

Shenzhen Toby Technology Co., Ltd.

Report No.: TB-FCC180594 Page: 1 of 47

# FCC Radio Test Report FCC ID: 2AWNK-VM300TX

## **Original Grant**

Report No.	-	TB-FCC180594
Applicant	15	Shenzhen Apeman Innovations Technology Co., Ltd.
Equipment Under T	est	(EUT)
EUT Name	:	Baby Monitor
Model No.	-	VM300TX
Series Model No.	:	VM300, VM300S, VM430, VM430S, VM500, VM510, VM550, VM200, VM200S, BM24, BM32, BM24S, BM32S
Brand Name	119	Voger
Sample ID	-	20210422-06-01
Receipt Date	1	2021-05-26
Test Date	2	2021-05-27 to 2021-07-01
Issue Date	3	2021-08-04
Standards		FCC Part 15, Subpart C 15.247
Test Method	: (	ANSI C63.10: 2013
Conclusions	): '	PASS

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

Made VI

Ivan Sunt

**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.

Wade W

WAN SU fay tai.

TB-RF-074-1.0



# Contents

CON	ITENTS	2
1.	GENERAL INFORMATION ABOUT EUT	
	1.1 Client Information	5
	1.2 General Description of EUT (Equipment Under Test)	
	1.3 Block Diagram Showing the Configuration of System Tested	
	1.4 Description of Support Units	
	1.5 Description of Test Mode	7
	1.6 Description of Test Software Setting	8
	1.7 Measurement Uncertainty	8
	1.8 Test Facility	
2.	TEST SUMMARY	10
3.	TEST SOFTWARE	10
4.	TEST EQUIPMENT	11
5.	CONDUCTED EMISSION TEST	13
	5.1 Test Standard and Limit	
	5.2 Test Setup	13
	5.3 Test Procedure	
	5.4 Deviation From Test Standard	14
	5.5 EUT Operating Mode	14
	5.6 Test Data	14
6.	RADIATED EMISSION TEST	15
	6.1 Test Standard and Limit	15
	6.2 Test Setup	16
	6.3 Test Procedure	17
	6.4 Deviation From Test Standard	
	6.5 EUT Operating Condition	18
	6.6 Test Data	18
7.	RESTRICTED BANDS AND BAND-EDGE TEST	19
	7.1 Test Standard and Limit	19
	7.2 Test Setup	19
	7.3 Test Procedure	
	7.4 Deviation From Test Standard	
	7.5 EUT Operating Condition	20
	7.6 Test Data	
8.	NUMBER OF HOPPING CHANNEL	21
	8.1 Test Standard and Limit	21
	8.2 Test Setup	
	8.3 Test Procedure	
	8.4 Deviation From Test Standard	
	8.5 EUT Operating Condition	21



	8.6 Test Data	21
9.	AVERAGE TIME OF OCCUPANCY	22
	9.1 Test Standard and Limit	22
	9.2 Test Setup	
	9.3 Test Procedure	
	9.4 EUT Operating Condition	22
	9.4 Deviation From Test Standard	22
	9.5 Test Data	22
10.	CHANNEL SEPARATION AND BANDWIDTH TEST	23
	10.1 Test Standard and Limit	23
	10.2 Test Setup	
	10.3 Test Procedure	
	10.4 Deviation From Test Standard	23
	10.5 EUT Operating Condition	23
	10.6 Test Data	23
11.	PEAK OUTPUT POWER TEST	24
	11.1 Test Standard and Limit	24
	11.2 Test Setup	24
	11.3 Test Procedure	24
	11.4 Deviation From Test Standard	24
	11.5 EUT Operating Condition	24
	11.6 Test Data	24
12.	ANTENNA REQUIREMENT	25
	12.1 Standard Requirement	25
	12.2 Deviation From Test Standard	
	12.3 Antenna Connected Construction	25
	12.4 Result	25
ATT	ACHMENT A CONDUCTED EMISSION TEST DATA	
	ACHMENT B RADIATED EMISSION TEST DATA	
	ACHMENT C RESTRICTED BANDS REQUIREMENT TEST DATA	
	ACHMENT D NUMBER OF HOPPING CHANNEL TEST DATA	
	ACHMENT E AVERAGE TIME OF OCCUPANCY TEST DATA	
	ACHMENT F CHANNEL SEPARATION AND BANDWIDTH TEST DATA	
ATT	ACHMENT G PEAK OUTPUT POWER TEST DATA	



# **Revision History**

Report No.	Version	Description	Issued Date
TB-FCC180594	Rev.01	Initial issue of report	2021-08-04
MBI	- TO!		1 mm
SI L	000	Change and the	m Bl
0000	a DP	TEL TEL	a row
A B			DP A
The state		The second	The Bullion
m Lan	MOBY	TOD OT O	E E E
TOB			B FOR
	000	The second second	TOD -

# 1. General Information about EUT

## **1.1 Client Information**

TOBY

Applicant	:	Shenzhen Apeman Innovations Technology Co., Ltd.	
Address	-	1808, Heng Lu E Times Building, No. 159, North Pingji Road, Hehua Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, CHINA	
Manufacturer		Shenzhen Apeman Innovations Technology Co., Ltd.	
Address		1808, Heng Lu E Times Building, No. 159, North Pingji Road, Hehua Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, CHINA	

