

# Radio Test Report FCC ID: 2AF2R-HB88RX

## **Original Grant**

Report No.	-	TB-FCC174727
Applicant	197	Shenzhen Videotimes Technology Co.,Ltd
Equipment Under	Test	(EUT)
EUT Name		2.4GHz Digital Wireless Video Baby Monitor
Model No.	-	HB88RX
Series Model No.	1	N/A
Brand Name	:	HelloBaby
Sample ID	11	TBBJ-20200714-15-01#
Receipt Date		2020-08-11
Test Date		2020-08-11 to 2020-08-31
Issue Date	-	2020-08-31
Standards		FCC Part 15, Subpart C 15.247
Test Method	65	ANSI C63.10: 2013
Conclusions	:	PASS
		In the configuration tested, the ELIT complied with the standards specified a

: Jack : WAN SU : fugti.

In the configuration tested, the EUT complied with the standards specified above, The EUT technically complies with the FCC requirements

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**Test/Witness Engineer** 

**Engineer Supervisor** 

**Engineer Manager** 

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

TB-RF-074-1.0



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# **Revision History**

Report No.	Version	Description	Issued Date
TB-FCC174727	Rev.01	Initial issue of report	2020-08-31
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# 1. General Information about EUT

## **1.1 Client Information**

TOBY

Applicant	:	Shenzhen Videotimes Technology Co.,Ltd				
Address	ess Room 601,Building B,Union Financial Building Fubao Street,Futian Fre Trade Zone,Shenzhen,China					
Manufacturer	: Shenzhen Videotimes Technology Co.,Ltd					
Address : Room 601,Building B,Union Financial Building Fubao Street,Futian Trade Zone,Shenzhen,China		Room 601, Building B, Union Financial Building Fubao Street, Futian Free Trade Zone, Shenzhen, China				

# 1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	2.4GHz Digital Wireless Video Baby Monitor		
Models No.	:	HB88RX		
Model Difference	:	N/A		
Sample ID	:	TBBJ-20200714-15-01#		
	2	Operation Frequency:	2410MHz~2473MHz	
000		Number of Channel:	19 Channels See Note 2	
Product Description	:	Max Peak Output Power:	10.268dBm	
Beeenplien	6	Antenna Gain:	2dBi Internal Antenna	
		Modulation Type:	GFSK (4Mbps)	
Power Supply		DC Voltage Supply from AC/DC Adapter DC Voltage supplied by Li-ion battery		
Power Rating	3	Adapter (Model:K05V050120U) Input: AC 100-240V~50/60Hz, 0.2A Output: DC 5.0V,1.2A DC 3.7V by 2000mAh Li-ion battery.		
Software Version	i	V1.0		
Hardware Version	:	V1.0		
Remark		The adapter and antenna gain provided by the applicant, the verified for the RF conduction test provided by TOBY test lab.		

#### Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



### (2) Channel List:

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)		
00	2410	15	2462.5	CIUS .			
01	2413.5	16	2466		2000		
02	2417	17	2469.5				
03	2420.5	18	2473				
04	2424						
05	2427.5		60100				
06	2431			683			
07	2434.5						
08	2438			611			
09	2441.5				600		
10	2445						
11	2448.5						
12	2452		NUM				
13	2455.5			2	NRU-		
14	2459						

Note: Test frequencies are lowest channel: 2410MHz, middle channel: 2441.5MHz and highest channel: 2473MHz.

(3) The Antenna information about the equipment is provided by the applicant.

## 1.3 Block Diagram Showing the Configuration of System Tested

## Adapter & TX Mode

Adapter

EUT



### 1.4 Description of Support Units

The EUT has been tested as an independent unit.

#### 1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test				
Final Test Mode Description				
Mode 1	Adapter+ TX Mode			

For Radiated Test				
Final Test Mode	Description			
Mode 1	TX GFSK Mode			
Mode 2	TX Mode(GFSK) Channel 00/09/18			

#### Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test modes above.

According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:

TX Mode: GFSK (4Mbps)

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.



### 1.6 Description of Test Software Setting

During testing channel power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

Test Software Version	Switch channels and modes by pressing buttons			
Frequency	2410 MHz 2441.5 MHz 2473 MHz			
GFSK	DEF	DEF	DEF	

### 1.7 Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

Test Item	Parameters	Expanded Uncertainty (U <sub>Lab</sub> )	
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.60 dB ±3.10 dB	
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB	
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.20 dB	
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB	



### 1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

#### CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

#### A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01. FCC Accredited Test Site Number: 854351.

#### IC Registration No.: (11950A)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A.

TOBY

# 2. Test Summary

FCC Part 15 Subpart C(15.247)/ RSS 247 Issue 2						
Standard Section						
FCC IC		Test Item	Test Sample(s)	Judgment	Remark	
15.203	2027	Antenna Requirement	TBBJ-20200714-15-01#	PASS	N/A	
15.207	RSS-GEN 8.8	Conducted Emission	TBBJ-20200714-15-01#	PASS	N/A	
15.205	RSS-Gen 8.10	Restricted Bands	TBBJ-20200714-15-01#	PASS	N/A	
15.247(a)(1)	RSS 247 5.1 (b)	Hopping Channel Separation	TBBJ-20200714-15-01#	PASS	N/A	
15.247(a)(1)	RSS 247 5.1 (d)	Dwell Time	TBBJ-20200714-15-01#	PASS	N/A	
15.247(b)(1)	RSS 247 5.4 (b)	Peak Output Power	TBBJ-20200714-15-01#	PASS	N/A	
15.247(b)(1)	RSS 247 5.1 (d)	Number of Hopping Frequency	TBBJ-20200714-15-01#	PASS	N/A	
15.247(d)	RSS 247 5.5	Band Edge	TBBJ-20200714-15-01#	PASS	N/A	
15.247(c)& 15.209	RSS 247 5.5 &RSS-GEN 8.9	Radiated Spurious Emission	TBBJ-20200714-15-01#	PASS	N/A	
15.247(a)	RSS 247 5.1 (a)	99% Occupied Bandwidth & 20dB Bandwidth	TBBJ-20200714-15-01#	PASS	N/A	

# 3. Test Software

Test Item	Test Software	Manufacturer	Version No.
Conducted Emission	EZ-EMC	EZ	CDI-03A2
Radiation Emission	EZ-EMC	EZ	FA-03A2RE
RF Conducted Measurement	MTS-8310	MWRFtest	V2.0.0.0

