FCC RADIO TEST REPORT

Applicant.....	: Vornado Air LLC
Address.....	: 415 E. 13th Street, Andover KS 67002 USA
Manufacturer.....	: Shenzhen Minghuida Plastic Electronics Co., Ltd.
Address.....	: 1-5/F, No.5 Bldg&1-5/F, No.6 Bldg, Row 2, Tangxiawei Industrial Zone, Jiangshi Community, Gongming Office, Guangming New District Shenzhen Guangdong China
Factory.....	: Shenzhen Minghuida Plastic Electronics Co., Ltd.
Address.....	: 1-5/F, No.5 Bldg&1-5/F, No.6 Bldg, Row 2, Tangxiawei Industrial Zone, Jiangshi Community, Gongming Office, Guangming New District Shenzhen Guangdong China
Product Name.....	: Remote Control
Brand Name.....	: Vornado, Sharper Image
Model No.	: AXIS 47
FCC ID.....	: WOT-AXIS472
Measurement Standard.....	: 47 CFR FCC Part 15, Subpart C (Section 15.249)
Receipt Date of Samples....	: August 28, 2021
Date of Tested.....	: September 03, 2021 to September 14, 2021
Date of Report.....	: October 15, 2021

This report shows that above equipment is technically compliant with the requirements of the standards above. All test results in this report apply only to the tested sample(s). Without prior written approval of Dongguan Nore Testing Center Co., Ltd, this report shall not be reproduced except in full.

Prepared by

Rose Hu / Project Engineer

Approved by

Iori Fan / Authorized Signatory

Dongguan NTC Co., Ltd.

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Revision History

Report Number	Description	Issued Date
NTC2108522FV00	Initial Issue	2021-10-15

1. Summary of Test Result

FCC Rules	Description of Test	Result	Remarks
§15.207 (a)	AC Power Conducted Emission	---	Not applicable
§15.249(a)/ 15.209	Radiated Emissions	PASS	---
§15.249(d)/ 15.205	Band Edge	PASS	---
§15.215(c)	20dB Bandwidth	PASS	---
§15.203	Antenna Requirement	PASS	---

2. General Description of EUT

Product Information	
Product Name:	Remote Control
Main Model Name:	AXIS 47
PCB Information:	RF Alt C
Additional Model Name:	N/A
Model Difference:	N/A
S/N:	2108-4813
Brand Name:	Vornado, Sharper Image
Hardware Version:	V01
Software Version:	V01
Rating:	2* DC 1.5V AAA come from battery
Typical Arrangement:	Table-top
I/O Port:	N/A
Accessories Information	
Adapter:	N/A
Cable:	N/A
Other:	N/A
Additional Information	
Note:	N/A
Remark:	All the information above are provided by the manufacturer. More detailed feature of the EUT please refers to the user manual.

Technical Specification (2.4G Function)	
Frequency Range:	2408MHz
Modulation Type:	GFSK
Number of Channel:	1 (refer to following channel list for details)
Channel Space:	N/A
Antenna Type:	Wire antenna
Antenna Gain:	0 dBi (Declared by the manufacturer)

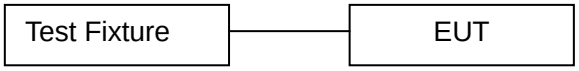
Channel List	
Channel	**Frequency (MHz)**
1	2408

3. Test Channels and Modes Detail

Mode		Channel		Frequency (MHz)	Modulation	Data Rate (Mbps)
1.	TX	1		2408	GFSK	1
2.	Normal	---	---	---	---	---
Note: TX mode means that the EUT was programmed to be in continuously transmitting mode.						

4. Configuration of EUT

TX Mode



Normal Mode

Note: The support device is kept in a remote area for normal mode.

5. Modification of EUT

No modifications are made to the EUT during all test items.

