COMPLIANCE
For FCC PART 15 Subpart E

Applicant Name:	Date of Testing
CanTops	March 02, 2016 to May 3, 2016
	Test Site/Location
Address:	#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
A-1208 Digital Empire, 16, Deogyeong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea	**Test Report No.:** BWS-16-RF-0003
	BWS FRN: 0009936881
FCC ID:	**RMNCTS-HCOM**

Equipment :	**Hybrid PIO**
Model(s) :	**CTS-HCOM-AA01, CTS-HCOM-AB01**
Frequency Range :	**5728-5825 MHz**
Modulation Type :	**GFSK**
FCC Classification :	**Unlicensed National Information Infrastructure TX (NII)**
FCC Rule Part(s) :	**FCC Part 15 Subpart E §15.407**

The product was received on March 02, 2016 and testing was completed on April 18, 2016. We, BWS TECH Inc. would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of BWS TECH Inc. the test report shall not be reproduced except in full.

(Date) 05/04/2016
Tested by **Hyun-Yong, Seol**

(Date)05/04/2016
Reviewed by **Bang-Hyun, Nam**

BWS TECH INC.

#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
TEL: +82-31-333-5997, FAX: +82-31-333-0017
http://www.bws.co.kr

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FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

1.1 Applicant

- **Company Name** : CanTops
- **Company Address** : A-1208 Digital Empire,16, Deogyeong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea
- **Phone/Fax** : Tel No. : +82-31-303-5231 Fax No. : +82-31-303-5233

1.2 Manufacturer

- **Company Name** : CanTops
- **Company Address** : A-1208 Digital Empire,16, Deogyeong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea
- **Phone/Fax** : Tel No. : +82-31-303-5231 Fax No. : +82-31-303-5233

1.3 Eut Description

- **Equipment** : Hybrid PIO
- **Model(s)** : CTS-HCOM-AA01, CTS-HCOM-AB01
- **S/N** : Prototype
- **Freq. Range** : 5728-5825 MHz
- **Number of Channels** : 95
- **Modulation Method** : GFSK
- **Input Voltage** : DC 24 V ±10 %
- **Antenna Peak Gain** : 2.4 dBi

1.4 Other Information

- **FCC Rule Part(s)** : Part 15 Subpart E §15.407
- **FCC ID** : RMNCTS-HCOM
- **Test Procedure** : ANSI C63.10-2013
  KDB 789033 D02 General U-NII Test Procedures New Rules v01r02
- **Date of Test** :March 02, 2016 to April 18, 2015
- **Place of Test** : BWS TECH Inc.(FCC Registration Number : 287786)
  #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
  TEL: +82 31 333 5997 FAX: +82 31 333 0017

2. Description of Test Facility

Site Description

Test Lab. :

Accredited by Industry Canada, February 10, 2015
The Certificate Registration Number is 4963A-2.

Accredited by FCC, September 03, 2013
The Certificate Registration Number is 287786.

Accredited by VCCI, September 11, 2015
The Certificate Registration Number is C-4326

Accredited by RRA(EMC,RF, SAR), December 16, 2016
The Certificate Registration Number is KR0017

Accredited by KOLAS(KS Q ISO/IEC 17025), April 08, 2016
The Certificate Registration Number is KT174

Name of Firm : BWS TECH Inc.

Site Location : #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea

3. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and the requirements of FCC Rules Part 15.207, 15.209 and 15.407.
Radio testing was performed according to KDB 789033 D02.

3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and is operated in a manner that intends to maximize its emission characteristics in a continuous normal application

3.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.407 under the FCC Rules Part 15 Subpart E.

3.3 FCC Part 15.205 Restricted Bands Of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
2 Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions.
The provisions in Section 15.35 apply to these measurements.

3.4 Description Of Test Modes

The EUT has been tested under operating condition.
After verification, all tests were carried out with the worst case test modes as shown below GFSK(1Mbps) Channel Low (5728MHz), Mid (5775MHz) and High (5825MHz), these were chosen for full testing.

4. Summary of Test Results

Clause	TEST Description	Standard Section	Requirements	Result
5.1	**6dB Bandwidth**	§15.407(e)	≥500 kHz	Pass
5.2	**Maximum Peak Conducted Output Power**	§15.407(a)(3)	≤30 dBm	Pass
5.3	**Power Spectral Density**	§15.407(a)(3)	≤30 dBm/500 kHz	Pass
5.4	**Radiated Spurious and Band Edge Emissions**	§15.407(b)	§15.407(b), §15.209(a)	Pass
5.5	**Power Conducted Emission**	§15.207	§15.207(a)	Pass
5.6	**Frequency Stability**	§15.407(g)	§15.407(g)	Pass
5.7	**Antenna Application**	§15.203	§15.203	Pass

5. Test Data

5.1 6dB Bandwidth

5.1.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	2016/09/14

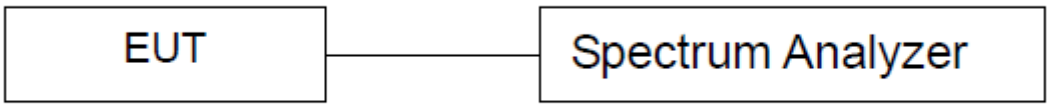
5.1.2 Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

5.1.3 Measurement Procedure

1. The testing follows FCC KDB 789033 D02 General U-NII Test Procedures New Rules v01r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set (RBW = 100 kHz, VBW = 300 kHz, Detector = Peak, Trace mode = Max Hold, Sweep = Auto).
5. Measure and record the results in the test report.

5.1.4 Test SET-UP (Block Diagram of Configuration)



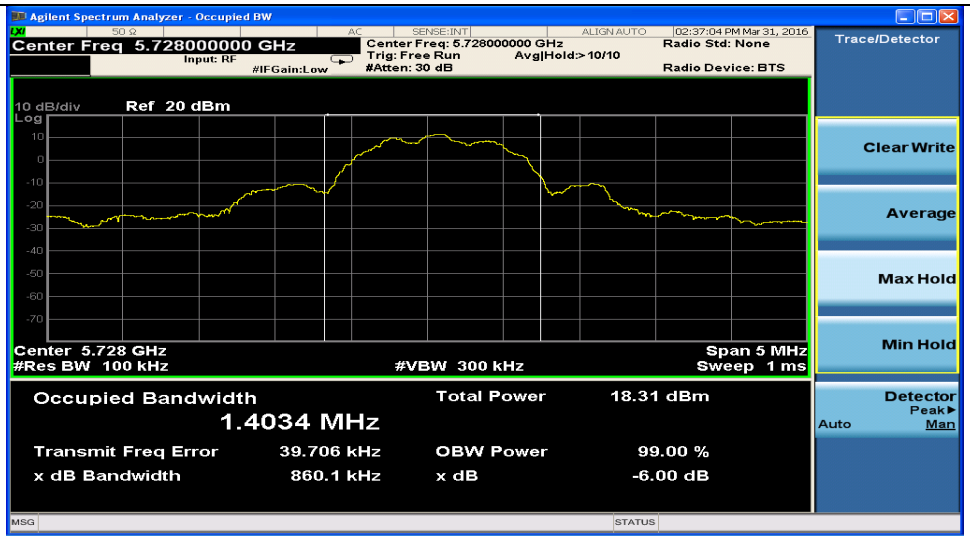
5.1.5 Test Result

Modulation	Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Test Result
GFSK	5728	0.86	≥ 0.5	PASS
	5775	0.86		PASS
	5825	0.88		PASS

