22           00         22           00         22           00         22           00         22           00         22           00         22           00         22           00         22           00         23           00         24           00         24           00         24           00         24           00         24           00         24           00         24           00         24           00         24           00         24           00         24           00         24           10         24           10         24           10         24           10         24           10         24           10         24           10         24           10         24           10         24 <td< th=""><th>ACE 1 2 3 4 YPE WWWWW DET N N N N</th><th>TR. T</th><th>: Log-Pwr</th><th>Avg Type</th><th></th><th></th><th></th><th>PNO: F IFGain:</th><th>ns</th><th>68000 m</th><th>1.6</th><th>r <b>1 /</b></th><th>rke</th><th>lar</th></td<>	ACE 1 2 3 4 YPE WWWWW DET N N N N	TR. T	: Log-Pwr	Avg Type				PNO: F IFGain:	ns	68000 m	1.6	r <b>1 /</b>	rke	lar
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Δ         Δ												ľ		
Image: state set of the set of	<b>1</b>		and the states			dap		AND .						
Context 2.402000000 GHz         #VBW 1.0 MHz         Function         Sweep 10.00 ms (           S BW 1.0 MHz         #VBW 1.0 MHz         Sweep 10.00 ms (           MODE         FOR         FUNCTION         FUNCTION WIDTH           A2 1         t         (Δ)         1.680 ms (Δ)         0.06 dB           F         1         t         2.920 ms         -11.30 dBm					-									
Server         ¥VBW 1.0 MHz         Sweep 10.00 ms (           Model TRC         Sci         ×         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ2         1         t         (Δ)         1.680 ms (Δ)         0.06 dB           F         1         t         2.920 ms         -11.30 dBm	- <b>1</b> ,		di na tata		1	-Uhaa		Jun M	<b>II</b> .			1	1	.0
Product TRC         Science         X         Y         FUNCTION         FUNCTION width         FUNCTION value           Δ2         1         t         (Δ)         1.680 ms (Δ)         0.06 dB         F         1         t         2.920 ms         -11.30 dBm           F         1         t         2.920 ms         -11.30 dBm         F         -11.30 dBm         <	Span 0 H					1.046				0000 GH	0200	2.40	nter	٩r
Δ2         1         t         (Δ)         1.680 ms         (Δ)         0.06 dB           F         1         t         2.920 ms         -11.30 dBm			Sweep			MHz	#VBW 1.							
F 1 t 2.920 ms -11.30 dBm		NCTION VALUE	FUN	CTION WIDTH	FL	FUNC	Y					e trc		
										(Δ)			Δ <u>2</u>	
							-11.50 0.511	520 ma	4		,			
														)
	>													



ent Spectrum Analyzer - Swept SA 01:05:40 AM May 12, 2020 TRACE 1 2 3 4 5 1 TYPE WWWWWW DET N N N N N 🛕 ALIO Marker 1 Δ 1.67000 ms Avg Type: Log-Pwr Trig: Free Run #Atten: 10 dB PNO: Fast 😱 IFGain:Low ΔMkr1 1.670 ms -0.07 dB 10 dB/div Ref 0.00 dBm **∆**1∆2 <mark>∦⁄2</mark> -10.0 -20.0 -30.0 -40.0 -50.0 -60.0 70.0 41.6.4.6 . د المالي 11/1 -80.0 -90.0 (SÈ di 10 Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 10.00 ms (1001 pts) #VBW 1.0 MHz UNCTION FUNCTION WIDTH FUNCTION VALUE -0.07 dB -10.09 dBm 1.670 ms (∆) 3.550 ms > **I**STATUS ISG

#### GFSK (1Mbps) Rate: DH3 Channel: 39

GFSK (1Mbps) Rate: DH3 Channel: 78

nt Spectrum Analyzer - Swe RF 50 Ω	AC	SENSE:II	T	🛕 ALIGN OFF		01:04:58 AM May 12,
ker 1 Δ 1.67000 ι	<b>ms</b> PNO: F IFGain:		g: Free Run ten: 10 dB	Ауд Туре	e: Log-Pwr	TRACE 1 2 3 TYPE WWW DET N N N
B/div Ref 0.00 dE	3m				L	Mkr1 1.670 -0.07
	N//		<u></u> 1∆2			
	A REAL PROVIDE		a le lerin		The other	
					11 .	
	THE REAL PROPERTY OF		<ul> <li>Make p</li> </ul>			
nter 2.480000000 G BW 1.0 MHz	iHz	#VBW 1.0	MHz		Sweep 1	Span 0 ا 10.00 ms (1001
MODE TRC SCL $\Delta 2 = 1 + t + (\Delta)$	× 1.670 ms (Δ)	Y -0.07 dB	FUNCTION	FUNCTION WIDTH	FUNCI	ION VALUE
Δ2 1 t (Δ) F 1 t	3.180 ms	-0.07 dB -11.59 dBm				



nt Spectrum Analyzer - Swept SA 01:07:13 AM May 12, 2020 TRACE 1 2 3 4 5 1 TYPE WWWWWW DET N N N N N 🛕 ALI Marker 1 Δ 2.93000 ms Avg Type: Log-Pwr Trig: Free Run #Atten: 10 dB PNO: Fast 😱 IFGain:Low ΔMkr1 2.930 ms 0.65 dB 10 dB/div Ref 0.00 dBm ▲1∆2 ₩2 -10.0 -20.0 -30.0 -40.0 -50.0 -60.0 70.0 المتر بالمات -80.0 -90.0 VP/H T'N F ባተ፣ Span 0 Hz Sweep 10.00 ms (1001 pts) Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz UNCTION FUNCTION WIDTH FUNCTION VALUE 2.930 ms (Δ) 4.380 ms 0.65 dB -10.18 dBm > **I**STATUS ISG

