



FCC TEST REPORT

FCC ID:2BREA-KE28

Applicant: Shenzhen Sanlead Industrial Co., Ltd.
Address: Room 908, China South Development Center, #1 Huanan Avenue, Longgang District, Shenzhen, China
Manufacturer: Dongguan Shanghao Plastic Products Co., Ltd.
Address: Room 101, Building 1, No. 3, 7th Industrial Road, Liyatang Village, Tangxia Town, Dongguan City, Guangdong Province, China
EUT: Wireless Liquid Mouse
Trade Mark: N/A
Model Number: KE-28
Date of Receipt: Jul. 24, 2025
Test Date: Jul. 24, 2025 to Aug. 07, 2025
Date of Report: Aug. 07, 2025
Prepared By: Shenzhen DL Testing Technology Co., Ltd.
Address: 101-201, Comprehensive Building, Tongzhou Electronics Longgang Factory Area, No. 1 Baolong Fifth Road, Baolong Community, Baolong Street, Longgang District, Shenzhen, China
Applicable Standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
ANSI C63.10:2013
Test Result: Pass
Report Number: DLE-250806009R

Prepared (Test Engineer): Ken Tan
Reviewer (Supervisor): Jack Bu
Approved (Manager): Jade Yang



This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Shenzhen DL Testing Technology Co., Ltd.



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**1. VERSION**

Report No.	Version	Description	Approved
DLE-250806009R	Rev.01	Initial issue of report	Aug. 07, 2025



2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
FCC part 15.203/15.247(b)(4)	Antenna requirement	PASS	
ANSI C63.10:2013	Duty Cycle	PASS	
FCC part 15.207	AC Power Line Conducted Emission	N/A	
FCC part 15.247 (b)(3)	Conducted Peak Output Power	PASS	
FCC part 15.247 (a)(2)	6DB Occupied Bandwidth	PASS	
FCC part 15.247 (e)	Power Spectral Density	PASS	
FCC part 15.247 (d)	Band Edge	PASS	
FCC part 15.205/15.209	Spurious Emission	PASS	

NOTE:

(1)"N/A" denotes test is not applicable in this Test Report



2.1 TEST FACILITY

Shenzhen DL Testing Technology Co., Ltd.

Add. : 101-201, Comprehensive Building, Tongzhou Electronics Longgang Factory Area, No.1 Baolong Fifth Road, Baolong Community, Baolong Street, Longgang District, Shenzhen, China

FCC Test Firm Registration Number: 854456

Designation Number: CN1307

IC Registered No.: 27485

CAB identifier: CN0118

2.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission (9KHz-30MHz)	U=4.5dB
2	3m chamber Radiated spurious emission (30MHz-1GHz)	U=4.8dB
3	3m chamber Radiated spurious emission (1GHz-6GHz)	U=4.9dB
4	3m chamber Radiated spurious emission (6GHz-40GHz)	U=5.0dB
5	Conducted Disturbance	U=3.2dB
6	RF Band Edge	U=1.68dB
7	RF Power Conducted	U=1.86dB
8	RF Conducted Spurious Emission	U=2.2dB
9	RF Occupied Bandwidth	U=1.8MHz
10	RF Power Spectral Density	U=1.75dB
11	Humidity Uncertainty	U=5.3%
12	Temperature Uncertainty	U=0.59°C



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Product Name:	Wireless Liquid Mouse
Model No.:	KE-28
Serial No.:	N/A
Model Different.:	N/A
Hardware Version:	V1.1
Software Version:	V1.0
Sample(s) Status:	Engineer sample
Wireless Connectivity:	2.4G ISM Band (GFSK Modulation)
Operation Frequency:	2402MHz ~ 2479MHz
Channel Numbers:	16 Channels
Transfer Rate:	2 Mbps
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	-7.51dBi
Power Supply:	Input: DC 3V For battery (AAA Battery*2)
Battery:	DC 3V



Operation Frequency each of channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	5	2421	9	2446	13	2468
2	2408	6	2423	10	2451	14	2474
3	2417	7	2428	11	2456	15	2478
4	2419	8	2437	12	2460	16	2479

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2446MHz
The Highest channel	2479MHz

3.2 DESCRIPTION OF TEST MODES

Transmitting mode	Keep the EUT in continuously transmitting mode
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data. For battery operated equipment, the equipment tests shall be performed using a new battery.	
Test Software	FCC_test_tool v2.4.3
Power level setup	Default



3.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Emission

EUT(E-1)	Battery(E-2)
----------	--------------

Conducted Spurious

EUT(E-1)	Battery(E-2)
----------	--------------

3.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Wireless Liquid Mouse	N/A	KE-28	N/A	EUT
E-2	AAA Battery*2	NANFU	ZKT-00	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) EUT is tested with new battery.



3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation test, Band-edge test and 6db bandwidth test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4408B	MY50140780	Nov. 01, 2024	Oct. 31, 2025
2	Test Receiver (9kHz-7GHz)	R&S	ESRP7	101393	Nov. 01, 2024	Oct. 31, 2025
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB9162	00306	Nov. 01, 2024	Oct. 31, 2025
4	Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA9120D	02139	Nov. 01, 2024	Oct. 31, 2025
5	Horn Antenna (18GHz-40GHz)	A.H. Systems	SAS-574	588	Nov. 01, 2024	Oct. 31, 2025
6	Amplifier (9KHz-6GHz)	Schwarzbeck	BBV9743B	00153	Nov. 01, 2024	Oct. 31, 2025
7	Amplifier (1GHz-18GHz)	EMEC	EM01G8GA	00270	Nov. 01, 2024	Oct. 31, 2025
8	Amplifier (18GHz-40GHz)	Quanjuda	DLE-161	97	Nov. 01, 2024	Oct. 31, 2025
9	Loop Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1519B	00014	Nov. 01, 2024	Oct. 31, 2025
10	RF cables1 (9kHz-1GHz)	ChengYu	966	004	Nov. 01, 2024	Oct. 31, 2025
11	RF cables2 (1GHz-40GHz)	ChengYu	966	003	Nov. 01, 2024	Oct. 31, 2025
12	Antenna connector	Florida RF Labs	N/A	RF 01#	Nov. 01, 2024	Oct. 31, 2025
13	Power probe	KEYSIGHT	U2021XA	MY55210018	Nov. 01, 2024	Oct. 31, 2025
14	Signal Analyzer 9kHz-26.5GHz	Agilent	N9020A	MY55370280	Nov. 01, 2024	Oct. 31, 2025
15	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	Nov. 01, 2024	Oct. 31, 2025
16	D.C. Power Supply	LongWei	PS-305D	010964729	Nov. 01, 2024	Oct. 31, 2025

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	843 Shielded Room	YIHENG	843 Room	843	Nov. 05, 2023	Nov. 04, 2026
2	EMI Receiver	R&S	ESR	101421	Nov. 01, 2024	Oct. 31, 2025
3	LISN	R&S	ENV216	102417	Nov. 01, 2024	Oct. 31, 2025
4	843 Cable 1#	ChengYu	CE Cable	001	Nov. 01, 2024	Oct. 31, 2025

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	FALA	EZ EMC	EMC-CON 3A1.1
2	EMC radiation test system	FALA	EZ EMC	FA-03A2
3	RF test system	MAIWEI	MTS8310	2.0.0.0
4	RF communication test system	MAIWEI	MTS8200	2.0.0.0



4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto

4.1.1 POWER LINE CONDUCTED EMISSION LIMITS

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quas -peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) *Decreases with the logarithm of the frequency.