6. Description of Support Device

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Brand	M/N	S/N	Cable Specification	Remarks
1.	Test Fixture	---	---	---	---	---

No.	Test Software	Modulation	Power Setting
1.	N/A	N/A	N/A

7. Test Facility and Location

Test Site	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)
Accreditations and Authorizations	:	The Laboratory has been assessed and proved to be in compliance with CNAS/CL01 Listed by CNAS, August 13, 2018 The Certificate Registration Number is L5795. The Certificate is valid until August 13, 2024 The Laboratory has been assessed and proved to be in compliance with ISO17025 Listed by A2LA, November 01, 2017 The Certificate Registration Number is 4429.01 The Certificate is valid until December 31, 2021 Listed by FCC, November 06, 2017 Test Firm Registration Number is 907417 Listed by Industry Canada, June 08, 2017 The Certificate Registration Number is 46405-9743A The CAB identifier number is CN0015
Test Site Location	:	Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China

8. Applicable Standards and References

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

Test Standards:

47 CFR Part 15, Subpart C, 15.249

ANSI C63.10-2013

References Test Guidance:

N/A

9. Deviations and Abnormalities from Standard Conditions

No additions, deviations and exclusions from the standard.

10. Test Conditions

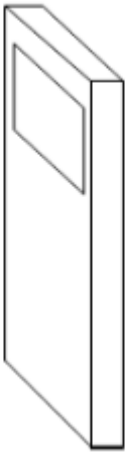
No.	Test Item	Test Mode	Test Voltage	Tested by	Remarks
1.	AC Power Conducted Emission	---	---	---	---
2.	Radiated Emissions	1	DC 3.0V	Sean Yuan	See note 1
3.	Band Edge	1	DC 3.0V	Sean Yuan	See note 1
4.	20dB Bandwidth	1	DC 3.0V	Sean Yuan	See note 1
5.	Antenna Requirement	---	---	---	See note 1

Note:

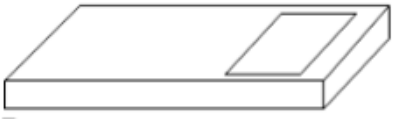
1. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35℃, 30~70%, 86~106kPa
2. As the EUT can be operated multiple positions, all X,Y,Z axis were considered during the test and only the worst case X was recorded.

X P□ane

Y Pla□e



Z Plane



3. Only the worst case was recorded in the report.
4. The New battery be used during test.

11. Measurement Uncertainty

No.	Test Item	Frequency	Uncertainty	Remarks
1.	Conducted Emission	150KHz ~ 30MHz	±2.52 dB	---
2.	Radiated Emission Test	9kHz ~ 30MHz	±2.60 dB	---
		30MHz ~ 1GHz	±4.68 dB	---
		1GHz ~ 18GHz	±5.14 dB	---
		18GHz ~ 40GHz	±5.14 dB	---

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The measurement uncertainly levels above are estimated and calculated according to CISPR 16-4-2.
3. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

12. Sample Calculations

Conducted Emission						
Freq. (MHz)	**Reading Level (dBuV)**	**Correct Factor (dB)**	**Measurement (dBuV)**	**Limit (dBuV)**	**Over (dB)**	**Detector**
0.1900	30.10	10.60	40.70	79.00	-38.30	QP

Where,

Freq.	= Emission frequency in MHz
Reading Level	= Uncorrected Analyzer/Receiver reading
Corrector Factor	= Insertion loss of LISN + Cable Loss + RF Switching Unit attenuation
Measurement	= Reading + Corrector Factor
Limit	= Limit stated in standard
Margin	= Measurement - Limit
Detector	= Reading for Quasi-Peak / Average / Peak

Radiated Spurious Emissions and Restricted Bands						
Freq. (MHz)	**Reading Level (dBuV)**	**Correct Factor (dB/m)**	**Measurement (dBuV/m)**	**Limit (dBuV/m)**	**Over (dB)**	**Detector**
60.0700	45.88	-18.38	27.50	49.00	-21.50	QP

Where,

Freq.	= Emission frequency in MHz
Reading Level	= Uncorrected Analyzer/Receiver reading
Corrector Factor	= Antenna Factor + Cable Loss - Pre-amplifier
Measurement	= Reading + Corrector Factor
Limit	= Limit stated in standard
Over	= Margin, which calculated by Measurement - Limit
Detector	= Reading for Quasi-Peak / Average / Peak

Note: For all conducted test items, the spectrum analyzer offset or transducer is derived from RF cable loss and attenuator factor. The offset or transducer is equal to the RF cable loss plus attenuator factor.