#### GFSK (1Mbps) Rate: DH5 Channel: 00

GFSK (1Mbps) Rate: DH5 Channel: 39

	RF	zer - Swept SA 50 Ω AC			ENSE:INT	AL.	IGN OFF		01:07:54 AMI	May 12, 202
arker 1	Δ 2.9	1000 ms		NO: Fast 😱 Gain:Low	Trig: Free Rui #Atten: 10 dB		Avg Type:	Log-Pwr	TRACE TYPE	1 2 3 4 5 WWWWW N N N N N
	Dof (	).00 dBm							ΔMkr1 2.9 -0	10 m .08 dl
dB/div	Reit					<b>Δ</b> 1Δ2				
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).0						_				
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.0										
		1º Providen				in the second			11	President
		- AIAIA	41			La M <sup>1</sup> in La	1			pi il,
enter 2.4 s BW 1		0000 GHz z		#VB\	V 1.0 MHz			Sweep	Sp 10.00 ms (1	an 0 H 001 pt
R MODE TF		×	0.010	Y A	FUNCTIO 8 dB	IN FUNCTI	ON WIDTH	FL	INCTION VALUE	
Δ2 1 F 1	t (/	(2	2.910 ms ( 2.450 ms	( <u>A)</u> -0.0 -10.79 (						
i										
i										
3										
)										
										>



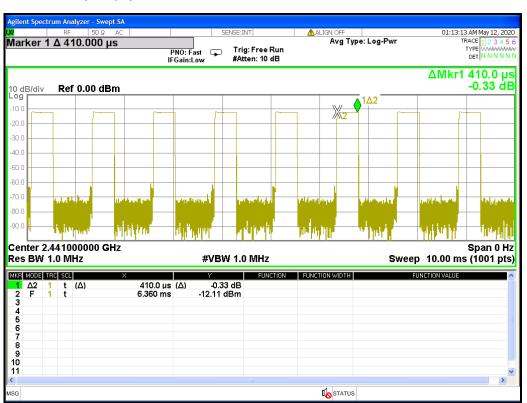
GFSK (1Mbps) Rate: DH5 Channel: 78



π/4-DQPSK (2Mbps) Rate: 2DH1 Channel: 00

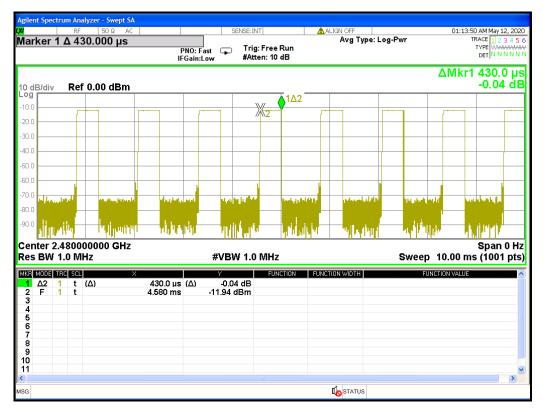
	um Analyzer - Sw							
₩ Marker 1	RF 50 Ω Δ 420.000	us		ISE:INT	ALIGN OFF	/pe: Log-Pwr	TR.	AM May 12, 2020 ACE 1 2 3 4 5 6
		- P	'NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 10 dB			Т	DET N N N N N N
							∆Mkr1	420.0 µs
10 dB/div Log	Ref 0.00 d	Bm				A 140		-0.06 dB
-10.0	1 1-		-1 [					
-20.0								_
-30.0								
-40.0								
-50.0								
-70.0								
-80.0	10 State (11	PARTY I		POP DE LE P	The second s	diseased.	strangter.	Territor.
-90.0 i.	thanks to	The state of the s	n di sil	I LAND	A kuldura	ull lis a		
Center 2 /	102000000 (			400 P		Pariat	in the second	Span 0 Hz
Res BW 1		9112	#VBW	1.0 MHz		Swee	ep 10.00 ms	(1001 pts)
MKR MODE TR		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	^
1 Δ2 1 2 F 1	t (Δ) t	420.0 μs 6.440 ms	(Δ) -0.06 d -10.60 dE					
3 4								
5 6								
7 8 9								
10								
11								>
MSG					<b>I</b> o statu	s		



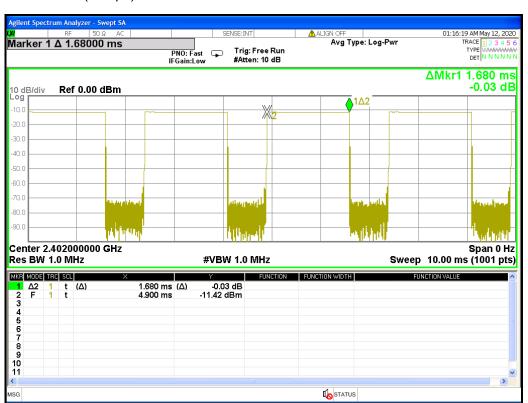


π/4-DQPSK (2Mbps) Rate: 2DH1 Channel: 39







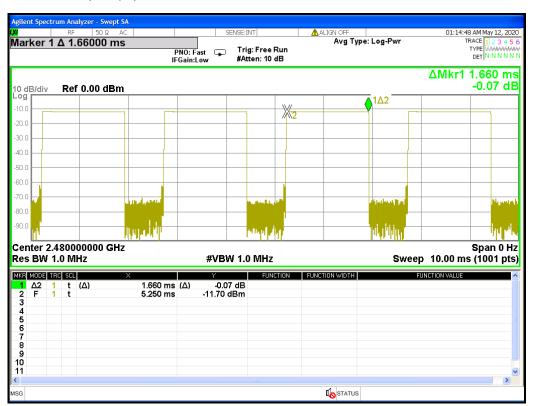


 $\pi$ /4-DQPSK (2Mbps) Rate: 2DH3 Channel: 00

π/4-DQPSK (2Mbps) Rate: 2DH3 Channel: 39

RF	- Swept SA 50 Ω AC	SENSE	INT	ALIGN OFF	01:15:32 AM May 12, 3
ker 1 Δ 1.670		PNO: Fast	rig: Free Run Atten: 10 dB	Avg Type: Log-F	
B/div Ref 0.0	0 dBm				∆Mkr1 1.670 r -0.06 c
				1∆2	
			¥ <u>2</u>		
			<b></b>		
	Amilda		1	"nj <sup>j</sup> išpit	Lits John
nter 2.44100000 BW 1.0 MHz	00 GHz	#VBW 1	.0 MHz		Span 0 Sweep 10.00 ms (1001 p
Mode tro SCL $\Delta 2$ 1 t ( $\Delta$ )		ms (Δ) -0.06 dE		FUNCTION WIDTH	FUNCTION VALUE
F 1 t	4.600	ms -11.99 dBm	1		