# 1.2 General Description of EUT (Equipment Under Test)

EUT Name		Baby Monitor		
Models No.		VM300TX, VM300, VM300S, VM430, VM430S, VM500, VM510, VM550, VM200, VM200S, BM24, BM32, BM24S, BM32S		
Model Difference	•	All these models are identical in the same PCB, layout and electrical circuit, The only difference is appearance.		
B		Operation Frequency: 2406MHz~2475MHz		
a w		Number of Channel:	24 Channels See Note 2	
Product Description	*	Max Peak Output Power:	18.638dBm	
		Antenna Gain:	3dBi Internal Antenna	
		Modulation Type:	GFSK (4Mbps)	
Power Rating	3	Adapter (TPQ-236A050100UW01) Input: 100-240V~, 50/60Hz, 0.3A Output: DC 5V1A		
Software Version		VM300-TX-V1.0		
Hardware Version	:	VM300TX-V01(20210430)		
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)
01	2406	09	2430	17	2454
02	2409	10	2433	18	2457
03	2412	11	2436	19	2460
04	2415	12	2439	20	2463
05	2418	13	2442	21	2466
06	2421	14	2445	22	2469
07	2424	15	2448	23	2472
08	2427	16	2451	24	2475

2475 MHz.

(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	TX Mode		

For Radiated Test			
Description			
TX GFSK Mode			
TX Mode (GFSK) Channel 01/13/24			

#### 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 Mobile 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	Control by pressing the button		
Frequency	2406 MHz	2442 MHz	2475 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	±3.50 dB ±3.10 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.50 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 1/F.,Building 6, Rundongsheng Industrial Zone, Longzhu, Xixiang, Bao'an District, 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: 2017 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: 2017 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. Designation Number: CN1223.

#### 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. CAB identifier: CN0056.



# 2. Test Summary

	FCC Part 15 Subpart C (15.247)/ RSS 247 Issue 2				
Standard Section	Track Many	To at Oammin(a)	lu dana a st		
FCC	Test Item	Test Sample(s)	Judgment	Remark	
15.203	Antenna Requirement	20210422-06-01	PASS	N/A	
15.207	Conducted Emission	20210422-06-01	PASS	N/A	
15.205	Restricted Bands	20210422-06-01	PASS	N/A	
15.247(a)(1)	Hopping Channel Separation	20210422-06-01	PASS	N/A	
15.247(a)(1)	Dwell Time	20210422-06-01	PASS	N/A	
15.247(b)(1)	Peak Output Power	20210422-06-01	PASS	N/A	
15.247(a)(1)	Number of Hopping Frequency	20210422-06-01	PASS	N/A	
15.247(d)	Band Edge	20210422-06-01	PASS	N/A	
15.247(c)& 15.209	Radiated Spurious Emission	20210422-06-01	PASS	N/A	
15.247(a)	99% Occupied Bandwidth & 20dB Bandwidth	20210422-06-01	PASS	N/A	

# 3. Test Software

е	st Software	and a	mous	
	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 Emission</b>	Test				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 06, 2020	Jul. 05, 2021
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 06, 2020	Jul. 05, 2021
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 06, 2020	Jul. 05, 2021
LISN	Rohde & Schwarz	ENV216	101131	Jul. 06, 2020	Jul. 05, 2021
Radiation Emission T	est	-	-	-	-
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 06, 2020	Jul. 05, 2021
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 06, 2020	Jul. 05, 2021
Spectrum Analyzer	Rohde & Schwarz	FSVR	102197	Jul. 06, 2020	Jul. 05, 2021
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	BBHA 9170	BBHA9170582	Mar.01, 2020	Feb. 28, 2022
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
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.01, 2020	Feb. 28, 2021
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted I	Emission				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 06, 2020	Jul. 05, 2021
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 06, 2020	Jul. 05, 2021
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 11, 2020	Sep. 10, 2021
Vector Signal Generator	Agilent	N5182A	MY50141294	Sep. 11, 2020	Sep. 10, 2021
Analog Signal Generator	Agilent	N5181A	MY50141953	Sep. 11, 2020	Sep. 10, 2021
No.	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO26	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO29	Sep. 11, 2020	Sep. 10, 2021
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO31	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments		17100015SNO33	Sep. 11, 2020	Sep. 10, 2021



<b>Conducted Emission</b>	Test				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 02, 2021	Jul. 01, 2022
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 02, 2021	Jul. 01, 2022
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 02, 2021	Jul. 01, 2022
LISN	Rohde & Schwarz	ENV216	101131	Jul. 02, 2021	Jul. 01, 2022
Radiation Emission T	est				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 02, 2021	Jul. 01, 2022
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 02, 2021	Jul. 01, 2022
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jul. 02, 2021	Jul. 01, 2022
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	BBHA 9170	BBHA9170582	Mar.01, 2020	Feb. 28, 2022
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 02, 2021	Jul. 01, 2022
Pre-amplifier	Sonoma	310N	185903	Feb. 25, 2021	Feb. 24, 2022
Pre-amplifier	HP	8449B	3008A00849	Feb. 25, 2021	Feb. 24, 2022
Pre-amplifier	SKET	LNPA_1840G-50	SK201904032	Feb. 25, 2021	Feb. 24, 2022
Cable	HUBER+SUHNER	100	SUCOFLEX	Feb. 25, 2021	Feb. 24, 2022
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted I	Emission				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 02, 2021	Jul. 01, 2022
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jul. 02, 2021	Jul. 01, 2022
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 11, 2020	Sep. 10, 2021
Vector Signal Generator	Agilent	N5182A	MY50141294	Sep. 11, 2020	Sep. 10, 2021
Analog Signal Generator	Agilent	N5181A	MY50141953	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO26	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO29	Sep. 11, 2020	Sep. 10, 2021
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO31	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO33	Sep. 11, 2020	Sep. 10, 2021



