

Test Report Number:	LCZE25020062	Total Page(s): 44
Applicant Name:	Kinglumi Co., Ltd	
Applicant Address:	First Floor, Unit 1, Building 1, Factory Building, West Side of Songbai Highway, North Side of JiheExpressway Interchange, Tangtou Community, Shiyao Street, Bao' an District, Shenzhen City, Guangdong, China.	
Test item:	LED Track light	
Model / Type Reference:	61193.XXX, 61194.XXX, 61195.XXX, 61196.XXX, 61197.XXX, 61198.XXX, 61246.8XX, 61246.8XX.1, 61247.8XX, 61248.8XX, 61249.8XX, 61249.8XX.1, 61250.8XX, 61251.8XX	
FCC ID:	2A8BD-61196XXX	
Date of Issue:	2025-05-09	
Testing Laboratory:	LCTECH Guangdong Testing Services Co., Ltd. 2/F., Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China	
Test Specification:	FCC 47 CFR Part 15 Subpart C: Section 15.247	
Test Result:	Passed	
Compiled by:	Reviewed by:	
2025-05-09 Rex He	2025-05-09 Alan Tian	
<i>Date</i>	<i>Name</i>	<i>Signature</i>
Remark:		
N/A		
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1 Summary of Test Results

Description of Test Item	Standard	Result
Antenna Requirement	FCC Part 15 Subpart C: 15.203/247(c)	PASS
AC Power Line Conducted Emission	FCC Part 15 Subpart C: 15.207	PASS
Conducted Peak Output Power	FCC Part 15 Subpart C: 15.247(b)	PASS
20dB Occupied Bandwidth	FCC Part 15 Subpart C: 15.247(a)	PASS
Carrier Frequencies Separation	FCC Part 15 Subpart C: 15.247(a)	PASS
Hopping Channel Number	FCC Part 15 Subpart C: 15.247(a)	PASS
Dwell Time	FCC Part 15 Subpart C: 15.247(e)	PASS
Band Edge	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10	PASS
Spurious Emission	FCC Part 15: 15.247(d)	PASS
Note: N/A is an abbreviation for Not Applicable		

Test Standard Used: 47 CFR Part 15 Subpart C: Section 15.247

Test procedure used: ANSI C63.10:2020

2 General test information

2.1 Description of EUT

Product Name	: LED Track light
Model Number	: 61193.XXX, 61194.XXX, 61195.XXX, 61196.XXX, 61197.XXX, 61198.XXX, 61246.8XX, 61246.8XX.1, 61247.8XX, 61248.8XX, 61249.8XX, 61249.8XX.1, 61250.8XX, 61251.8XX
EUT function description	: Please reference user manual of this device
Power supply	: AC 120V/60Hz
FCC ID	: 2A8BD-61196XXX
Radio Specification	: Bluetooth V2.1+EDR
Operation frequency	: 2402MHz -2480MHz
Modulation	: GFSK, $\pi/4$ -DQPSK, 8-DPSK
Data rate	: 1Mbps, 2Mbps, 3Mbps
Antenna Type	: FPC Antenna
Antenna Gain	: 2.4dBi

Remark:The device meets the requirements stated within Parts 15.247(g)&(h) in that they were Developed under the Bluetooth protocol and operate as a true frequency hopping system.The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

According to the declaration from the applicant, this report covers the model as below: 61193.XXX, 61194.XXX, 61195.XXX, 61196.XXX, 61197.XXX, 61198.XXX, 61246.8XX, 61246.8XX.1, 61247.8XX, 61248.8XX, 61249.8XX, 61249.8XX.1, 61250.8XX, 61251.8XX. These models have the same RF Chip, PCB layout, components, antenna and appearance, only the model power and CCT is different. Therefore only one model 61196.XXX was fully tested in the report

2.2 Operation channel list

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402 MHz	21	2422 MHz	41	2442 MHz	61	2462 MHz
2	2403 MHz	22	2423 MHz	42	2443 MHz	62	2463 MHz
3	2404 MHz	23	2424 MHz	43	2444 MHz	63	2464 MHz
4	2405 MHz	24	2425 MHz	44	2445 MHz	64	2465 MHz
5	2406 MHz	25	2426 MHz	45	2446 MHz	65	2466 MHz
6	2407 MHz	26	2427 MHz	46	2447 MHz	66	2467 MHz
7	2408 MHz	27	2428 MHz	47	2448 MHz	67	2468 MHz
8	2409 MHz	28	2429 MHz	48	2449 MHz	68	2469 MHz
9	2410 MHz	29	2430 MHz	49	2450 MHz	69	2470 MHz
10	2411 MHz	30	2431 MHz	50	2451 MHz	70	2471 MHz
11	2412 MHz	31	2432 MHz	51	2452 MHz	71	2472 MHz
12	2413 MHz	32	2433 MHz	52	2453 MHz	72	2473 MHz
13	2414MHz	33	2434 MHz	53	2454 MHz	73	2474 MHz
14	2415 MHz	34	2435 MHz	54	2455 MHz	74	2475 MHz
15	2416 MHz	35	2436 MHz	55	2456 MHz	75	2476 MHz
16	2417 MHz	36	2437 MHz	56	2457 MHz	76	2477 MHz
17	2418 MHz	37	2438 MHz	57	2458 MHz	77	2478 MHz
18	2419 MHz	38	2439 MHz	58	2459 MHz	78	2479 MHz
19	2420 MHz	39	2440 MHz	59	2460 MHz	79	2480 MHz
20	2421 MHz	40	2441 MHz	60	2461 MHz		

2.3 Test channel list

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz

2.4 Testing

Date of receipt of test item : 2025-01-09

Date (s) of performance of tests : 2025-04-18 to 2025-05-07

2.5 Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	15-35°C
Humidity range:	20-75%
Pressure range:	98-101kPa

2.6 Test laboratory

LCTECH Guangdong Testing Services Co., Ltd.

Add: 2/F., Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China

Test Sites: 1/F., Building I, Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China

2.7 Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	3.74dB
Uncertainty for Radiation Emission test(30MHz-1GHz)	4.92dB
Uncertainty for Radiation Emission test (Above 1GHz)	4.23dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3 Equipment list

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
Radiated Emission (30 MHz–1000 MHz) ☒						
1	EMI Test Receiver	R&S	ESCI 7	100965	2024-06-14	2025-06-13
2	Log-periodic Dipole Antenna	Schwarzbeck	VULB 9162	058	2022-06-15	2025-06-14
3	3m Semi-anechoic	Zhongshuo Electronics	9mx6mx6m	N/A	2024-12-17	2027-12-16
4	RF Cable	R&S	R01	10403	2024-12-09	2025-12-08
5	EMI Test Software	AUDIX	E3	Version No: 6.111221a	N/A	N/A
Disturbance Voltage ☒						
6	EMI Test Receiver	Rohde&Schwarz	ESCI	100939	2024-12-09	2025-12-08
7	Artificial Mains Network	ROHDE&SCHWARZ	ENV216	3560.6550.12	2024-12-09	2025-12-08
8	Shield Room	Rongxiang	8X5X3.5	992276296	2022-07-01	2027-06-30
9	Conducted Emission Test Software	FALA	EZ-EMC	Version No: LCTECH-03A	N/A	N/A
Radiated Emission (Above 1 GHz) ☒						
10	EMI Test Receiver	R&S	ESCI 7	100965	2024-06-14	2025-06-13
11	Log-periodic Dipole Antenna	Schwarzbeck	VULB 9162	058	2022-06-15	2025-06-14
12	3m Semi-anechoic	Zhongshuo Electronics	9mx6mx6m	N/A	2024-12-17	2027-12-16
13	RF Cable	R&S	R01	10403	2024-12-09	2025-12-08
14	Doppelsteg Breitband Hornantenne Double Ridge Broadband Horn	Schwarzbeck	BBHA 9120 D	N/A	2024-12-11	2025-12-10
15	Signal Analyzer	Keysight	N9020A	SER MY52220373	2024-12-09	2025-12-08
16	Pre-amplifier	sinancidian	COP-01G18G-45dB	N/A	2024-12-09	2025-12-08
Radiated electromagnetic disturbances(>1.6m) ☒						
17	EMI Test Receiver	R&S	ESCI 7	100965	2024-06-14	2025-06-13
18	EMI Test Software	AUDIX	E3	Version No: 6.111221a	N/A	N/A
19	Active loop antenna	SCHWARZBECK	FMZB1519	1519-045	2022-06-15	2025-06-14
RF Conducted Test ☒						
20	Signal Analyzer	Keysight	N9020A	MY52220373	2024-12-09	2025-12-08

4 Test Results

4.1 Antenna requirement

Standard requirement:

15.203 requirement:

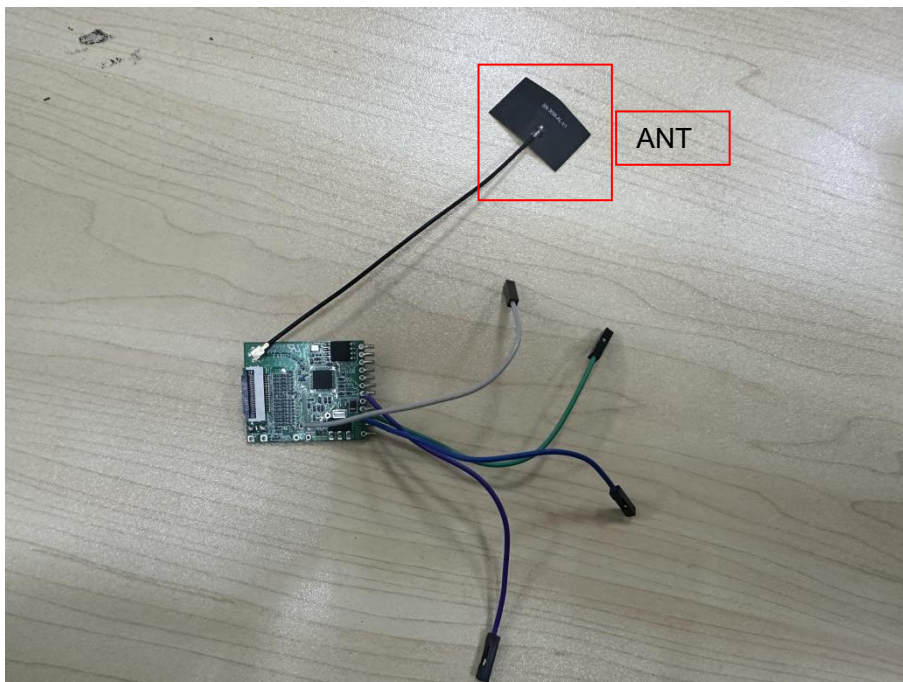
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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(c) (1)(i) requirement:

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

E.U.T Antenna:

The antenna is FPC antenna. It comply with the standard requirement.