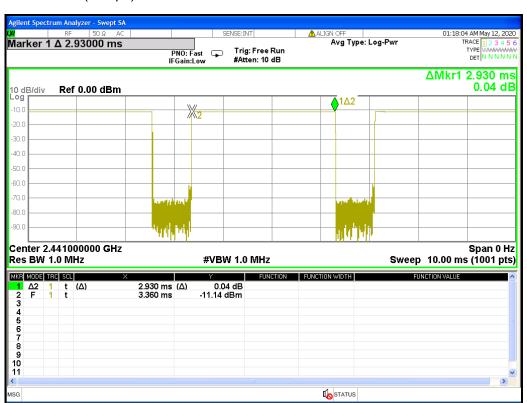


π/4-DQPSK (2Mbps) Rate: 2DH3 Channel: 78

π/4-DQPSK (2Mbps) Rate: 2DH5 Channel: 00

gilent Spectr	r <mark>um Analyzer - Swe</mark> RF 50 Ω	AC	SENSE	INT	ALIGN OFF		01:17:24 AM N	Apy 12, 202
	Δ 2.94000 I	ms	PNO: Fast TI	rig: Free Run Atten: 10 dB		e: Log-Pwr	TRACE	1 2 3 4 5 WWWWW N N N N N
0 dB/div	Ref 0.00 dB	Зm					∆Mkr1 2.9 -0.	40 m 47 di
. <b>og</b> 10.0							1Δ2	
20.0				7 *	2		<b>-</b>	
30.0								
40.0								
50.0								
0.0								
0.0	and publications in			Therefore			4 brows	
0.0	i <sub>len</sub> ival			phaging phil				
enter 2.4 es BW 1	402000000 G I.0 MHz	iHz	#VBW 1	.0 MHz		Sweep	Sp 10.00 ms (10	an 0 H )01 pt
Kr mode tr <mark>1</mark> ∆2 1	t (Δ)	× 2.940 ms	Y : (∆) -0.47 dE		FUNCTION WIDTH	FU	NCTION VALUE	
2 F 1 3	t	5.380 ms	-12.20 dBm	1				
4 5								
5 7								
8 9								
D 1								
					· · · · · ·			>
					<b>I</b> STATUS			



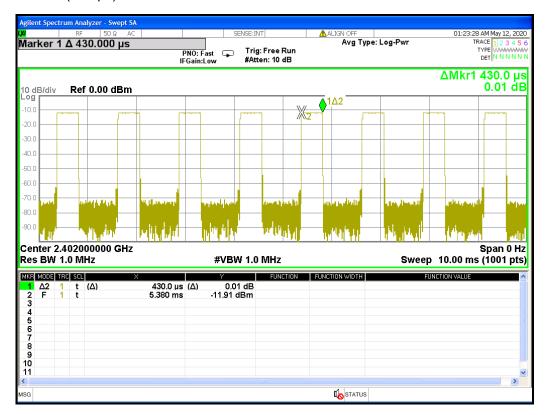


π/4-DQPSK (2Mbps) Rate: 2DH5 Channel: 39

π/4-DQPSK (2Mbps) Rate: 2DH5 Channel: 78

Ient Spectrum Analyzer - Swept SA RF 50 Ω AC	SENSE:INT	ALIGN OFF	01.10	(F. 614 May 10, 00
arker 1 Δ 2.92000 ms				45 AM May 12, 20 TRACE 1 2 3 4 5 TYPE WWWW
	PNO: Fast 😱 Trig: F IFGain:Low #Atten	: 10 dB		DET N N N N
			∆Mkr1	2.920 m -0.07 d
dB/div Ref 0.00 dBm			▲1∆2	-0.07 G
1.0	· · · · · · · · · · · · · · · · ·	X2		
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	la di in d	1	L. silice	
<u>ין אירט א</u>	11.4.00		t N (Day)	
enter 2.480000000 GHz es BW 1.0 MHz	#VBW 1.0 N	1Hz	Sweep 10.00 m	Span 0 l s (1001 p
r Mode TRC SCL X	Y I	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
Δ2 1 t (Δ) F 1 t	2.920 ms (∆) -0.07 dB 4.770 ms -12.09 dBm			
	1.100 42.00			