4.1.2 TEST PROCEDURE

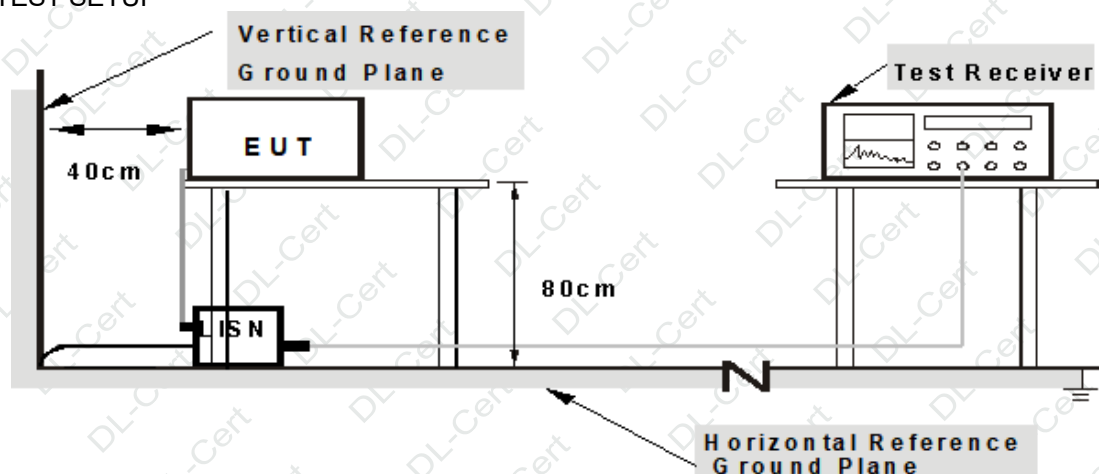
- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 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.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation



4.1.4 TEST SETUP



- Note: 1. Support units were connected to second LISN.**
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.1.6 TEST RESULT

N/A

Note: Only AC products need to test this item, DC products are not applicable.



4.2 RADIATED EMISSION MEASUREMENT

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average

4.2.1 RADIATED EMISSION LIMITS

Frequencies (MHz)	Field Strength (micromvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT

Frequency (MHz)	Limit (dBuV/m) (at 3M)	
	Peak	Average
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).



4.2.2 TEST PROCEDURE

- The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 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.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
- For the radiated emission test above 1GHz:
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.

Note:

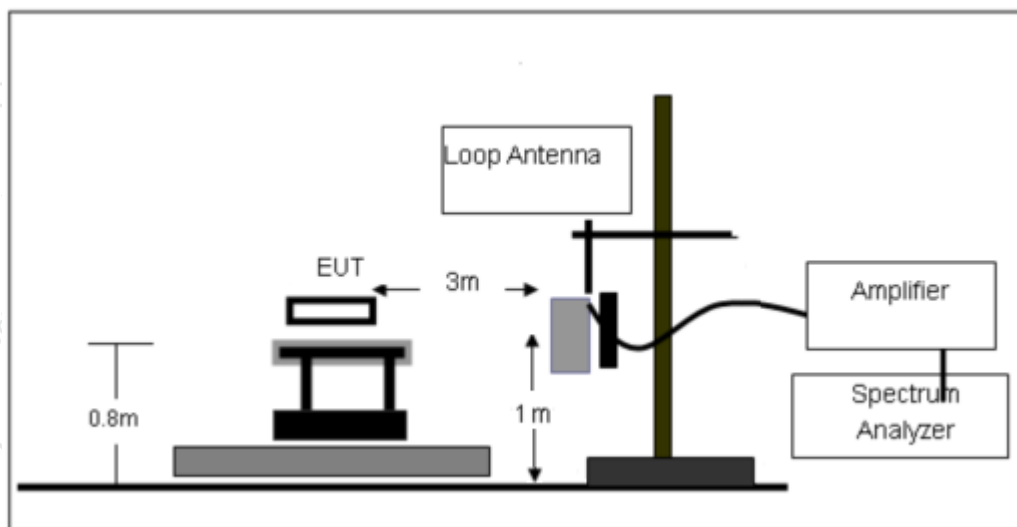
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

4.2.3 DEVIATION FROM TEST STANDARD

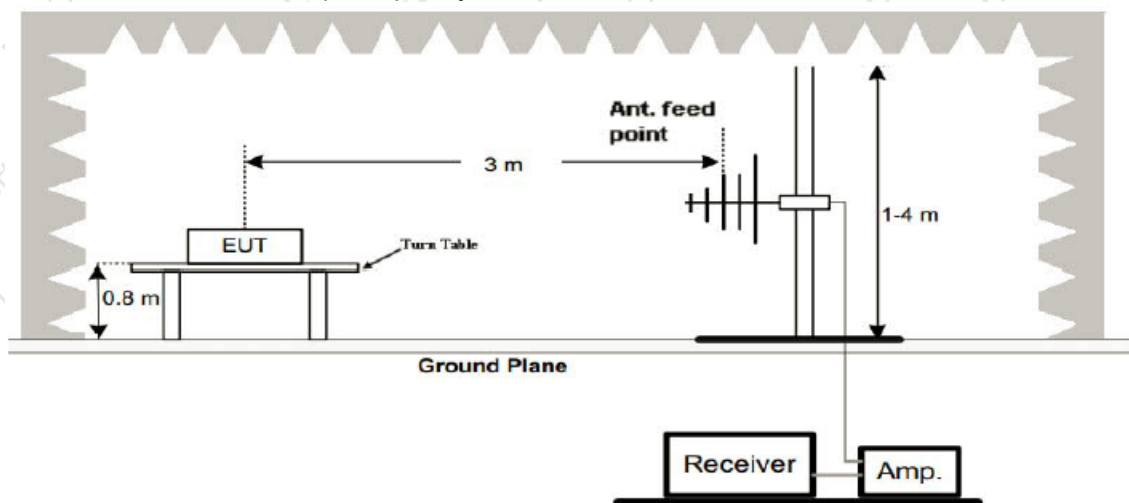
No deviation

4.2.4 TEST SETUP

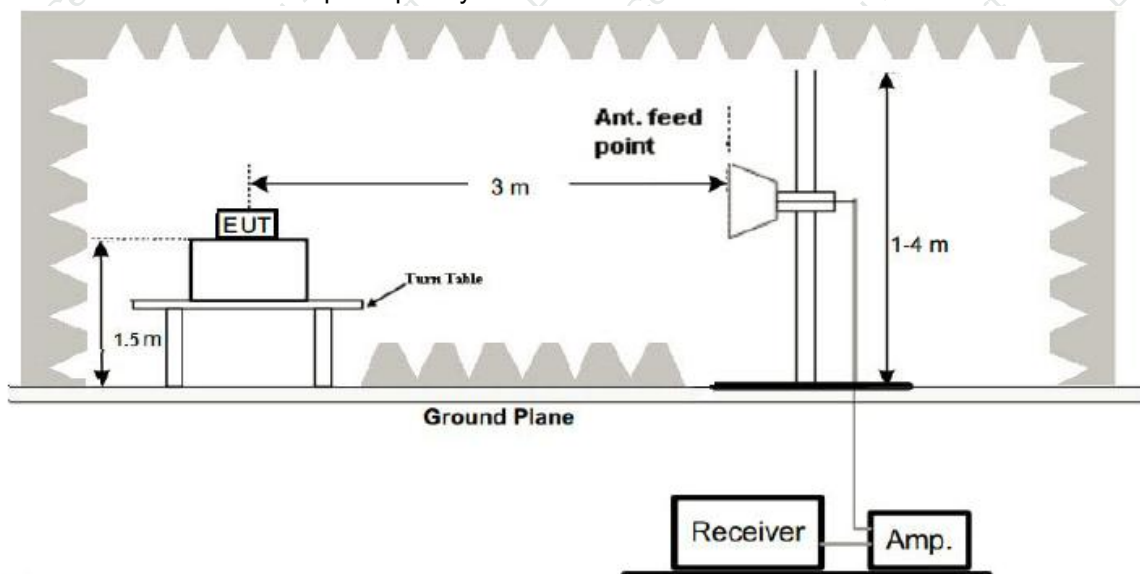
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.2.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.2.6 TEST RESULTS