# 4. Test Equipment

<b>Conducted Emiss</b>	ion Test				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 12, 2020	Jul. 11, 2021
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 12, 2020	Jul. 11, 2021
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 12, 2020	Jul. 11, 2021
LISN	Rohde & Schwarz	ENV216	101131	Jul. 12, 2020	Jul. 11, 2021
Radiation Emissio	on Test		·	-	-
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 12, 2020	Jul. 11, 2021
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 12, 2020	Jul. 11, 2021
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jul. 06, 2020	Jul. 05, 2021
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.01, 2020	Feb. 28, 2021
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.01, 2020	Feb. 28, 2021
Horn Antenna	ETS-LINDGREN	BBHA 9170	BBHA9170582	Aug.07, 2020	Aug. 06, 2021
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 07, 2020	Jul. 06, 2021
Pre-amplifier	Sonoma	310N	185903	Mar.01, 2020	Feb. 28, 2021
Pre-amplifier	HP	8449B	3008A00849	Mar.01, 2020	Feb. 28, 2021
Pre-amplifier	SKET	LNPA_1840G-50	SK201904032	Jul. 27, 2020	Jul. 26, 2021
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar. 07, 2020	Mar. 06, 2021
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A

# Antenna Conducted Emission

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 12, 2020	Jul. 11, 2021
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 12, 2020	Jul. 11, 2021
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 16, 2019	Sep. 15, 2020
Vector Signal Generator	Agilent	N5182A	MY50141294	Sep. 16, 2019	Sep. 15, 2020
Analog Signal Generator	Agilent	N5181A	MY50141953	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO26	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO29	Sep. 16, 2019	Sep. 15, 2020
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO31	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO33	Sep. 16, 2019	Sep. 15, 2020



# 5. Conducted Emission Test

- 5.1 Test Standard and Limit
  - 5.1.1Test Standard FCC Part 15.207/RSS-GEN 8.8
  - 5.1.2 Test Limit

Conducted Emission Test Limit			
Executionary	Maximum RF Line Voltage (dBμV)		
Frequency	Quasi-peak Level	Average Level	
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *	
500kHz~5MHz	56	46	
5MHz~30MHz	60	50	

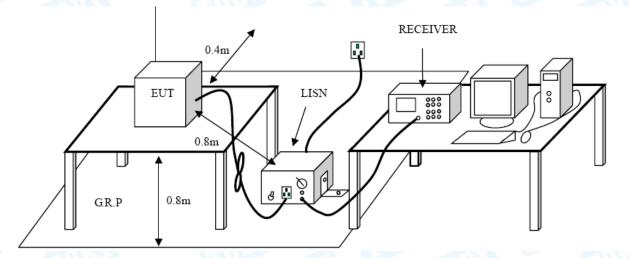
#### Notes:

(1) \*Decreasing linearly with logarithm of the frequency.

(2) The lower limit shall apply at the transition frequencies.

(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 5.2 Test Setup





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#### 5.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

#### 5.4 Deviation From Test Standard

No deviation

5.5 EUT Operating Mode

Please refer to the description of test mode.

#### 5.6 Test Data

Please refer to the Attachment A.



# 6. Radiated Emission Test

- 6.1 Test Standard and Limit
  - 6.1.1 Test Standard
    - FCC Part 15.209/RSS-GEN 8.9
  - 6.1.2 Test Limit

#### Radiated Emission Limit (9 kHz~1000MHz)

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

Frequency	Distance Me	Meters(at 3m)	
(MHz)	Peak	Average	
Above 1000	74	54	

#### Note:

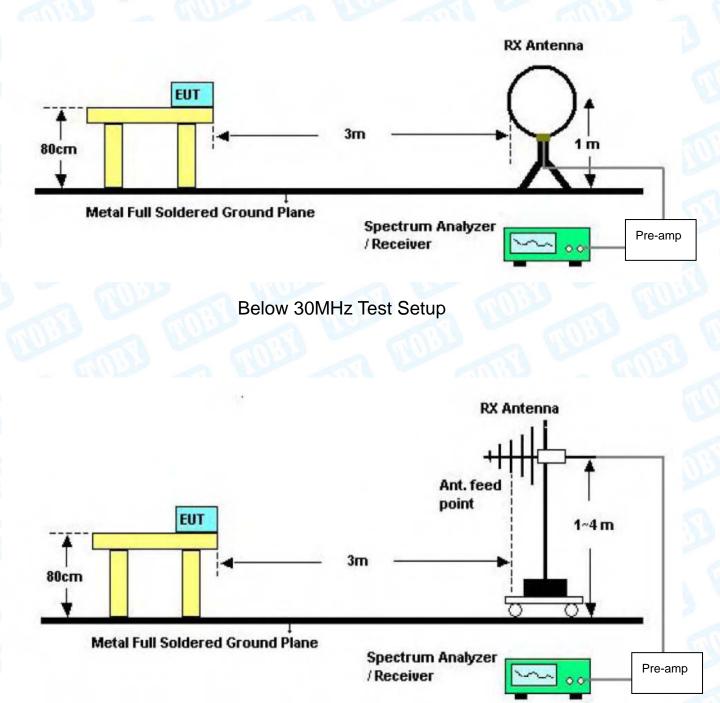
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m)



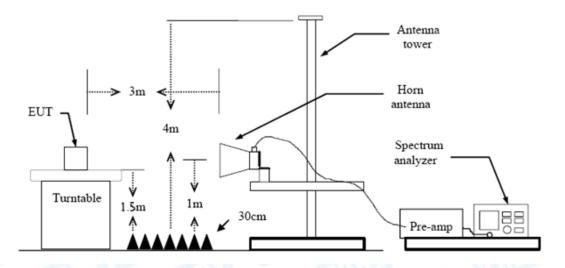
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6.2 Test Setup



Below 1000MHz Test Setup





Above 1GHz Test Setup

#### 6.3 Test Procedure

- (1) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency Below 1GHz. The EUT was placed on a rotating 0.8m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.



6.4 Deviation From Test Standard

No deviation

6.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

### 6.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values. Please refer to the Attachment B.

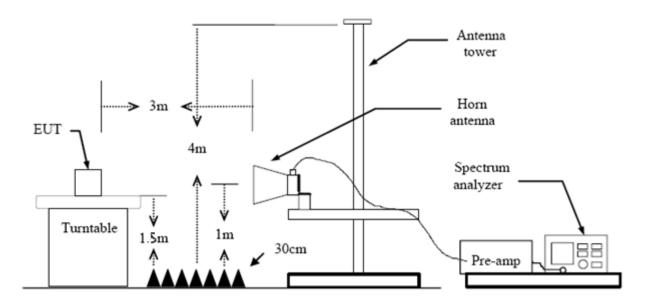


# 7. Restricted Bands and Band-edge test

- 7.1 Test Standard and Limit
  - 7.1.1 Test Standard FCC Part 15.209&15.205 RSS-GEN 8.9&8.10
  - 7.1.2 Test Limit

Restricted Frequency	Distance Meters(at 3m)		
Band (MHz)	Peak	Average	
2310 ~2390	74	54	
2483.5 ~2500	74	54	

## 7.2 Test Setup





### 7.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with AVG Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.
- 7.4 Deviation From Test Standard

No deviation

### 7.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

#### 7.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

All restriction bands have been tested, only the worst case is reported. Please refer to the Attachment C.