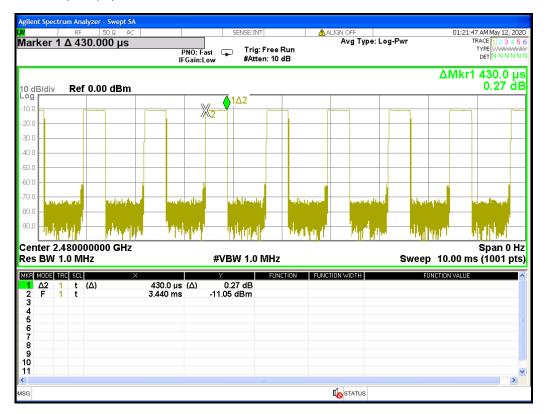


#### 8DPSK (3Mbps) Rate: 3DH1 Channel: 00

8DPSK (3Mbps) Rate: 3DH1 Channel: 39

Agilent Spectrum Analyzer - Swept SA				
Marker 1 Δ 410.000 μs		INT ALI ig: Free Run tten: 10 dB	IGN OFF Avg Type: Log-Pwr	01:22:51 AM May 12, 2020 TRACE 1 2 3 4 5 6 TYPE WAAWAAA DET N N N N N N
10 dB/div Ref 0.00 dBm				ΔMkr1 410.0 μs -0.06 dB
Log				
-20.0		X2-		
-30.0				
-40.0				
-50.0				
-60.0				
-70.0 min. brook -	plana paperne	ल जुल्लाकर्षात्र	and Barpate	anitala anitala anitala
	iti atha sa aiti dha	n naj pisti	Just H. Sala	halin kajinaka
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 1.	0 MHz	Swe	Span 0 Hz ep 10.00 ms (1001 pts
MKR MODE TRC SCL × 1 Δ2 1 t (Δ) 2 F 1 t	410.0 μs (Δ) -0.06 dB 4.590 ms -12.33 dBm	FUNCTION FUNCTI	ON WIDTH	FUNCTION VALUE
3 4				
5				
7 8				
9 10				
11 <b>(</b>				>
ISG		[	STATUS	





8DPSK (3Mbps) Rate: 3DH1 Channel: 78

8DPSK (3Mbps) Rate: 3DH3 Channel: 00

RF	50 Ω AC	SENSE:I	NT	🛕 ALIGN OFF		01:24:29 AM May 12, 20
rker 1 Δ 1.68	3000 ms		g: Free Run ten: 10 dB	Avg Type: Log		TRACE 1 2 3 4 1 TYPE WWWWW DET N N N N N
dB/div Ref0	.00 dBm				۵N	lkr1 1.680 m -0.03 d
			N.//	1∆2		
	and a start of the	in the second	1-p. c	the states		is a second second
	_					
	<b>CALCER</b>		alte	idea dat	1	JIN, LINA
nter 2.402000	000 GHz					Span 0
BW 1.0 MHz		#VBW 1.0	) MHz		Sweep 10.0	00 ms (1001 p
MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION	VALUE
Δ2 1 t (Δ F 1 t	.) 1.680 ı 4.880 ı					
	4.0001	13 -12.02 dDin				
						)
						>



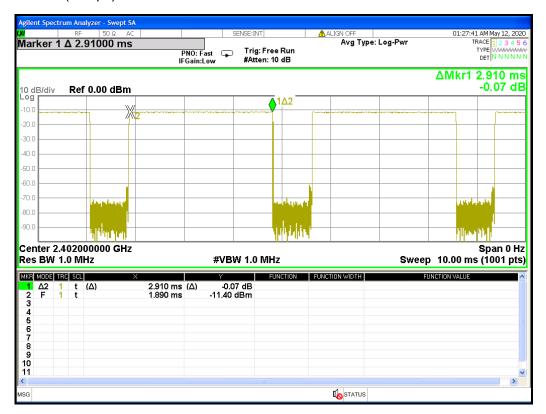


8DPSK (3Mbps) Rate: 3DH3 Channel: 39

8DPSK (3Mbps) Rate: 3DH3 Channel: 78

RF 50	Swept SA	SENSE:INT	ALIGN OFF	01:25:45 AM May 12, 202
arker 1 Δ 1.6800		at 👝 Trig: Free Run	Avg Type: Log-Pw	
0 dB/div Ref 0.00	dBm			ΔMkr1 1.680 m -0.41 d
<b>9</b> 0.0		1∆2		
0.0	X			
.0				
.0				
.0		and a data		
	internal (			
0.0 <b>J</b> acobiat	ada i tal	. dibilits of		a alt
enter 2.480000000 es BW 1.0 MHz	) GHz	#VBW 1.0 MHz		Span 0 H Sweep 10.00 ms (1001 pt
R MODE TRC SCL	×	Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
Δ2 1 t (Δ) 2 F 1 t	1.680 ms (∆) 3.120 ms	-0.41 dB -10.51 dBm		
3 L				
5				
3				
)				
D				
				>



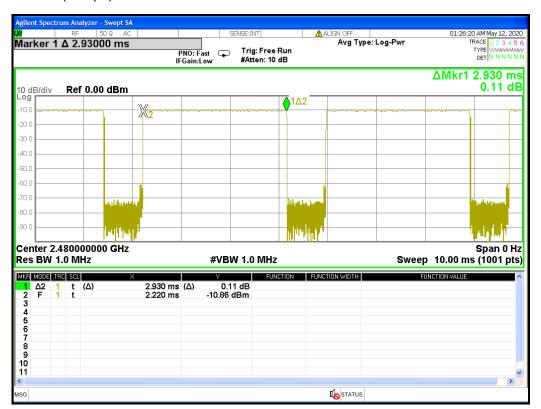


8DPSK (3Mbps) Rate: 3DH5 Channel: 00

8DPSK (3Mbps) Rate: 3DH5 Channel: 39

RF 50 Ω AC		SENSE:INT	ALIGN OFF	01:27:02 AM May 12
arker 1 Δ 2.94000 ms	PNO: Fast IFGain:Lov	Trig: Free Run W #Atten: 10 dB	Avg Type: Log-Pv	WY TRACE 1 2 3 TYPE WWW DET N N N
dB/div Ref 0.00 dBm				∆Mkr1 2.940 -0.04
9				_1Δ2
.0				
.0				
0				
0				
) as lead (P <sup>1</sup> ).		a support		Philipping .
)		a static		
nter 2.441000000 GHz				Span (
s BW 1.0 MHz		#VBW 1.0 MHz	\$	Spand Sweep 10.00 ms (1001
MODE TRC SCL X		Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
Δ2 1 t (Δ)	2.940 ms (Δ)	-0.04 dB		
F 1 t	4.940 ms -	12.02 dBm		





8DPSK (3Mbps) Rate: 3DH5 Channel: 78



WH Technology Corp.