4.2 AC Power Line Conducted Emission

Results:

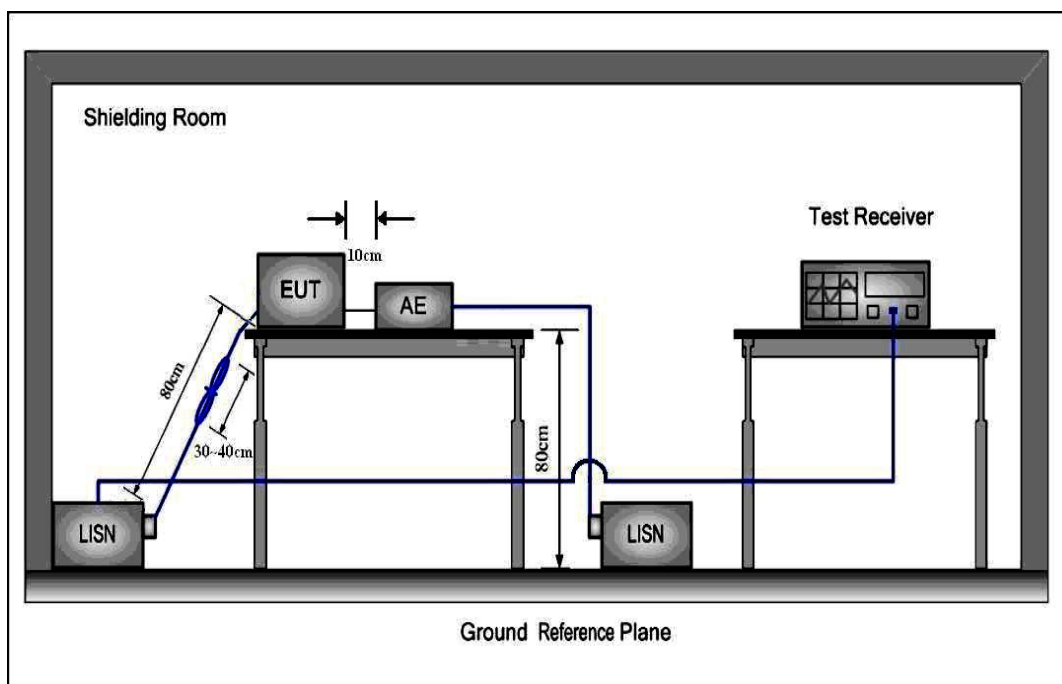
Pass

Date of testing : Apr 16, 2025
 Test procedure : ANSI C63.10 Clause 6.2
 Frequency range : 0.15- 30MHz
 Kind of test site : shielded room
 Limits : CFR Title 47 Part 15 Subpart C: Section 15.207

Test setup

Artificial Hand : Not applied
 Earthing : Applied
 Temperature : 25°C
 Humidity : 57%
 Air pressure : 101KPA

Test Connection Diagram

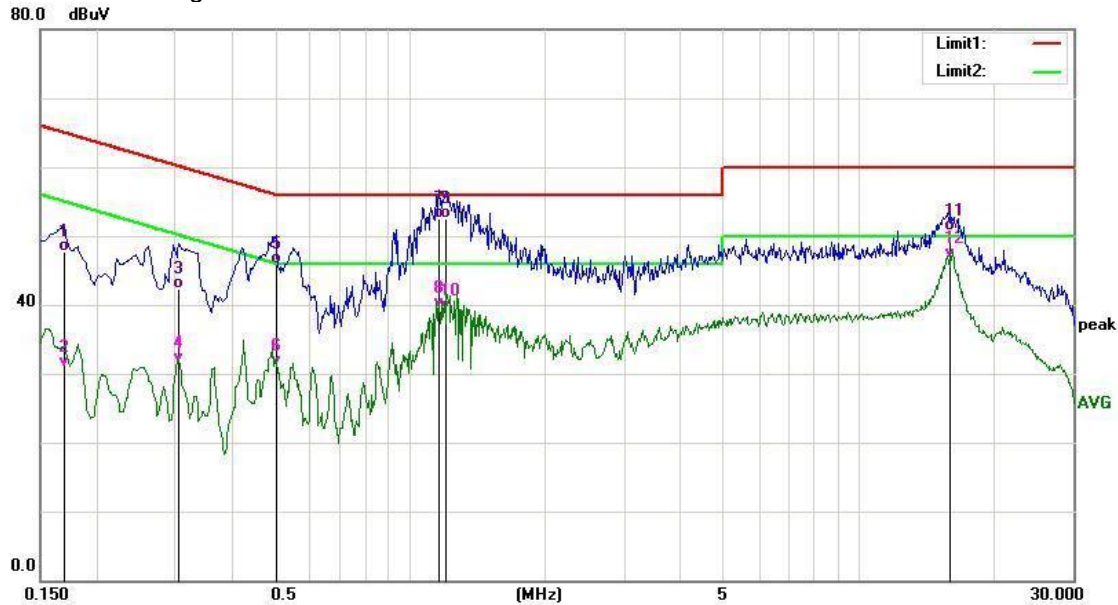


Pre-scan all test modes, found worst case at 2402MHz GFSK, and so only show the test result of 2402MHz

Power Source :120Vac, 60Hz

Terminal under Test: Live Line

Peak and Average Scan:



Quasi-peak and Average measurement:

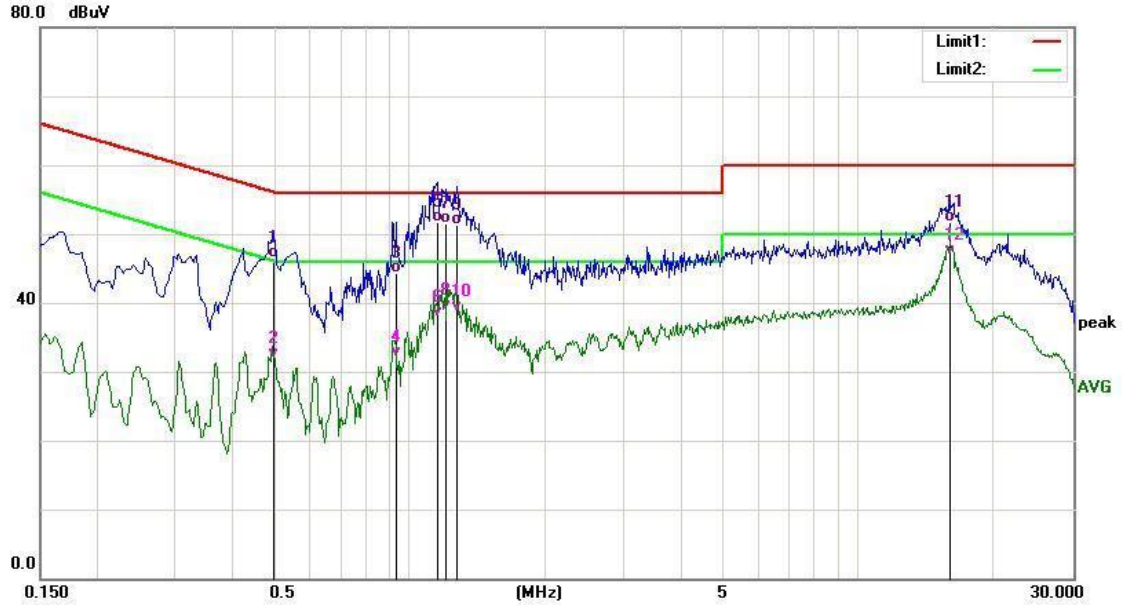
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1700	37.98	9.75	47.73	64.96	-17.23	QP
2	0.1700	21.22	9.75	30.97	54.96	-23.99	AVG
3	0.3060	32.36	9.92	42.28	60.08	-17.80	QP
4	0.3060	21.56	9.92	31.48	50.08	-18.60	AVG
5	0.5020	35.81	10.10	45.91	56.00	-10.09	QP
6	0.5020	21.02	10.10	31.12	46.00	-14.88	AVG
7	1.1620	42.31	10.19	52.50	56.00	-3.50	QP
8	1.1620	29.41	10.19	39.60	46.00	-6.40	AVG
9	1.2020	42.32	10.18	52.50	56.00	-3.50	QP
10	1.2020	28.92	10.18	39.10	46.00	-6.90	AVG
11	15.9900	39.97	10.83	50.80	60.00	-9.20	QP
12	15.9900	35.87	10.83	46.70	50.00	-3.30	AVG

Pre-scan all test modes, found worst case at 2402MHz GFSK, and so only show the test result of 2402MHz

Power Source :120Vac, 60Hz

Terminal under Test: Neutral Line

Peak and Average Scan:

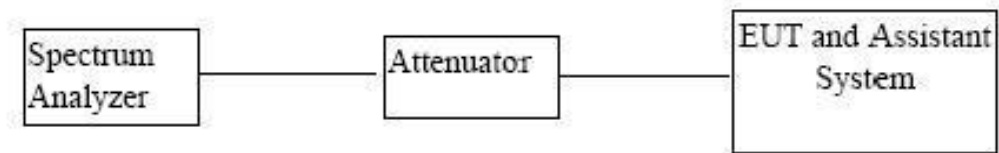


Quasi-peak and Average measurement:

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.4980	36.46	10.10	46.56	56.03	-9.47	QP
2	0.4980	21.81	10.10	31.91	46.03	-14.12	AVG
3	0.9300	34.18	10.21	44.39	56.00	-11.61	QP
4	0.9300	21.85	10.21	32.06	46.00	-13.94	AVG
5	1.1500	41.51	10.19	51.70	56.00	-4.30	QP
6	1.1500	27.71	10.19	37.90	46.00	-8.10	AVG
7	1.1980	41.32	10.18	51.50	56.00	-4.50	QP
8	1.1980	28.72	10.18	38.90	46.00	-7.10	AVG
9	1.2740	41.13	10.17	51.30	56.00	-4.70	QP
10	1.2740	28.53	10.17	38.70	46.00	-7.30	AVG
11	15.9100	40.96	10.83	51.79	60.00	-8.21	QP
12	15.9100	36.05	10.83	46.88	50.00	-3.12	AVG

4.3 Conducted Peak Output Power

Test Connection Diagram



Test Procedure

- (1) Configure EUT and assistant system according clause 2.3 and 3.2
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (3) Configure EUT work in test mode as stated in clause 2.3.
- (4) Measure the maximum output power of EUT by spectrum analyzer with PK detector and RBW=2MHz(above 20dB bandwidth of measured signal), VBW=3MHz

Note: The attenuator loss was inputted into spectrum analyzer as amplitude offset.

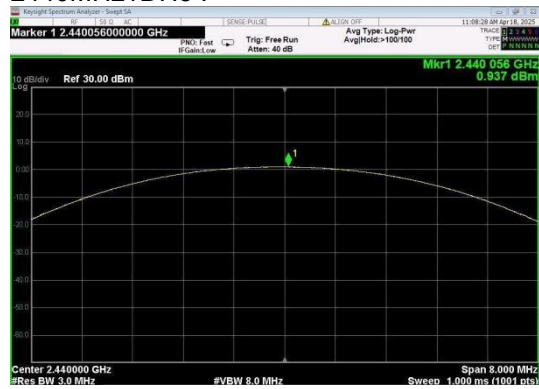
Test Result:

Test Mode	Antenna	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Limit (dBm)	Verdict
DH5	Ant1	2402	0.888	≤30	PASS
DH5	Ant1	2440	0.937	≤30	PASS
DH5	Ant1	2480	2.034	≤30	PASS
2DH5	Ant1	2402	3.067	≤20.97	PASS
2DH5	Ant1	2440	3.259	≤20.97	PASS
2DH5	Ant1	2480	4.139	≤20.97	PASS
3DH5	Ant1	2402	3.418	≤20.97	PASS
3DH5	Ant1	2440	3.418	≤20.97	PASS
3DH5	Ant1	2480	4.399	≤20.97	PASS

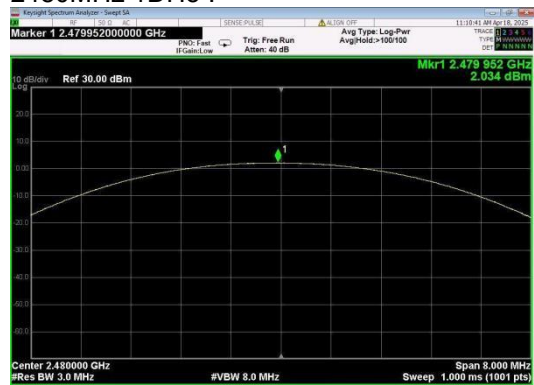
2402MHz 1DH5 :