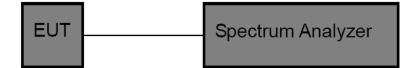


# 8. Number of Hopping Channel

- 8.1 Test Standard and Limit
  - 8.1.1 Test Standard
    - FCC Part 15.247 (a)(1)
  - 8.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

### 8.2 Test Setup



### 8.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.
- 8.4 Deviation From Test Standard

No deviation

8.5 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

### 8.6 Test Data

Please refer to the Attachment D.



# 9. Average Time of Occupancy

- 9.1 Test Standard and Limit
  - 9.1.1 Test Standard
    - FCC Part 15.247 (a)(1) / RSS 247 5.1(d)
  - 9.1.2 Test Limit

Test Item	Limit
Average Time of Occupancy	0.4 sec

9.2 Test Setup

EUT .	Spectrum Analyzer

### 9.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=100KHz, VBW=300KHz.
- (3) Use video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for packet transmitting.
- (8) Measure the maximum time duration of one single pulse.

## 9.4 EUT Operating Condition

The average time of occupancy on any channel within the Period can be calculated with formulas:

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 20 [ch] = 8.0 [s\*ch]; The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in  $8.0s = 3^{*}(8.0/0.24) = 100$ 

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

The EUT was set to the Hopping Mode by the Customer.

#### 9.4 Deviation From Test Standard

No deviation

### 9.5 Test Data

Please refer to the Attachment E.



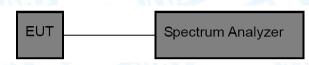
# 10. Channel Separation and Bandwidth Test

10.1 Test Standard and Limit

- 10.1.1 Test Standard
  - FCC Part 15.247/RSS 247 5.1(b)
- 10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

10.2 Test Setup



### 10.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
   Channel Separation: RBW=100 kHz, VBW=100 kHz.
   Bandwidth: RBW=30 kHz, VBW=100 kHz.
- (3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.
- (4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

### 10.4 Deviation From Test Standard

No deviation

### 10.5 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

### 10.6 Test Data

Please refer to the Attachment F.

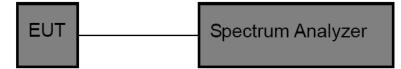


# 11. Peak Output Power Test

- 11.1 Test Standard and Limit
  - 11.1.1 Test Standard
    - FCC Part 15.247 (b) (1)/RSS 247 5.4(b)
  - 11.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm)	2400~2483.5
	Other <125 mW(21dBm)	

11.2 Test Setup



## 11.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz. RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

#### 11.4 Deviation From Test Standard

No deviation

11.5 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

11.6 Test Data

Please refer to the Attachment G.



# 12. Antenna Requirement

12.1 Standard Requirement

#### 12.1.1 Standard

FCC Part 15.203

#### 12.1.2 Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### 12.2 Deviation From Test Standard

No deviation

#### 12.3 Antenna Connected Construction

The gains of the antenna used for transmitting is 2dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

#### 12.4 Result

The EUT antenna is a Internal Antenna. It complies with the standard requirement.

	Antenna Type
	Permanent attached antenna
19	Unique connector antenna
	Professional installation antenna

# **Attachment A-- Conducted Emission Test Data**

Temperature:	<b>25</b> ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60Hz		89
Terminal:	Line		
Test Mode:	TX GFSK Mode 2410MHz	60132	A MUL
Remark:	All channels have been tes	sted and Shows only the w	orst channels.
90.0 dBuV			QP: AVG:
40 × 10	M Mung Mary May May May Market Market	www.www.www.www.www.www.www.www.www.ww	Mandraryhladener hereda an he p

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3180	24.73	9.70	34.43	59.76	-25.33	QP
2		0.3180	15.61	9.70	25.31	49.76	-24.45	AVG
3	*	0.4780	30.00	9.70	39.70	56.37	-16.67	QP
4		0.4780	19.95	9.70	29.65	46.37	-16.72	AVG
5		0.9980	24.86	9.80	34.66	56.00	-21.34	QP
6		0.9980	14.41	9.80	24.21	46.00	-21.79	AVG
7		1.8300	21.63	9.72	31.35	56.00	-24.65	QP
8		1.8300	12.01	9.72	21.73	46.00	-24.27	AVG
9		3.0620	21.82	9.90	31.72	56.00	-24.28	QP
10		3.0620	11.20	9.90	21.10	46.00	-24.90	AVG
11		4.9660	17.99	9.90	27.89	56.00	-28.11	QP
12		4.9660	9.77	9.90	19.67	46.00	-26.33	AVG



Temperature:	<b>25</b> ℃		Relative Humidity:	55%
Test Voltage:	AC 120V/60	Hz		
Terminal:	Neutral	TRU T		
Test Mode:	TX GFSK M	ode 2410MHz	51 - 6	5:39
Remark:	All channels	have been teste	ed and Shows only the	worst channels.
90.0 dBuV		Whyny wy Marine		QP: AVG:
	$\sqrt{1}$ $\sqrt{1}$	Www	some management	- manufacture appear
-10 0.150	0.5	(MHz)	5	30.000
		ding Correct	t Measure-	

No. Mk	. Freq.	Level	Factor	ment	Limit	Over	
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	0.3220	24.69	9.80	34.49	59.65	-25.16	QP
2	0.3220	19.59	9.80	29.39	49.65	-20.26	AVG
3	0.4740	33.06	9.80	42.86	56.44	-13.58	QP
4 *	0.4740	27.97	9.80	37.77	46.44	-8.67	AVG
5	0.7860	25.52	9.80	35.32	56.00	-20.68	QP
6	0.7860	20.02	9.80	29.82	46.00	-16.18	AVG
7	1.9020	23.18	9.80	32.98	56.00	-23.02	QP
8	1.9020	16.02	9.80	25.82	46.00	-20.18	AVG
9	3.0740	22.47	9.80	32.27	56.00	-23.73	QP
10	3.0740	15.61	9.80	25.41	46.00	-20.59	AVG
11	4.9219	21.06	9.80	30.86	56.00	-25.14	QP
12	4.9219	15.50	9.80	25.30	46.00	-20.70	AVG



# **Attachment B-- Radiated Emission Test Data**

#### 9KHz~30MHz

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

#### 30MHz~1GHz

HZ~1GHZ				
Temperature:	<b>25℃</b>	-	Relative Humidity	r: 55%
Test Voltage:	AC 120V/60Hz	The second	AV	
Ant. Pol.	Horizontal		TUDE	
Test Mode:	TX GFSK Mode	2410MHz	003	
Remark:	Only worse case	is reported	10	
80.0 dBuV/m				
30	Mundan	2 X Mum umuh		15C 3M Radiation Margin - 6 dB
20 30.000 40 50	60 70 80 Reading	(MH2) Correct	Measure-	500 600 700 1000.000
	req. Level	Factor	ment Limit	Over
М	IHz dBuV	dB/m	dBuV/m dBuV/r	m dB Detecto
1 24.0	NACE 20.04	16.06	22.69 40.00	