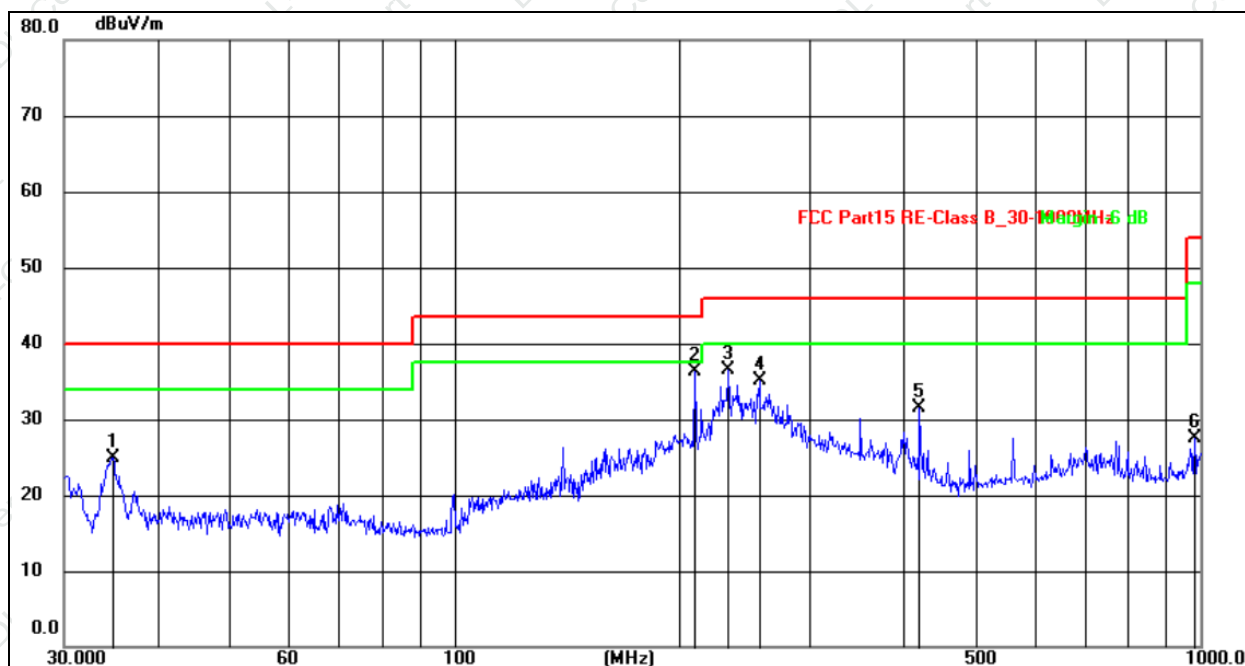
a, Between 9KHz – 30 MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.



b. Between 30MHz – 1GHz

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 3V	Test Mode :	TX GFSK - 2402MHz



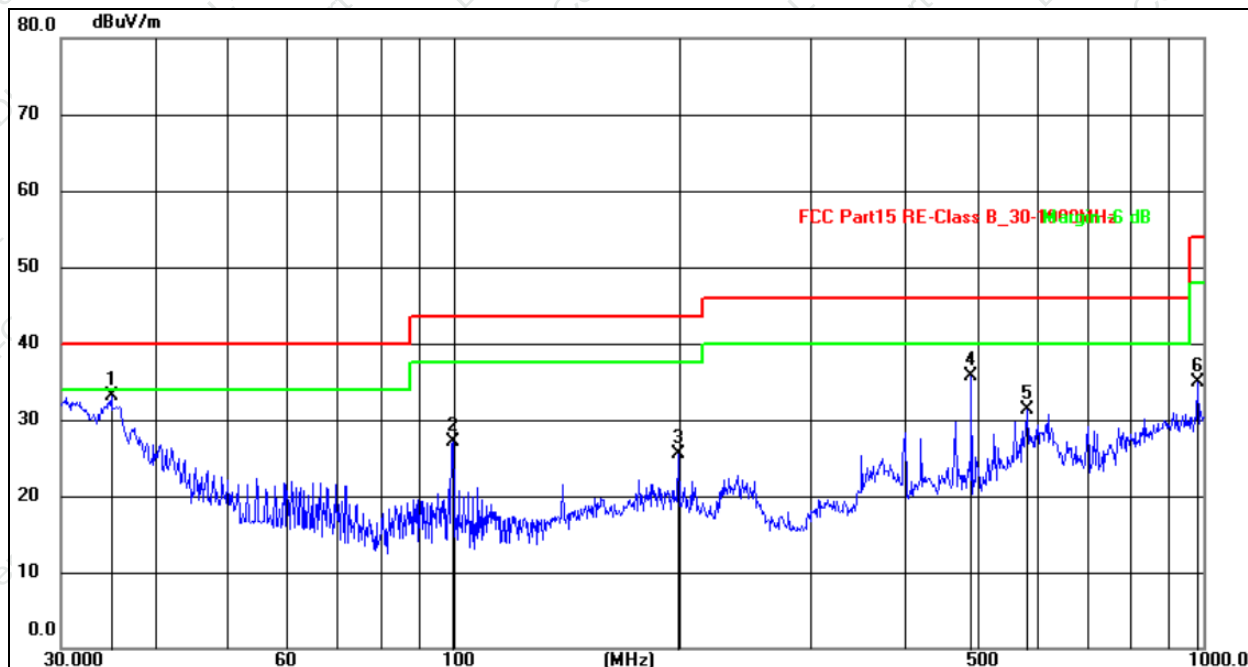
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	34.8821	39.81	-14.92	24.89	40.00	-15.11	QP
2	210.0481	54.35	-17.98	36.37	43.50	-7.13	QP
3	233.3486	52.98	-16.44	36.54	46.00	-9.46	QP
4	256.5210	50.33	-15.31	35.02	46.00	-10.98	QP
5	420.5803	46.51	-15.02	31.49	46.00	-14.51	QP
6	982.6200	32.35	-4.94	27.41	54.00	-26.59	QP

Remarks:

1. An initial pre-scan was performed on the peak detector.
2. Quasi - Peak measurement were performed at the frequencies with maximized peak emission.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Final Level = Reading level + Correct Factor.
5. Correct Factor = Antenna factor+ Cable loss factor - Amplifier factor.
6. Margin = Measurement Level-Limit.
7. The test data shows only the worst case TX GFSK - 2402MHz.



Temperature:	26°C	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 3V	Test Mode :	TX GFSK - 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	35.0048	50.51	-17.50	33.01	40.00	-6.99	QP
2	99.8777	48.18	-21.10	27.08	43.50	-16.42	QP
3	199.2855	45.96	-20.37	25.59	43.50	-17.91	QP
4	490.7445	46.97	-11.31	35.66	46.00	-10.34	QP
5	582.7423	39.28	-7.96	31.32	46.00	-14.68	QP
6	982.6200	34.86	-0.01	34.85	54.00	-19.15	QP

Remarks:

1. An initial pre-scan was performed on the peak detector.
2. Quasi - Peak measurement were performed at the frequencies with maximized peak emission.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Final Level = Reading level + Correct Factor.
5. Correct Factor= Antenna factor+ Cable loss factor - Amplifier factor.
6. Margin= Measurement Level-Limit.
7. The test data shows only the worst case TX GFSK - 2402MHz.



1GHz~25GHz

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low Channel:2402MHz									
V	4804.00	53.89	30.55	5.77	24.66	53.77	74.00	-20.23	PK
V	4804.00	43.37	30.55	5.77	24.66	43.25	54.00	-10.75	AV
V	7206.00	51.54	30.33	6.32	24.55	52.08	74.00	-21.92	PK
V	7206.00	43.88	30.33	6.32	24.55	44.42	54.00	-9.58	AV
V	9608.00	50.85	30.85	7.45	24.69	52.14	74.00	-21.86	PK
V	9608.00	43.63	30.85	7.45	24.69	44.92	54.00	-9.08	AV
V	12010.00	52.15	31.02	8.99	25.57	55.69	74.00	-18.31	PK
V	12010.00	43.25	31.02	8.99	25.57	46.79	54.00	-7.21	AV
H	4804.00	54.97	30.55	5.77	24.66	54.85	74.00	-19.15	PK
H	4804.00	43.45	30.55	5.77	24.66	43.33	54.00	-10.67	AV
H	7206.00	54.50	30.33	6.32	24.55	55.04	74.00	-18.96	PK
H	7206.00	43.02	30.33	6.32	24.55	43.56	54.00	-10.44	AV
H	9608.00	52.26	30.85	7.45	24.69	53.55	74.00	-20.45	PK
H	9608.00	43.74	30.85	7.45	24.69	45.03	54.00	-8.97	AV
H	12010.00	50.44	31.02	8.99	25.57	53.98	74.00	-20.02	PK
H	12010.00	43.25	31.02	8.99	25.57	46.79	54.00	-7.21	AV