# 11. Number of Hopping Channels

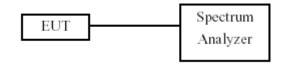
## 11.1 Test Limit

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

#### 11.2 Test Procedures

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 100 kHz and VBW to 100 kHz.
- c. Set the MaxHold function, and then keep the EUT in hopping mode.Record all the signals from each channel until each one has been record.

#### 11.3 Test Setup Layout



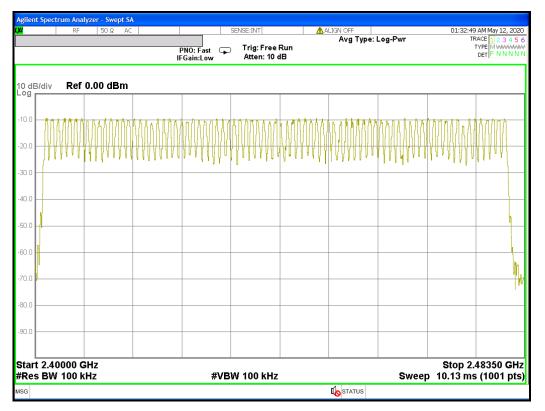
#### 11.4 Test Result and Data

Test Date: 2020.05.12 Atmospheric pressure: 1012 hPa Temperature: 23°C Humidity: 57%

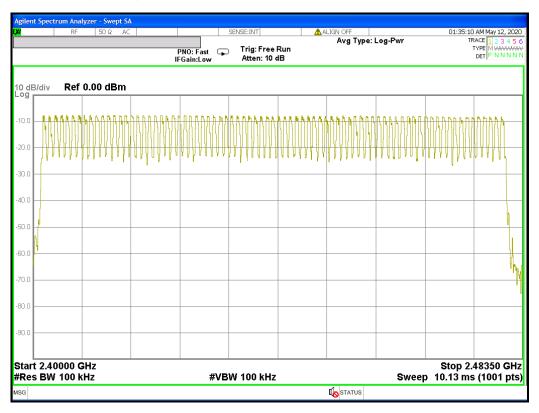
Modulation Standard	Hopping Channels
GFSK (1Mbps)	79
π/4-DQPSK (2Mbps)	79
8DPSK (2Mbps)	79



GFSK (1Mbps)

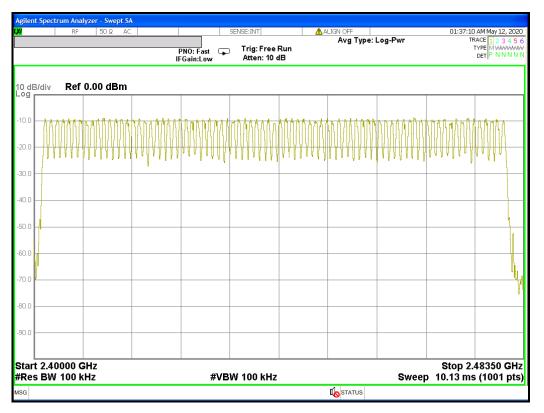


#### π/4-DQPSK (2Mbps)





8DPSK (3Mbps)





## 12. Maximum Peak Output Power

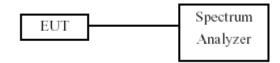
#### 12.1 Test Limit

The Maximum Peak Output Power Measurement is 30 dBm.

#### **12.2 Test Procedures**

The transmitter output was connected to the spectrum analyzer. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

#### 12.3 Test Setup Layout



#### 12.4 Test Result and Data

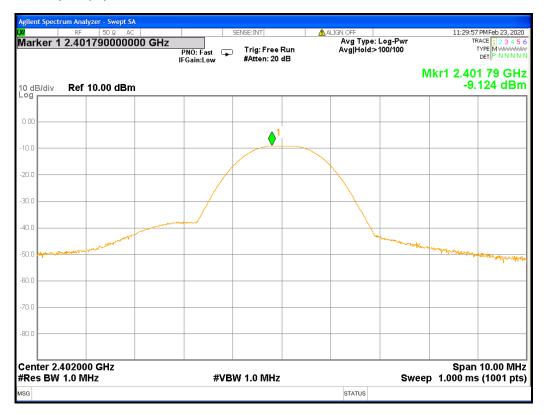
Test Date: 2020.02.23 Atmospheric pressure: 1012 hPa Temperature: 23°C

Humidity: 57%
---------------

Modulation Standard	Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
	00	2402	-9.124	0.122349
GFSK (1Mbps)	39	2441	-9.086	0.123424
(Thisps)	78	2480	-8.498	0.141319
	00	2402	-8.727	0.134060
π/4-DQPSK (2Mbps)	39	2441	-8.860	0.130017
(2000)	78	2480	-8.382	0.145144
	00	2402	-8.906	0.128647
8DPSK (3Mbps)	39	2441	-8.820	0.131220
(0.0000)	78	2480	-8.331	0.146859