No	. Mk.	Freq.	Level	Factor	ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		34.0365	39.94	-16.26	23.68	40.00	-16.32	QP
2		152.6641	49.73	-21.43	28.30	43.50	-15.20	QP
3		229.2931	49.17	-18.68	30.49	46.00	-15.51	QP
4		305.6800	51.57	-16.45	35.12	46.00	-10.88	QP
5		382.5879	48.28	-13.34	34.94	46.00	-11.06	QP
6	*	766.0571	46.57	-6.38	40.19	46.00	-5.81	QP

\*:Maximum data x:Over limit !:over margin



Temperature:	<b>25</b> ℃		10	Relative H	umidity:	55%	1
Test Voltage:	AC 12	0V/60Hz			52		J.M.S.
Ant. Pol.	Vertica	al			-0	29	
Test Mode:	TX GF	SK Mode 24	410MHz		120		13
Remark:	Only v	vorse case i	s reported	CIN 3	2	19	1 yes
80.0 dBuV/m							
					(RF)FCC 150	3M Radiation Margin -6	
1			2	3 4	5	6	
30	、			× ×	X	udlathat	alaha
W	$\mathbf{x}$	1 million of	mon	MMahmumh	mann		
	Man	Man	4				
-20 30.000 40 50	0 60 70	80	(MHz)	300	400 500	600 700	1000.000
		Reading	Correct	Measure-			
No. Mk.	Freq.	Level	Factor	ment	Limit	Over	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1 * 44	.7433	54.99	-21.58	33.41	40.00	-6.59	QP
	2.6641	53.77	-21.43	32.34	43.50	-11.16	QP
							-
	9.2931	46.84	-18.68	28.16	46.00	-17.84	QP
4 305	5.6800	46.00	-16.45	29.55	46.00	-16.45	QP
			40.04	24.22	40.00	44 70	00
5 382	2.5879	44.56	-13.34	31.22	46.00	-14.78	QP
	2.5879 2.0642	44.56 39.49	-13.34	31.22	46.00	-14.78	

\*:Maximum data x:Over limit !:over margin

#### Above 1GHz (Only worse case is reported)

Tempe	eratu	re:	<b>25°</b> ℃			Relative I	lumidity:	55%	
Test Voltage: AC 120V/60Hz							32	-	IL US
Ant. P	ol.		Horiz	zontal			-0	25	
Test Mode: TX GFSK Mode 2410MHz						13			
Remai	'k:			eport for the cribed limit.	emission w	hich more th	an 10 dB b	elow the	ULL C
No.	Mk.	Fre	eq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MH	Z	dBuV	dD /m	dBuV/m	dBuV/m	dB	Detector
			-	ubuv	dB/m	ubuv/m	uDuv/III	uВ	Delector
1		4820.	150	48.01	11.99	60.00	74.00	-14.00	peak
1	*	4820. 4821.							



Temperatu	re:	<b>25°</b> ℃		- S	Relative Hun	nidity:	55%	100	
Test Voltag	je:	AC 1	20V/60Hz			52	-	100 ×	
Ant. Pol.		Verti	cal			-0	23.9	-	
Test Mode:		TX C	TX GFSK Mode 2410MHz						
Remark:			No report for the emission which more than 10 dB below the prescribed limit.						
No. Mk.	Fre	eq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
	MH	z	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	
1	4819.	664	49.08	11.99	61.07	74.00	-12.93	peak	
2 *	4821.	260	33.21	12.00	45.21	54.00	-8.79	AVG	



Temperature:	<b>25</b> ℃		Relative Hum	nidity:	55%	100
Test Voltage:	AC 120V/60Hz			52	-	Bass
Ant. Pol.	Horizontal			-0	25	-
Test Mode: TX GFSK Mode 2441.5MHz						
Remark:         No report for the emission which more than 10 dB below the prescribed limit.						
No. Mk. Fr	Reading eq. Level	Correct Factor	Measure- ment	Limit	Over	
M	Hz dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1 4883	.092 48.71	12.33	61.04	74.00	-12.96	peak
2 * 4883	.092 33.74	12.33	46.07	54.00	-7.93	AVG



Temperature:	<b>25</b> ℃		Relative H	umidity:	55%	1
Test Voltage:	AC 120V/60Hz			52		los
Ant. Pol.	Vertical			0	20	
Test Mode: TX GFSK Mode 2441.5MHz						
Remark:	No report for the prescribed limit.	emission w	nich more tha	in 10 dB b	elow the	م م
No. Mk. F	Reading req. Level	Correct Factor	Measure- ment	Limit	Over	
Ν	MHz dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1 488	1.340 48.55	12.33	60.88	74.00	-13.12	peak
2 * 488	1.340 33.67	12.33	46.00	54.00	-8.00	AVG



Temperature:25°C			Relative Humidity:			55%	
Test Voltage:	st Voltage: AC 120V/60Hz			32	-	IL DE	
Ant. Pol.	Horiz	zontal			-0	23	
Test Mode:	TX GFSK Mode 2473MHz						137
Remark:		eport for the cribed limit.	emission w	hich more the	an 10 dB b	elow the	and the second
No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1 4	946.834	48.63	12.69	61.32	74.00	-12.68	peak
2 * 4	946.834	33,59	12.69	46.28	54.00	-7.72	AVG



Temperature:25°C				<b>Relative Humidity:</b>		55%		
Test Voltage	AC 120V/60Hz			1157	32	-	NO.	
Ant. Pol.		Verti	cal			0	23.9	-
Test Mode:	Test Mode: TX GFSK Mode 2473MHz							
Remark:			eport for the cribed limit.	emission w	hich more th	an 10 dB l	below the	ULL C
No. Mk.	Fre	eq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MF	z	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	4944.	758	47.86	12.67	60.53	74.00	-13.47	peak
2 *	4944.	758	33.59	12.67	46.26	54.00	-7.74	AVG
								· ·



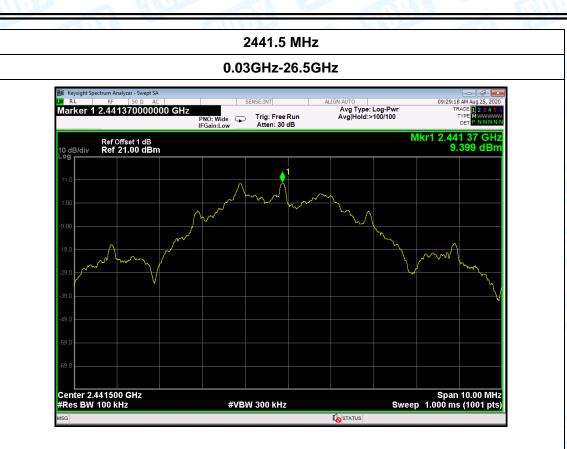
#### **Conducted Emission Test Data**

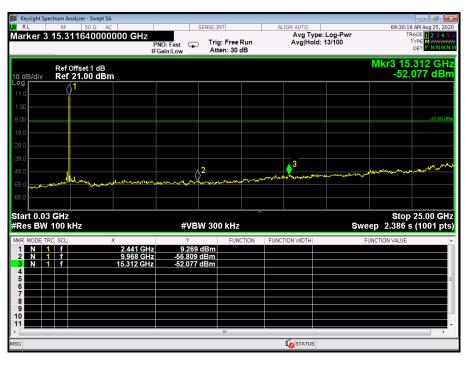
Temperature:	<b>25</b> ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60Hz	- Company	
Test Mode:	TX GFSK Mode		RU
Remark:	This report only shall the wo	orst case mode.	
	2410 M	Hz	