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Middle Channel:2446MHz									
V	4892.00	52.69	30.55	5.77	24.66	52.57	74.00	-21.43	PK
V	7338.00	43.27	30.55	5.77	24.66	43.15	54.00	-10.85	AV
V	9784.00	52.21	30.33	6.32	24.55	52.75	74.00	-21.25	PK
V	12230.00	43.39	30.33	6.32	24.55	43.93	54.00	-10.07	AV
V	4892.00	54.67	30.85	7.45	24.69	55.96	74.00	-18.04	PK
V	7338.00	43.85	30.85	7.45	24.69	45.14	54.00	-8.86	AV
V	9784.00	54.55	31.02	8.99	25.57	58.09	74.00	-15.91	PK
V	12230.00	44.00	31.02	8.99	25.57	47.54	54.00	-6.46	AV
H	4892.00	51.05	30.55	5.77	24.66	50.93	74.00	-23.07	PK
H	7338.00	43.75	30.55	5.77	24.66	43.63	54.00	-10.37	AV
H	9784.00	54.86	30.33	6.32	24.55	55.40	74.00	-18.60	PK
H	12230.00	43.56	30.33	6.32	24.55	44.10	54.00	-9.90	AV
H	4892.00	51.70	30.85	7.45	24.69	52.99	74.00	-21.01	PK
H	7338.00	43.46	30.85	7.45	24.69	44.75	54.00	-9.25	AV
H	9784.00	54.62	31.02	8.99	25.57	58.16	74.00	-15.84	PK
H	12230.00	43.08	31.02	8.99	25.57	46.62	54.00	-7.38	AV



Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
High Channel:2479MHz									
V	4958.00	51.60	30.55	5.77	24.66	51.48	74.00	-22.52	PK
V	7437.00	43.77	30.55	5.77	24.66	43.65	54.00	-10.35	AV
V	9916.00	54.35	30.33	6.32	24.55	54.89	74.00	-19.11	PK
V	12395.00	43.19	30.33	6.32	24.55	43.73	54.00	-10.27	AV
V	4958.00	53.06	30.85	7.45	24.69	54.35	74.00	-19.65	PK
V	7437.00	43.03	30.85	7.45	24.69	44.32	54.00	-9.68	AV
V	9916.00	52.56	31.02	8.99	25.57	56.10	74.00	-17.90	PK
V	12395.00	43.63	31.02	8.99	25.57	47.17	54.00	-6.83	AV
H	4958.00	52.93	30.55	5.77	24.66	52.81	74.00	-21.19	PK
H	7437.00	43.49	30.55	5.77	24.66	43.37	54.00	-10.63	AV
H	9916.00	52.72	30.33	6.32	24.55	53.26	74.00	-20.74	PK
H	12395.00	43.36	30.33	6.32	24.55	43.90	54.00	-10.10	AV
H	4958.00	52.51	30.85	7.45	24.69	53.80	74.00	-20.20	PK
H	7437.00	43.07	30.85	7.45	24.69	44.36	54.00	-9.64	AV
H	9916.00	54.63	31.02	8.99	25.57	58.17	74.00	-15.83	PK
H	12395.00	43.63	31.02	8.99	25.57	47.17	54.00	-6.83	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

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



5. RADIATED BAND EMISSION MEASUREMENT

5.1 TEST REQUIREMENT

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Average	1MHz	3MHz	Average

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

Frequency (MHz)	Limit (dBuV/m) (at 3M)	
	Peak	Average
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2310MHz
Stop Frequency	2500MHz
RB / VB (emission in restricted band)	1 MHz / 3 MHz for Peak, 1 MHz / 3MHz for Average

5.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height 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.
- d. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.



g. Test the EUT in the lowest channel, the highest channel

Note:

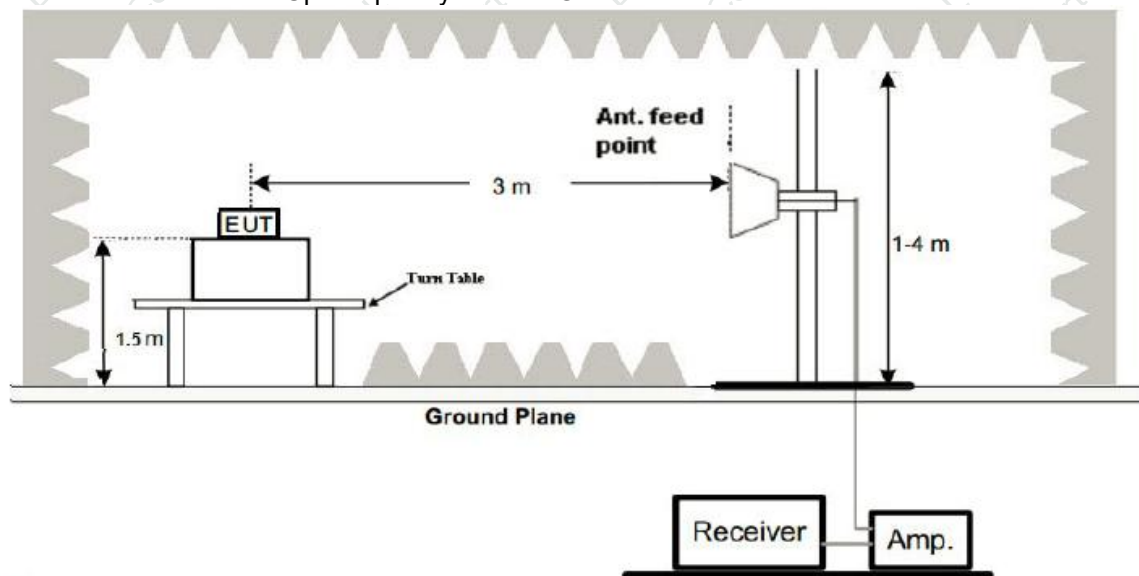
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

5.3 DEVIATION FROM TEST STANDARD

No deviation

5.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



5.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



5.6 TEST RESULT

	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detect or Type	Result
GFSK	Low Channel: 2402MHz										
	H	2310.00	54.07	30.22	4.85	23.98	52.68	74.00	-21.32	PK	PASS
	H	2310.00	44.38	30.22	4.85	23.98	42.99	54.00	-11.01	AV	PASS
	H	2350.00	54.17	30.22	4.85	23.98	52.78	74.00	-21.22	PK	PASS
	H	2350.00	44.28	30.22	4.85	23.98	42.89	54.00	-11.11	AV	PASS
	H	2390.00	54.54	30.22	4.85	23.98	53.15	74.00	-20.85	PK	PASS
	H	2390.00	44.37	30.22	4.85	23.98	42.98	54.00	-11.02	AV	PASS
	V	2310.00	54.59	30.22	4.85	23.98	53.20	74.00	-20.80	PK	PASS
	V	2310.00	44.15	30.22	4.85	23.98	42.76	54.00	-11.24	AV	PASS
	V	2350.00	54.15	30.22	4.85	23.98	52.76	74.00	-21.24	PK	PASS
	V	2350.00	44.36	30.22	4.85	23.98	42.97	54.00	-11.03	AV	PASS
	V	2390.00	54.41	30.22	4.85	23.98	53.02	74.00	-20.98	PK	PASS
	V	2390.00	44.76	30.22	4.85	23.98	43.37	54.00	-10.63	AV	PASS
	High Channel: 2479MHz										
	H	2483.50	54.54	30.22	4.85	23.98	53.15	74.00	-20.85	PK	PASS
	H	2483.50	44.49	30.22	4.85	23.98	43.10	54.00	-10.90	AV	PASS
	H	2490.00	53.09	30.22	4.85	23.98	51.70	74.00	-22.30	PK	PASS
	H	2490.00	44.27	30.22	4.85	23.98	42.88	54.00	-11.12	AV	PASS
	H	2500.00	54.11	30.22	4.85	23.98	52.72	74.00	-21.28	PK	PASS
	H	2500.00	44.62	30.22	4.85	23.98	43.23	54.00	-10.77	AV	PASS
	V	2483.50	54.87	30.22	4.85	23.98	53.48	74.00	-20.52	PK	PASS
	V	2483.50	44.17	30.22	4.85	23.98	42.78	54.00	-11.22	AV	PASS
	V	2490.00	53.57	30.22	4.85	23.98	52.18	74.00	-21.82	PK	PASS
	V	2490.00	44.63	30.22	4.85	23.98	43.24	54.00	-10.76	AV	PASS
	V	2500.00	54.28	30.22	4.85	23.98	52.89	74.00	-21.11	PK	PASS
	V	2500.00	44.18	30.22	4.85	23.98	42.79	54.00	-11.21	AV	PASS
Remark:											
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit.											