# 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

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

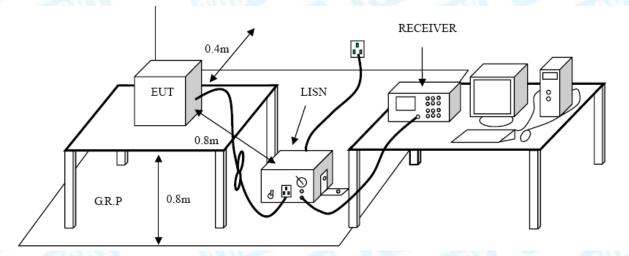
#### Notes:

(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



#### ctod Emission To 1.2



## 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

#### Radiated Emission Limit (Above 1000MHz)

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

#### Note:

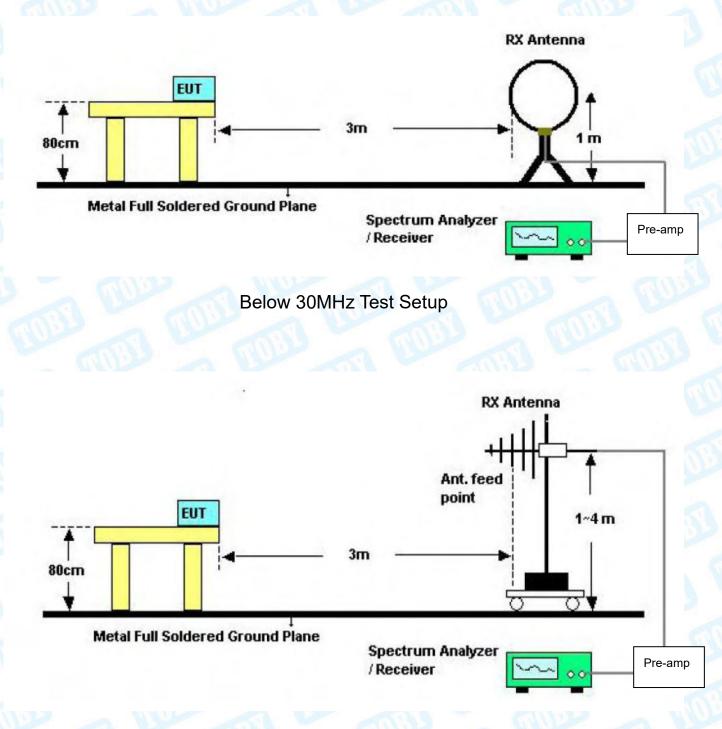
(1) The tighter limit applies at the band edges.

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



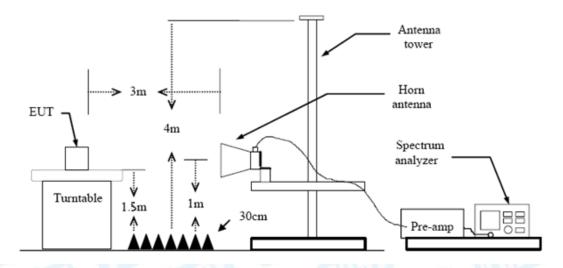
Report No.: TB-FCC180594 Page: 16 of 47

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.

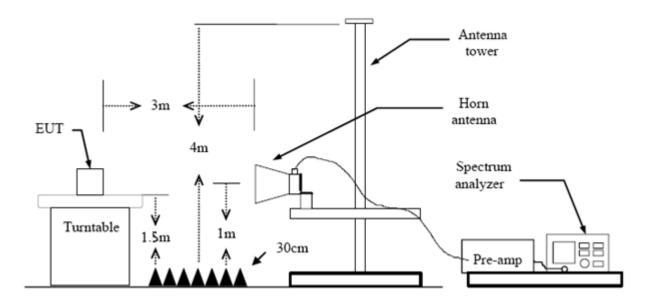


# 7. Restricted Bands and Band-edge test

- 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 M	leters(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.

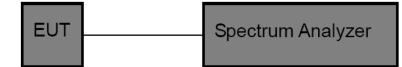


# 8. Number of Hopping Channel

- 8.1 Test Standard and Limit
  - 8.1.1 Test Standard
    - FCC Part 15.247 (a)(1) / RSS 247 5.1(4)
  - 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.

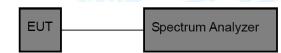


# 9. Average Time of Occupancy

- 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



## 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.



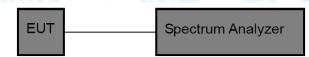
# 10. Channel Separation and Bandwidth Test

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.

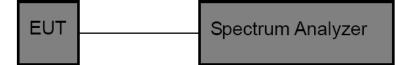


# 11. Peak Output Power Test

- 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)	2400 2403.3

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 3dBi, 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
22	Permanent attached antenna
10	Unique connector antenna
	Professional installation antenna

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

Temperature:	<b>22.5℃</b>	Relative Humidity:	42%
Test Voltage:	AC 120V/60Hz		and the
Ferminal:	Line		
Fest Mode:	TX GFSK Mode 240	06MHz	- MUP
Remark:	All channels have be	een tested and Shows only the	worst channels.
80.0 dBuV			
			QP: AVG:
mm			
30	S AN 8		
MMM4.	m Mar man	M M A MAAAAAAAA	Jun Why
A CAN	more many a have	who has a har a har	www.white
		M D. J. M M M M M M M M M M M M M M M M M M	Www.
			A
20			
0.150	0.5	(MHz) 5	30.000