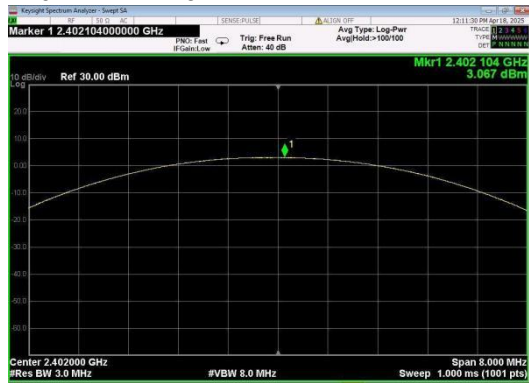
2440MHz1DH5 :



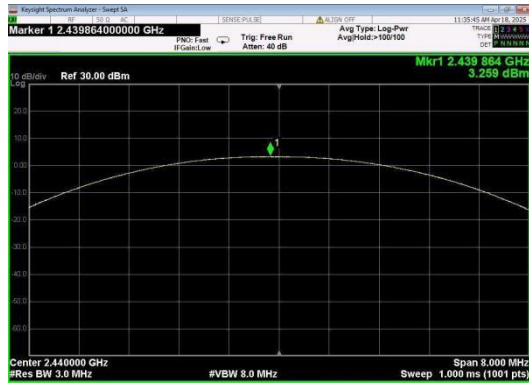
2480MHz 1DH5 :



2402MHz 2DH5 :



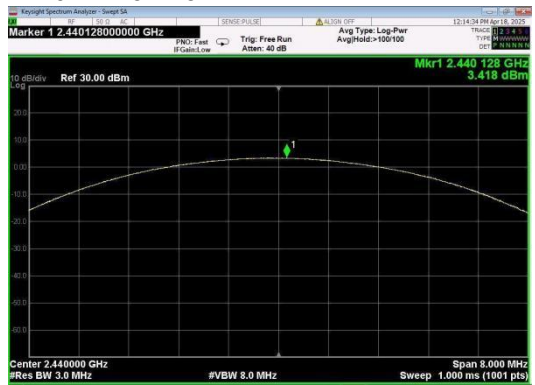
2440MHz 2DH5 :



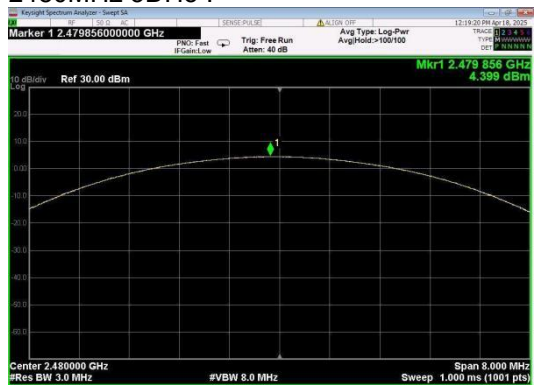
2402MHz 3DH5 :



2440MHz 3DH5 :



2480MHz 3DH5 :

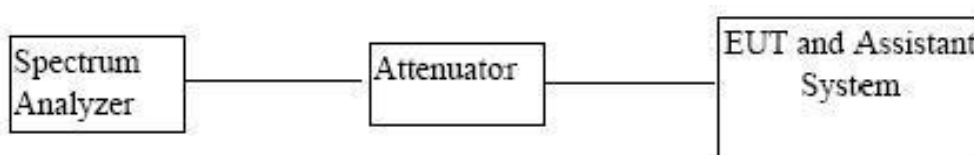


4.4 20dB Occupied Bandwidth

Limit:

Frequency range (MHz)	Standard requirement	Limit
2400-2483.5	FCC Part 15 Subpart C: 15.247(a)(1)	N/A

Test setup:



Test procedure:

Set the spectrum analyzer:

- Set RBW = 30 kHz
- Set the VBW $\geq [3 \times \text{RBW}]$
- Detector = peak.
- Trace mode = max hold.
- Sweep = auto couple
- Allow the trace to stabilize.
- 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 20 dB relative to the maximum level measured in the fundamental emission.
- Span=2*BW~5*BW

Test Mode	Antenna	Frequency (MHz)	20dB EBW (MHz)
DH5	Ant1	2402	0.96
DH5	Ant1	2440	0.95
DH5	Ant1	2480	0.95
2DH5	Ant1	2402	1.29
2DH5	Ant1	2440	1.30
2DH5	Ant1	2480	1.29
3DH5	Ant1	2402	1.31
3DH5	Ant1	2440	1.31
3DH5	Ant1	2480	1.31

Test results:

2402MHz 1DH5:



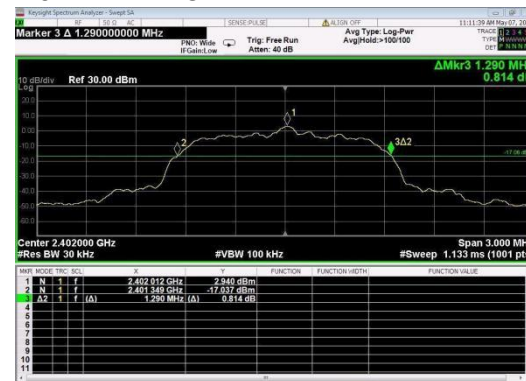
2440MHz 1DH5:



2480MHz 1DH5:



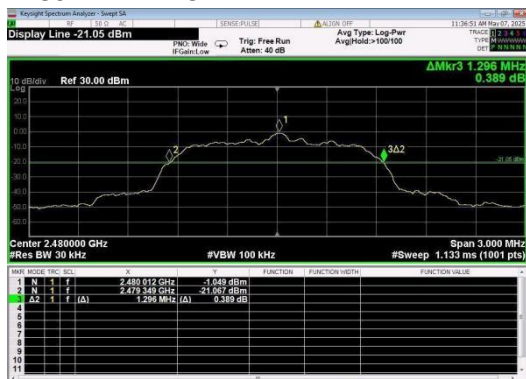
2402MHz 2DH5:



2440MHz 2DH5:



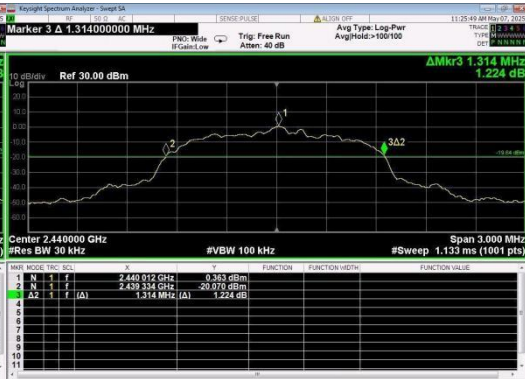
2480MHz 2DH5:



2402MHz 3DH5:



2440MHz 3DH5:



2480MHz 3DH5:

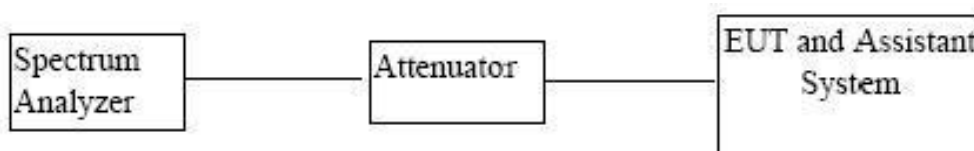


4.5 Carrier Frequencies Separation

Limit:

Frequency range (MHz)	Standard requirement	Limit
2400-2483.5	FCC Part 15 Subpart C: 15.247 (a)(1)	GFSK: 20dB bandwidth $\pi/4$ -DQPSK, 8-DPSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

Test setup:



Test procedure:

Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= 1.5 × DTS bandwidth.
- Set the RBW to 100 kHz.
- Set the VBW to 300 kHz.
- 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 within the RBW.
- If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test results:

Test Mode	Frequency (MHz)	Result (MHz)	Limit (MHz)	Result
DH5	Hop	1.162	≥ 0.64	Pass
2DH5	Hop	0.988	≥ 0.86	Pass
3DH5	Hop	1.032	≥ 0.87	Pass

DH5:



2DH5:



3DH5:

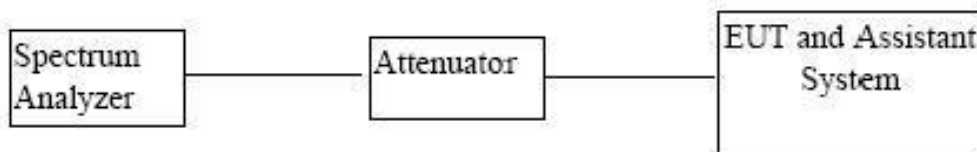


4.6 Hopping Channel Number

Limit:

Frequency range (MHz)	Standard requirement	Limit
2400-2483.5	FCC Part 15 Subpart C: 15.247 (a)(1)(iii)	15 channels

Test setup:



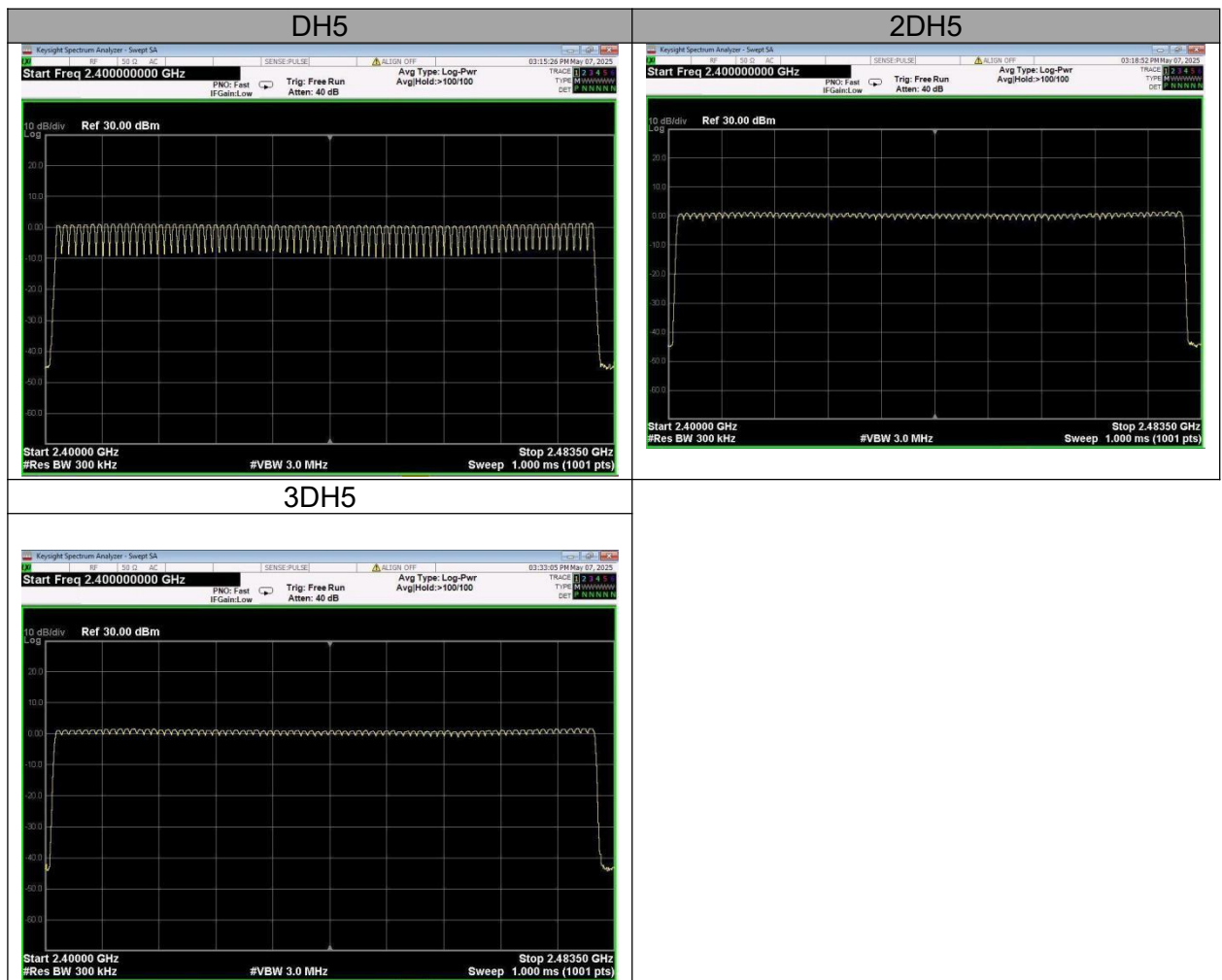
Test procedure:

Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= $1.5 \times$ DTS bandwidth.
- Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- 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 within the RBW.
- If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test results:

Test Mode	Frequency (MHz)	Result (Num)	Limit (Num)	Result
DH5	Hop	79	≥ 15	Pass
2DH5	Hop	79	≥ 15	Pass
3DH5	Hop	79	≥ 15	Pass

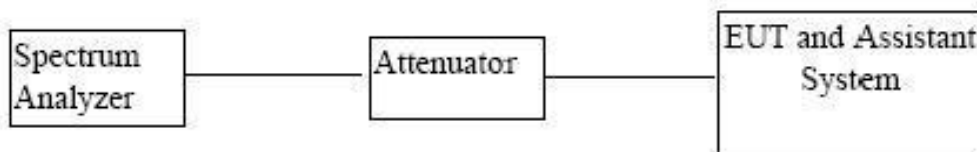


4.7 Dwell Time

Limit:

Frequency range (MHz)	Standard requirement	Limit
2400-2483.5	FCC Part 15 Subpart C: 15.247 (a)(1)(iii)	15 channels

Test setup:



Test procedure:

Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= $1.5 \times$ DTS bandwidth.
- Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- 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 within the RBW.
- If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test results:

Test Mode	Antenna	Frequency (MHz)	BurstWidth (ms)	TotalHops (Num)	Result (s)	Limit [dBm]	Verdict
DH5	Ant1	Hop	2.840	106.67	0.302	≤ 0.4	PASS
DH1	Ant1	Hop	0.340	320	0.108	≤ 0.4	PASS
DH3	Ant1	Hop	1.600	160	0.256	≤ 0.4	PASS
2DH5	Ant1	Hop	2.760	106.67	0.294	≤ 0.4	PASS
2DH1	Ant1	Hop	0.380	320	0.121	≤ 0.4	PASS
2DH3	Ant1	Hop	1.620	160	0.260	≤ 0.4	PASS
3DH5	Ant1	Hop	2.900	106.67	0.309	≤ 0.4	PASS
3DH1	Ant1	Hop	0.380	320	0.121	≤ 0.4	PASS
3DH3	Ant1	Hop	1.640	160	0.262	≤ 0.4	PASS

Note:

DH5/2DH5/3DH5: TotalHops=1600/79/6*0.4*79

DH5/2DH5/3DH5: Time of occupancy=TotalHops*(BurstWidth)/1000

DH3/2DH3/3DH3: TotalHops=1600/79/4*0.4*79

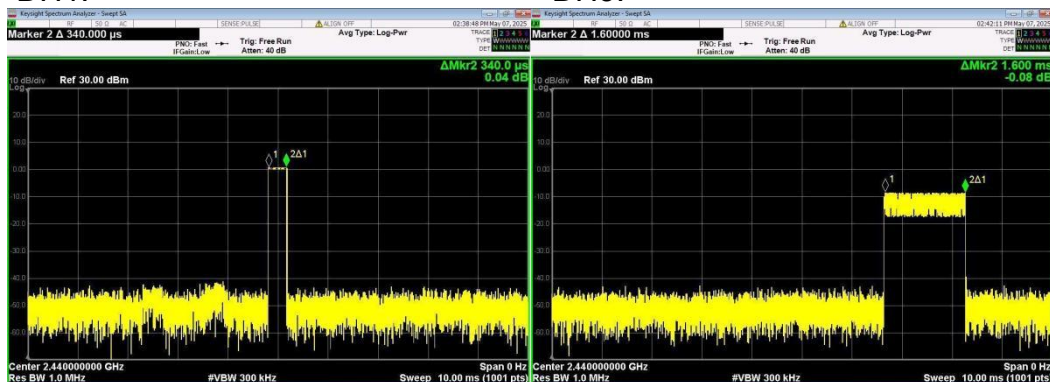
DH3/2DH3/3DH3: Time of occupancy=TotalHops*(BurstWidth)/1000

DH1/2DH1/3DH1: TotalHops=1600/79/2*0.4*79

DH1/2DH1/3DH1: Time of occupancy=TotalHops*(BurstWidth)/1000

DH1:

DH3:

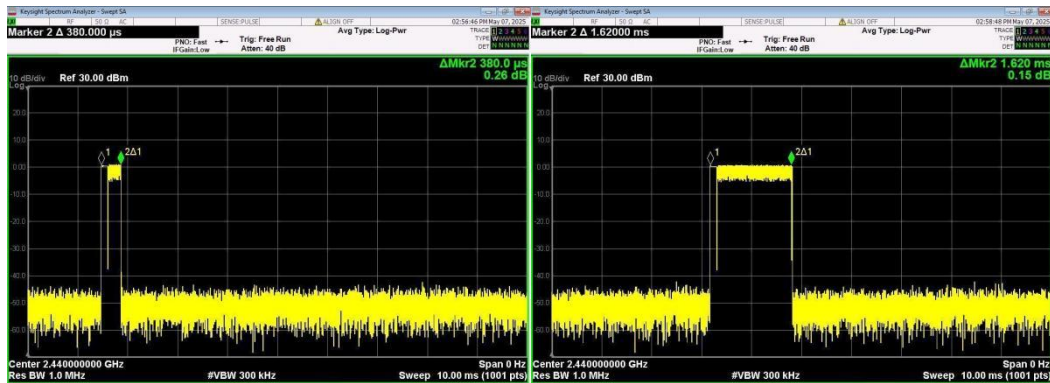


DH5:

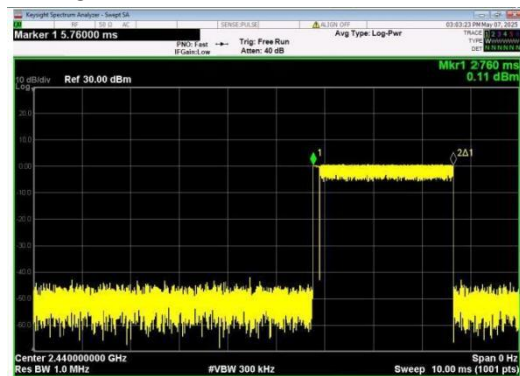


2DH1:

2DH3:

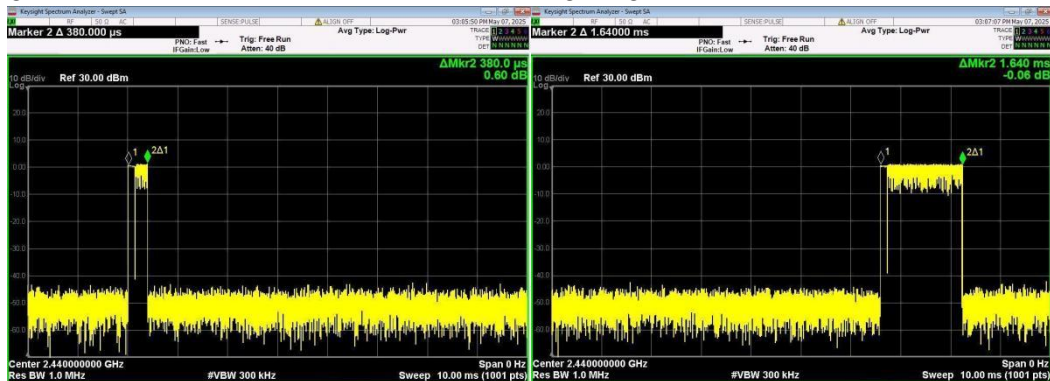


2DH5:



3DH1:

3DH3:



3DH5:

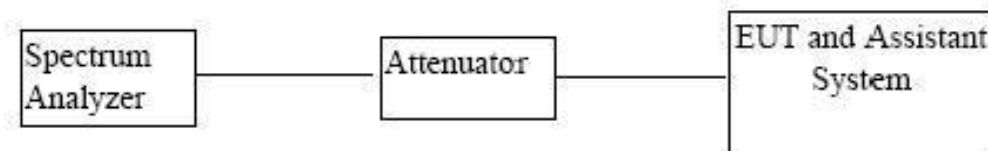


4.8 Band Edge

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Based on either an RF conducted or a radiated measurement. Provided the transmitter demonstrates compliance with the peak conducted power limits.

Test setup:



Test procedure:

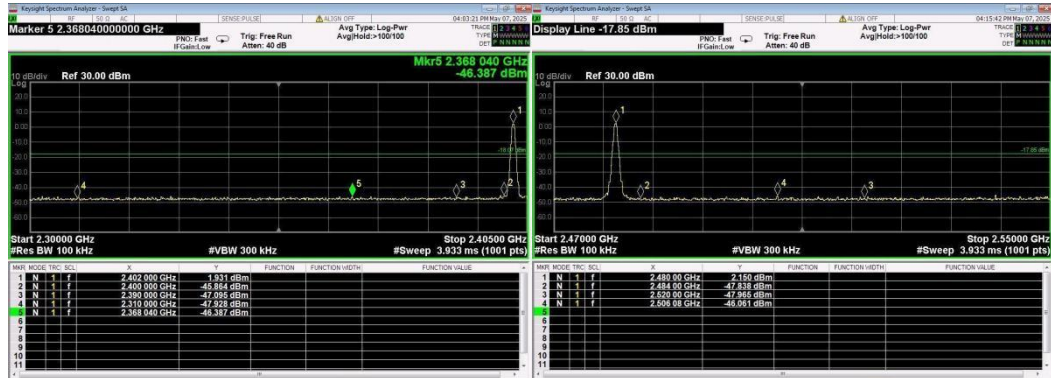
Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= $1.5 \times$ DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW $\geq [3 \times$ 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 within the RBW.
- If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test results:

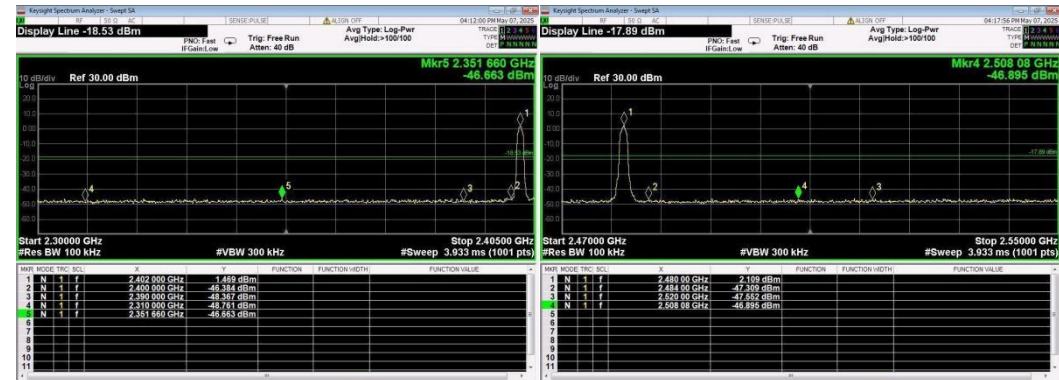
2402MHz 1DH5:

2480MHz 1DH5:



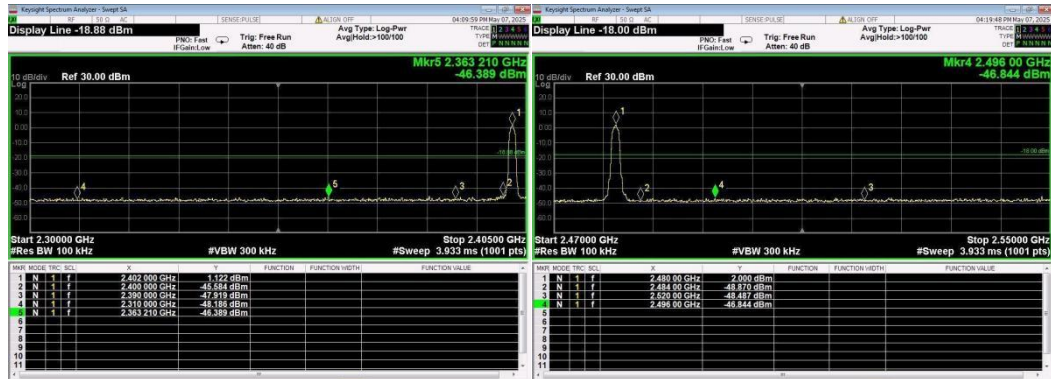
2402MHz 2DH5:

2480MHz 2DH5:

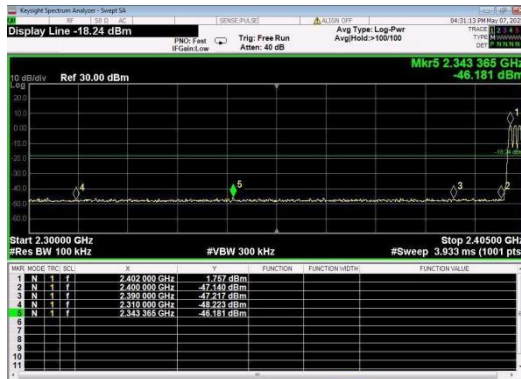


2402MHz 3DH5:

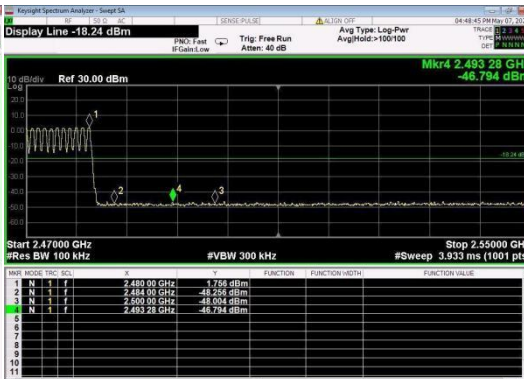
2480MHz 3DH5:



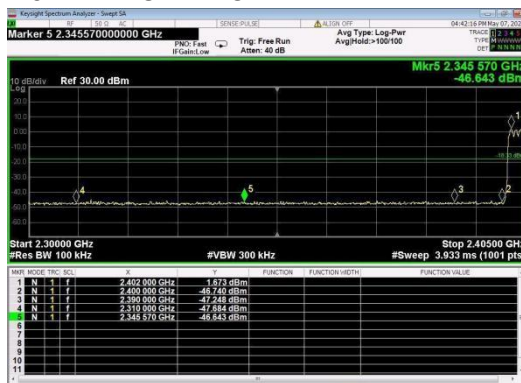
2402MHz HOP 1DH5:



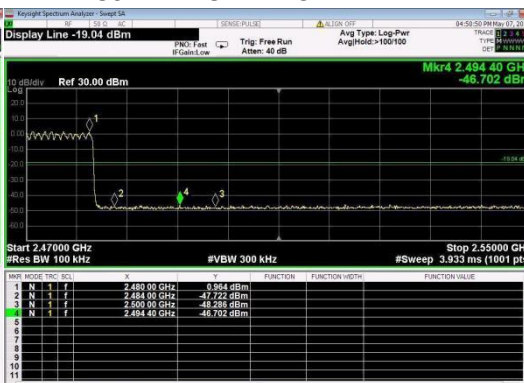
2480MHz HOP 1DH5:



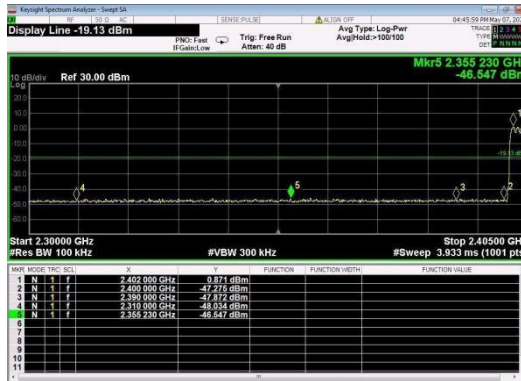
2402MHz HOP 2DH5:



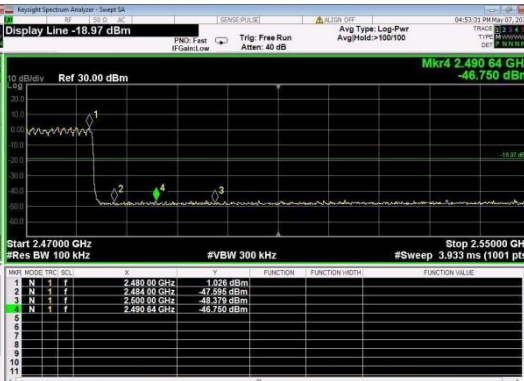
2480MHz HOP 2DH5:



2402MHz HOP 3DH5:



2480MHz HOP 3DH5:

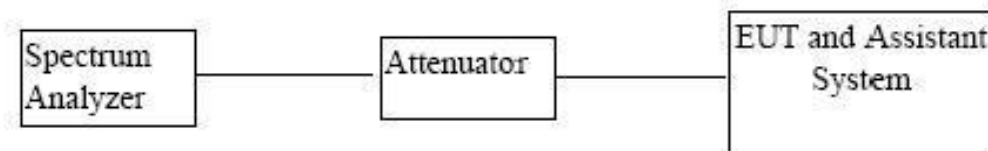


4.9 Spurious RF conducted emissions

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Based on either an RF conducted or a radiated measurement. Provided the transmitter demonstrates compliance with the peak conducted power limits.

Test setup:

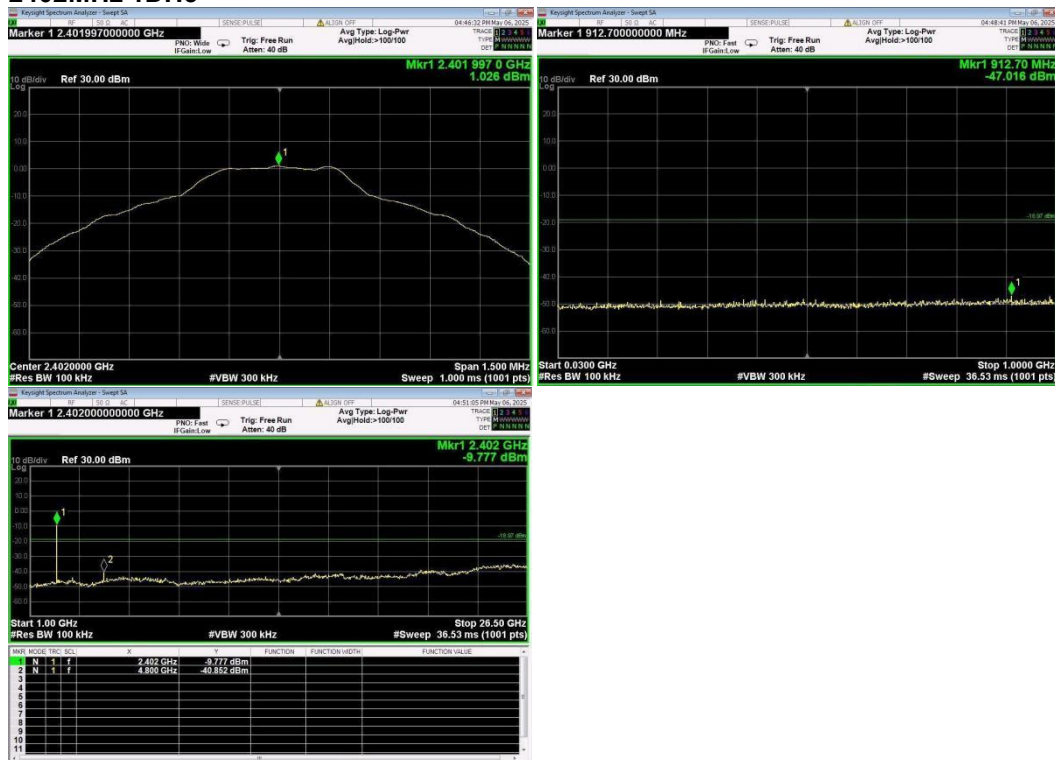


Test procedure:

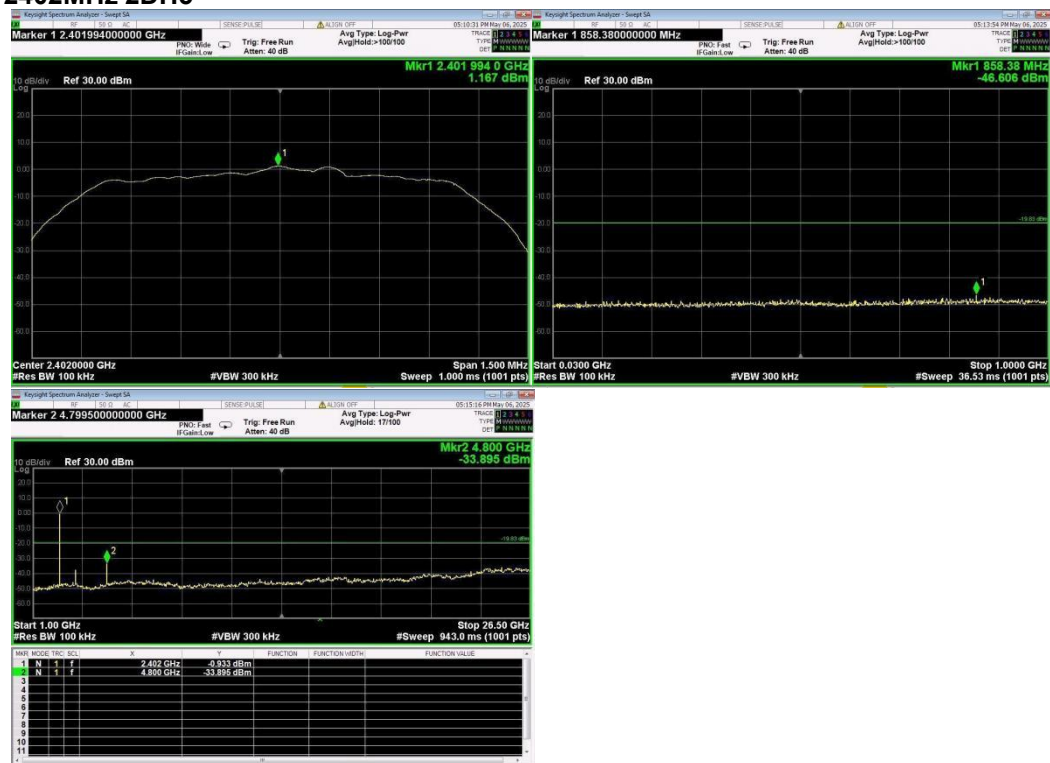
Set the spectrum analyzer:

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span= $1.5 \times$ DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq [3 \times$ RBW].
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

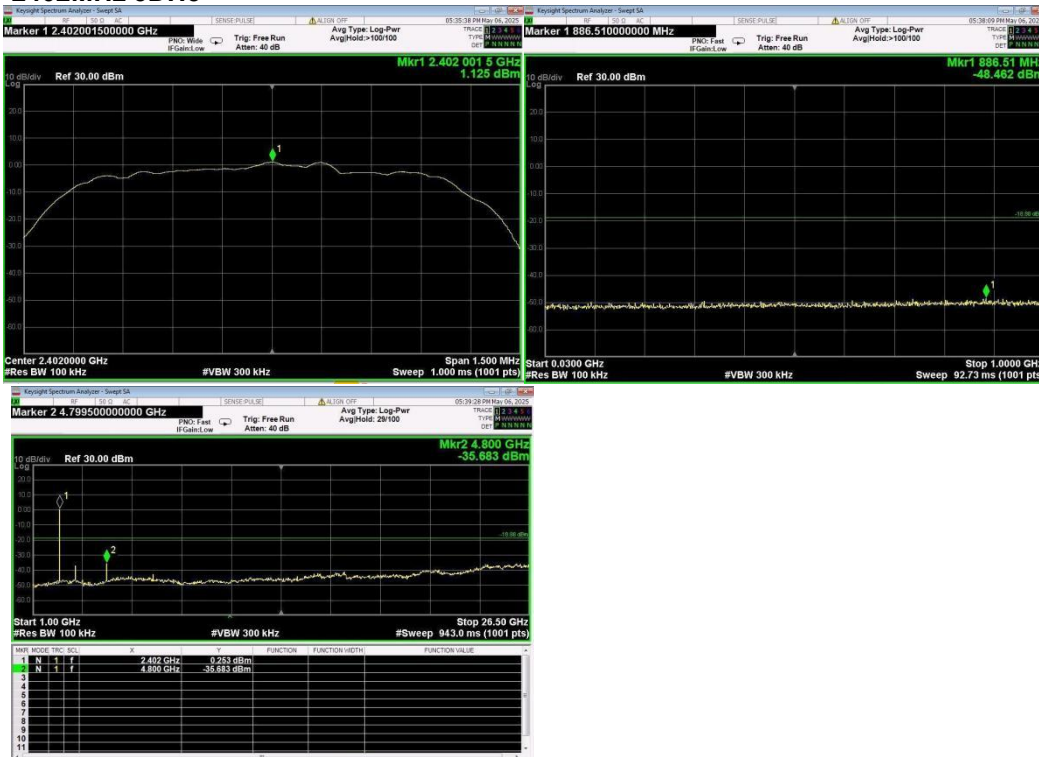
Test results: 2402MHz 1DH5



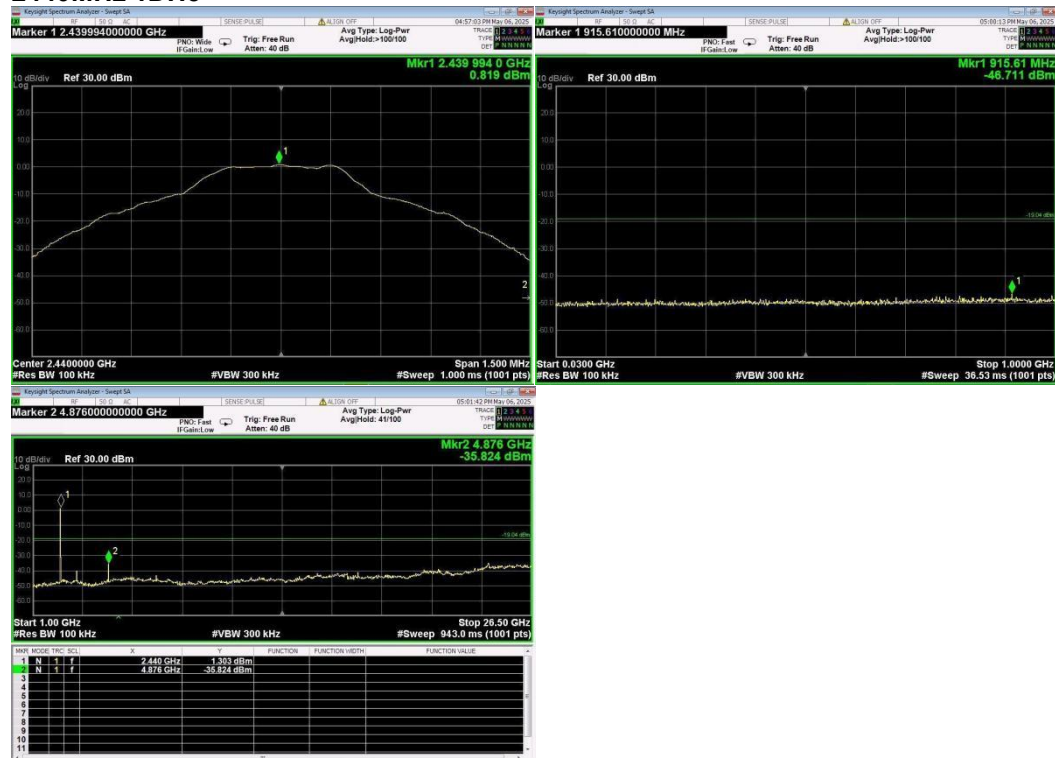
2402MHz 2DH5



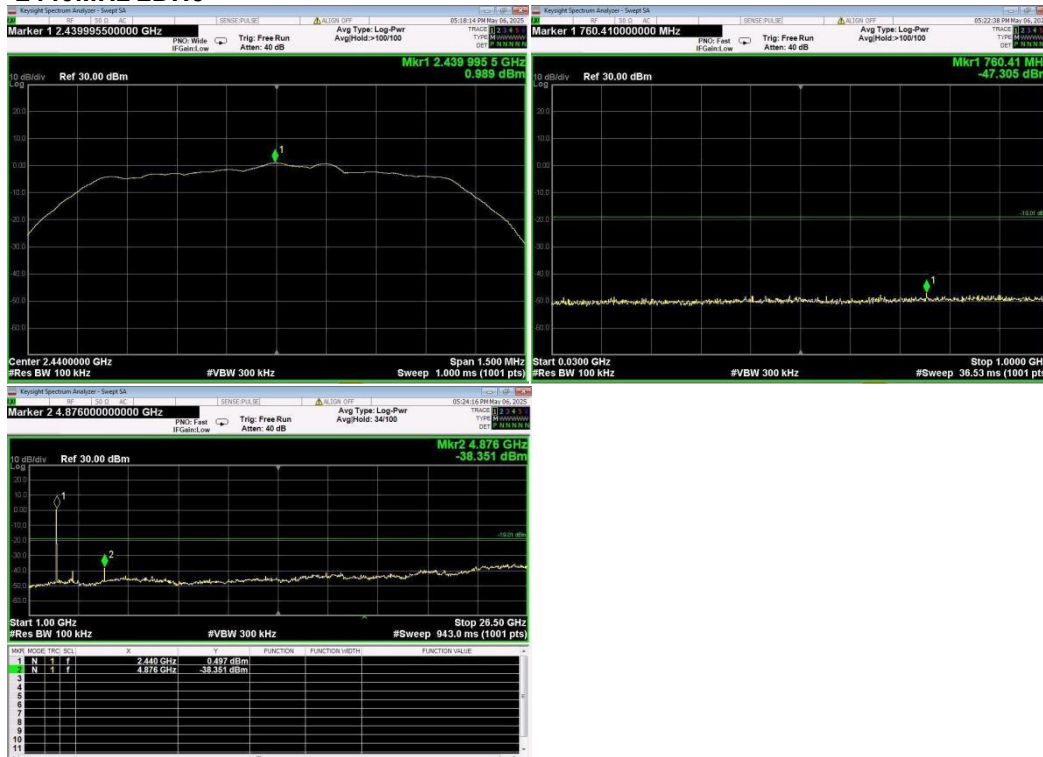
2402MHz 3DH5



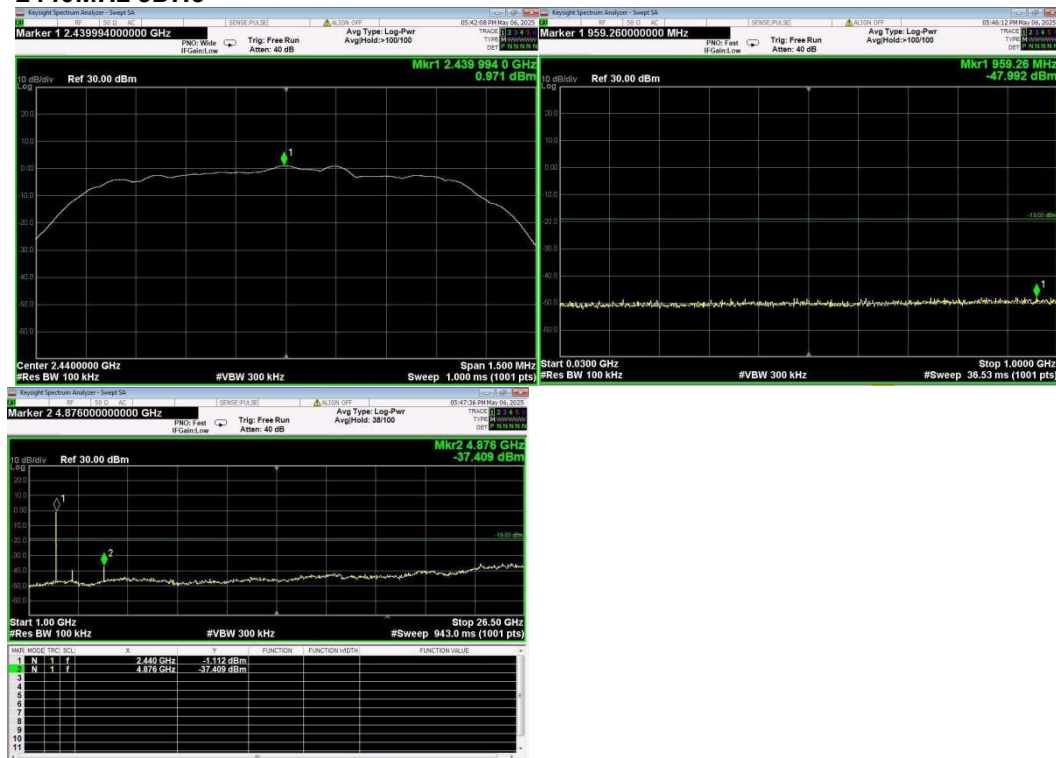
2440MHz 1DH5



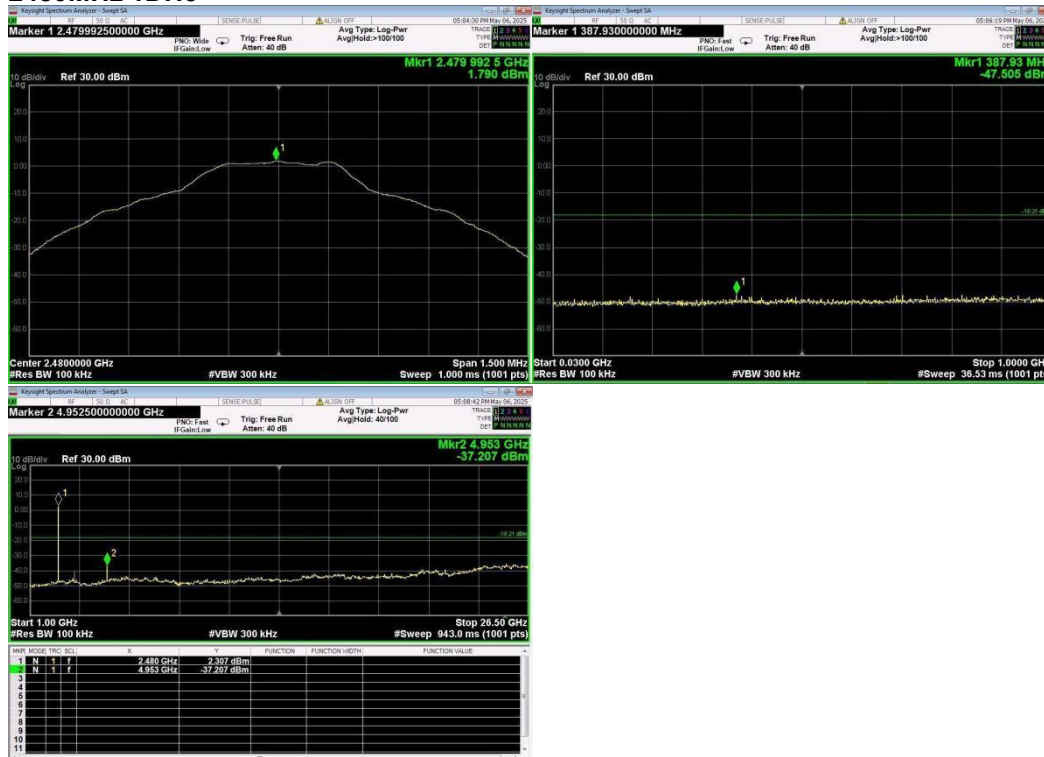
2440MHz 2DH5



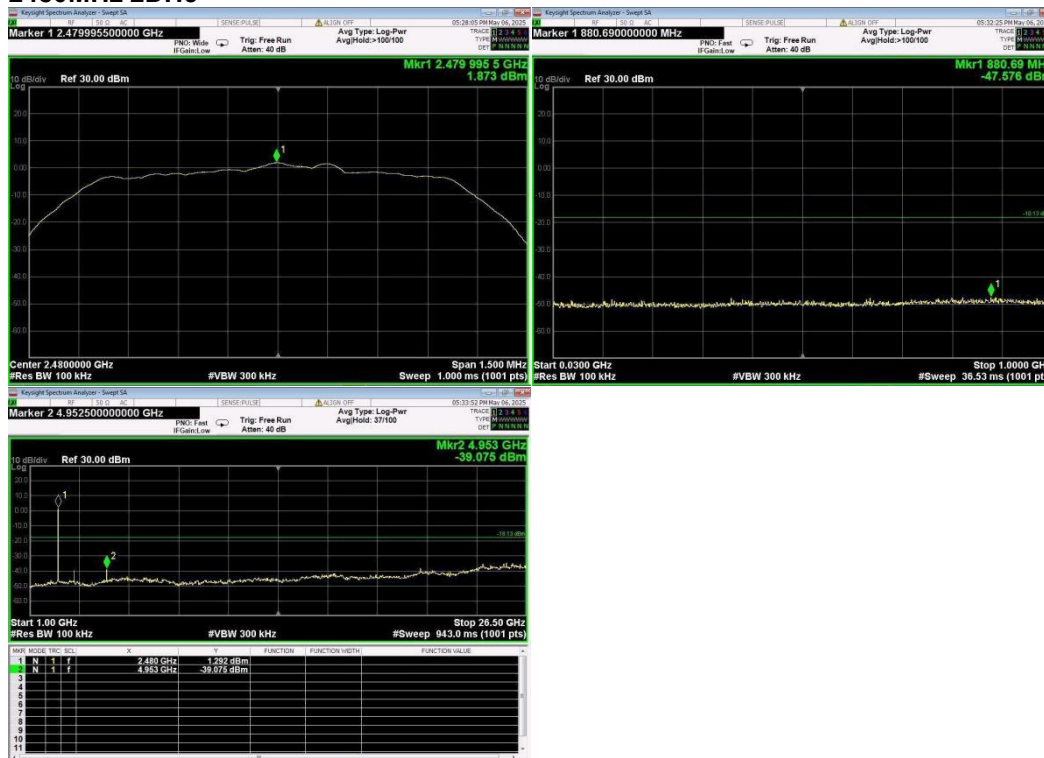
2440MHz 3DH5