D.03GHz-26.5GHz

RL RL	ectrum Analyzer - S RF 50	Swept SA Ω AC	SENSE:	INT	ALIGN AUTO		09:34:00 AM Aug 25, 2
		000000 GHz	NO: Fast 🕟 Tri	g: Free Run ten: 30 dB	Avg Ty	pe: Log-Pwr d: 60/100	TRACE 1 2 3 4 TYPE MWW DET P N N
0 dB/div	Ref Offset 1 Ref 21.00						Mkr3 4.824 G -52.061 dB
-og 11.0	{↓1						
1.00							
9.00							-10.30
19.0							
29.0							
39.0	2						
49.0	<u> </u>	<mark>3</mark>					and the second and the second se
59 0	Jos Kon	and marken and	and the second	and a second second	and and a second se	and some and a second	
59.0							
Start 0.03 Res BW	GHz 100 kHz		#VBW 30	0 kHz		Swe	Stop 25.00 G ep 2.386 s (1001 p
IKR MODE TR		х	Ŷ	FUNCTION	FUNCTION WIDTH	FI	JNCTION VALUE
	f	2.409 GHz 1.728 GHz	-46.772 dBm				
2 N 1		4.824 GHz	-52.061 dBm				
1 N 1 2 N 1 3 N 1	f	4.024 GHZ	-02.001 ubiii				
3 N 1 4 5	f	4.624 GHZ	-02.001 0.511				
3 N 1 4 5 6 7		4.024 GHZ	-02.001 4511				
3 N 1 4 5 6	f	4.024 GHZ	-02.001 UDII				
3 N 1 4 5 6 7 8 9 10		4.024 GHZ	-02.001 dBm				
3 N 1 4 5 6 7 8 8		4.024 GHZ		m			