13. Test Items and Results

13.1 Conducted Emissions Measurement

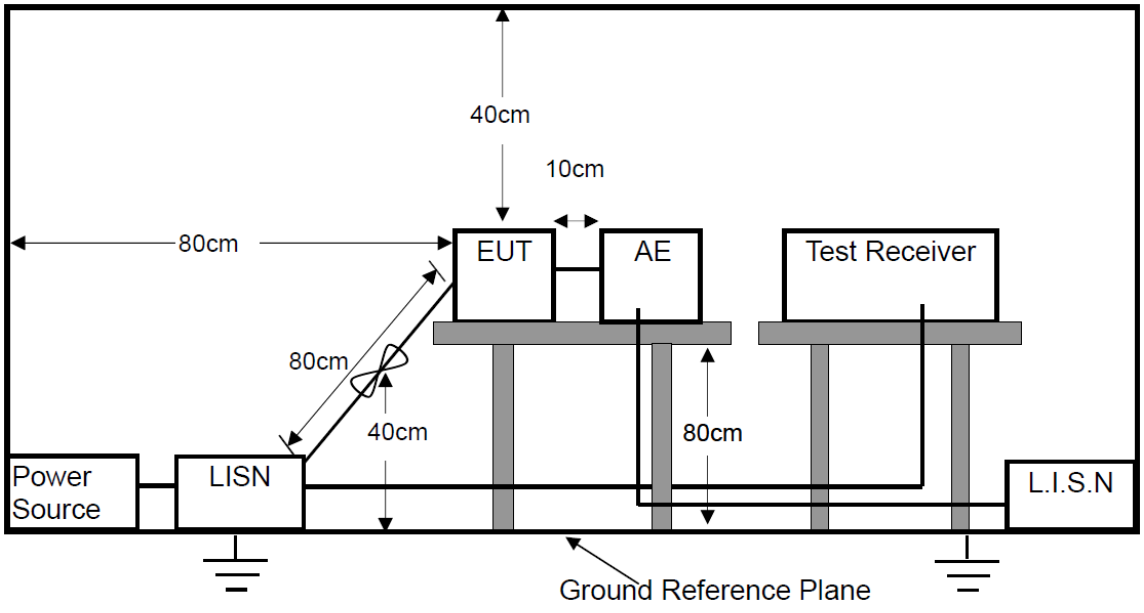
LIMITS

According to the requirements of FCC PART 15.207, the limits are as follows:

Frequency (MHz)	Quasi-peak	Average
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50

Note:
1. If the limits for the average detector are met when using the quasi-peak detector, then the limits for the measurements with the average detector are considered to be met.
2. The lower limit shall apply at the transition frequencies.
3. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5MHz.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The EUT was placed on a wooden table 0.8m height from the metal ground plan and 0.4m from the conducting wall of the shielding room and it was kept at 0.8m from any other grounded conducting surface.

b. All I/O cables and support devices were positioned as per ANSI C63.10.

c. Connect mains power port of the EUT to a line impedance stabilization network (LISN).

d. Connect all support devices to the other LISN and AAN, if needed.

e. Scan the frequency range from 150KHz to 30MHz at both sides of AC line for maximum conducted interference checking and record the test data.

TEST RESULTS

Not applicable.