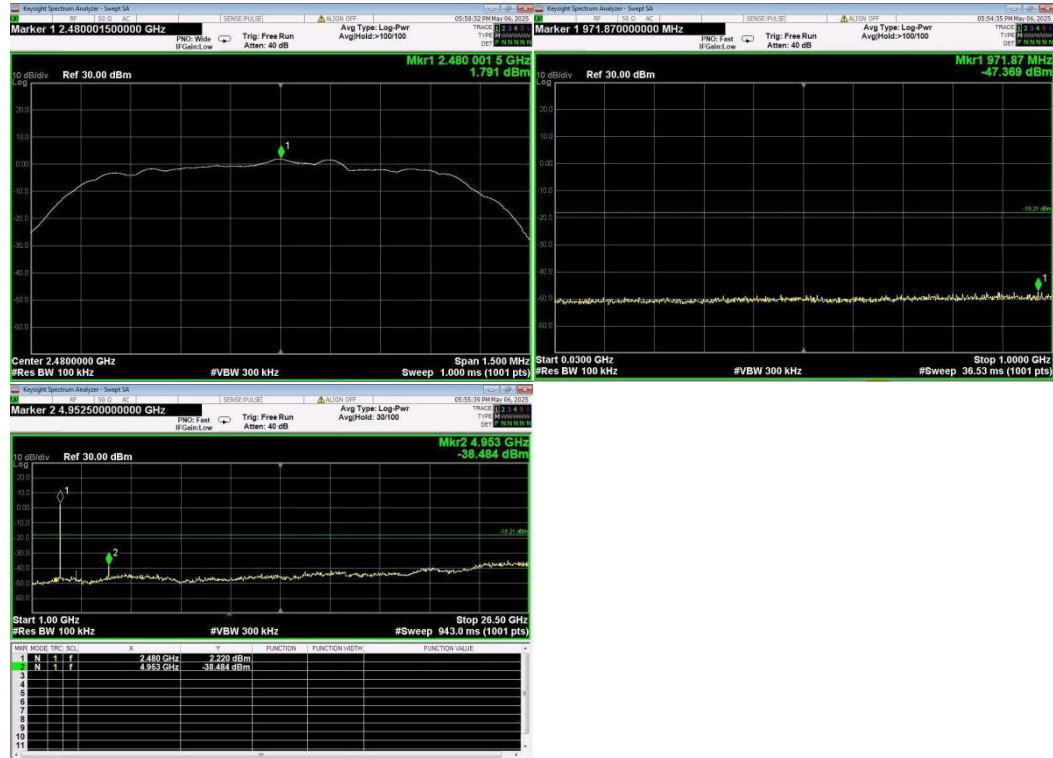
2480MHz 1DH5



2480MHz 2DH5



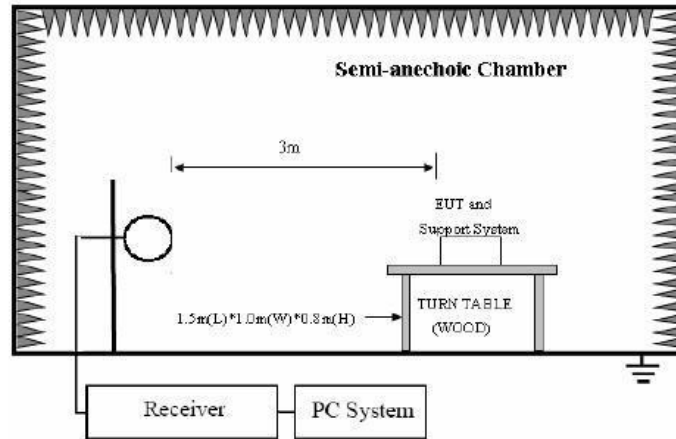
2480MHz 3DH5



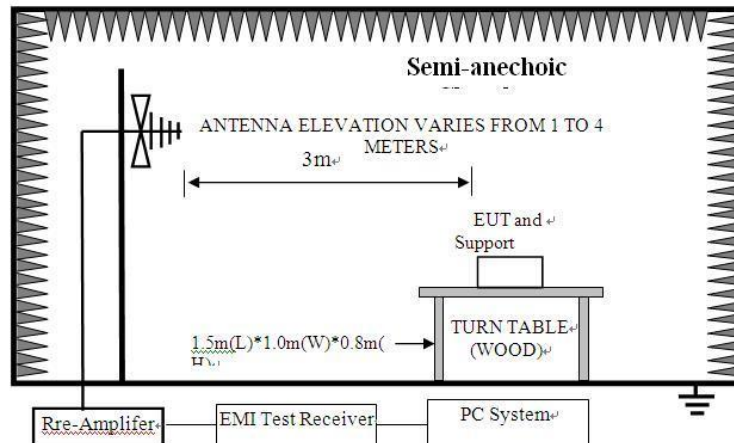
4.10 Spurious Radiated emission

Test setup:

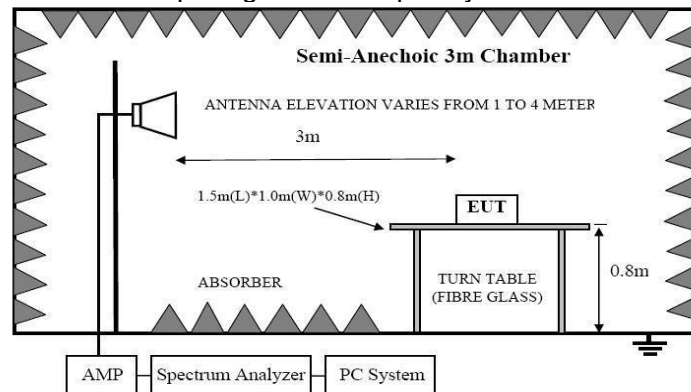
In 3m Anechoic Chamber Test Setup Diagram for 9KHz-30MHz



In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

Limit

FCC 15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
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	2690 - 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			

FCC 15.209 Limit.