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	0.5980	30.00	9.70	39.70	56.00	-16.30	QP
2 *	0.5980	22.54	9.70	32.24	46.00	-13.76	AVG
3	1.2059	18.04	9.78	27.82	56.00	-28.18	QP
4	1.2059	6.97	9.78	16.75	46.00	-29.25	AVG
5	1.7940	14.48	9.72	24.20	56.00	-31.80	QP
6	1.7940	6.73	9.72	16.45	46.00	-29.55	AVG
7	2.8500	13.07	9.87	22.94	56.00	-33.06	QP
8	2.8500	5.40	9.87	15.27	46.00	-30.73	AVG
9	3.9140	12.48	9.90	22.38	56.00	-33.62	QP
10	3.9140	4.86	9.90	14.76	46.00	-31.24	AVG
11	17.8260	6.13	10.00	16.13	60.00	-43.87	QP
12	17.8260	-0.86	10.00	9.14	50.00	-40.86	AVG

Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)

2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)



Test Voltage: AC 120V/60Hz Terminal: Neutral Test Mode: TX GFSK Mode 2406MHz Remark: All channels have been tested and Shows only the worst channels 80.0 dBuv QP: AVG: - AVG: - 30 40 40 40 40 40 40 40 40 40 4	Temperature:	<b>22.5℃</b>	Relative Humidity:	42%
Fest Mode:    TX GFSK Mode 2406MHz      Remark:    All channels have been tested and Shows only the worst channels      80.0    dBuV      0    0      0 <td>Fest Voltage:</td> <td>AC 120V/60Hz</td> <td></td> <td></td>	Fest Voltage:	AC 120V/60Hz		
Remark: All channels have been tested and Shows only the worst channels 80.0 dBuV 90.0	ferminal:	Neutral	CODD -	
80.0 dBuV QP:AVG:	est Mode:	TX GFSK Mode 2406M	ИНz	
30 MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM	Remark:	All channels have been	n tested and Shows only the	worst channels.
30 MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM	80.0 dBu¥			
				Ava. —
	m	*		
	and the			
		Mun Man 1	X X M A X I	. X
	WWWW	menter have been a for the	WWWWWWW	vighter and the second
		" MANY	M M M M M M M M M M M M M M M M M M M	- Mannung F
			N. J	mount
n				
	20			

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.6140	29.88	9.80	39.68	56.00	-16.32	QP
2	*	0.6140	22.70	9.80	32.50	46.00	-13.50	AVG
3		1.2059	18.01	9.80	27.81	56.00	-28.19	QP
4		1.2059	6.91	9.80	16.71	46.00	-29.29	AVG
5		1.8020	14.34	9.80	24.14	56.00	-31.86	QP
6		1.8020	6.51	9.80	16.31	46.00	-29.69	AVG
7		2.3540	13.16	9.80	22.96	56.00	-33.04	QP
8		2.3540	5.27	9.80	15.07	46.00	-30.93	AVG
9		4.4380	11.70	9.80	21.50	56.00	-34.50	QP
10		4.4380	4.36	9.80	14.16	46.00	-31.84	AVG
11		18.4300	9.05	10.00	19.05	60.00	-40.95	QP
12		18.4300	2.77	10.00	12.77	50.00	-37.23	AVG

Remark: 1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)

2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)