GFSK (1Mbps) Channel: 00

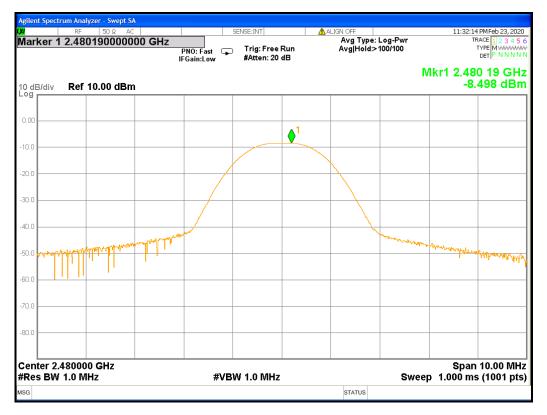


GFSK (1Mbps) Channel: 39

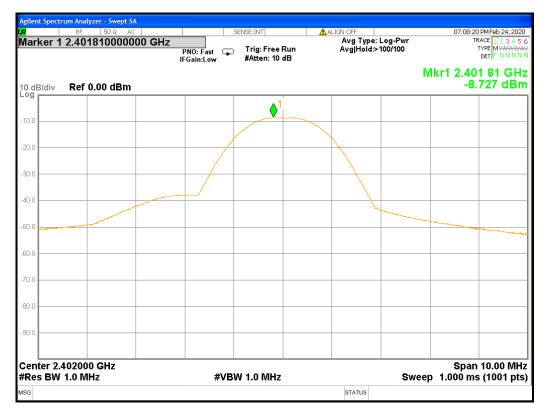




GFSK (1Mbps) Channel: 78



π/4-DQPSK (2Mbps) Channel: 00

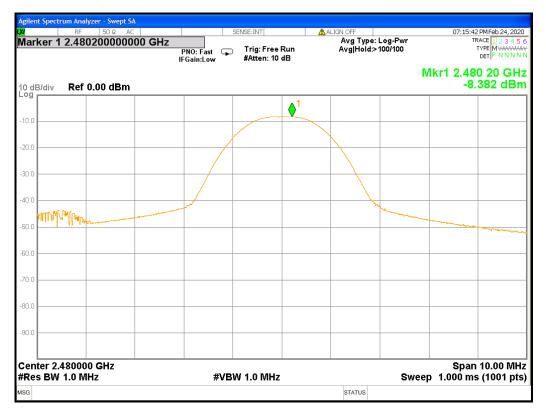




π/4-DQPSK (2Mbps) Channel: 39



π/4-DQPSK (2Mbps) Channel: 78

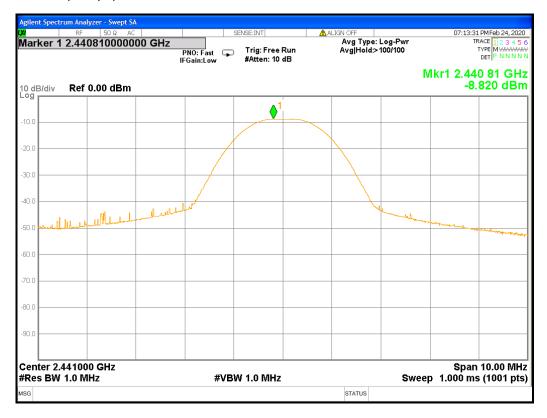




8DPSK (3Mbps) Channel: 00



8DPSK (3Mbps) Channel: 39





8DPSK (3Mbps) Channel: 78





## 13. Band Edges Measurement

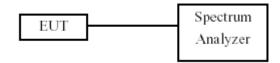
#### 13.1 Test Limit

Below – 20 dB of the highest emission level of operating band (In 100 kHz Resolution Bandwidth)

#### 13.2 Test Procedure

- a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
- b. Set both RBW and VBW of spectrum analyzer to 100 kHz with convenient frequency span including 100 kHz bandwidth from band edge.
- c. The band edges was measured and recorded.

#### 13.3 Test Setup Layout



#### 13.4 Test Result and Data

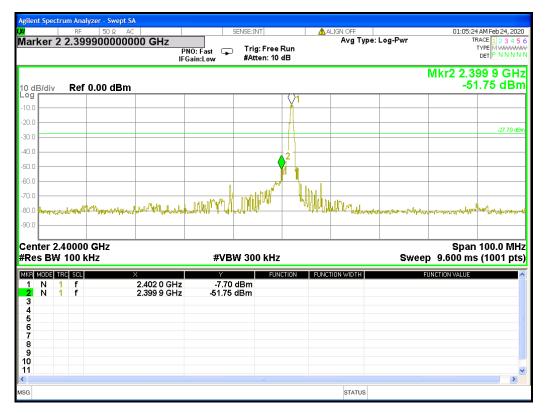
Test Date: 2020.02.24 Atmospheric pressure: 1012 hPa Temperature: 23°C

Humidity: 57%

Modulation Standard	Channel	Frequency (MHz)	maximum value in frequency (MHz)	maximum value (dBm)
GFSK	00	2402	2399.9	-51.75
(1Mbps)	78	2480	2483.5	-64.81
π/4-DQPSK	00	2402	2399.8	-54.23
(2Mbps)	78	2480	2483.5	-65.99
8DPSK	00	2402	2399.8	-55.43
(3Mbps)	78	2480	2483.5	-73.00



GFSK (1Mbps) Channel: 00

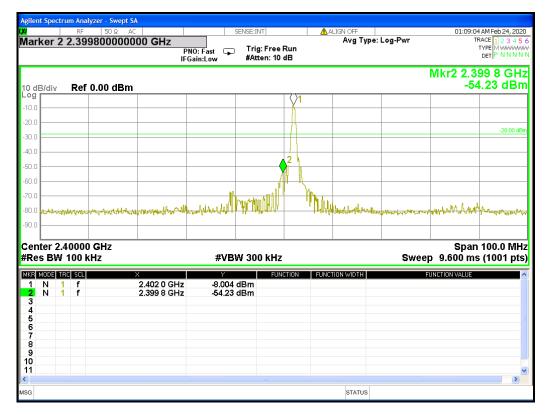


#### GFSK (1Mbps) Channel: 78

F	RF 50Ω AC		SEI	NSE:INT	ALIGN OFF		01:12:07 AM Feb 24, 20
arker 2 2.4	1835000000	PN	IO: Fast 😱 ain:Low	Trig: Free Run #Atten: 10 dB	Avg Tyj	e: Log-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P N N N
	ef 0.00 dBm						Mkr2 2.483 5 GH -64.81 dB
<b>9</b> .0				V1			
.0							-26.73 (
.0							
0							
0				2			
0 Jantachitela	When me many M	a de artentor			Mary Hall Marchan		
		ANTAL ALAbort	11111.			Mral Marah	Marga My marked and the second of the second
nter 2.483	50 OU-						Onen 100.0 M
es BW 100			#VBW	300 kHz		Swee	Span 100.0 M p   9.600 ms (1001 p
N 1 f N 1 f	•	× 2.480 0 GHz 2.483 5 GHz	-6.732 di -64.81 di		FUNCTION WIDTH		FUNCTION VALUE
							>