Frequency (MHz)	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		uV/m	dB(uV)/m
0.009 ~ 0.490	300	2400/F(KHz) 67.6	20log(F)
0.490 ~ 1.705	30	24000/F(KHz) 87.6	20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1)The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$$\text{Limit}_{3m}(\text{dBuV/m}) = \text{Limit}_{30m}(\text{dBuV/m}) + 40\text{Log}(30m/3m)$$

Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.
- (2) Setup EUT and assistant system according clause 2.3 and 8.2
- (3) Test antenna was located 3m from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used
9KHz-30MHz	Active Loop antenna
30MHz-1GHz	Trilog Broadband Antenna
1GHz-18GHz	Double Ridged Horn Antenna(1GHz-18GHz)
18GHz-40GHz	Horn Antenna(18GHz-40GHz)

According ANSI C63.10:2020 clause 6.4.4.2 and 6.5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. For measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT,Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

- (4) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiatedemissions from 9KHz to 25GHz:
 - (a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1m to 4m(Except loop antenna, it's fixed 1m above ground.)
 - (b) Change work frequency or channel of device if practicable.
 - (c) Change modulation type of device if practicable.
 - (d) Change power supply range from 85% to 115% of the rated supply voltage
 - (e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produceshighest emissions.Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 18GHz to 25GHz, so below final test was performed with frequency range from 9KHz to 18GHz.

(5) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2020 on Radiated Emission test.

(6) The emissions from 9KHz to 1GHz were measured based on CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz, for emissions from 9KHz-90KHz, 110KHz-490KHz and above 1GHz were measured based on average detector, for emissions above 1GHz, peak emissions also be measured and need comply with Peak limit.

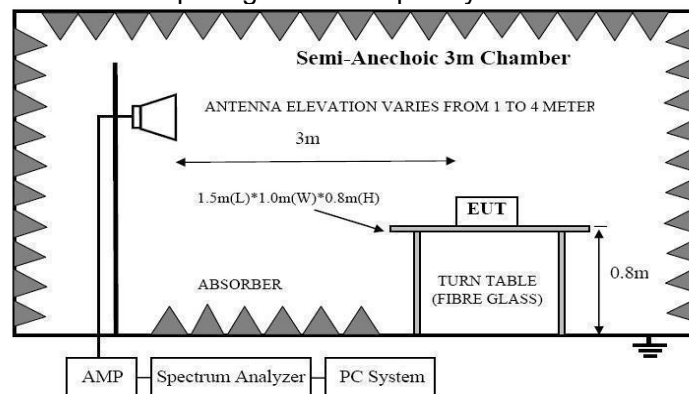
(7) The emissions from 9KHz to 1GHz, QP or average values were measured with EMI receiver with below RBW

Frequency Band	RBW
9KHz-150KHz	200Hz
150KHz-30MHz	9KHz
30MHz-1GHz	120KHz

(8) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure(according ANSI C63.10:2020 clause 4.2.3.2.3 procedure for average measure). Both PK and AV level test, PK detector is used.

Block diagram of test setup

In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

Limit:Block diagram of test setup

All the lower and upper band-edges emissions appearing within all restriction band for example 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions.

Test Procedure

Same with clause 8.4 except change investigated frequency range from 2310MHz to 2415MHz and 2475MHz to 2500MHz.

Remark: All restriction band have been tested, and only the worse case is shown in report.

Test result

PASS. (See below detailed test result)

All the emissions except fundamental emission from 9 KHz to 25GHz were comply with 8.3.2 limit.

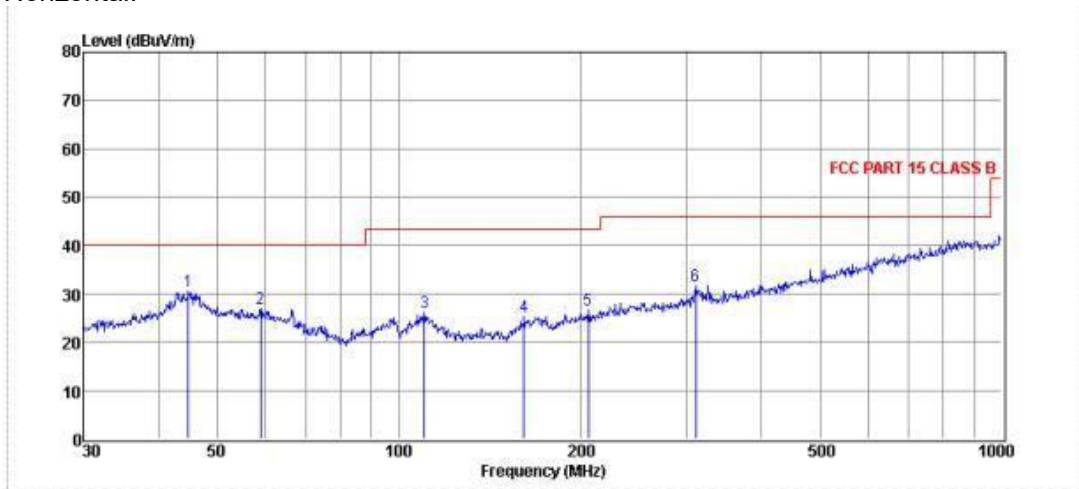
Note1: According exploratory test no any obvious emission were detected from 9KHz to 30MHz and 18GHz to 25GHz, so the final test was performed with frequency range from 30MHz to 18GHz and recorded in below.

Note2: For emissions below 1GHz, according exploratory explorer test, when change Tx mode and channel,have no distinct influence on emissions level, so for emissions below 1GHz, the final test was only performed with EUT working in GFSK, Tx 2441MHz mode.

Note3: For emissions above 1GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

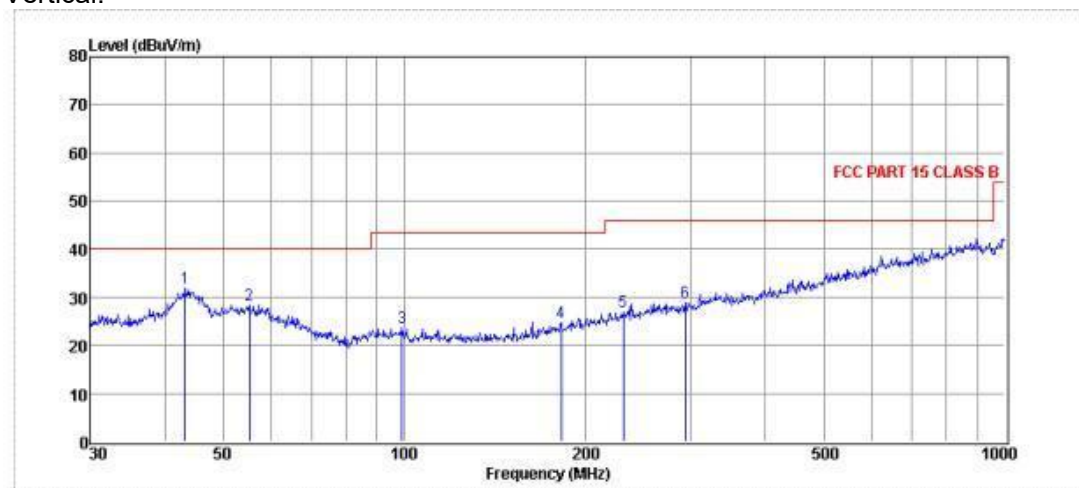
9 kHz~30 MHz Field Strength of Unwanted Emissions. Peak or Quasi-Peak measurement:
The measurements with active loop antenna were lower than 20dB below the average limit, so the test data were not recorded in the test report.

Pre-scan all test modes, found worst case at GFSK 2402MHz, and so only show the test result of it Horizontal:



Item (Mark)	Freq (MHz)	Read Level (dBuV)	Antenna Factor (dBm)	PRM Factor dB	Cable Loss dB	Result Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Detector	Polarization
1	44.74	13.36	16.56	0.00	0.67	30.59	40.00	-9.41	Peak	HORIZONTAL
2	59.03	13.73	12.60	0.00	0.73	27.06	40.00	-12.94	Peak	HORIZONTAL
3	110.18	12.68	12.43	0.00	1.13	26.24	43.50	-17.26	Peak	HORIZONTAL
4	161.47	13.69	10.32	0.00	1.28	25.29	43.50	-18.21	Peak	HORIZONTAL
5	206.40	14.17	10.89	0.00	1.64	26.70	43.50	-16.80	Peak	HORIZONTAL
6	311.09	15.51	14.02	0.00	2.18	31.71	46.00	-14.29	Peak	HORIZONTAL

Vertical:



Item (Mark)	Freq (MHz)	Read Level (dBuV)	Antenna Factor (dBm)	PRM Factor dB	Cable Loss dB	Result Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Detector	Polarization
1	43.20	14.76	16.39	0.00	0.66	31.81	40.00	-8.19	Peak	VERTICAL
2	55.22	13.28	14.38	0.00	0.69	28.35	40.00	-11.65	Peak	VERTICAL
3	99.18	12.76	10.10	0.00	0.83	23.69	43.50	-19.81	Peak	VERTICAL
4	182.56	13.84	9.60	0.00	1.38	24.82	43.50	-18.68	Peak	VERTICAL
5	231.72	13.46	11.87	0.00	1.70	27.03	46.00	-18.97	Peak	VERTICAL
6	294.11	12.85	13.81	0.00	2.08	28.74	46.00	-17.26	Peak	VERTICAL

Lowest channel

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2122.00	57.35	26.92	53.99	4.15	34.43	54.00	-19.57	Average	HORIZONTAL
2	2122.00	67.01	26.92	53.99	4.15	44.09	74.00	-29.91	Peak	HORIZONTAL
3	2054.00	53.25	26.76	53.99	4.07	30.09	54.00	-23.91	Average	VERTICAL
4	2054.00	62.42	26.76	53.99	4.07	39.26	74.00	-34.74	Peak	VERTICAL

Middle channel:

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	3261.00	55.33	29.40	53.85	5.00	35.88	54.00	-18.12	Average	HORIZONTAL
2	3261.00	64.91	29.40	53.85	5.00	45.46	74.00	-28.54	Peak	HORIZONTAL
3	2173.00	50.86	27.03	53.98	4.20	28.11	54.00	-25.89	Average	VERTICAL
4	2173.00	60.39	27.03	53.98	4.20	37.64	74.00	-36.36	Peak	VERTICAL

Highest channel:

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2122.00	54.25	26.92	53.99	4.15	31.33	54.00	-22.67	Average	HORIZONTAL
2	2122.00	63.61	26.92	53.99	4.15	40.69	74.00	-33.31	Peak	HORIZONTAL
3	2122.00	55.24	26.92	53.99	4.15	32.32	54.00	-21.68	Average	VERTICAL
4	2122.00	64.86	26.92	53.99	4.15	41.94	74.00	-32.06	Peak	VERTICAL

Unwanted Emissions in Non-restricted Frequency Bands
2402MHz:

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2390.00	56.57	26.92	53.99	4.15	33.65	54.00	-20.35	Average	HORIZONTAL
2	2390.00	67.76	26.92	53.99	4.15	44.84	74.00	-29.16	Peak	HORIZONTAL
3	2390.00	60.37	26.96	53.99	4.17	37.51	54.00	-16.49	Average	VERTICAL
4	2390.00	71.35	26.96	53.99	4.17	48.49	74.00	-25.51	Peak	VERTICAL

2480MHz:

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	62.66	26.92	53.99	4.15	39.74	54.00	-14.26	Average	HORIZONTAL
2	2483.50	71.47	26.92	53.99	4.15	48.55	74.00	-25.45	Peak	HORIZONTAL
3	2483.50	62.32	26.96	53.99	4.17	39.46	54.00	-14.54	Average	VERTICAL
4	2483.50	71.98	26.96	53.99	4.17	49.12	74.00	-24.88	Peak	VERTICAL

5 Test Setup Photo

Refer to <Setup Photos>

6 Test Setup of EUT

Refer to <External Photos and Internal Photos>

-----End of test report-----