13.2 Radiated Spurious Emissions and Restricted Bands Measurement

LIMITS

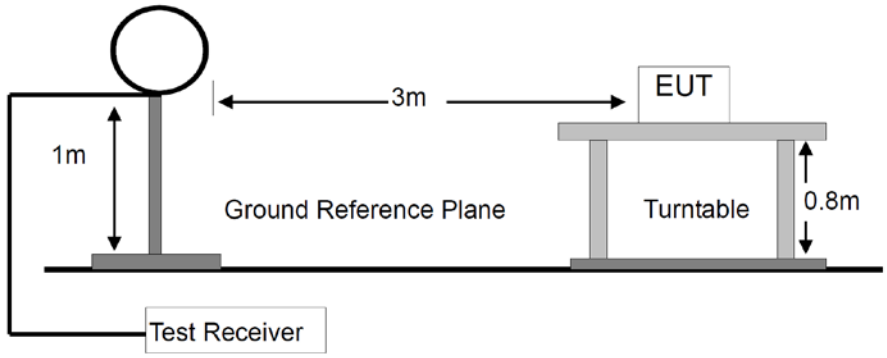
Frequency range MHz	Distance Meters	Field Strengths Limit (15.209) μV/m
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960	3	500

Frequency range MHz	Distance Meters	Field Strengths Limit (15.249)	
		mV/m (Field strength of fundamental)	μV/m (Field strength of Harmonics)
902 ~ 928	3	50	500
2400 ~ 2483.5	3	50	500
5725 ~ 5875	3	50	500
24000 ~ 2425000	3	250	2500

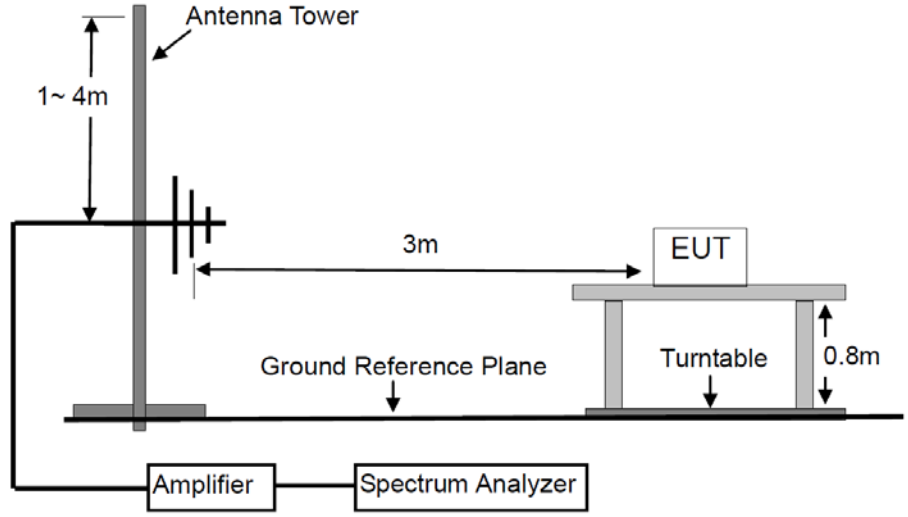
Remark:
(1) Emission level (dB)μV = 20 log Emission level μV/m
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
(4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.
(5) §15.249(d) specifies that emissions which fall in the restricted bands, as defined in §15.205 comply with radiated emission limits specified in §15.209.