π/4-DQPSK (2Mbps) Channel: 00

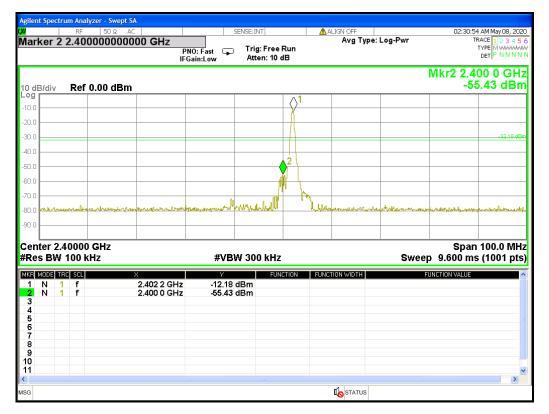


π/4-DQPSK (2Mbps) Channel: 78

gilent Spectrum Analyzer - Sv			A	
RF   50 : larker 2 2.4835000	000000 GHz	sense:INT ast Trig: Free Run Low #Atten: 10 dB	ALIGN OFF Avg Type: Log-Pwr	01:10:57 AM Feb 24, 20 TRACE 1 2 3 4 5 TYPE MWWW DET P N N N
0 dB/div Ref 0.00 d	lBm			Mkr2 2.483 5 GH -65.99 dBr
<b>og</b>		V1		
0.0				-26.54 dt
0.0				
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		2		
	Warmen Milling Jack Marow ra	rmmulta <sup>n m</sup> ula	1111000000	n
).0 month and the second se		TÎ IIL TÎNXÎ AN A ANDÂN	Manunprocession	oglite de gitter to contrada a ser de la contrada de
enter 2.48350 GHz Res BW 100 kHz		#VBW 300 kHz	Sw	Span 100.0 Mł eep   9.600 ms (1001 pt
R MODE TRC SCL 1 N 1 f 2 N 1 f 3	× 2.480 0 GHz 2.483 5 GHz	Y FUNCTION -6.54 dBm -65.99 dBm	FUNCTION WIDTH	FUNCTION VALUE
5				
3 9 1				
3			STATUS	



8DPSK (3Mbps) Channel: 00



#### 8DPSK (3Mbps) Channel: 78

RF 50	Swept SA	SENSE:INT	A	ALIGN OFF	02:32:46 AM May 08, 1
arker 2 2.485000	0000000 GHz		ree Run	Avg Type: Log-F	
dB/div Ref 0.00	dBm				Mkr2 2.485 0 G -73.00 dE
9 <b>9</b>			1		
		X			
					-34.53
.0					-34.53
.0					
.0			<u>}</u>		
.0		l marker	$\wedge^2$		
0 Commence	waterman	velower Illian	WWWhatmas	artimental property and a second	and the second state of the second states and
.0					
enter 2.48350 GHz	,				Span 100.0 M
Res BW 100 kHz	<u>-</u>	#VBW 300 k	Hz		Sweep 9.600 ms (1001 p
R MODE TRC SCL N 1 f	× 2.480 0 GHz	14.529 dBm	FUNCTION FUI	NCTION WIDTH	FUNCTION VALUE
2 N 1 f	2.485 0 GHz	-73.00 dBm			
3					



Po	ower	:	DC 3V					Pol/	/Phase		:	HORIZO	NTAL
Те	mperatur	re :	18 °C					Hun	nidity		:	71 %	
	st Mode		CH LO	8 HI -	- Restric	cted E	Bands	Mer	no		:	GFSK	
) Le	vel (dBuV/r	m)										Date: 2	020-02-24
													LASS-B
<b>-</b>													
												CLASS	D (AVC)
,				-						2			-B (AVG)
23	00 233	30. 2	350. 23	370. 2		410. reque	2430. ncy (MHz	<b>24</b> 50. )	2470.	24	90.	2510. 2	530. 255
			R	ead					Lim	it		Over	
	I	Fred	l Le	vel	Fact	or	Lev	el	Li	ne	L	imit	Rema
-		MHz	d d	BuV	dE	8/m	dBuV	/m	dBuV	/ m		dB	
	2387	.300	55	.57	-10.	06	45.	51	74.	00	- 2	8.49	Peak
0	2483	.500	60	.16	-9.	87	50.	29	74.	00	- 2	3.71	Peak

### 13.5 Restrict Band Emission Measurement Data

Note:

1. Result = Meter Reading + Factor

- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



Pc	ower	:	DC 3\	/				Pol	/Phase		:	VERTIC	CAL
Те	mperatu	ire :	18 °C					Hur	nidity		:	71 %	
Те	st Mode	:	CHLC	D & HI	– Rest	ricted I	Bands	Me	mo		:	GFSK	
	vel (dBuV	/m)										Date: 2	020-02-24
													CLASS-B
0													
0													
0										2		CLAS	8-B (AVG)
				1									
0													
0													
0													
0													
0230	00 23	330.	2350. 2	370.	2390.	2410. Freque	2430. ency (MHz	2450	2470.	249	90.	2510. 2	2530. 255
			F	≷ead					Lim	i+		Over	
		Fre	-			tor	Lev	el	Li				Remar
-		МН	z	BuV		B/m	dBuV	//m	dBuV	/m		dB	
	2383	.20	0 54	1.78	-10	. 07	44.	71	74.	<b>0</b> 0	- 2	9.29	Peak
0	2483	.50	0 59	.87	- 9	87	50.	aa	74	aa	- 2	1 99	Peak

- 1. Result = Meter Reading + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