6dB Bandwidth

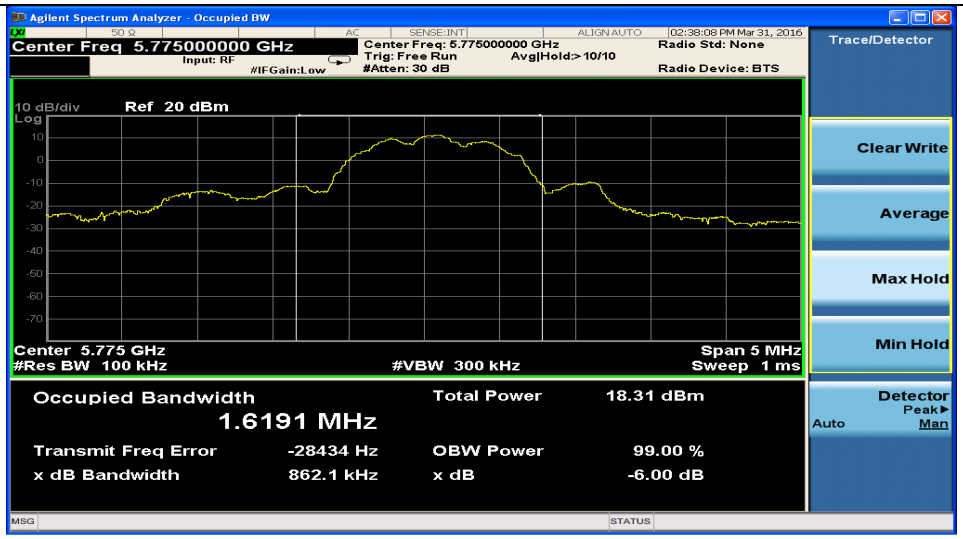
GFSK - 5728 MHz

(Low Channel)



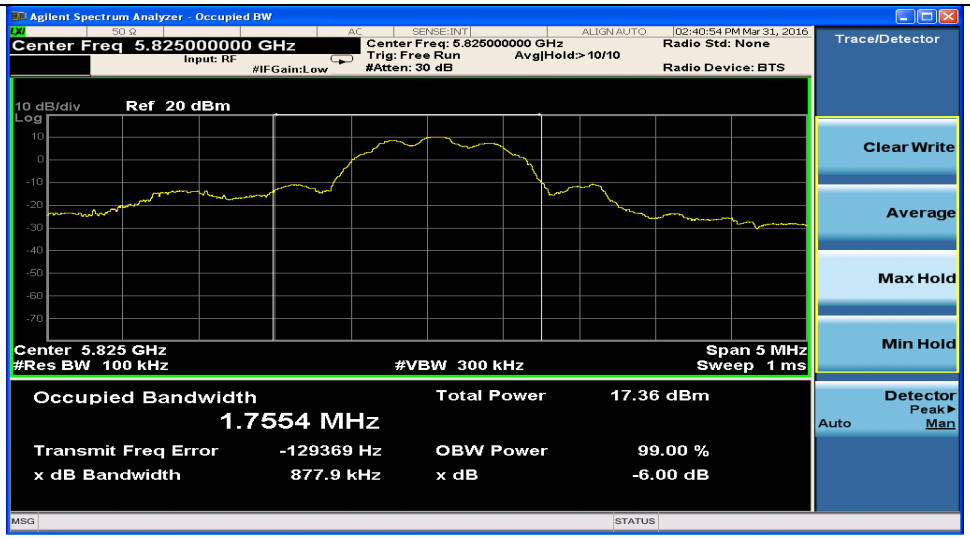
GFSK - 5775 MHz

(Middle Channel)



GFSK - 5825 MHz

(High Channel)



5.2 Maximum Peak Conducted Output Power

5.2.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Power Meter	RPR3006W	D.A.R.E!! Insrtuments	14I00048SNO09	2017/04/25

5.2.2 Test Limit

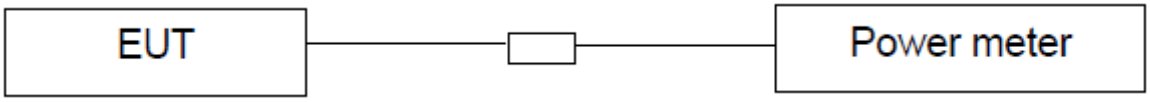
The maximum peak power shall be less than 1 Watt (30dBm).

Note: If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the direction gain of the antenna exceeds 6dBi, In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

5.2.3 Measurement Procedure

1. The testing follows FCC KDB 789033 D02 General U-NII Test Procedures New Rules v01r02
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum output power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.

5.2.4 Test SET-UP (Block Diagram of Configuration)



5.2.5 Test Result

Modulation	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Test Result
GFSK	5728	11.02	≤ 30	PASS
	5775	10.66		PASS
	5825	10.32		PASS

5.3 Power Spectral Density

5.3.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	2016/09/14

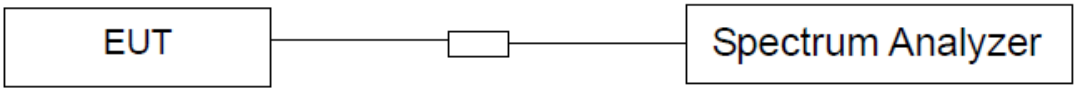
5.3.2 Test Limit

The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band..

5.3.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General U-NII Test Procedures New Rules v01r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set (RBW = 500 kHz, VBW = 1.5 MHz, Detector = Peak, Span = 30 MHz, Trace mode = Max Hold, Sweep = Auto).
5. Measure and record the results in the test report.

5.3.4 Block Diagram of Test Setup



5.3.5 Test Result

Modulation	Frequency (MHz)	PPSD (dBm/500kHz)	Limit (dBm/500kHz)	Test Result
GFSK	5728	11.141	≤ 30	PASS
	5775	11.014		PASS
	5825	9.789		PASS

Power Spectral Density

GFSK – 5728 MHz

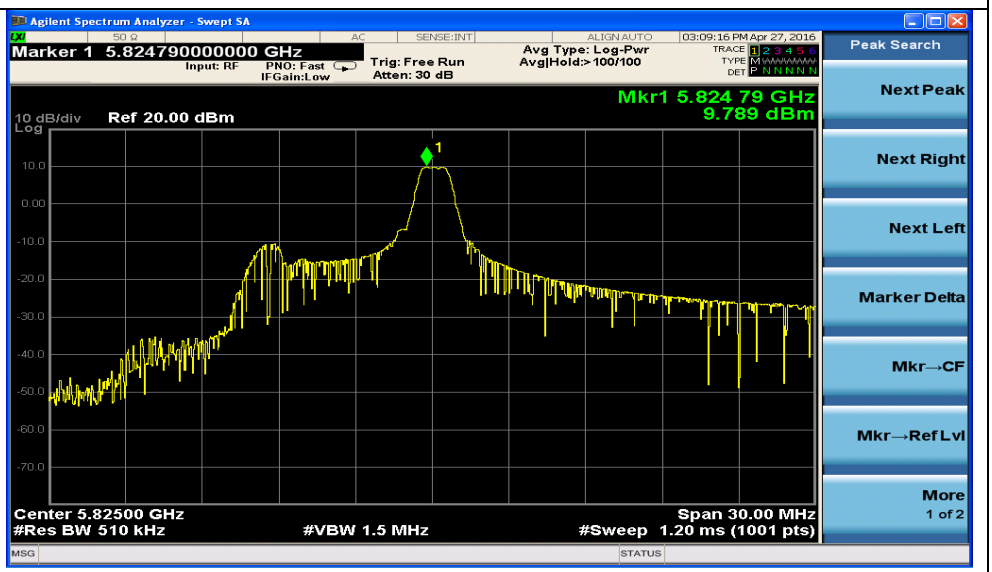
(Low Channel)