BLOCK DIAGRAM OF TEST SETUP

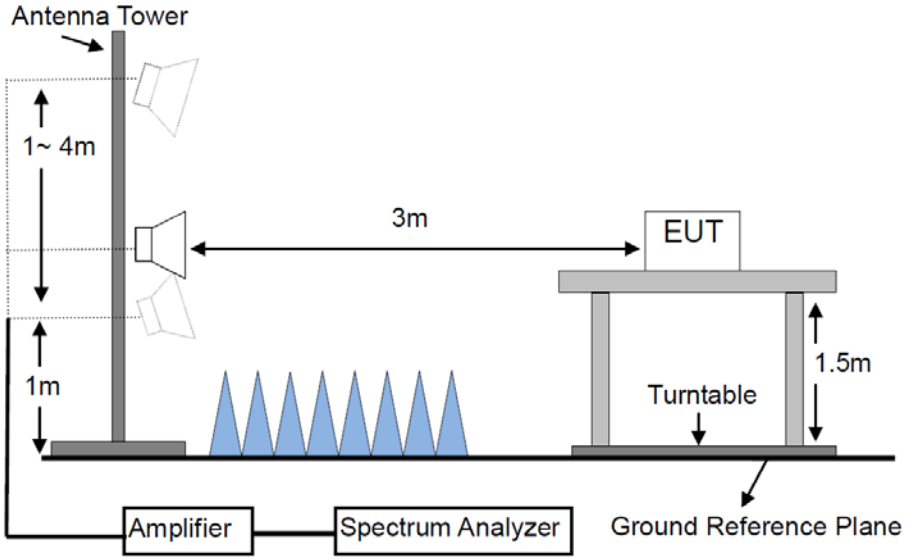
For Radiated Emission below 30MHz



For Radiated Emission 30-1000MHz



For Radiated Emission Above 1000MHz.



TEST PROCEDURES

a. Below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room.

b. For the radiated emission test above 1GHz:

The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.

f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Detector	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

TEST RESULTS

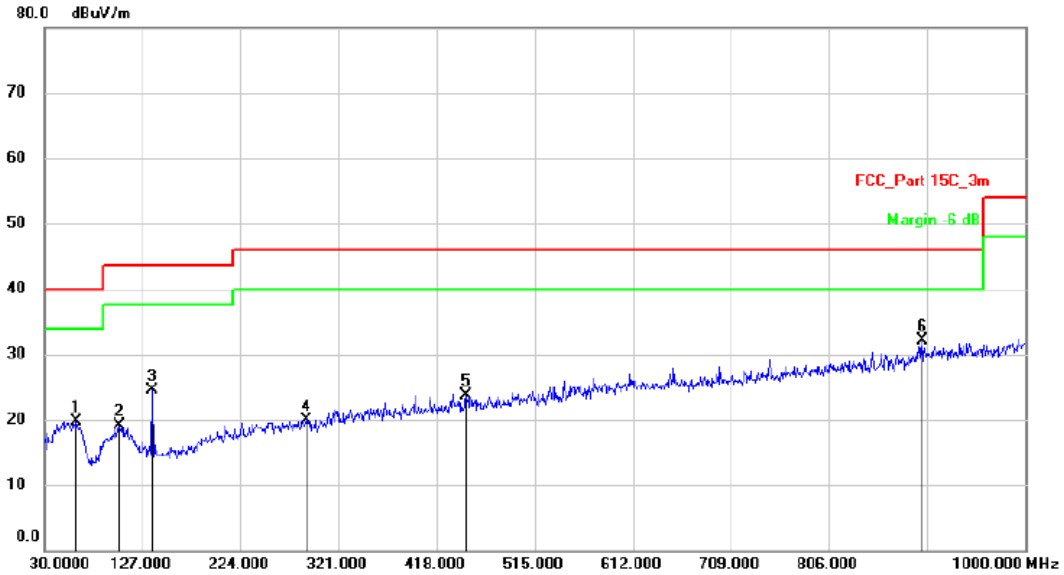
PASS

Please refer to the following pages.

M/N: AXIS 47	Testing Voltage: DC 3.0V come from Battery
Polarization: Horizontal	Detector: QP
Test Mode: 1	Distance: 3m