# **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

	GHz										
Temp	erature	:	23.	.9℃				Relative	Humidity:	44%	
Test V	/oltage	•	AC	; 120	0V/6	0Hz	NU	T		TOR	
Ant. F	Pol.		Ho	rizo	ntal				-	1 yes	
Test N	lode:		TX	GF	SKI	Mode	2406MHz	6	1		2
Rema	rk:		On	ly w	orse	e case	is reported	2		189	
80.0 d	lBuV/m										
									(RF)FCC 15	C 3M Radiation	
										Margin -6	
-							1 2 *	▲ ★ 5	6 X		
30								ALL AT 1		1 where	rha
~							, ALL MAR	WWWWW	N. Mulal	wenn .	
	when we want		γ.	Inh	mh	MM	ww.thtt.	x citth	W.		
		~~~	m								
20 30.000	) 40	50	60	70 8	30		(MHz)	300	400 500	) 600 700	1000.000
	, 40	50	00						400 500	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1000.000
No	. Mk.	Er	24	F		ding	Correct	Measure-	Limit	Over	
	. IVIK.		eq.			vel	Factor	ment			
		M				lu∨	dB/m	dBuV/m	dBuV/m	dB	Detecto
1		44.3	348	3	55	.78	-21.93	33.85	43.50	-9.65	peak
							00.00	04.00	40.50	0.00	
2		75.6	6516	6	55	.16	-20.28	34.88	43.50	- <mark>8</mark> .62	реак
2 3		75.6  92.4				.16 .72	-20.28	34.88	43.50	-8.62	•
3	*	92.4	185	5	56	.72	-19.83	36.89	43.50	- <mark>6.61</mark>	peak
3	* *	192.4 240.8	185 303	5 3	56 54	.72 .52	-19.83 -17.72	36.89 36.80	43.50 46.00	-6.61 -9.20	peak peak
3	* ~	92.4	185 3303 020	5 3 )	56 54 51	.72	-19.83	36.89	43.50	- <mark>6.61</mark>	peak peak peak peak peak

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

#### Remark:

- 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
- 2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
- 3. Margin (dB) = QuasiPeak (dBµV/m)-Limit QPK(dBµV/m)



Temperature:	<b>23.9℃</b>		Relative Humidity	<b>':</b> 44%	
Test Voltage:	AC 120V/60	Hz	60000		RAF
Ant. Pol.	Vertical	No.		201	
Test Mode:	TX GFSK M	ode 2406MHz			51
Remark:	Only worse	case is reported	6000		
80.0 dBuV/m					
30 ×	m Manal		5	: 15C 3M Radiation Margin -6	
	50 60 70 80	(MHz)	300 400	500 600 700	1000.00
No. Mk.		ading Correct vel Factor	Measure- ment Limit	Over	
	MHz de	3uV dB/m	dBuV/m dBuV/r	n dB	Detecto
1 3	0.8535 43	.92 -13.58	30.34 40.00	-9.66	peak
2 1	26.3285 55	.56 -22.27	33.29 43.50	0 -10.21	peak
	44.3348 58	.62 -21.93	36.69 43.50	) -6.81	peak
3 * 14	44.3340 30	.02 -21.35			
				) -10.75	peak
4 19	92.4185 52	.58 -19.83	32.75 43.50		peak
4 19 5 24	92.4185 52 40.8303 50			) -13.47	peak peak peak

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

#### Remark:

- 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB) 2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
- 3. Margin (dB) = QuasiPeak (dBµV/m)-Limit QPK(dBµV/m)

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

Ant. Pol.	AC 120V/60Hz Horizontal TX GFSK Mode 2	2406MHz	3	E	3	3
		2406MHz	35	R	00	a
Test Mode:	TX GFSK Mode 2	2406MHz	2			671
No. Mk. Free	Reading q. Level	Correct Factor	Measure- ment	Limit	Over	
MHz	z dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1 * 4811.6	688 34.51	13.07	47.58	54.00	-6.42	AVG
2 4812.3	328 48.27	13.07	61.34	74.00	-12.66	peak

#### Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

Temp	peratu	re:	23.2	°C		<b>Relative Hun</b>	nidity:	41%	
Test	Voltag	ge:	AC 1	20V/60Hz	Can BL		011	0.0	
Ant.	Ant. Pol. Vertical								
Test	Mode	•	TX G	FSK Mode 2	2406MHz		AUM		
N	o. Mk	. Fr	eq.	Reading Level	Correct Factor		Limit	Over	
		M	Hz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4811	.918	52.14	13.07	65.21	74.00	-8.79	peak
2	*	4812	.026	37.25	13.07	50.32	54.00	-3.68	AVG
4									

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

4. The tests evaluated1-26.5GHz, The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.



Temp	oeratu	ire: 2	<b>3.2℃</b>		Relative Hur	nidity:	41%	
Test \	Voltag	ge: A	C 120V/60Hz	20	1177	500		M. M. K.
Ant. Pol. Horizontal								
Test	Mode	: Т	X GFSK Mode	2442MHz	2			130
No	. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4884.01	4 35.14	13.60	48.74	54.00	-5.26	AVG
2		4884.31	0 48.83	13.61	62.44	74.00	-11.56	peak

#### Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

4. The tests evaluated1-26.5GHz, The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	<b>23.2℃</b>	Relative Humidity:	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical	TOBY T	61000
Test Mode:	TX GFSK Mode 2442MHz		

1	No.	Mk.	Freq.			Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1			4883.638	48.74	13.59	62.33	74.00	-11.67	peak
2		*	4884.330	35.17	13.61	48.78	54.00	-5.22	AVG

#### Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

4. The tests evaluated1-26.5GHz, The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.



Tempe	eratu	re: 2	23.2	°C		Relative H	lumidity:	41%	
Test Voltage:AC 120V/60Hz						610	52		RUN
Ant. Pol. Horizontal									
Test Mode: TX GFSK M					2475MHz	2			5
No.	Mk	. Frec	Į.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz		dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4949.9	66	48.15	14.08	62.23	74.00	-11.77	peak
2	*	4950.1	04	34.90	14.08	48.98	54.00	-5.02	AVG

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dB $\mu$ V/m)-Limit PK/AVG(dB $\mu$ V/m)

4. The tests evaluated1-26.5GHz, The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

			and the second sec							
Tempe	Temperature:		23.2	°C	(anb)	Relative Hu	umidity:	41%		
Test V	Test Voltage:AC 120V/60Hz					1.900		1100	162	
Ant. P	ol.		Verti	cal	~					
Test Mode: TX GFSK Mode 2475MHz					400	1				
No.	Mk	. Fre	əq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MH	Ηz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector	
1		4949.	640	48.35	14.08	62.43	74.00	-11.57	peak	
2	*	4949.	888	35.02	14.08	49.10	54.00	-4.90	AVG	

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)

3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

4. The tests evaluated1-26.5GHz, The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

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

	ure:	<b>23.2℃</b>	(CHI)		Relative	Humidity:	41%
Test Volta			)V/60Hz	1000			
Ant. Pol.	5	Horizor			200		- (11)
Test Mod	e:			2406MHz	ALC: N		
Remark:		Only w	orse case	e is reported		CULD .	
120.0 dBu¥/	m						
							4 3 X
							3 X
							$\uparrow$
						(RF) FCC P	ART 15C (PEAK
70							l L
							1
						(RF) FOC	PART 15C AVO
						× 2	
						×	
20.0		41.00 23	351.00 23	61.00 2371.00	2381.00 23	91.00 2401.0	10 2
20.0	331.00 23			01.00 2571.00	2381.00 23		
	331.00 23			2371.00	2381.00 23		
	331.00 23						
		F	Reading Level	Correct Factor	Measure- ment	Limit	Over
2321.000 2		F q.	Reading	Correct	Measure-		Over dB
2321.000 2	k. Fre	F :q. z	Reading Level	Correct Factor	Measure- ment	Limit	
2321.000 2	k. Fre MH:	F q. z 000	Reading Level dBu∨	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	dB
2321.000 2 No. M	k. Fre MH: 2390.0	F q. z 000 000	Reading Level dBu∨ 44.87	Correct Factor dB/m 1.28	Measure- ment dBuV/m 46.15	Limit dBuV/m 74.00	dB -27.85 -17.42

Remark:

- Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
  Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
- 3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)



Temperature:	23.2°C	Relative Humidity: 41%					
Fest Voltage:	AC 120V/60Hz						
Ant. Pol.	Vertical						
fest Mode:	TX GFSK Mode 2406MHz						
Remark:	Only worse case is reported	ted					
120.0 dBu∀/m							
70	Image:	(FF) FCC PART 15C (PEAK)					
20.0	2348.00 2358.00 2368.00 2378.0						

Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
	2390.000	52.04	1.28	53.32	74.00	-20.68	peak
	2390.000	41.55	1.28	42.83	54.00	-11.17	AVG
*	2405.200	103.32	1.35	104.67	Fundamental	Frequency	AVG
Х	2407.000	107.79	1.35	109.14	Fundamental	Frequency	peak
	*	MHz 2390.000 2390.000 * 2405.200	Mk.      Freq.      Level        MHz      dBu∨        2390.000      52.04        2390.000      41.55        *      2405.200      103.32	Mk.      Freq.      Level      Factor        MHz      dBuV      dB/m        2390.000      52.04      1.28        2390.000      41.55      1.28        *      2405.200      103.32      1.35	Mk.      Freq.      Level      Factor      ment        MHz      dBuV      dB/m      dBuV/m        2390.000      52.04      1.28      53.32        2390.000      41.55      1.28      42.83        *      2405.200      103.32      1.35      104.67	Mk.      Freq.      Level      Factor      ment      Limit        MHz      dBuV      dB/m      dBuV/m      dBuV/m        2390.000      52.04      1.28      53.32      74.00        2390.000      41.55      1.28      42.83      54.00        *      2405.200      103.32      1.35      104.67      Fundamental	Mk.      Freq.      Level      Factor      ment      Limit      Over        MHz      dBuV      dB/m      dBuV/m      dBuV/m      dB        2390.000      52.04      1.28      53.32      74.00      -20.68        2390.000      41.55      1.28      42.83      54.00      -11.17        *      2405.200      103.32      1.35      104.67      Fundamental Frequency

- Remark: 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB) 2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
- 3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)



Temperature:	<b>23.2℃</b>			Re	elative H	umidity	: 41%	5		
Test Voltage:	AC 120V/	60Hz	3		610	20		13		
Ant. Pol.	Horizonta		-	20		6	130	1		
Test Mode:	TX GFSK	Mode 2	475 MHz							
Remark:	Only wors	se case i	s reporte	d						
120.0 dBuV/m										
1										
Å										
						(RF) FCC	PART 15C (I	PEAK)		
70	3									
, M	X					(RF) FC	C PART 15C	(AVG)		
m	×.									
N <sup>N</sup>	- M	<b>~</b>								
		~~~~~								
20.0										
2460.000 2470.00 2	2480.00 2490	.00 2500.	.00 2510.0	0 252	0.00 2530	.00 254	D.00	2560.00		