GFSK – 5775 MHz

(Middle hannel)

GFSK – 5825 MHz

(High Channel)



5.4 Radiated Spurious and Band Edge Emissions

5.4.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
EMI Receiver	ESR	Rohde & Schwarz	101320	2017/03/25
Bilog Antenna	VULB9160	Schwarzbeck	9160-3052	2017/10/06
Antenna Mast(4m)	AM-4.0	MATURO	AM4.0/225/17240915	-
Antenna Mast(2m)	AM-2.5	MATURO	AM2.5/226/17240915	-
Turn Table Controller	CO2000	MATURO	NCU/459/17240915	
Loop Antenna	HEH2-Z2	Rohde & Schwarz	881056/6	2017/01/06
Horn Antenna	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D 234	2017/09/03
RF Amplifier	LPA-10-20	RF Bay	11160801	2017/03/25
RF Amplifier	PAM-118A	COM-POWER	551019	2016/07/20
RE_10 m CHAMBER #1	N/A	SY Corp.	N/A	N/A

5.4.2 Test Limit

5.4.2.1 Restricted band emissions Limit

According to §15.209, except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/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

Note1:

Qusai-Peak value is measured for frequency below 1GHz except for 9-90 kHz, 110-490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note2:

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below;

Frequency at or above 30 MHz: 20 dB/decade, Frequency below 30 MHz: 40 dB/decade

5.4.2.2 Un-restricted band emissions above 1GHz Limit

Operating Band	Limit
5.725 – 5.850 GHz	5.715-5.725 GHz: e.i.r.p. -17 dBm [78.2 dBuV/m @3m] 5.850-5.860 GHz: e.i.r.p. -17 dBm [78.2 dBuV/m @3m] Other un-restricted band: e.i.r.p. -27 dBm [68.2 dBuV/m @3m]

5.4.3 Test Procedure

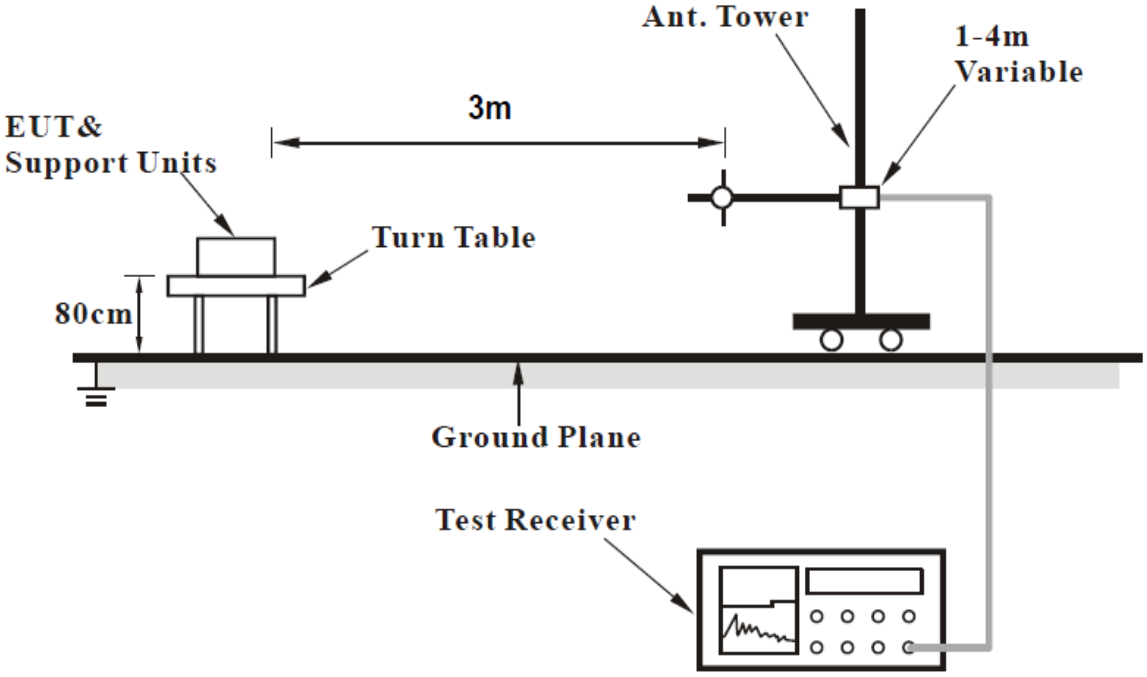
1. The testing follows FCC KDB 789033 D02 General U-NII Test Procedures New Rules v01r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable. For emissions testing at or below 1 GHz, the table height was 80cm above the reference ground plane. For emission measurements above 1 GHz, the table height was 1.5m.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings and peak emission levels are measured :
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW (9-150kHz: 200Hz, 0.15-30MHz: 9kHz, 30-1000MHz: 120kHz, above 1GHz: 1MHz).
   (3) VBW ≥ 3 x RBW ; Sweep = auto; Detector function = peak; Trace = max hold

   For average measurement:
   • VBW = 10 Hz, when duty cycle is no less than 98 percent.
   • VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

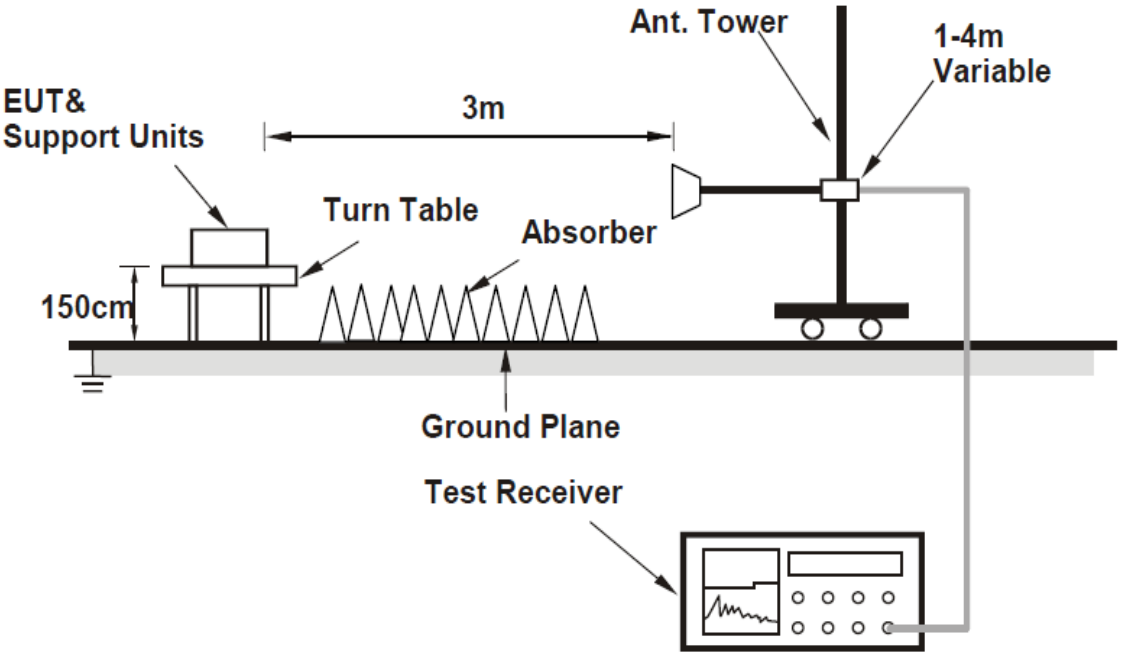
8. Measure and record the results in the test report.