Radiated Emission Measurement

Date: 2021-08-30 Time: 17:24:12



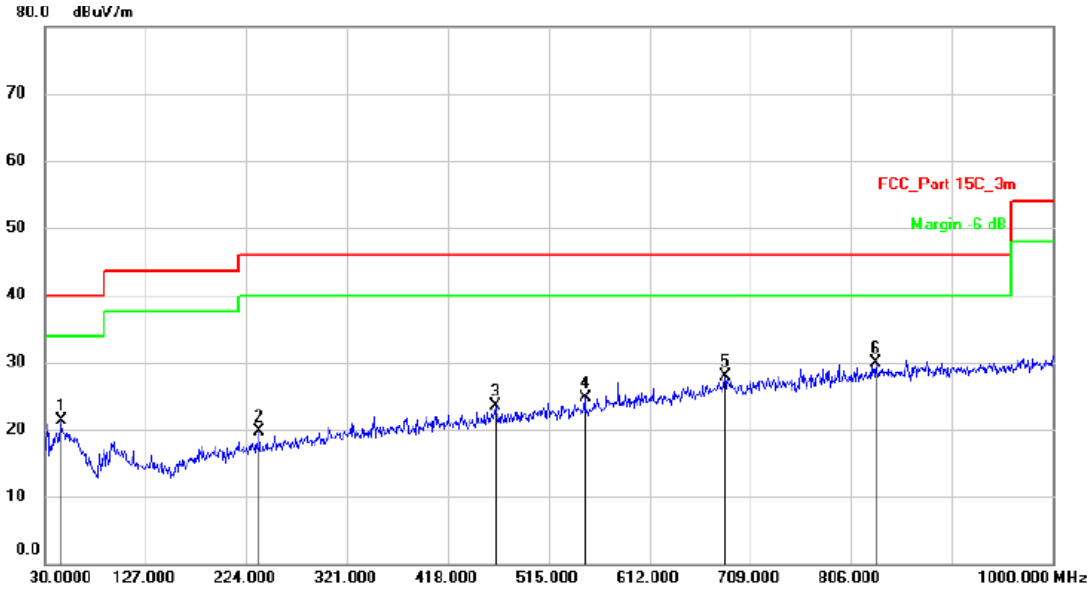
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		62.0100	26.95	-7.29	19.66	40.00	-20.34	QP	
2		103.7200	26.72	-7.52	19.20	43.50	-24.30	QP	
3		136.7000	35.30	-10.81	24.49	43.50	-19.01	QP	
4		288.9900	25.68	-5.75	19.93	46.00	-26.07	QP	
5		447.1000	26.36	-2.59	23.77	46.00	-22.23	QP	
6	*	898.1500	26.04	6.08	32.12	46.00	-13.88	QP	

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

M/N: AXIS 47	Testing Voltage: DC 3.0V come from Battery
Polarization: Vertical	Detector: QP
Test Mode: 1	Distance: 3m

Radiated Emission Measurement

Date: 2021-08-30 Time: 17:30:18



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		45.5200	28.79	-7.56	21.23	40.00	-18.77	QP	
2		236.6100	27.50	-7.73	19.77	46.00	-26.23	QP	
3		463.5900	26.81	-3.34	23.47	46.00	-22.53	QP	
4		549.9200	26.62	-1.82	24.80	46.00	-21.20	QP	
5		684.7500	25.92	1.90	27.82	46.00	-18.18	QP	
6	*	829.2800	25.37	4.48	29.85	46.00	-16.15	QP	

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

Modulation: GFSK			Test Result: PASS				Test frequency range: 1-25GHz			
Freq. (MHz)	Ant. Pol. (H/V)	Reading Level(dBuV)		Factor (dB/m)	Emission Level (dBuV/m)		Limit 3m (dBuV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
Operation Mode: TX Mode										
2408	V	91.82	46.16	0.15	91.97	46.31	114.00	94.00	-22.03	-47.69
4816	V	48.76	34.90	6.36	55.12	41.26	74.00	54.00	-18.88	-12.74
7224	V	48.57	33.79	10.46	59.03	44.25	74.00	54.00	-14.97	-9.75