Po	ower	:	DC 3V				Pol/	Phase	HORIZONTAL		
Ter	mperature	:	18 °C				Hur	nidity	:	71 %	
Tes	st Mode	:	CH LO & HI	– Restric	ted E	Bands	Mer	no	:	π/4-DQI	PSK
Le	vel (dBuV/m)									Date: 2	020-02-2
											CLASS-B
-								2		CLAS	s-B (AVG)
				1							
-											
-											
)											
23	00 2330.	2	350. 2370.	2390. 2	410.	2430.	2450	. 2470. 24	190.	2510. 2	530. 25
2.5	2550.	-	550. 2570.			ency (MHz		2470. 24	-50.	2510. 2	.JJU. 2J
			Read					Limit		Over	
	Fre	20	l Level	Fact	or	Lev	el	Line		Limit	Rema
-	MI	Iz	dBuV	dE	8/m	dBu∖	//m	dBuV/m		dB	
	2386.10	96	56.96	-10.	06	46.	90	74.00		27.10	Peak
0	2483.50	20		- 9	97	EQ	00	74.00		22 02	Dook

- 1. Result = Meter Reading + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



Po	Power : DC 3V							Pol/Phase :				VERTICAL		
Te	mperatu	re :	18 °C					Humidity :			:	71 %		
Test Mode : CH LO & HI – Rest						cted Bands Memo			no		: π/4-DQ		PSK	
	vel (dBuV/	m)										Date: 2	020-02-24	
													CLASS-B	
0														
<b>)</b>														
										2		CLASS	8-B (AVG)	
				1						Ĩ				
1														
<b>)</b>								_						
0 <mark>230</mark>	00 23	30. 2	350. 2	370. 2		410. Freque	2430. ncy (MHz	2450. )	2470.	24	90.	2510. 2	2530. 25	
			F	lead					Lim	it		0ver		
		Fre	q Le	vel	Fact	or	Lev	el	Li	.ne	l	Limit	Rema	
-		MH	z c	BuV	dI	3/m	dBu∖	//m	dBuV	/m		dB		
	2382	. 80	<b>o</b> 54	.95	-10	. 07	44.	88	74.	00	-2	29.12	Peak	
0	2483	. 50	a 66	06	- 9	87	50	19	74	<u>aa</u>	- 1	23.81	Poak	

- 1. Result = Meter Reading + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



Po	ower	:	DC 3V						/Phase		: 1	HORIZONTAL		
Te	emperature : 18 °C						Humidity : 71 %							
Test Mode : CH LO & HI – Restricted Bands Memo							no		: 8	BDPSK				
Le	vel (dBuV/m)											Date: 2	020-02-24	
													LASS-B	
0														
										2		CLASS	S-B (AVG)	
					1									
0														
0														
0														
0 <mark>23</mark>	00 2330.	2	350. 23	70. 2		410. reque	2430. ency (MHz	2450 )	. 2470.	249	0. 2	2510. 2	530. 25	
			R	ead					Lim:	it	0	Over		
	Fr	eq	Le	vel	Fact	or	Lev	el	Li	ne	L	imit	Rema	
-	Μ	١Hz	d	BuV	dB	/ m	dBuV	/m	dBuV	/ m		dB		
	2387.9	00	57	. 08	-10.	06	47.	02	74.0	90	-26	5.98	Peak	
0	2483.5	60	59	84	- 9	87	19	97	74 0	aa	- 2/	1 03	Poak	

- 1. Result = Meter Reading + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



Power	:	DC 3V						/Phase	:	VERTICAL		
Temperature				Hur	nidity	71 %						
Test Mode : CH LO & HI – Restricted Bands Memo								:	8DPSK			
0 Level (dBuV/m	1)									Date: 2	2020-02-24	
											CLASS-B	
0				_								
0												
									2	CLAS	S-B (AVG)	
0			1						Ī			
0												
0												
0												
0												
<sup>0</sup> 2300 233	0. Z	350. 23	70. Z		10. reque	2430. ncy (MHz	2450 )	. 2470.	2490.	2510.	2530. 255	
		R	ead					Limi	it	Over		
F	rec	l Le	vel	Fact	or	Lev	el	Lir	ne	Limit	Remai	
	MHz	d	BuV	dB	/ m	dBuV	/m	dBuV/	/m	dB		
2385.	500	55	.16	-10.	07	45.	<b>0</b> 9	74.0	90 -	28.91	Peak	
@ 2483.	FOO	50	24	- 0	07	40	47	74 0	0	24 52	Deele	

- 1. Result = Meter Reading + Factor
- 2. Factor = Antenna Factor + Cable Loss Amplifier
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 10 Hz for Average detection at frequency above 1 GHz.



# 14. Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 - 0.11000	16.42000 – 16.42300	399.9 - 410.0	4.500 - 5.150
0.49500 - 0.505**	16.69475 – 16.69525	608.0 - 614.0	5.350 - 5.460
2.17350 - 2.19050	16.80425 – 16.80475	960.0 - 1240.0	7.250 – 7.750
4.12500 - 4.12800	25.50000 - 25.67000	1300.0 - 1427.0	8.025 - 8.500
4.17725 – 4.17775	37.50000 - 38.25000	1435.0 – 1626.5	9.000 - 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 - 9.500
6.21500 - 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 - 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 - 13.400
6.31175 – 6.31225	123.00000 - 138.00000	2200.0 - 2300.0	14.470 – 14.500
8.29100 - 8.29400	149.90000 - 150.05000	2310.0 - 2390.0	15.350 – 16.200
8.36200 - 8.36600	156.52475 – 156.52525	2483.5 - 2500.0	17.700 – 21.400
8.37625 - 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 - 3267.0	23.600 - 24.000
12.29000 - 12.29300	167.72000 – 173.20000	3332.0 - 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 - 285.00000	3345.8 - 3358.0	36.430 - 36.500
12.57675 – 12.57725	322.00000 - 335.40000	3600.0 - 4400.0	Above 38.6
13.36000 - 13.41000			

\*\*: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

### 14.1 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.