5.4.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000 MHz



(B) Radiated Emission Test Set-Up, Frequency above 1000 MHz



5.4.5 Test Result

5.4.5.1 Radiated Spurious Emission

5.4.5.1.1 0.009–30 MHz

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	State
-	-	-	-	-	-	-	PASS

Remark: §15.31(o)_The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part

5.4.5.1.2 30–1000 MHz

GFSK - 5728 MHz(Low)

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
49.046	45.9	V	-17.5	28.4	40	11.6	QP
64.540	53.5	H	-18.1	35.4	40	4.6	QP
68.979	55.5	H	-18.1	37.4	40	2.6	QP
72.162	49.7	H	-18.3	31.4	40	8.6	QP
81.370	52.2	H	-19.2	33.0	40	7.0	QP
900.008	43.4	H	-3.0	40.4	46	5.6	QP

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5775 MHz(Middle)

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
49.668	46.1	V	-17.5	28.6	40	11.4	QP
64.547	53.5	H	-18.1	35.4	40	4.6	QP
69.160	55.8	H	-18.1	37.7	40	2.3	QP
81.099	51.6	H	-19.2	32.4	40	7.6	QP
244.736	43.5	H	-17.1	26.4	46	19.6	QP
900.008	43.0	H	-3.0	40.0	46	6.0	QP

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5825 MHz(High)

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
49.119	46.9	V	-17.5	29.4	40	10.6	QP
63.365	52.7	H	-18.1	34.6	40	5.4	QP
69.131	55.0	H	-18.1	36.9	40	3.1	QP
81.255	51.6	H	-19.2	32.4	40	7.6	QP
586.493	45.9	V	-8.5	37.4	46	8.6	QP
900.002	43.7	H	-3.0	40.7	46	5.3	QP

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

5.4.5.1.3 Above 1 GHz

GFSK - 5728 MHz(Low)_Vertical

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
1736.100	53.2	V	-9.4	43.8	68.2	24.4	Peak
1736.100	29.4	V	-9.4	20.0	54.0	34.0	AVG
2999.200	47.2	V	-4.6	42.6	68.2	25.6	Peak
2999.200	37.7	V	-4.6	33.1	54.0	20.9	AVG
5756.600	46.7	V	2.0	48.7	78.2	29.5	Peak
5756.600	24.3	V	2.0	26.3	54.0	27.7	AVG
11291.800	44.9	V	11.8	56.7	68.2	11.5	Peak
11291.800	24.3	V	11.8	36.1	54.0	17.9	AVG
14877.100	59.9	V	14.0	59.9	68.2	8.3	Peak
14877.100	25.4	V	14.0	39.4	54.0	14.6	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5728 MHz(Low)_Horizontal

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
2999.200	51.8	H	-4.6	47.2	68.2	21.0	Peak
2999.200	42.9	H	-4.6	38.3	54.0	15.7	AVG
5737.900	49.1	H	1.9	51.0	78.2	27.2	Peak
5737.900	30.9	H	1.9	32.8	54.0	21.2	AVG
7759.200	43.8	H	7.4	51.2	68.2	17.0	Peak
7759.200	25.3	H	7.4	32.7	54.0	21.3	AVG
11808.600	43.6	H	11.6	55.2	68.2	13.0	Peak
11808.600	24.8	H	11.6	36.4	54.0	17.6	AVG
12850.700	44.6	H	11.1	55.7	68.2	12.5	Peak
12850.700	24.6	H	11.1	35.7	54.0	18.3	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5775 MHz(Middle)_Vertical

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
1736.100	51.1	V	-9.4	41.7	68.2	26.5	Peak
1736.100	29.7	V	-9.4	20.3	54.0	33.7	AVG
2999.200	46.3	V	-4.6	41.7	68.2	26.5	Peak
2999.200	35.6	V	-4.6	31.0	54.0	23.0	AVG
5804.200	48.0	V	2.1	50.1	78.2	28.1	Peak
5804.200	28.3	V	2.1	30.4	54.0	23.6	AVG
8690.800	44.4	V	8.7	53.1	68.2	15.1	Peak
8690.800	25.1	V	8.7	33.8	54.0	20.2	AVG
12906.800	44.8	V	11.1	55.9	68.2	12.3	Peak
12906.800	24.2	V	11.1	35.3	54.0	18.7	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5775 MHz(Middle)_Horizontal

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
2999.200	50.1	H	-4.6	45.5	68.2	22.7	Peak
2999.200	40.9	H	-4.6	36.3	54.0	17.7	AVG
5800.800	50.1	H	2.1	52.2	78.2	26.0	Peak
5800.800	23.7	H	2.1	25.8	54.0	28.2	AVG
9000.200	44.5	H	8.9	53.4	68.2	14.8	Peak
9000.200	30.6	H	8.9	39.5	54.0	14.5	AVG
11001.100	43.2	H	11.9	55.1	68.2	13.1	Peak
11001.100	23.9	H	11.9	35.8	54.0	18.2	AVG
15366.700	45.1	H	12.4	57.5	68.2	10.7	Peak
15366.700	22.8	H	12.4	35.2	54.0	18.8	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5825 MHz(High)_Vertical

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
2999.200	45.9	V	-4.6	41.3	68.2	26.9	Peak
2999.200	37.9	V	-4.6	33.3	54.0	20.7	AVG
5836.500	51.2	V	2.2	53.4	78.2	24.8	Peak
5836.500	27.7	V	2.2	29.9	54.0	24.1	AVG
5850.100	50.8	V	2.2	53.0	78.2	25.2	Peak
5850.100	29.2	V	2.2	31.4	54.0	22.6	AVG
7902.000	44.0	V	7.9	51.9	68.2	16.3	Peak
7902.000	26.1	V	7.9	34.0	54.0	20.0	AVG
9177.000	43.4	V	8.8	52.2	68.2	16.0	Peak
9177.000	25.8	V	8.8	34.6	54.0	19.4	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