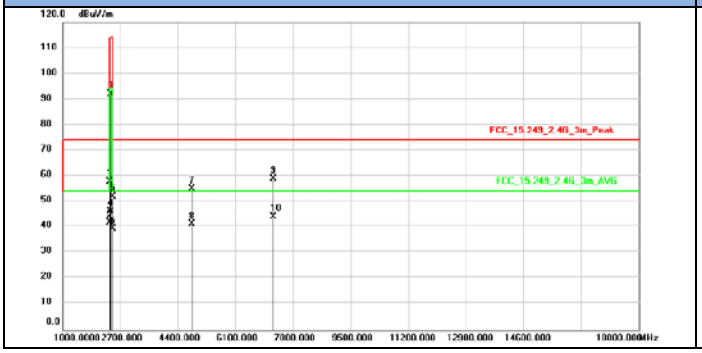
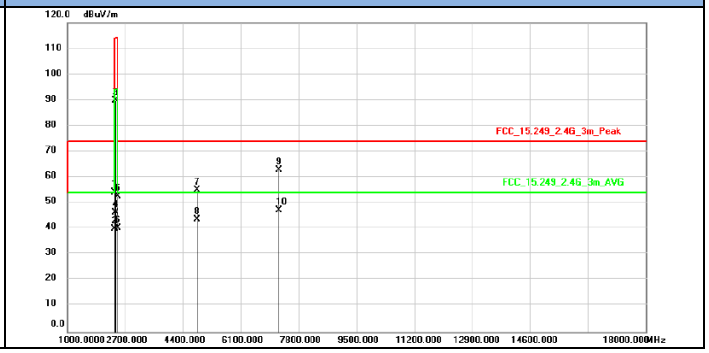
2408	H	89.84	46.21	0.15	89.99	46.36	114.00	94.00	-24.01	-47.64
4816	H	48.77	37.35	6.36	55.13	43.71	74.00	54.00	-18.87	-10.29
7224	H	52.38	36.73	10.46	62.84	47.19	74.00	54.00	-11.16	-6.81

Remark: Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits.

Band edge										
2390.000	H	57.68	41.60	0.13	57.81	41.73	74.00	54.00	-16.19	-12.27
2390.000	V	53.92	40.02	0.13	54.05	40.15	74.00	54.00	-19.95	-13.85
2483.500	H	51.71	39.07	0.34	52.05	39.41	74.00	54.00	-21.95	-14.59
2483.500	V	52.42	40.05	0.34	52.76	40.39	74.00	54.00	-21.24	-13.61

Note: 1. Other band edge, the emissions are lower than 20dB below the allowable limit.
2. The emissions for frequency range 18G~25GHz are attenuated 20dB below the limit, so it does not record in report.

channel

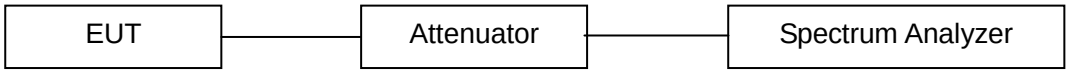
Horizontal	Vertical
	

13.3 20dB Bandwidth Measurement

LIMIT

There is no limit.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

The 20dB bandwidth of the emission was contained within the frequency band designated which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered, FCC Rule 15.215(c):

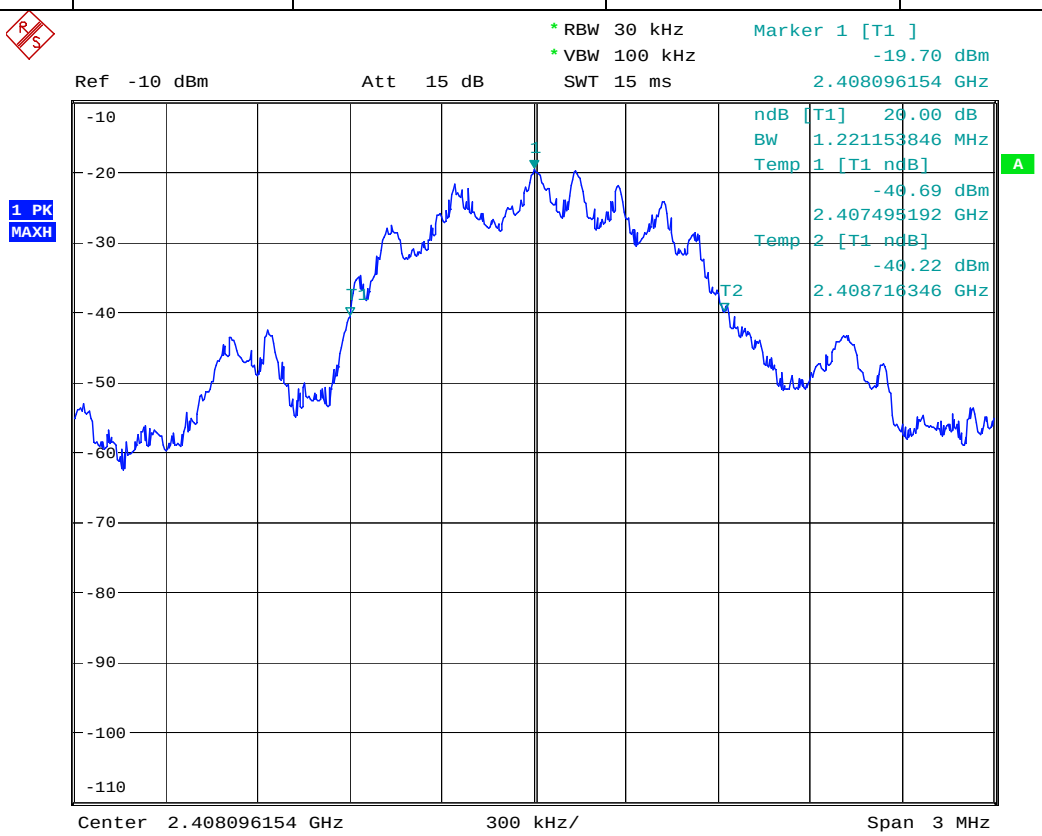
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the tested channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