# **Attachment C-- Restricted Bands Requirement Test Data**

Temperature:	<b>25</b> ℃	NUL	Rel	ative Humidity:	55%
Test Voltage:	AC 120	V/60Hz	1000	A LE	
Ant. Pol.	Horizon	tal			
Test Mode:	TX GFS	K Mode 241	0MHz		
Remark:	Only wo	orse case is r	eported	- GIUS	1
110.0 dBuV/m					
					3
					¥
					$-\Delta$
				(RF) FCC PA	RT 15C (PEAK)
					$\rightarrow$
60					
				/	ART 15C (AVE)
				1 X	
				2	
			~~~~~	×	
10.0					

No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	45.18	1.08	46.26	74.00	-27.74	peak
2		2390.000	34.58	1.08	35.66	54.00	-18.34	AVG
3	Х	2409.000	99.00	1.16	100.16	Fundamental	Frequency	peak
4	*	2409.200	94.45	1.17	95.62	Fundamental	Frequency	AVG



emperature:	<b>25</b> ℃		Relative Humidity	<b>/:</b> 55%
fest Voltage:	AC 120V/6	i0Hz	- GUUL	
Ant. Pol.	Vertical			1:22
fest Mode:	TX GFSK I	Mode 2410MHz		
Remark:	Only worse	e case is reported	THE P	a
110.0 dBu¥/m				
				3
				¥ ×
			(RF) FCC	PART 15C (PEAK)
60				
			(RF) FC	C PART 15C (AVG)
			1 X	
			2 X	
10.0				

No.	Mk.	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	42.89	1.08	43.97	74.00	-30.03	peak
2		2390.000	33.50	1.08	34.58	54.00	-19.42	AVG
3	Х	2409.000	94.42	1.16	95.58	Fundamental I	Frequency	peak
4	*	2409.200	89.79	1.17	90.96	Fundamental I	Frequency	AVG



Temperature:	<b>25</b> ℃	Relative Humidity:55%
Test Voltage:	AC 120V/60Hz	
Ant. Pol.	Horizontal	and and
Test Mode:	TX GFSK Mode 2473 MH	Iz
Remark:	Only worse case is report	ed
110.0 dBuV/m		
60		(RF) FCC PART 15C (PEAK)
	3 × 4 ×	(RF) FCC PART 15C (AVG)
10.0	2482.00 2492.00 2502.00 2512	.00 2522.00 2532.00 2542.00 2562.00

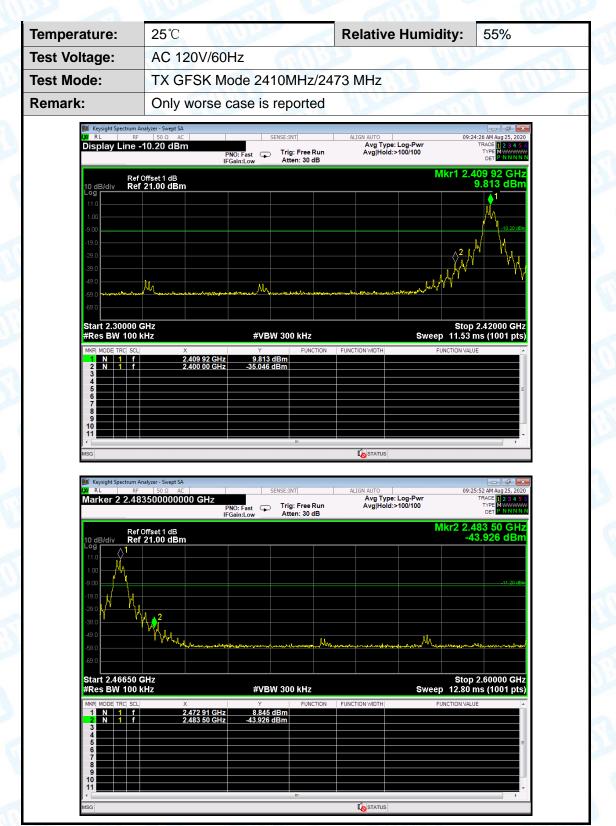
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	Х	2471.800	97.49	1.58	99.07	Fundamental	Frequency	peak
2	*	2472.200	92.74	1.58	94.32	Fundamental	Frequency	AVG
3		2483.500	52.76	1.65	54.41	74.00	-19.59	peak
4		2483.500	41.27	1.65	42.92	54.00	-11.08	AVG



Temperature	:	<b>25°</b> ℃			Relativ	e Humidity:	55%		
Test Voltage:	:	AC 12	20V/60Hz			197	2	Ross	
Ant. Pol.		Vertic	/ertical						
Test Mode:		TX G	TX GFSK Mode 2473 MHz						
Remark:		Only \	worse cas	e is reporte	d	30	19		
110.0 dBuV/m									
ž						(RF) FCC PAI	3T 15C (PEAK)		
60	1	3 X 4 X	~			(RF) FCC P/	ART 15C (AVG)		
10.0 2462.000 2472.0	0 2482			02.00 2512.0		2532.00 2542.00	25	62.00 MHz	
No. MI	<b>F</b>		Reading	Correc		e- Limit	Over		
No. Mk.	Free	·	Level	Factor					
	MHz	:	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	
1 X 2	471.8	00	94.07	1.58	95.65	Fundamental F	requency	peak	
2 * 2	472.0	00	89.29	1.58	90.87	Fundamental F	requency	AVG	
3 2	483.5	00	49.66	1.65	51.31	74.00	-22.69	peak	



### (2) Conducted Band Edge Test





erature:	<b>25</b> ℃		Relative Humidity:	55%
/oltage:	AC 120V/60H	Ηz		-
Node:	GFSK Hoppi	ng Mode	1	CB3
ırk:	Only worse o	ase is reported		
	n Analyzer - Swept SA RF 50 Ω AC			
	100000000000 GHz	SENSE:INT	Avg Type: Log-Pwr	9:23:13 AM Aug 25, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N
R	IFC ef Offset 1 dB	Gain:Low Atten: 30 dB		.400 00 GHz
10 dB/div R Log	ef 21.00 dBm			-39.536 dBm 01
1.00				Mythyline
-9.00				-10.66.48m
-29.0				N
-49.0		1, handle Mar Mar Mar Mar Mar 1	White Min Hing Man Advertised and the second strate of the second strate	
-69.0				
Start 2.30000 #Res BW 100		#VBW 300 kHz		op 2.42000 GHz 3 ms (1001 pts)
MKR MODE TRC S	CL X	Y FUNCTIO		
1 N 1 1 2 N 1 1 3	2.416 88 GHz 2.400 00 GHz	9.505 dBm -39.536 dBm		
4 5 6				E
7 8 9				
10				
11				
		III	<b>Ko</b> status	Þ.
MSG	n Analyzer - Swept SA	m	<b>I</b> STATUS	
MSG Keysight Spectrum	RF 50 Ω AC 83500000000 GHz	" SENSE:INT SENSE:INT	ALIGN AUTO 09 Avg Type: Log-Pwr	9:21:37 AM Aug 25, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW
11 MSG Keysight Spectrum (X) RL f Marker 2 2.4	RF 50 Ω AC 1835000000000 GHz IFC	W: Fast Sain:Low Trig: Free Rut Atten: 30 dB	ALIGN AUTO 01 Avg Type: Log-Pwr n Avg Hold:>100/100	9:21:37 AM Aug 25, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N
11 MSG Keysight Spectrum (X) RL f Marker 2 2.4	F 50 Ω AC B3500000000 GHz	NO: Fast 😱 Trig: Free Rui	ALIGN AUTO 0 Avg Type: Log-Pwr n Avg Hold:>100/100 MKr2 2.4	9:21:37 AM Aug 25, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW
11 MSG MSG Marker 2 2.4 10 dB/cliv R Log ↓1 1.1 AL	RF 50 Ω AC 1835000000000 GHz IFC	NO: Fast 😱 Trig: Free Rui	ALIGN AUTO 0 Avg Type: Log-Pwr n Avg Hold:>100/100 MKr2 2.4	9:21:37 AM Aug 25, 2020 TRACE 2 2 3 4 5 6 TYPE MWWWWW DET P N N N N N 483 500 GHz
11 MSG MSG MG MG MG Marker 2 2.4 10 dB/d/v R Log 11.0 1.00 9.00	RF 50 Ω AC 1835000000000 GHz IFC	NO: Fast 😱 Trig: Free Rui	ALIGN AUTO 0 Avg Type: Log-Pwr n Avg Hold:>100/100 MKr2 2.4	9:21:37 AM Aug 25, 2020 TRACE 2 2 3 4 5 6 TYPE MWWWWW DET P N N N N N 483 500 GHz