GFSK - 5825 MHz(High)_Horizontal

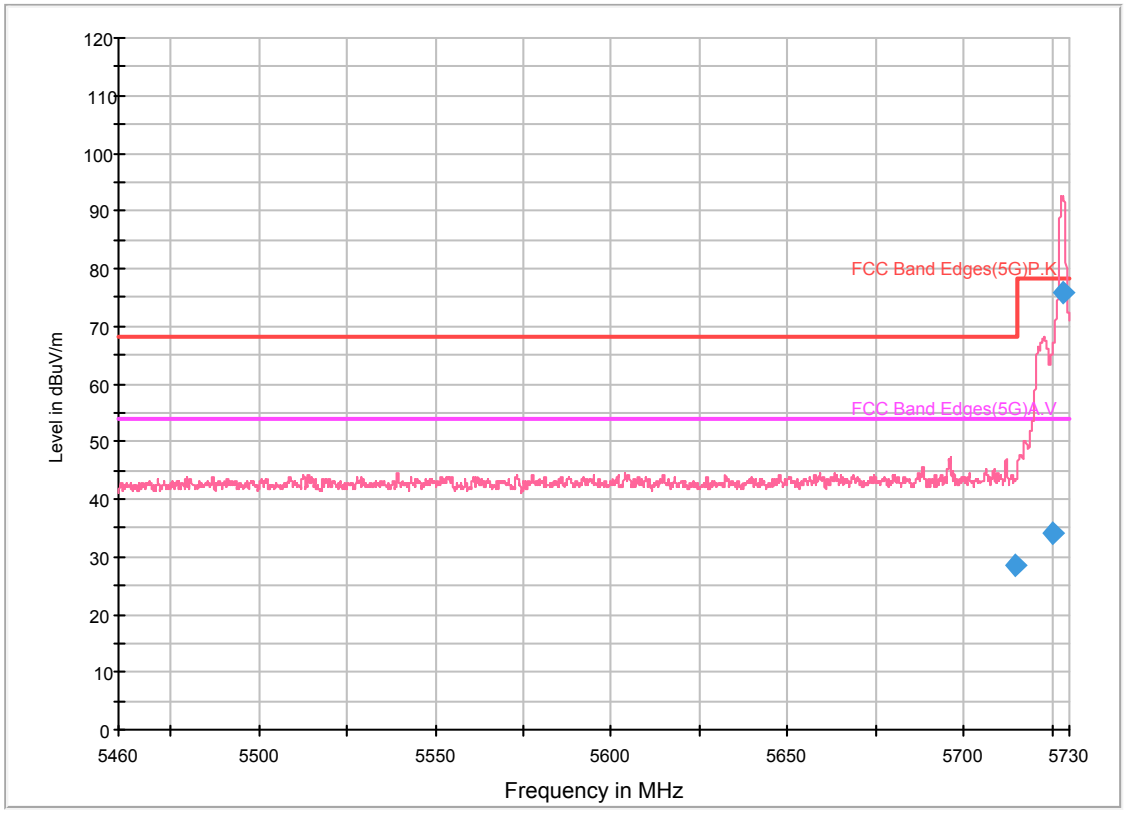
Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
2999.200	52.2	H	-4.6	47.6	68.2	20.6	Peak
2999.200	45.0	H	-4.6	40.4	54.0	13.6	AVG
4427.200	45.0	H	-1.4	43.6	68.2	24.6	Peak
4427.200	25.9	H	-1.4	24.5	54.0	29.5	AVG
9000.200	45.8	H	8.9	54.7	68.2	13.5	Peak
9000.200	39.3	H	8.9	48.2	54.0	5.8	AVG
12667.100	45.0	H	11.2	56.2	68.2	12.0	Peak
12667.100	24.7	H	11.2	35.9	54.0	18.1	AVG
15412.600	46.8	H	12.2	59.0	68.2	9.2	Peak
15412.600	22.9	H	12.2	35.1	54.0	18.9	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

5.4.5.2 Radiated Band Edge Emission

Radiated Band Edges(5728 MHz)_Vertical

EUT Name: Hybrid PIO
Manufacturer: CanTops
Model Name: CTS-HCOM
Test Mode: GFSK-5728(low)

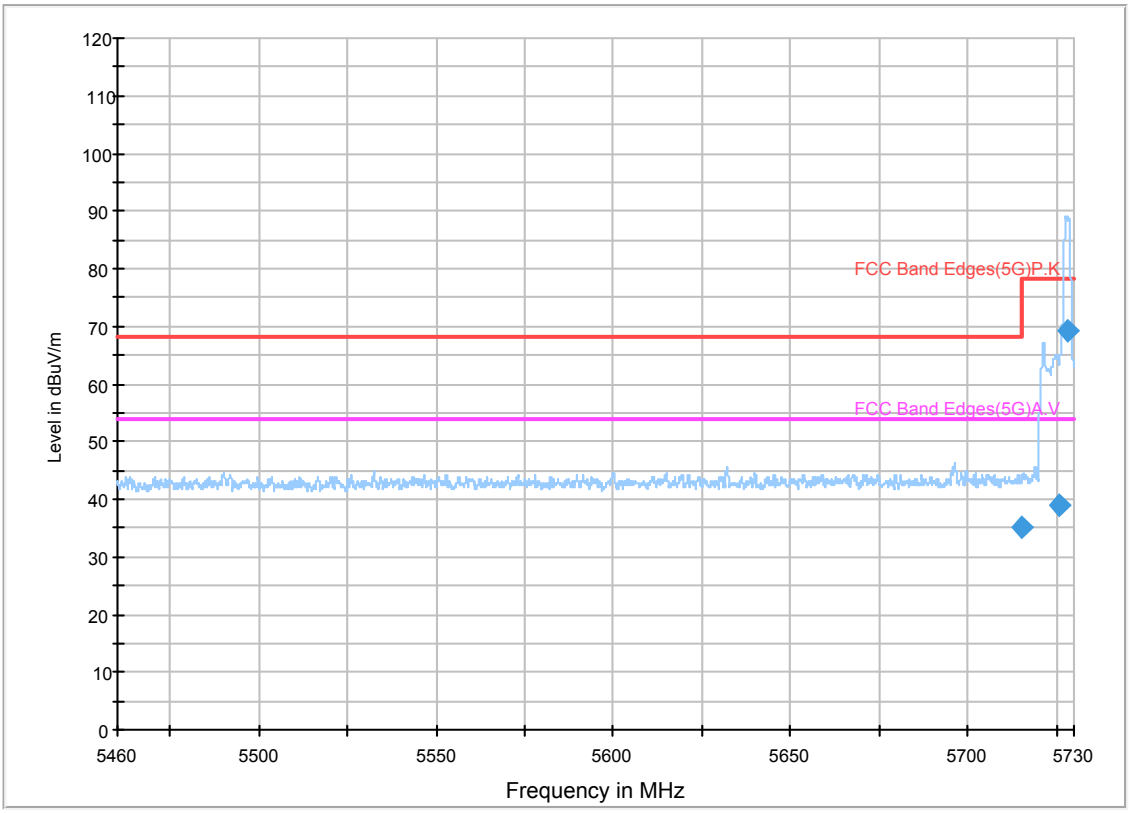


Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
5715.000	41.7	V	1.9	43.6	68.2	24.6	Peak
5715.000	26.6	V	1.9	28.5	54.0	25.5	AVG
5725.000	63.2	V	1.9	65.1	78.2	13.1	Peak
5725.000	32.1	V	1.9	34.0	54.0	20.0	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

Radiated Band Edges(5728 MHz)_Horizontal

EUT Name: Hybrid PIO
Manufacturer: CanTops
Model Name: CTS-HCOM
Test Mode: GFSK-5728(low)