TEST RESULTS

PASS

Please refer to the following table.

GFSK				
Channel	Frequency (MHz)	Data Rate (Mbps)	20dB Bandwidth (MHz)	Result
1	2408	1	1.221	PASS



13.4 Antenna Requirement

STANDARD APPLICABLE

According to of FCC part 15C section 15.203 and 15.240:

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, 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.

Systems operating in the 2400-2483.5MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

ANTENNA CONNECTED CONSTRUCTION

The antenna is Wire antenna that no antenna other than furnished by the responsible party shall be used with the device, and the best case gain of the antenna is 0dBi, Therefore, the antenna is consider meet the requirement.

14. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI7	100837	Mar. 13, 2021	1 Year
2.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 23, 2021	1 Year
3.	Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	Mar. 13, 2021	1 Year
4.	Spectrum Analyzer	Keysight	N9020A	MY54200831	Mar. 13, 2021	1 Year
5.	Spectrum Analyzer	Rohde & Schwarz	FSV40	101094	Mar. 13, 2021	1 Year
6.	Horn Antenna	Schwarzbeck	BBHA9170	9170-172	Mar. 22, 2021	2 Year
7.	Power Sensor	DARE	RPR3006W	15I00041SNO64	Mar. 13, 2021	1 Year
8.	Communication Tester	Rohde & Schwarz	CMW500	149004	Mar. 13, 2021	1 Year
9.	Horn Antenna	COM-Power	AH-118	071078	Mar. 23, 2021	1 Year
10.	Pre-Amplifier	HP	HP 8449B	3008A00964	Mar. 13, 2021	1 Year
11.	Pre-Amplifier	HP	HP 8447D	1145A00203	Mar. 13, 2021	1 Year
12.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-272	Mar. 23, 2021	1 Year
13.	Test Receiver	Rohde & Schwarz	ESCI	101152	Mar. 14, 2021	1 Year
14.	L.I.S.N	Rohde & Schwarz	ENV 216	101317	Mar. 13, 2021	1 Year
15.	L.I.S.N	Rohde & Schwarz	ESH2-Z5	893606/014	Mar. 13, 2021	1 Year
16.	RF Switching Unit	Compliance Direction Systems Inc.	RSU-M2	38311	Mar.13, 2021	1 Year
17.	Temperature & Humidity Chamber	REMAFEE	SYHR225L	N/A	Mar. 13, 2021	1 Year
18.	DC Source	Maynuo	MY8811	N/A	Mar. 13, 2021	1 Year
19.	Temporary antenna connector	TESCOM	SS402	N/A	N/A	N/A
20.	Chamber	SAEMC	9*7*7m	N/A	Apr. 21, 2021	2 Year
21.	Test Software	EZ	EZ_EMC	N/A	N/A	N/A

Note: For photographs of EUT and measurement, please refer to appendix in separate documents.

---End---