6. POWER SPECTRAL DENSITY TEST

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (e)	Power Spectral Density	8dBm/3kHz	2400-2483.5	PASS

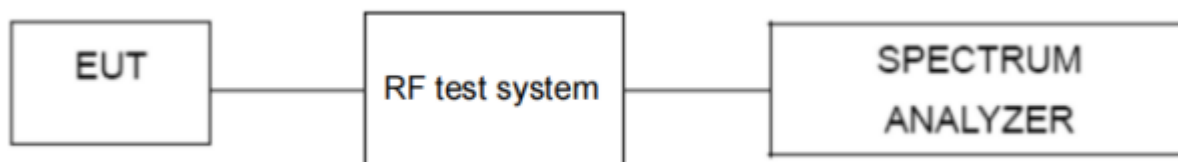
6.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of chapter 3, Unless otherwise a special operating condition is specified in the follows during the testing.



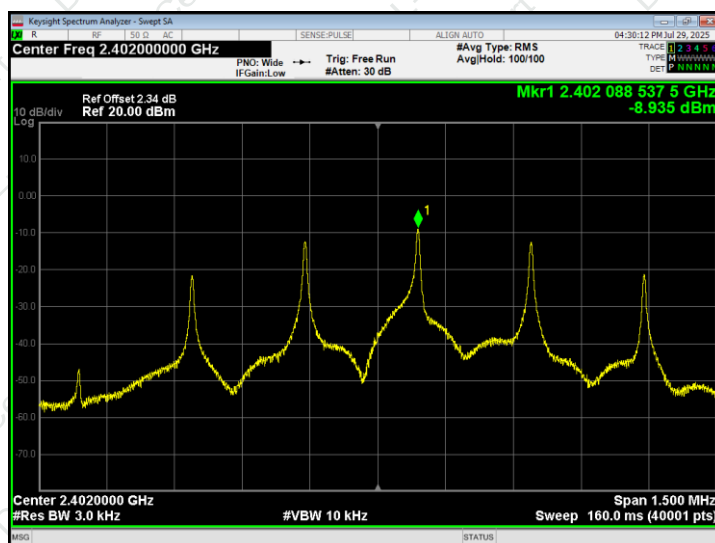
6.6 TEST RESULT

Temperature :	26°C	Relative Humidity :	54%
Pressure:	101kPa	Test Voltage:	DC 3V

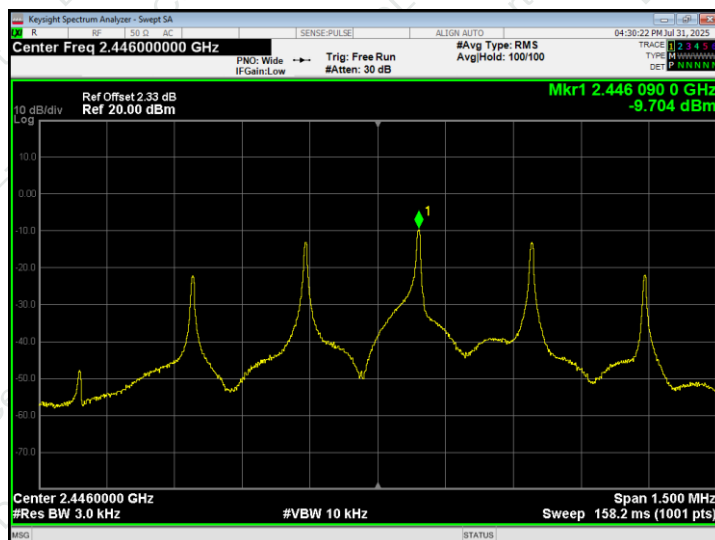
Test Mode	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK	2402	-8.935	8	PASS
	2446	-9.704	8	PASS
	2479	-10.309	8	PASS



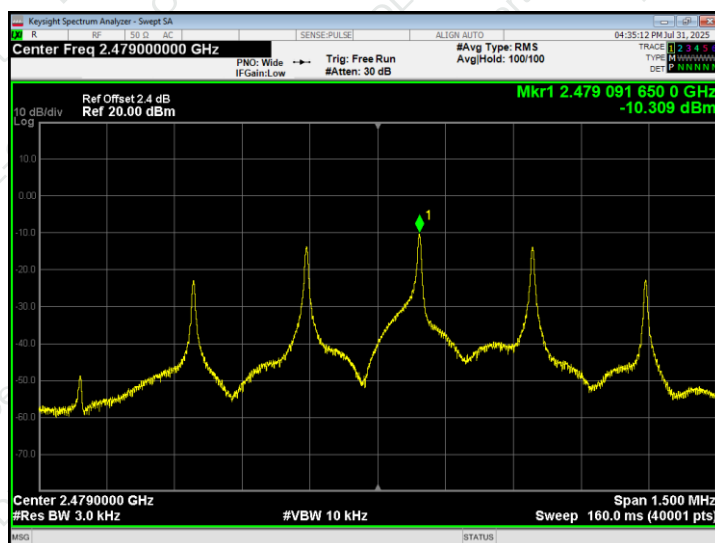
2402MHz



2446MHz



2479MHz





7. 6DB OCCUPIED BANDWIDTH

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{kHz}$ (6dB Occupied Bandwidth)	2400-2483.5 (MHz)	PASS

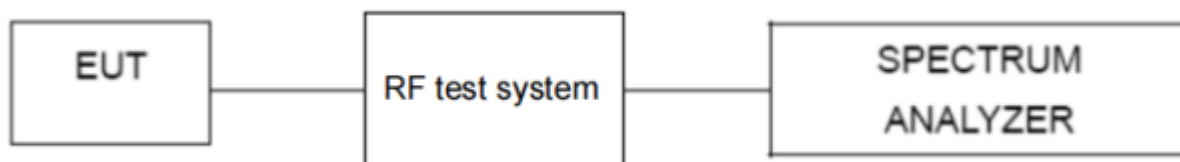
7.2 TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of chapter 3, Unless otherwise a special operating condition is specified in the follows during the testing.