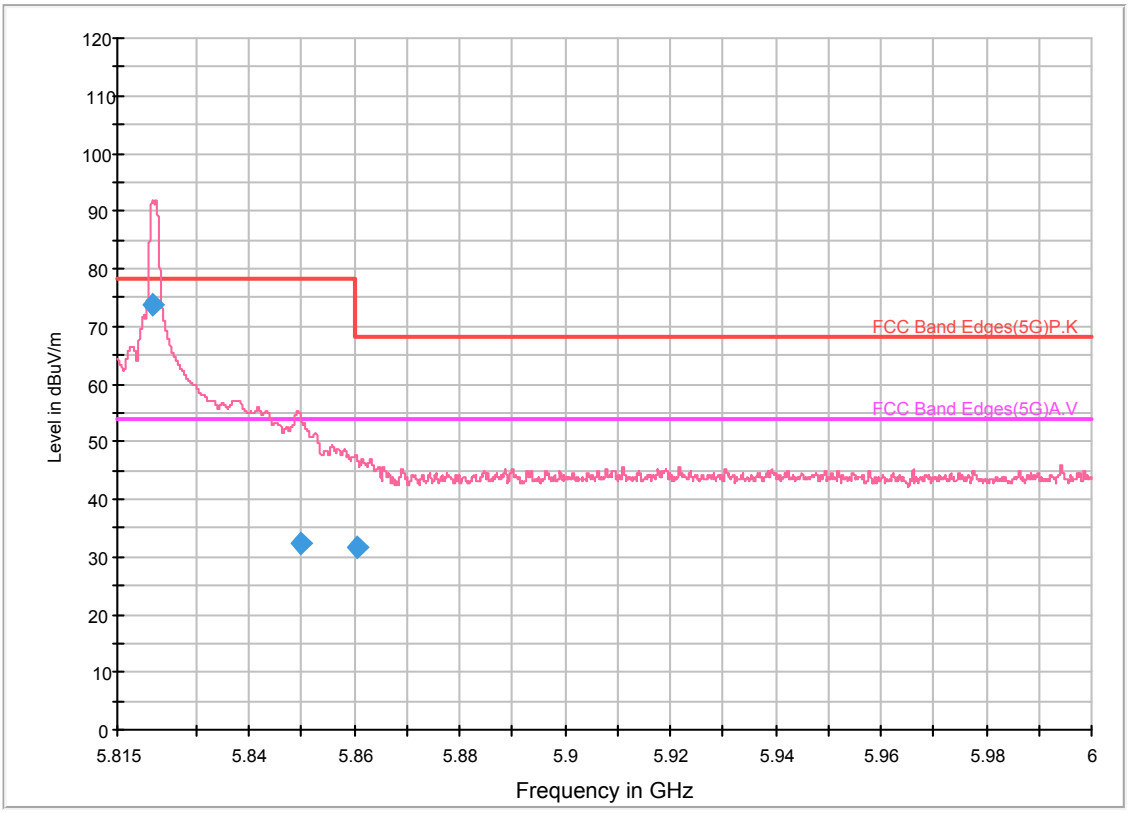


Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
5715.000	40.9	H	1.9	42.8	68.2	25.4	Peak
5715.000	33.4	H	1.9	35.3	54.0	18.7	AVG
5725.000	63	H	1.9	64.9	78.2	13.3	Peak
5725.000	36.9	H	1.9	38.8	54.0	15.2	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

Radiated Band Edges(5825 MHz)_Vertical

EUT Name: Hybrid PIO
Manufacturer: CanTops
Model Name: CTS-HCOM
Test Mode: GFSK-5825(High)

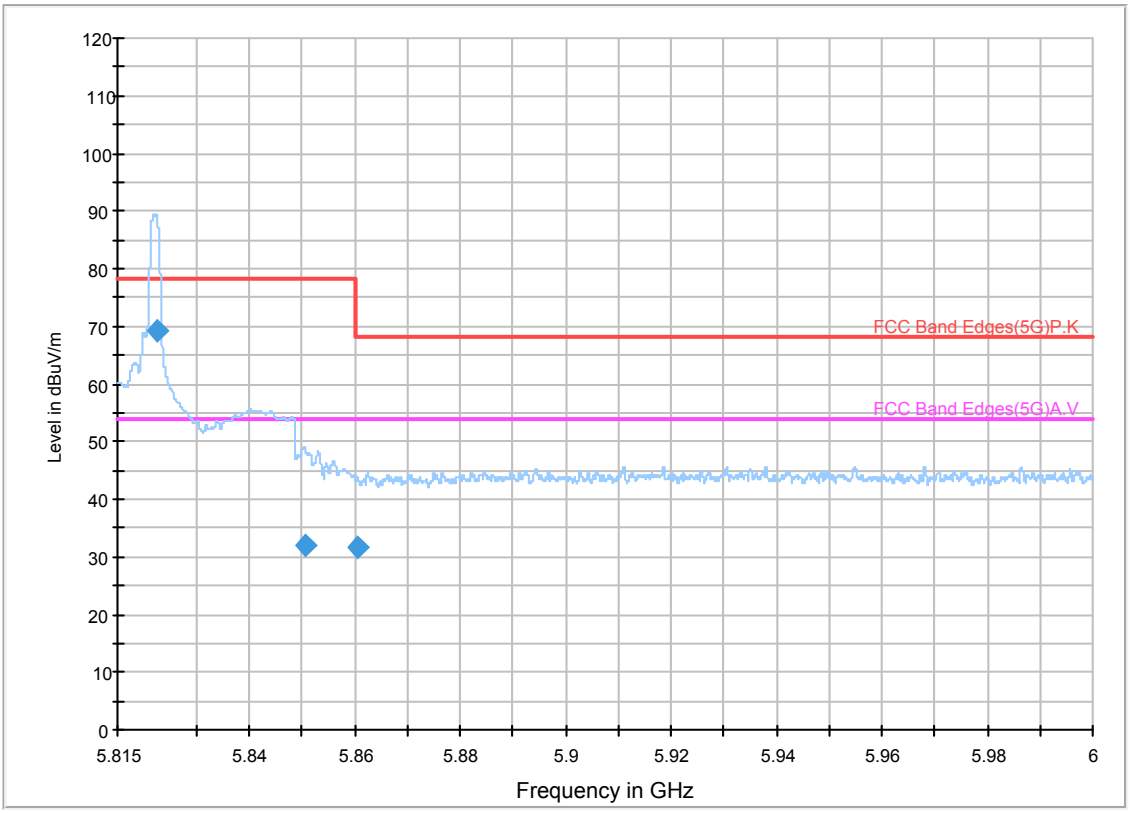


Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
5850.000	51.7	V	2.2	53.9	78.2	24.3	Peak
5850.000	30.3	V	2.2	32.5	54.0	21.5	AVG
5860.000	45.3	V	2.2	47.5	68.2	20.7	Peak
5860.000	29.4	V	2.2	31.6	54.0	22.4	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

Radiated Band Edges(5825 MHz)_Horizontal

EUT Name: Hybrid PIO
Manufacturer: CanTops
Model Name: CTS-HCOM
Test Mode: GFSK-5825(High)



Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
5850.000	45.9	H	2.2	48.1	78.2	30.1	Peak
5850.000	29.7	H	2.2	31.9	54.0	22.1	AVG
5860.000	41.8	H	2.2	44.0	68.2	24.2	Peak
5860.000	29.4	H	2.2	31.6	54.0	22.4	AVG

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

5.5 Power Conducted Emission

5.5.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Test Receiver	ESPI	ROHDE & SCHWARZ	100063	2017/01/08
#2 Conducted Cable_2.7m	N/A	N/A	N/A	2017/01/08
LISN	NSLK 8127	SCHWARZBECK	8127-414	2017/01/07
Impuls-Begrenzer Pulse Limiter	ESH3-Z2	ROHDE & SCHWARZ	100092	2017/01/06
CE CHAMBER	N/A	SY Corp.	N/A	N/A
DC POWER SUPPLY	IPS-30B03DD	INTERACT	00420502	2016/09/10