MSG MSG Marker 2 2.4 10 dB/div R Log 1 1.0 4	E 50 Q AC B3500000000 GHz PP IFC ef Offset 1 dB ef 21.00 dBm	NO: Fast 😱 Trig: Free Rui	ALIGN AUTO 0 Avg Type: Log-Pwr n Avg Hold:>100/100 MKr2 2.4	9:21:37 AM Aug 25, 2020 TRACE 2 2 3 4 5 6 TYPE MWWWWW DET P N N N N N 483 500 GHz
11 MSC MSC MSC Marker 2 2.4 10 dB/div R 10 dB/div	E 50 0 AC B3500000000 GHz PP FC ef Offset 1 dB ef 21.00 dBm	O: Fast Atten: 30 dB	ALIGN AUTO 01 Avg Type: Log-Pwr n Avg Hold:>100/100 Mkr2 2.4	9:21:37 AM Aug 25, 20:20 TRACE [] 23 4 5 6 TYPE MWWWW GET PINNNN 483 500 GHz -44.691 dBm
11 MSC MSC 00 RL ↓ ↓ Marker 2 2.4 10 dB/div R 10 dB/div R	E 50 0 AC B350000000 GHz P FC FO FFC FC FC FC FC FC FC FC FC F	O: Fast Atten: 30 dB	ALIGN AUTO 0 Avg Type: Log-Pwr n Avg Hold:>100/100 MKr2 2.4	9:21:37 AM Aug 25, 20:20 TRACE [] 23 4 5 6 TYPE MWWWW GET PINNNN 483 500 GHz -44.691 dBm
11           MSG           IM           MSG           IM           RL           IO	PE 150 Q. AC PIER B3500000000 GHz PF PFC FO FO FO FO FO FO FO FO FO FO	O: Fast Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr n Avg Hold:>100/100 Mkr2 2.4 	9:21:37 AM Aug 25, 2020 TRACE [] 2:3 4, 5 6 VER MANNANA DET P N N N N 483 5000 GHz 444.691 dBm 11:28:4866 11:28:4866 Ally, Auril, J. Annue
11           MSG           Image: Section of the s	E SOR AC B350000000 GHz Profile of Offset 1 dB ef 21.00 dBm	O: Fast Atten: 30 dB	ALIGN AUTO 01 Avg Type: Log-Pwr Avg Hold:>100/100 Mkr2 2.4	9:21:37 AM Aug 25, 20:20 TRACE [] 23 4 5 6 TYPE MWWWW GET PINNNN 483 500 GHz -44.691 dBm
11           MSG           MK	F         \$0.0         AC         P           83500000000 GHz         P         P           of Offset 1 dB         P         P           of Offset 2         P         P           of Offset 2 </td <td>HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.</td> <td>ALIGN AUTO AVG Type: Log-Pwr Avg Hold:&gt;100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:&gt;100/100 Stoppe: Log-Pwr Stoppe: L</td> <td>9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)</td>	HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.	ALIGN AUTO AVG Type: Log-Pwr Avg Hold:>100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:>100/100 Stoppe: Log-Pwr Stoppe: L	9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)
11 MSC MSC MSC Marker 2 2.4 Marker 2 2.4 Marker 2 2.4 10 dB/div R 10 dB/div	E         \$0.0         AC         P           E83500000000 GHz         P         P         P           ef Offset1 dB         ef 21.00 dBm         P         P           0         GHz         P         P         P           0         GHz         P         P         P         P           0         GHz         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P <td< td=""><td>O: Fast O: Fast Trig: Free Ru Atten: 30 dB</td><td>ALIGN AUTO AVG Type: Log-Pwr Avg Hold:&gt;100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:&gt;100/100 Stoppe: Log-Pwr Stoppe: L</td><td>9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)</td></td<>	O: Fast O: Fast Trig: Free Ru Atten: 30 dB	ALIGN AUTO AVG Type: Log-Pwr Avg Hold:>100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:>100/100 Stoppe: Log-Pwr Stoppe: L	9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)
11	F         \$0.0         AC         P           83500000000 GHz         P         P           of Offset 1 dB         P         P           of Offset 2         P         P           of Offset 2 </td <td>HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.</td> <td>ALIGN AUTO AVG Type: Log-Pwr Avg Hold:&gt;100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:&gt;100/100 Stoppe: Log-Pwr Stoppe: L</td> <td>9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)</td>	HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.	ALIGN AUTO AVG Type: Log-Pwr Avg Hold:>100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:>100/100 Stoppe: Log-Pwr Stoppe: L	9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)
11         MSG         MSG         MSG         MSG         MSG         Marker 2 2.4         MSG         MSG         Marker 2 2.4         MSG         MSG         MSG         Marker 2 2.4         Start 2.46500         #Res BW 100         MRR MODE TRC S         1       1         3       1         4         5         6	F         \$0.0         AC         P           83500000000 GHz         P         P           of Offset 1 dB         P         P           of Offset 2         P         P           of Offset 2 </td <td>HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.</td> <td>ALIGN AUTO AVG Type: Log-Pwr Avg Hold:&gt;100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:&gt;100/100 Stoppe: Log-Pwr Stoppe: L</td> <td>9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)</td>	HO: Fast     Trig: Free Ru       Atten: 30 dB       M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.M.	ALIGN AUTO AVG Type: Log-Pwr Avg Hold:>100/100 Mkr2 2.4 Mkr2 2.4 Mkr2 2.4 Stoppe: Log-Pwr Avg Hold:>100/100 Stoppe: Log-Pwr Stoppe: L	9:21:37 AM Aug 25, 2020 TRACE [] 23 4 5 6 TYPE [] MANNAN 483 500 GHz 444.691 dBm 11:23 dBm 11:23 dBm 0.01 pt 2.60000 GHz 3 ms (1001 pts)