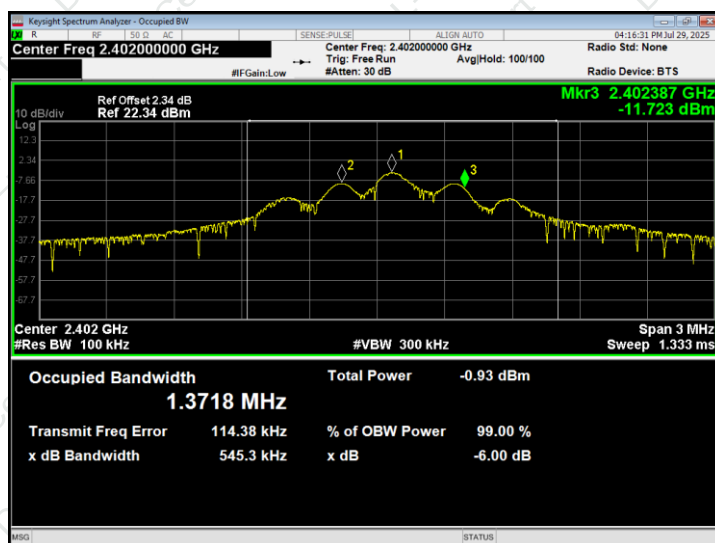
7.6 TEST RESULT

Temperature :	26°C	Relative Humidity :	54%
Pressure:	101kPa	Test Voltage:	DC 3V

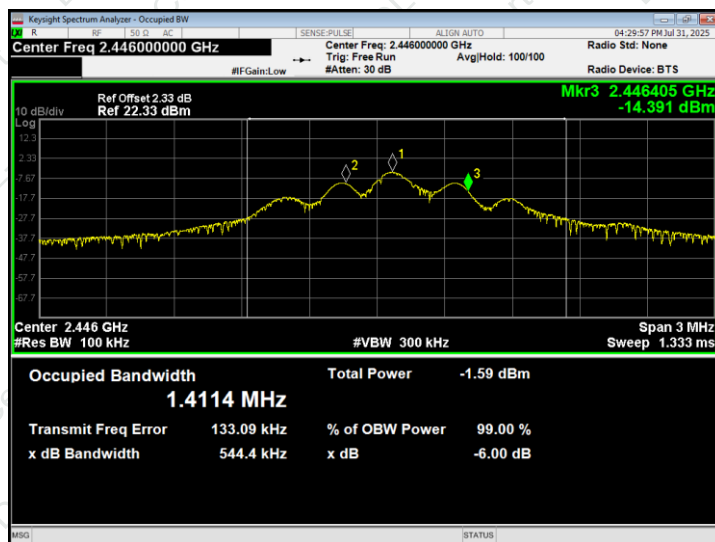
Test Mode	Frequency (MHz)	6dB Occupied Bandwidth (MHz)	Limit (kHz)	Result
GFSK	2402	0.5453	>500	Pass
	2446	0.5444		
	2479	0.5425		



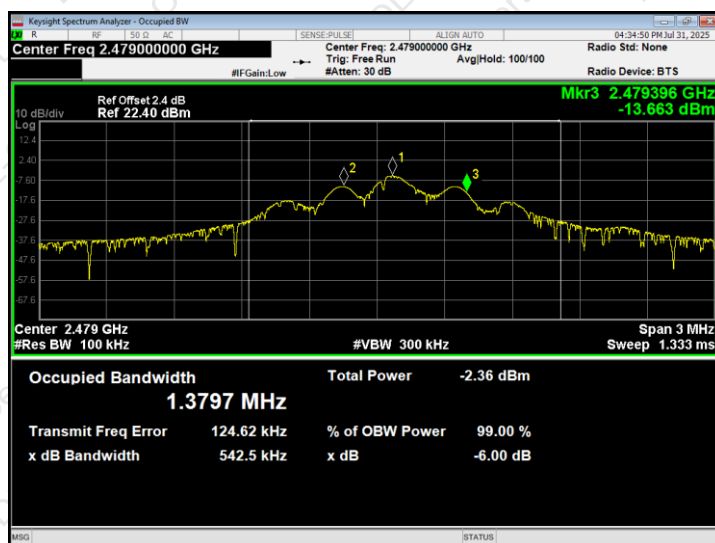
2402MHz



2446MHz



2479MHz





8. PEAK OUTPUT POWER TEST

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02

8.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5 (MHz)	PASS

8.2 TEST PROCEDURE

- a. The EUT was directly connected to the Power meter

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of chapter 3, Unless otherwise a special operating condition is specified in the follows during the testing.



8.6 TEST RESULT

Temperature :	26°C	Relative Humidity :	54%
Pressure:	101kPa	Test Voltage:	DC 3V

Test Mode	Test Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	2402	-2.824	30.00	Pass
	2446	-3.410		
	2479	-4.055		



9. CONDUCTED BAND EDGE AND SPURIOUS EMISSION

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02

9.1 APPLICABLE STANDARD

Typical regulatory requirements specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions⁸⁹:

The maximum peak conducted output power procedure was used to determine compliance as described in 11.9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

9.2 TEST PROCEDURE

A. Reference level measurement, establish a reference level by using the following procedure:

- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 times the DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW $\geq [3 \times \text{RBW}]$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

B. Emission level measurement, establish an emission level by using the following procedure:

- Set the center frequency and span to encompass frequency range to be measured.
- Set the RBW = 100 kHz.
- Set the VBW $\geq [3 \times \text{RBW}]$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

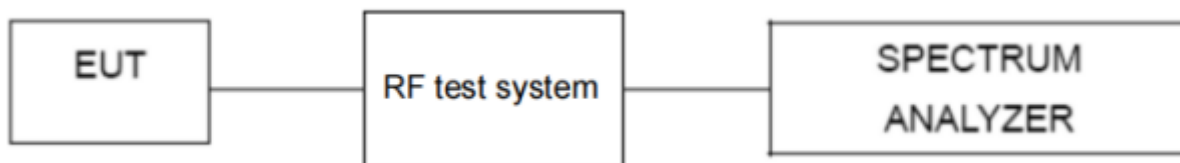
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.



9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 EUT OPERATION CONDITIONS

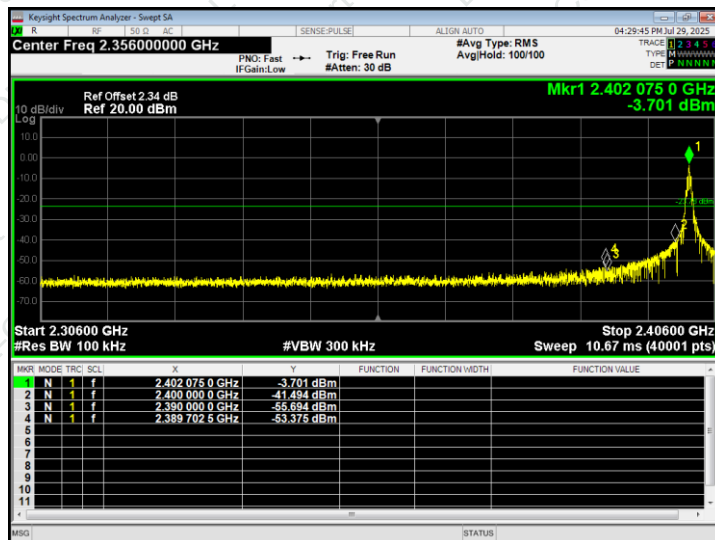
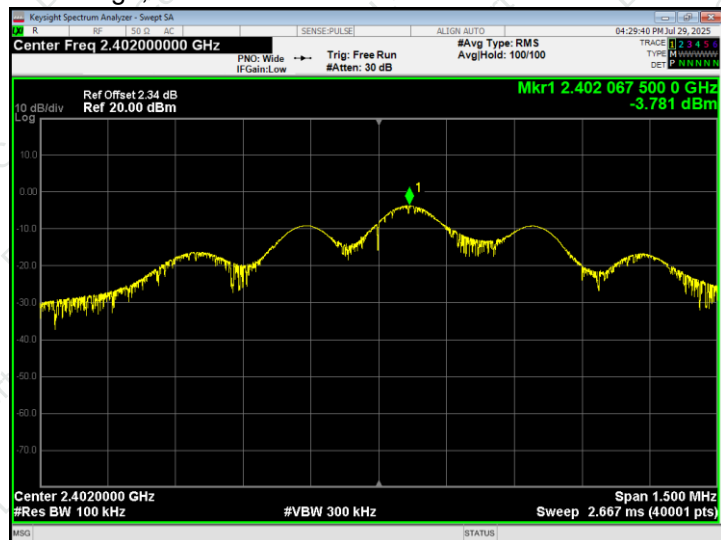
The EUT tested system was configured as the statements of chapter 3, Unless otherwise a special operating condition is specified in the follows during the testing.