5.5.2 Test Limit

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

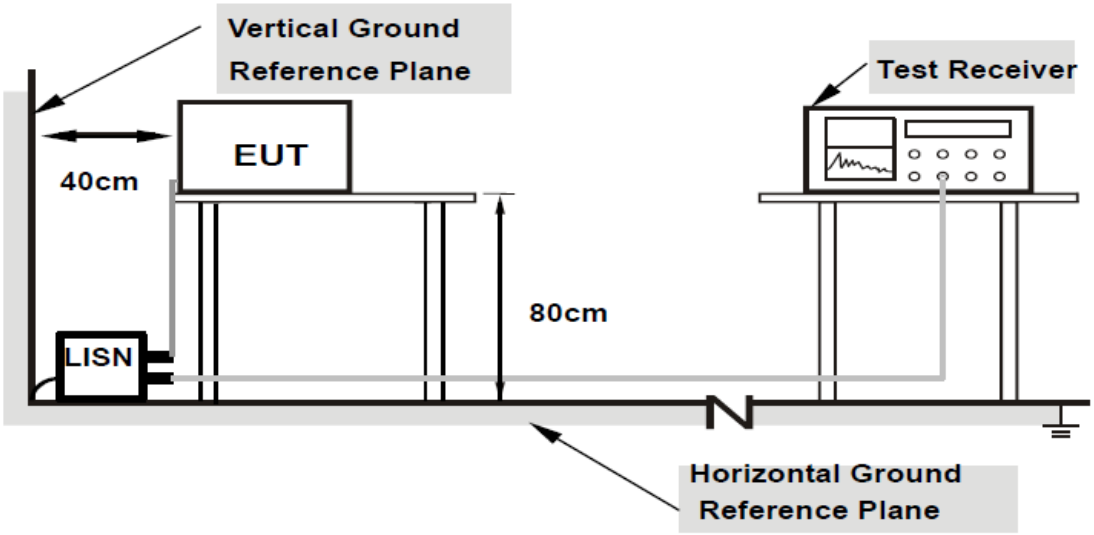
Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

5.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room and was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network(LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