No	. Mł	k. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1	Х	2474.000	99.24	1.81	101.05	Fundamental	Frequency	peak
2	*	2474.400	95.87	1.82	97.69	Fundamental	Frequency	AVG
3		2483.500	59.16	1.88	61.04	74.00	-12.96	peak
4		2483.500	47.31	1.88	49.19	54.00	-4.81	AVG

- Remark: 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB) 2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
- 3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)



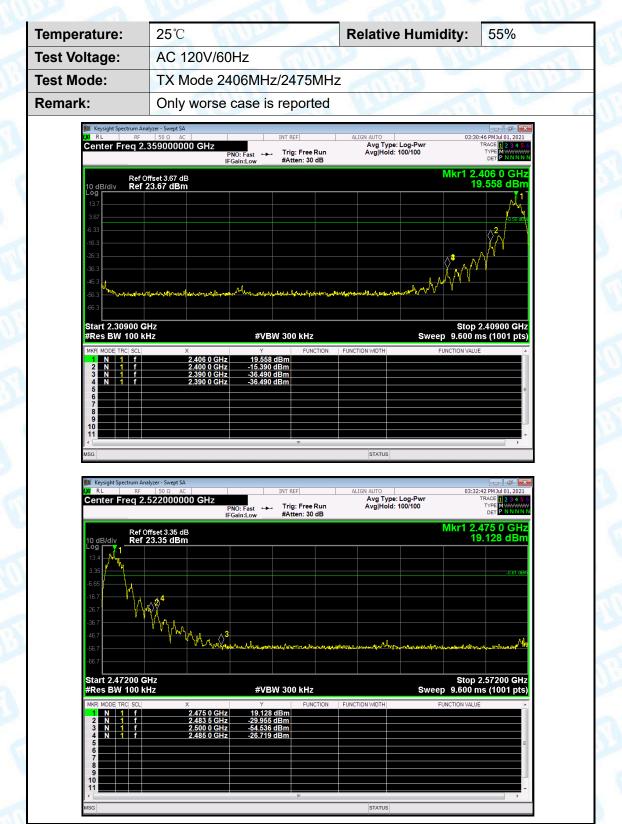
emperature:	<b>23.2℃</b>		Relative Humidity:	41%
est Voltage:	AC 120V/6	0Hz	(10) P	~ 100
nt. Pol.	Vertical	When we want		
est Mode:	TX GFSK	Mode 2475 MHz	2 1 1	
emark:	Only worse	e case is reporte	d and a	A MUL
120.0 dBuV/m				
70 70 70	3 1 2 3 2 3 2 3 2 3 2 3 2 3 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3 2 3			PART 15C (PEAK)
20.0				
2460.000 2470.00	2480.00 2490.0	0 2500.00 2510.0	0 2520.00 2530.00 2540.1	DO 2560.00 MI