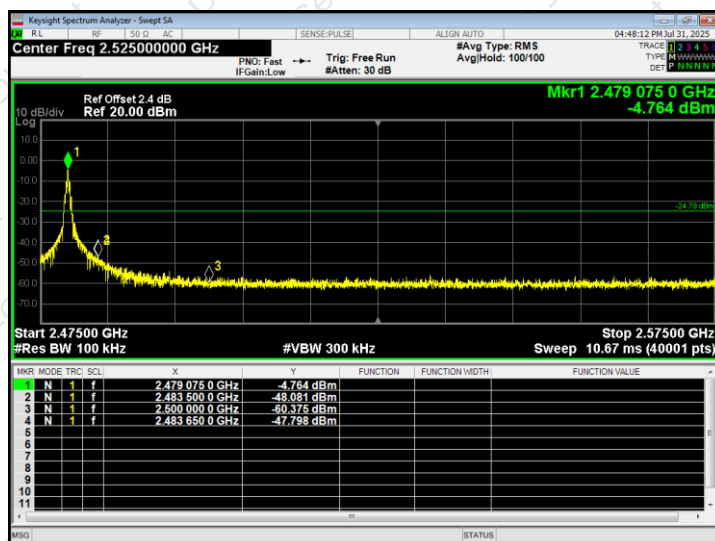
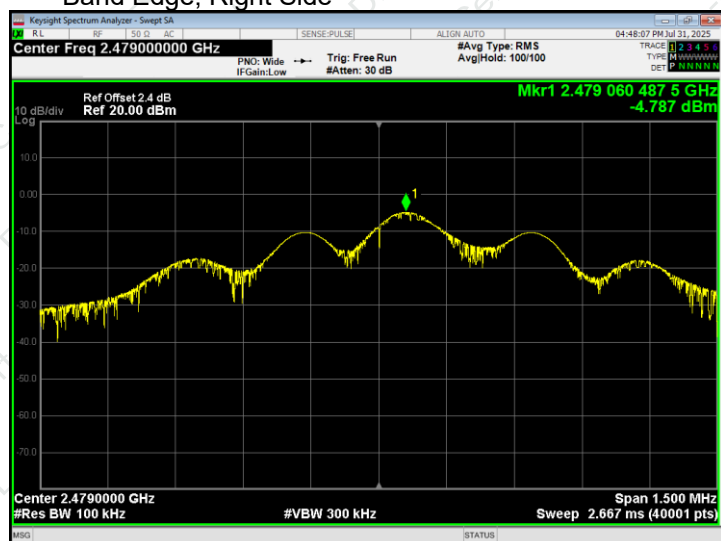
9.6 TEST RESULTS

Temperature :	26°C	Relative Humidity :	54%
Pressure:	101kPa	Test Voltage:	DC 3V

Band Edge, Left Side

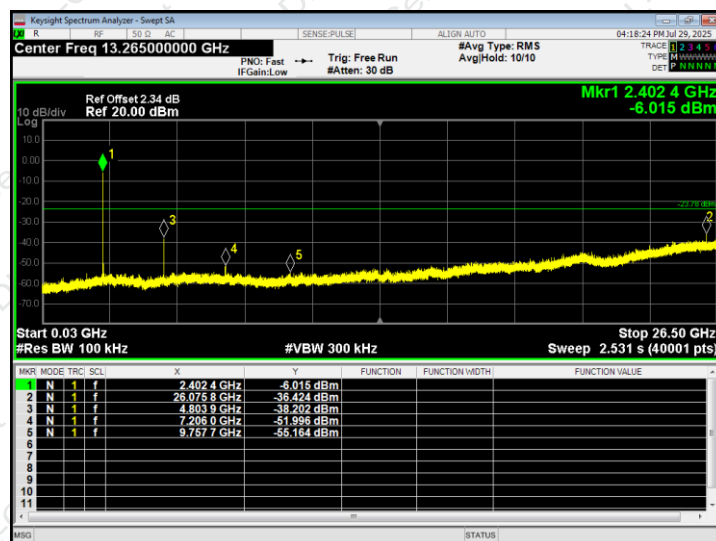
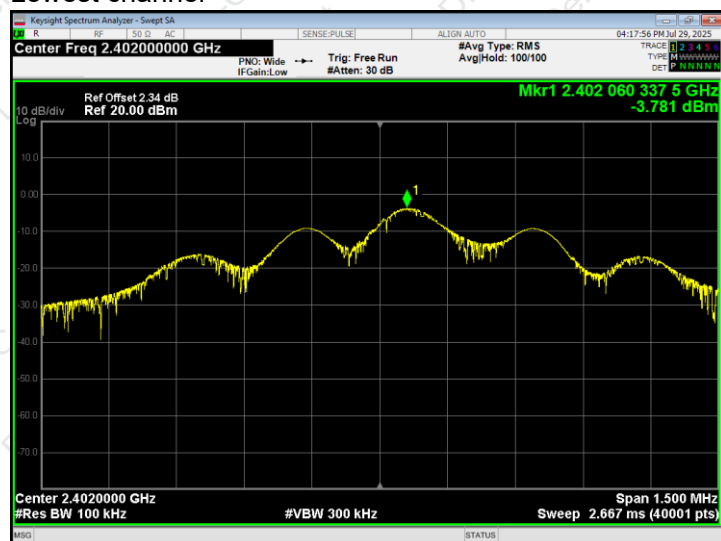


Band Edge, Right Side

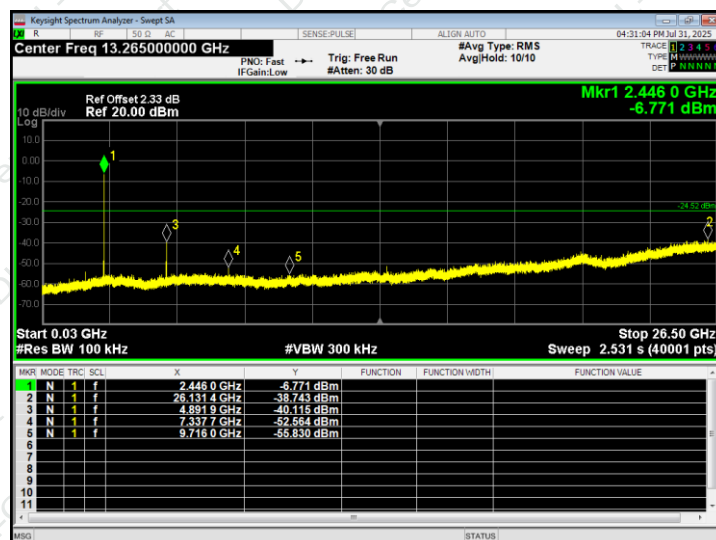
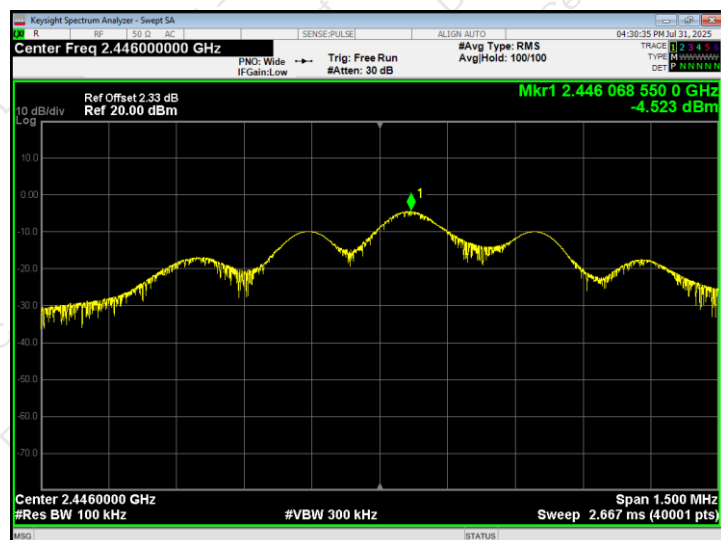