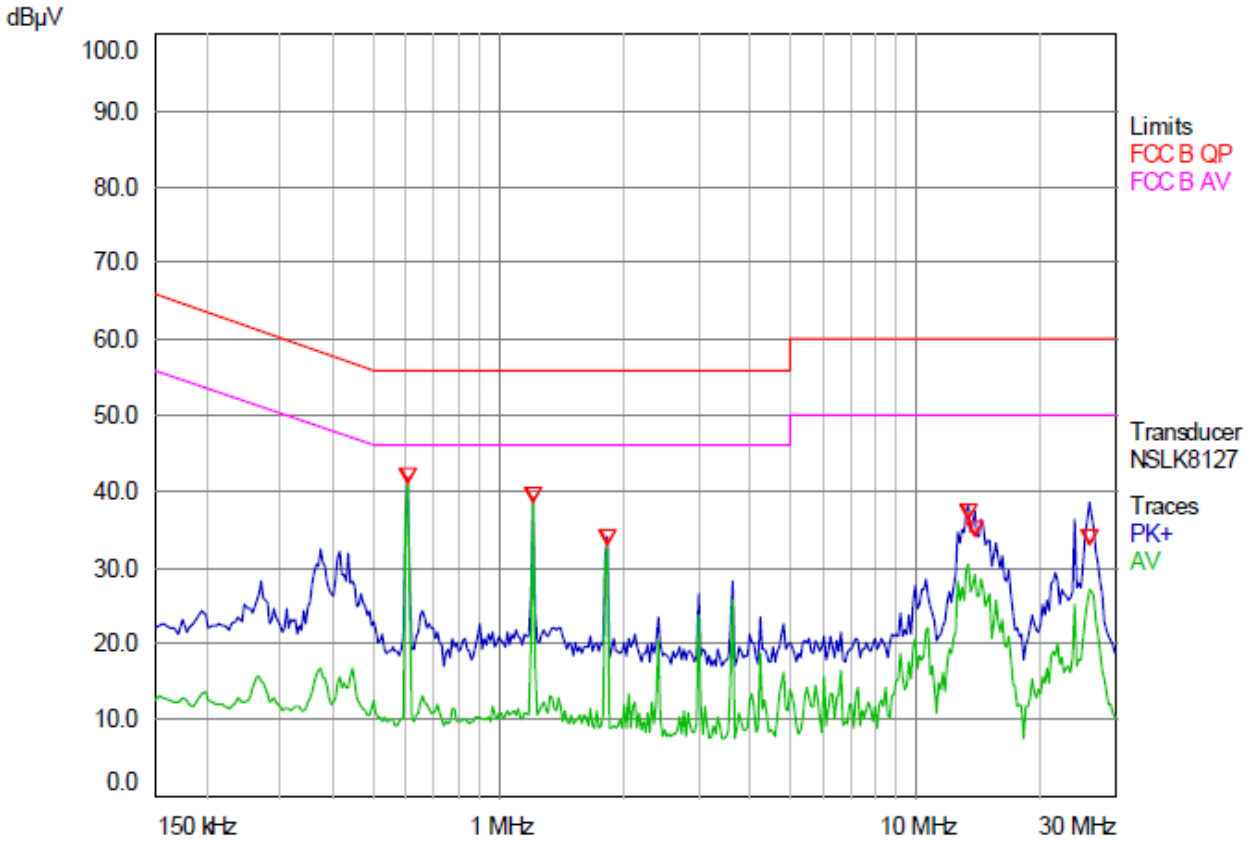
5.5.4 Block Diagram of Test Setup



5.5.5 Test Result

Direct Current +

Pre-measurement Graph



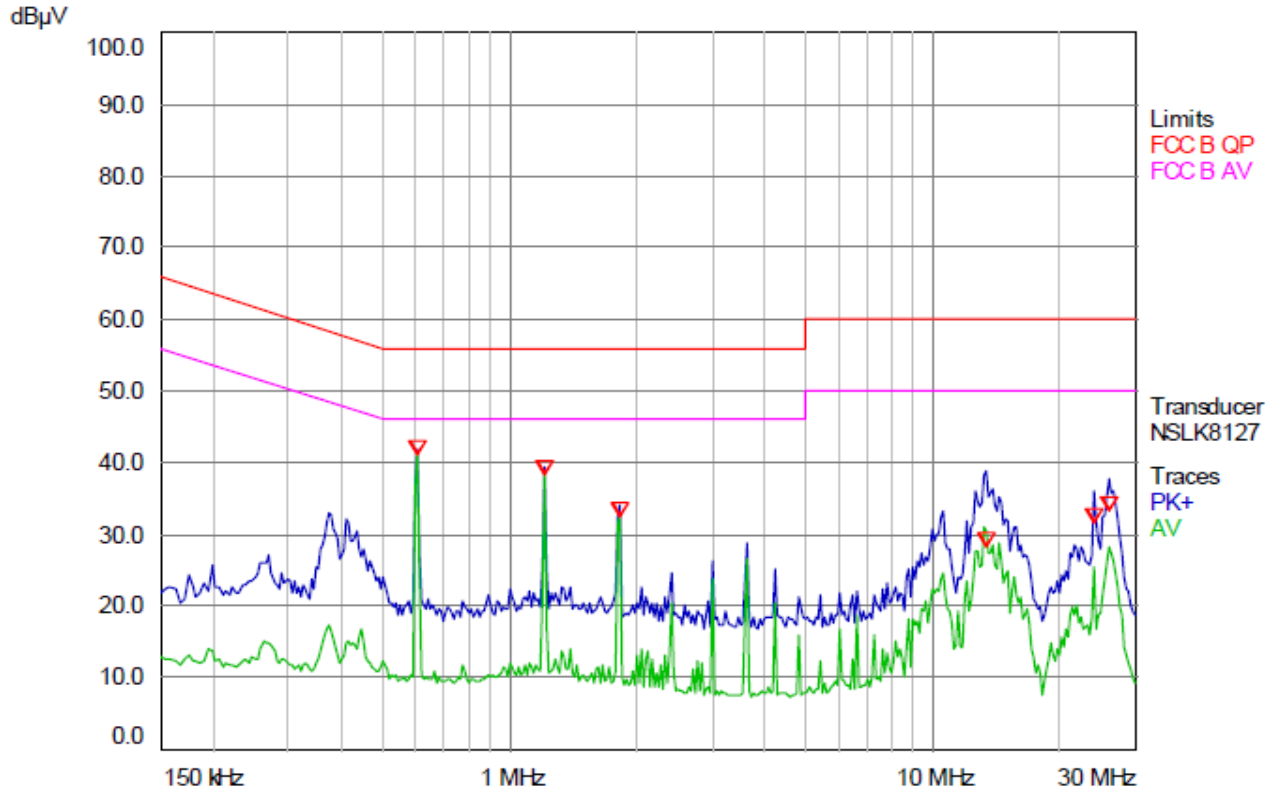
Final Measurement Results

Trace	Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.604	41.17	56.00	-14.83		
1 QP	1.208	38.46	56.00	-17.54		
1 QP	1.812	32.93	56.00	-23.07		
1 QP	13.328	36.22	60.00	-23.78		
1 QP	13.912	34.09	60.00	-25.91		
1 QP	26.196	32.85	60.00	-27.15		

* = limit exceeded

Direct Current -

Pre-measurement Graph



Final Measurement Results

Trace	Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.604	41.06	56.00	-14.94		
1 QP	1.208	38.30	56.00	-17.70		
1 QP	1.812	32.37	56.00	-23.63		
1 QP	13.32	28.09	60.00	-31.91		
1 QP	24.0	31.64	60.00	-28.36		
1 QP	26.192	33.11	60.00	-26.89		

* = limit exceeded

5.6 Frequency Stability

5.6.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	2016/09/14

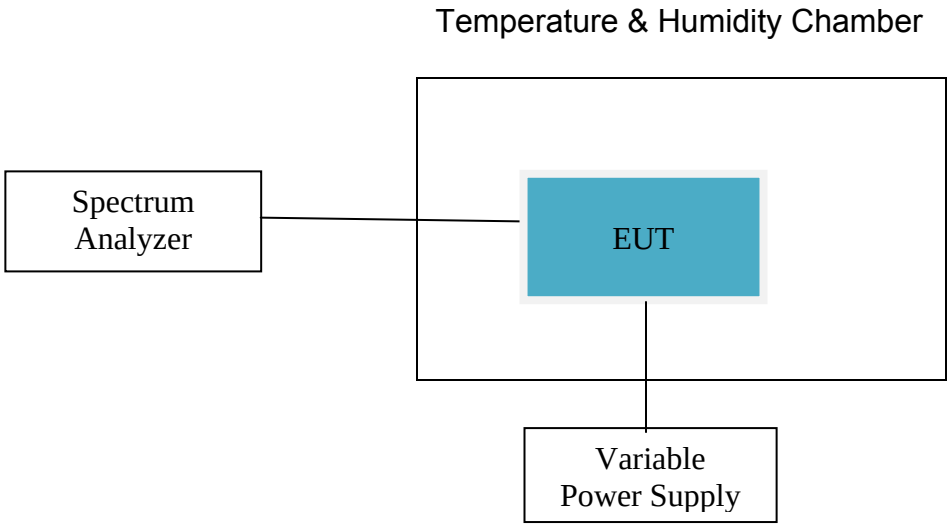
5.6.2 Test Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual

5.6.3 Test Procedures

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 minutes) for the temperature of chamber to stabilize, turn The EUT on and measure the operating frequency after 2, 5 and 10 minutes.
5. Repeat step 3 and 4 with 10°C increased per stage until the lowest temperature.
6. The test chamber was allowed to stabilize at 20°C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115.

5.6.4 Block Diagram of Test Setup



5.6.5 Test Result

Frequency: 5.728GHz	Measured Frequency(GHz)			
Temperature(℃)	0 minute	2 minutes	5minutes	10 minutes
T20℃Vmax	5.728082	5.728079	5.728077	5.728065
T20℃Vmin	5.728079	5.728076	5.728074	5.728061
T40℃Vnom	5.728050	5.728045	5.728041	5.728039
T30℃Vnom	5.728078	5.728074	5.728071	5.728063
T20℃Vnom	5.728077	5.728076	5.728071	5.728067
T10℃Vnom	5.728092	5.728091	5.728089	5.728084
T0℃Vnom	5.728095	5.728093	5.728091	5.728089
Vnom[Vdc]: 24		Vmax[Vdc]: 27.6		Vmin[Vdc]: 20.4
Tnom[℃]: 20		Tmax[℃]: 40		Tmin[℃]: 0

Frequency: 5.775GHz	Measured Frequency(GHz)			
Temperature(℃)	0 minute	2 minutes	5minutes	10 minutes
T20℃Vmax	5.775078	5.775076	5.775072	5.775068
T20℃Vmin	5.775077	5.775073	5.775069	5.775068
T40℃Vnom	5.775043	5.775042	5.775039	5.775034
T30℃Vnom	5.775062	5.775059	5.775054	5.775051
T20℃Vnom	5.775071	5.775068	5.775063	5.775062
T10℃Vnom	5.775085	5.775083	5.775081	5.775079
T0℃Vnom	5.775093	5.775091	5.775089	5.5775084
Vnom[Vdc]: 24		Vmax[Vdc]: 27.6		Vmin[Vdc]: 20.4
Tnom[℃]: 20		Tmax[℃]: 40		Tmin[℃]: 0

Frequency: 5.825GHz	Measured Frequency(GHz)			
Temperature(℃)	0 minute	2 minutes	5minutes	10 minutes
T20℃Vmax	5.825085	5.825083	5.825081	5.825075
T20℃Vmin	5.825078	5.825075	5.825073	5.825071
T40℃Vnom	5.825049	5.825047	5.825043	5.825041
T30℃Vnom	5.825063	5.825061	5.825058	5.825053
T20℃Vnom	5.825082	5.825080	5.825078	5.825077
T10℃Vnom	5.825088	5.825087	5.825084	5.825081
T0℃Vnom	5.825090	5.825085	5.825078	5.825074
Vnom[Vdc]: 24		Vmax[Vdc]: 27.6		Vmin[Vdc]: 20.4
Tnom[℃]: 20		Tmax[℃]: 40		Tmin[℃]: 0

5.7 Antenna Application

5.8.1 Antenna Requirement

Standard	Requirement
FCC CFR Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Type	Frequency	Antenna Gain	Limit
Chip Antenna	5 GHz	2.4 dBi	≤6 dBi

5.8.2 Result

PASS