No.	Mk	. Freq.	Level	Factor	ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2474.400	102.41	1.82	104.23	Fundamental	Frequency	AVG
2	Х	2476.000	107.52	1.83	109.35	Fundamental	Frequency	peak
3		2483.500	63.34	1.88	65.22	74.00	-8.78	peak
4		2483.500	48.76	1.88	50.64	54.00	-3.36	AVG

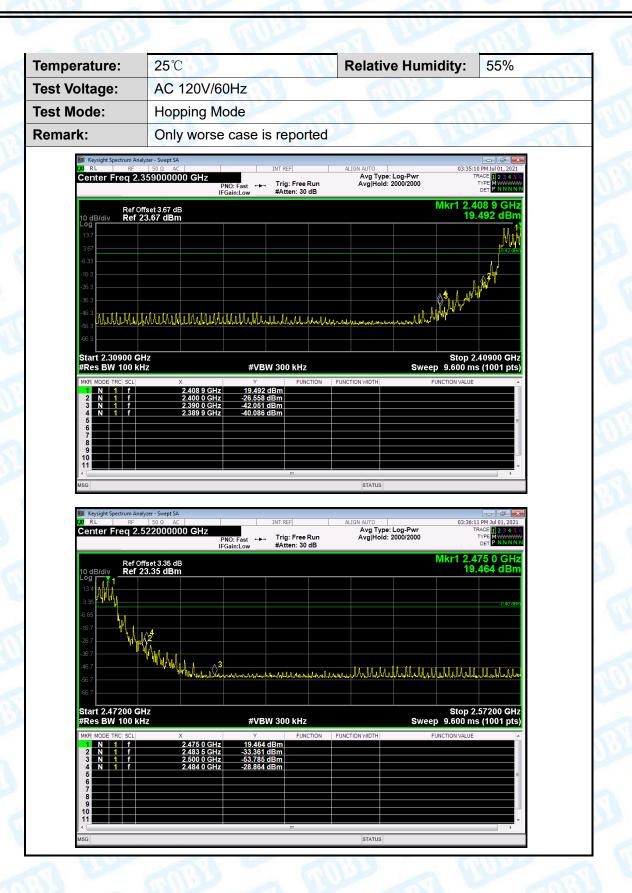
- Remark: 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB) 2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
- 3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)



#### (2) Conducted Band Edge Test









# Attachment D-- Number of Hopping Channel Test Data

Temperature:	<b>25</b> ℃	600	Relative Humidity:	55%
Test Voltage:	AC 1	20V/60Hz		
Test Mode:	Норр	ing Mode		
Frequency Rar	Frequency Range		Quantity of Hopping Channel	Limit
2406MHz~2475	MHz	GFSK	24	>15

#### **GFSK Mode**

L RF 50 Ω AC ter Freg 2.441750000 GHz	INT REF	ALIGN AUT	O Type: Log-Pwr	03:19:22 PM Jul 01, 2021 TRACE 1 2 3 4 5
	PNO: Fast ↔→ Trig: Fre Gain:Low #Atten: 4	eRun Avg	Hold: 2000/2000	DET PNNN
Ref Offset 3.61 dB B/div Ref 30.00 dBm			Mkr1	2.404 926 5 GH 11.493 dBn
Mulleyder John John John John John John John John	بالاتر إيالير إيالير إدايور إداري	the bole the black	wlabarryphartyhelmy	my Mulik 2
v^				
rt 2.40000 GHz				Stop 2.48350 GH
s BW 100 kHz	#VBW 300 kH	z	Sweep	8.000 ms (1001 pts
MODE TRC SCL X	Y FU	INCTION FUNCTION WID	TH FUN	CTION VALUE

# Attachment E-- Average Time of Occupancy Test Data

Temper	ature:	25°	C	55%	MUM					
Test Vo	Itage:	AC	AC 120V/60Hz							
Test Mo	de:	Нор	Hopping Mode (GFSK)							
Remark	:	The number of total hopping frequencies up to 24.								
Test	Chan	nel	Reading Time	Total hops	Test Result	Limit	Result			
Mode	(MH:	z)	(ms)	(N)	(ms)	(ms)	Result			
GFSK	244	2			51.81	400	PASS			

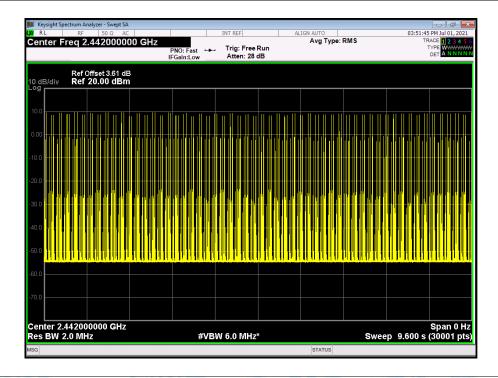
The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 24[ch] = 9.6[s\*ch];

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

The maximum number of hopping channels in 9.6s is 110.