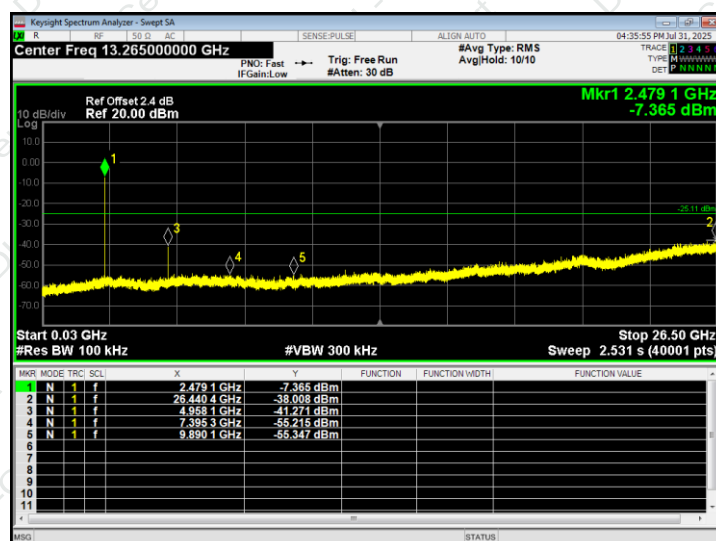
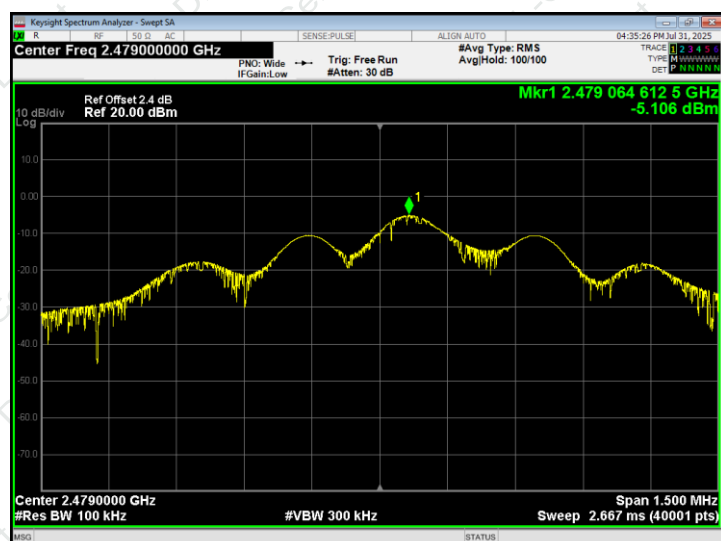
Lowest channel



Middle channel



Highest channel



30MHz-26.5GHz



10. DUTY CYCLE

Test Method:	ANSI C63.10:2013
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10.1 APPLIED PROCEDURES / LIMIT

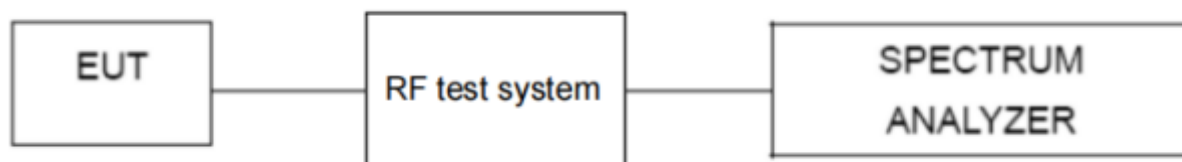
Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

- A diode detector and an oscilloscope that together have a sufficiently short response time to permit accurate measurements of the ON and OFF times of the transmitted signal.
- The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:
 - Set the center frequency of the instrument to the center frequency of the transmission.
 - Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value.
 - Set $VBW \geq RBW$. Set detector = peak or average.
 - The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if $T \leq 16.7 \mu s$.)

10.2 DEVIATION FROM STANDARD

No deviation.

10.3 TEST SETUP



10.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of chapter 3, Unless otherwise a special operating condition is specified in the follows during the testing.



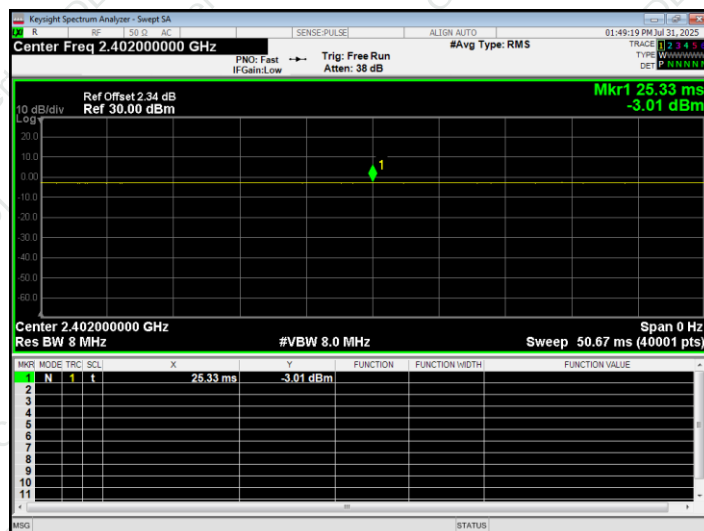
10.5 TEST RESULTS

Temperature :	26°C	Relative Humidity :	54%
Pressure:	101kPa	Test Voltage:	DC 3V

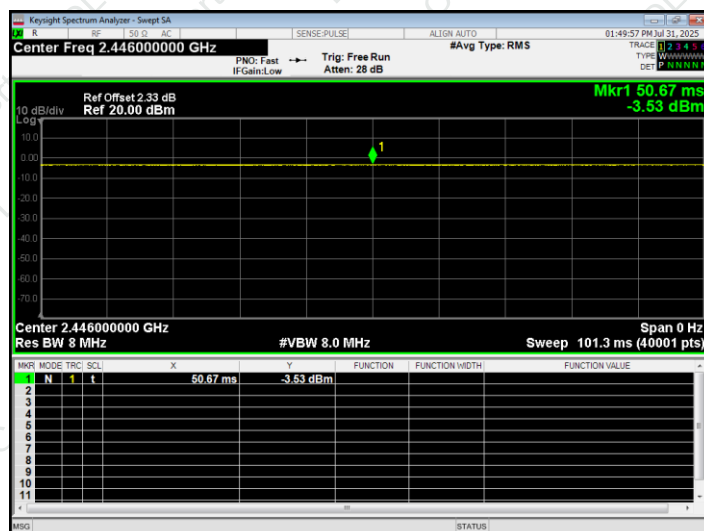
Test Mode	Frequency (MHz)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Result
GFSK	2402	100	0.00	Pass
	2446	100	0.00	Pass
	2479	100	0.00	Pass
Note: Duty Cycle = Ton /Total*100%				
Duty Cycle Correction Factor = 10log (1/Duty Cycle)				



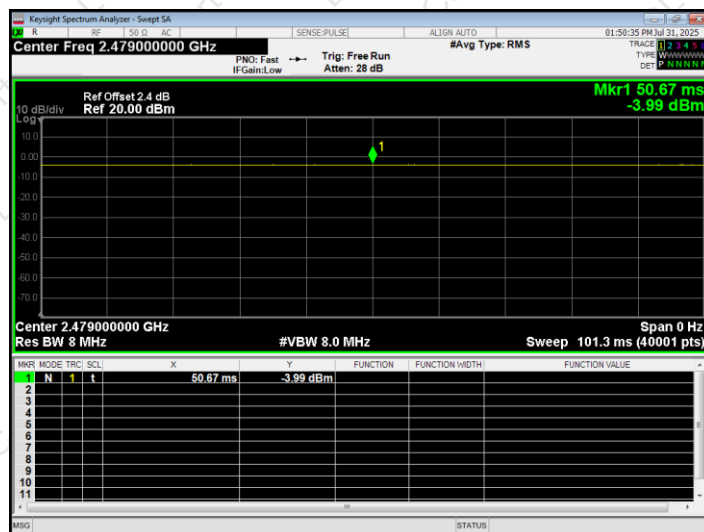
2402MHz



2446MHz



2479MHz





11. ANTENNA REQUIREMENT

Standard requirement:	FCC Part15 C Section 15.203 /247(b)(4)
15.203 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, 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.	
15.247(b)(4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is PCB antenna, the best case gain of the antennas is -7.51dBi, reference to the appendix II for details	



12. TEST SETUP PHOTO

Reference to the appendix I for details.

13. EUT CONSTRUCTIONAL DETAILS

Reference to the appendix II for details.

***** END OF REPORT *****