# Attachment D-- Number of Hopping Channel Test Data

Temperature:	<b>25</b> ℃	and	Relative Humidity:	55%
Test Voltage:	AC 1	20V/60Hz		39
Test Mode:	Норр	oing Mode		
Frequency Ran	ge	Test Mode	Quantity of Hopping Channel	Limit
2410MHz~2473MHz		GFSK	19	>15

### **GFSK Mode**

	- Swept SA 0 Ω AC	CEN CEN	NSE:INT	ALIGN AUTO		09:17:13 AM Aug 25, 2020
rker 2 2.473981			Trig: Free Run	Avg Typ	be: Log-Pwr d:>100/100	TRACE 1 2 3 4 5 TYPE M
		PNO: Fast 😱 IFGain:Low	Atten: 30 dB			DET P NNNN
Ref Offset IB/div Ref 21.0	1 dB 0 dBm				Mkr2	2.473 981 0 GHz 8.696 dBm
Δ1						<u>^</u> 2
°├──── Ă~\	$\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim\sim$	$\sqrt{m}$	$\sqrt{m}$	$\sqrt{m}$	$\sqrt{2}$	mm
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° <b>⊢−−−</b> /┼──						<u>\</u>
m						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
						\v~
)						
, 						
						Stop 2.48350 GHz
					Current and	4 000
		#VBW	300 kHz		sweep	1.000 ms (1001 pts)
6 BW 820 kHz	X	Y	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 pts)
6 BW 820 kHz	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
6 BW 820 kHz		y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
6 BW 820 kHz	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
6 BW 820 kHz	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
s BW 820 kHz	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
6 BW 820 kHz	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		
rt 2.40000 GHz s BW 820 kHz MODE TRC SCL N 1 f N 1 f	2.409 018 0 GH	y z 9.651 dE	FUNCTION	FUNCTION WIDTH		

## Attachment E-- Average Time of Occupancy Test Data

Temper	ature:	25°C Relative Humidity:					CIU P	
Test Vo	Itage:	AC	AC 120V/60Hz					
Test Mo	de:	Hop	Hopping Mode (GFSK)					
Remark	:	The number of total hopping frequencies up to 19.					UPP -	
Test	Chan	nel	Reading	Total hops	Test Result	Limit	Result	
Mode	(MH:	z)	Time (ms)	Total hops	(ms)	(ms)	Result	
GFSK	241	0	0.860	84	72.24	400	PASS	

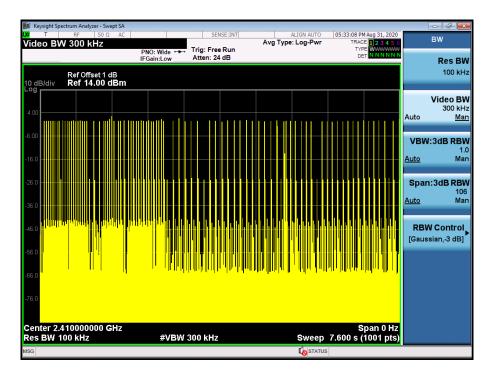
The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 19 [ch] = 7.60[s\*ch];

The burst width, which is directly measured, refers to the duration on one channel hop.

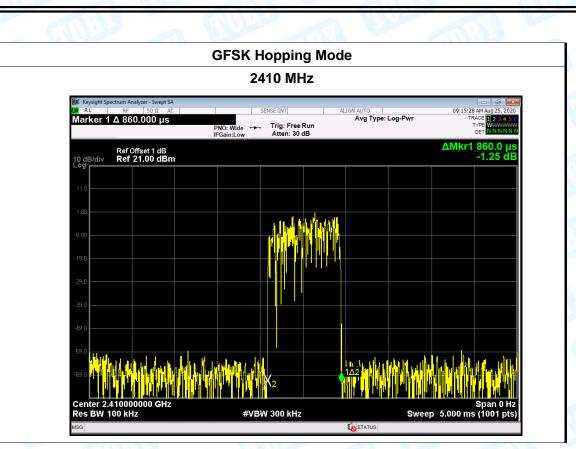
The maximum number of hopping channels in 7.6s is 84.

Reading Time=0.860ms

### **GFSK Hopping Mode**





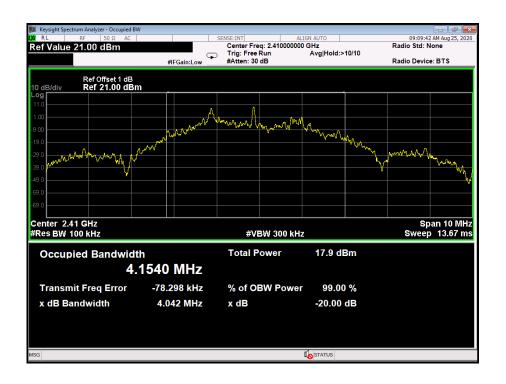




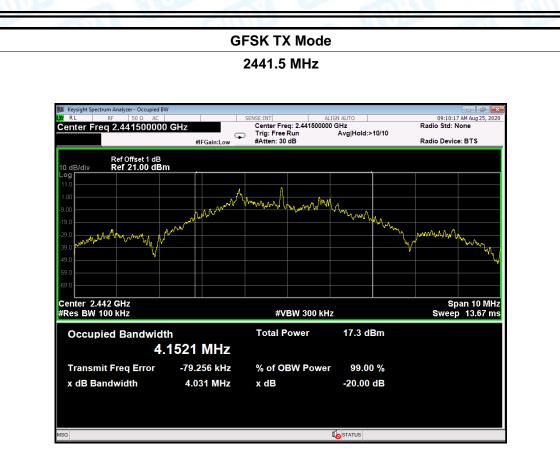
# **Attachment F-- Channel Separation and Bandwidth Test**

## Data

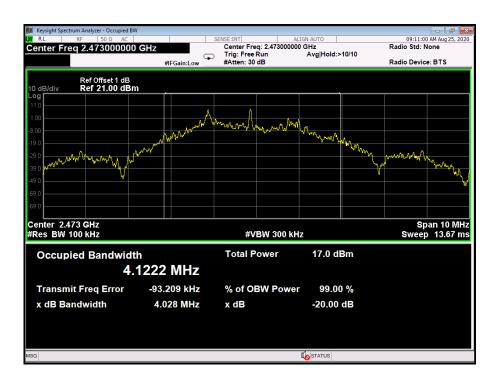
Bandwidth Test	Data:		ALL A	2			
Temperature:	25°	С	Relative Humidity:	55%			
Test Voltage:	AC	AC 120V/60Hz					
Test Mode:	TX Mode (GFSK)						
Channel freque (MHz)	ncy	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)			
2410		4.1540	4.042	2.6947			
2441.5		4.1521	4.031	2.6873			
2473.0		4.1222	4.028	2.6853			
GFSK TX Mode							







## GFSK TX Mode





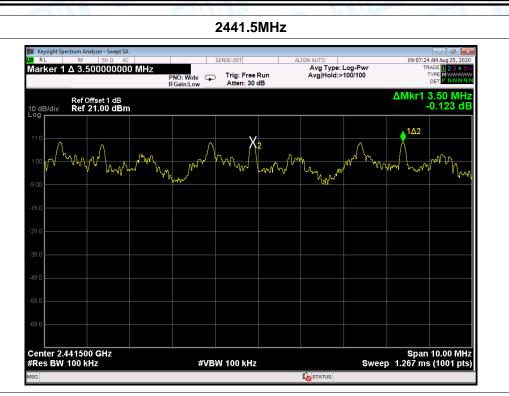
### **Channel Separation Test data:**

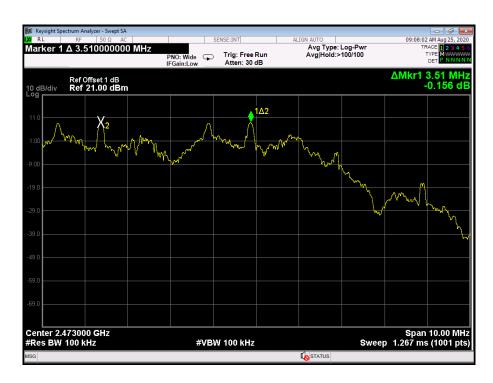
ocparation rest a	atai						
Temperature:	<b>25</b> ℃		Relative Hu	midity:	55%		
Test Voltage:	AC 120V/60Hz						
Test Mode:	Hopping Mode (GFSK)						
Remark:	We test all channel and worse case recorded in the report.						
Channel frequency		Separation Read Value S			eparation Limit		
(MHz)		(kH	z)		(kHz)		
2410		3500.0		2.6947			
2441.5		3500.0		2.6873			
2473.0		351	).0		2.6853		
			1				

### **GFSK Hopping Mode**







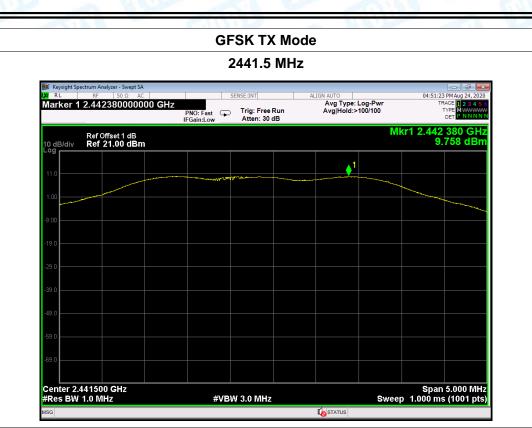


# Attachment G-- Peak Output Power Test Data

Temperature:	nperature: 25°C		Relative Humidity:	55%		
Test Voltage:	AC 120V/60Hz					
Test Mode:	TX Mode	(GFSK)				
Channel frequency (MHz)		Test Result	(dBm)	Limit (dBm)		
2410		10.268	3			
2441.5		9.758		21		
2473.0		9.285				
		GFSK TX N	lode			

RL	RF 50 Ω A	IC		SENSE:INT	AL	IGN AUTO		04:50:5	58 PM Aug 24, 202
larker 1	2.408880000		PNO: Fast 🕞 FGain:Low	Trig: Free F Atten: 30 d		Avg Type: Avg Hold:>	Log-Pwr 100/100	T	RACE 1 2 3 4 5 TYPE MWWWW DET P NNNN
) dB/div	Ref Offset 1 dB Ref 21.00 dBi	n					м	kr1 2.408 10	3 880 GH .268 dBr
1.0		●1					Western 1997		
.00									
.00									
9.0									
3.0									
9.0									
3.0									
9.0									
3.0									
	410000 GHz 1.0 MHz		# <u>VB</u>	W 3.0 MHz			Swee	Spar p 1.000 <u>m</u>	n 5.000 MH is (1001 pts
3						STATUS			





GFSK TX Mode

2473.0 MHz



-----END OF REPORT-----