Reading Time=0.471ms\*110=51.81ms

#### Hopping Channels in 9.6s





		GFS	К Норј	oing M	ode			
🎉 Keysight Spectrum Analyze								
x RL RF Center Freq 2.44		PNO: Fast ↔ FGain:Low	INT REF Trig Delay Trig: Video #Atten: 40	-1.000 ms	LIGN AUTO Avg Type	e: Log-Pwr	т	4 PM Jul 01, 2021 RACE 1 2 3 4 5 6 TYPE WWWWWWWW DET PNNNNN
10 dB/div Ref 30.	et 3.61 dB 00 dBm						ΔMkr1	471.0 μs -0.20 dB
20.0	1Δ2							
10.0 X								TRIG LVL
-10.0								
-20.0								
-30.0	Les taltas	https:/			les an			
-40.0 0000000000000000000000000000000000		y berne linge få trynsprovere. Het kan trykstande av det so	lesi aper a la come da Unattalla se a classes a	ni en en en en en en arment, besta, palki	landi Karaya (a. <mark>), II waada (a. (</mark> 11,	and a ray strand with a so	n an an Ingelse an Anna an Anna an Anna Anna an Anna an	a anna an an anna an an Iomraichean anna an an Arth
-60.0		1 1 1 1 1				<u>. 1 </u>		
Center 2.44200000 Res BW 1.0 MHz	00 GHz	#VB	W 3.0 MHz			Sweep	10.00 ms	Span 0 Hz (10001 pts)
MKR MODE TRC SCL	Х	Y	FUN	CTION   FUNC	TION WIDTH	F	UNCTION VALUE	
2 1								
4 5								E
6 7 8								
9 10								
11								
MSG					STATUS			

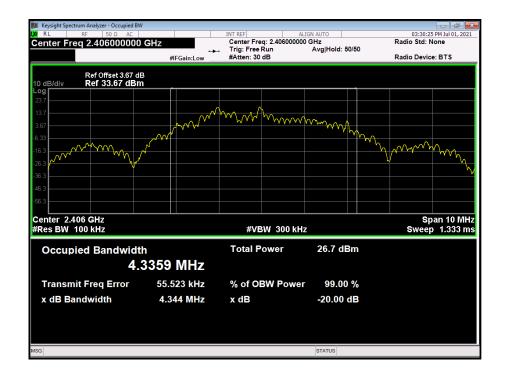
# TOBY

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

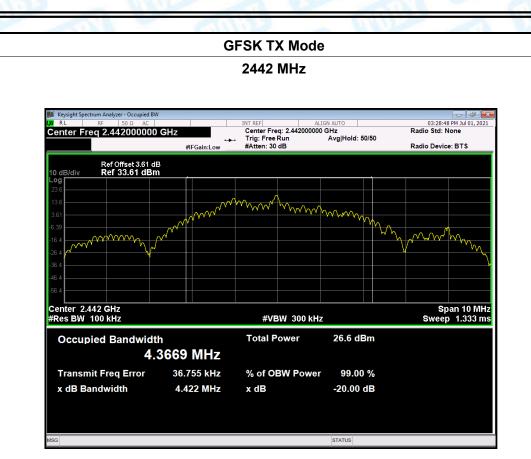
# Data

	P							
Temperature:	25	C	Relative Humidity:	55%				
Test Voltage:	AC	AC 120V/60Hz						
Test Mode:	TX	TX Mode (GFSK)						
Channel frequency (MHz)		99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)				
2406		4335.9	4344	2896.00				
2442		4366.9	4422	2948.00				
2475		2475 4421.7		2954.67				
		GESK TY	Mode					

GFSK TX Mode







# GFSK TX Mode





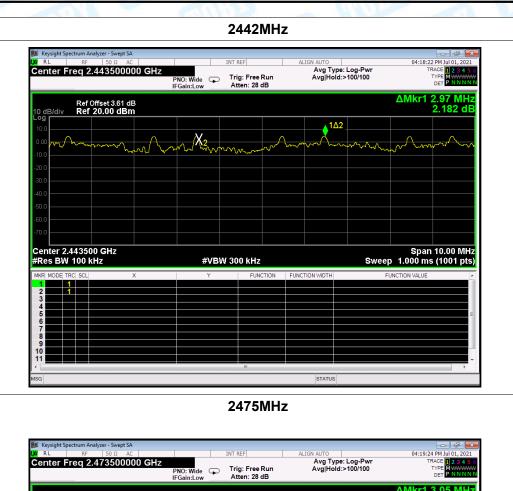
#### **Channel Separation Test data:**

Temperature:	<b>25</b> ℃		Relative Humidity	<b>7:</b> 55%				
Test Voltage:	AC 120V/60Hz							
Test Mode:	Hopping Mode (GFSK)							
Remark:	We test all channel and worse case recorded in the report.							
Channel freq	uency	Separation Re	ad Value S	Separation Limit				
(MHz)		(kHz)		(kHz)				
2406		3090		2896.00				
2442		2970		2948.00				
2475		3050		2954.67				

#### Hopping Mode







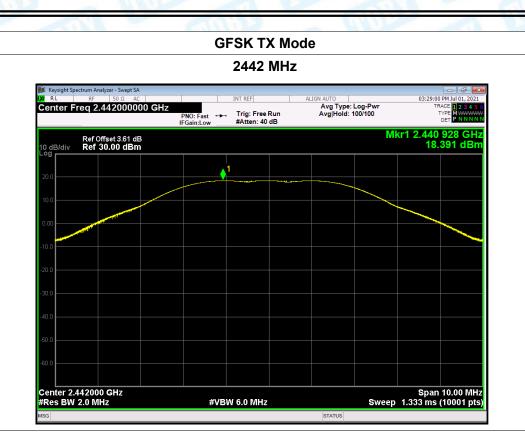


# **Attachment G-- Peak Output Power Test Data**

Temperature:	<b>25</b> ℃		Relative Humidity:	55%			
Test Voltage:	AC 120V/60Hz						
Test Mode:	TX Mode (GFSK)						
Channel frequen	cy (MHz)	Test Result	(dBm) L	Limit (dBm)			
2406		18.638	<b>;</b>				
2442		18.391		30			
2475		18.270	)				
		GFSK TX I	lode				







**GFSK TX Mode** 





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