



Test Report Number:	LCZE26080002	Total Page(s): 40
Applicant Name:	Shenzhen Rongbo Jiachuang Technology Co., Ltd.	
Applicant Address:	Building C, No. 137 Xuegang South Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen	
Test item:	amplifier board	
Model / Type Reference:	ZK-1001U	
FCC ID:	2BX2S-ZK-1001U	
Date of Issue:	2026-08-25	
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:	
2026-08-25 Rex He 	2026-08-25 Alan Tian 	
<i>Date</i> <i>Name</i> <i>Signature</i>	<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 :2009	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	: amplifier board
Model Number	: ZK-1001U
EUT function description	: Please reference user manual of this device
Power supply	: DC9-24V
FCC ID	: 2BX2S-ZK-1001U
Radio Specification	: Bluetooth V5.3+EDR+BLE
Operation frequency	: 2402MHz -2480MHz
Modulation	: GFSK, $\pi/4$ -DQPSK, 8-DPSK
Data rate	: 1Mbps, 2Mbps
Antenna Type	: PCB Antenna
Antenna Gain	: 1.2dBi

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.

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	2441MHz
The Highest channel	2480MHz

2.4 Testing

Date of receipt of test item : 2026-08-01

Date (s) of performance of tests : 2026-08-04 to 2026-08-06

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	3.45dB
Uncertainty for Radiation Emission test(30MHz-1GHz)	4.85dB
Uncertainty for Radiation Emission test (Above 1GHz)	5.15dB

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	2026-06-05	2027-06-04
2	Log-periodic Dipole Antenna	Schwarzbeck	VULB 9162	058	2025-06-14	2028-06-13
3	3m Semi-anechoic	Zhongshuo Electronics	9mx6mx6m	N/A	2024-12-17	2027-12-16
4	RF Cable	R&S	R01	10403	2025-11-28	2026-11-27
5	EMI Test Software	AUDIX	E3	Version No: 6.111221a	N/A	N/A
Disturbance Voltage ☒						
6	EMI Test Receiver	Rohde&Schwarz	ESCI	100939	2025-11-28	2026-11-27
7	Artificial Mains Network	ROHDE&SCHWARZ	ENV216	3560.6550.12	2025-11-28	2026-11-27
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	2026-06-05	2027-06-04
11	Log-periodic Dipole Antenna	Schwarzbeck	VULB 9162	058	2025-06-14	2028-06-13
12	3m Semi-anechoic	Zhongshuo Electronics	9mx6mx6m	N/A	2024-12-17	2027-12-16
13	RF Cable	R&S	R02	10403	2025-11-28	2026-11-27
14	Doppelsteg Breitband Hornantenne Double Ridge Broadband Horn	Schwarzbeck	BBHA 9120 D	N/A	2025-12-04	2026-12-03
15	Signal Analyzer	Keysight	N9020A	SER MY52220373	2025-11-28	2026-11-27
16	Pre-amplifier	sinancidian	COP-01G18G-45dB	N/A	2025-11-28	2026-11-27
Radiated electromagnetic disturbances(>1.6m) ☒						
17	EMI Test Receiver	R&S	ESCI 7	100965	2026-06-05	2027-06-04
18	EMI Test Software	AUDIX	E3	Version No: 6.111221a	N/A	N/A
19	Active loop antenna	SCHWARZBECK	FMZB1519	1519-045	2026-06-09	2027-06-08
RF Conducted Test ☒						
20	Signal Analyzer	Keysight	N9020A	MY52220373	2025-11-28	2026-11-27

4 Test Results

4.1 Antenna requirement

Standard requirement:

15.203 requirement:

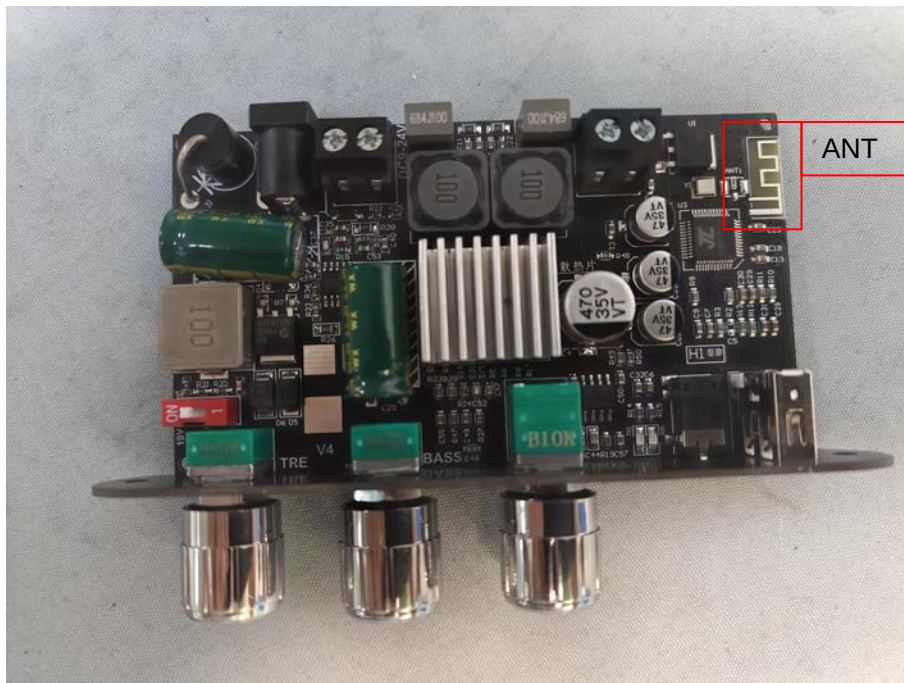
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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 PCB antenna. It comply with the standard requirement.



4.2 AC Power Line Conducted Emission

Results:

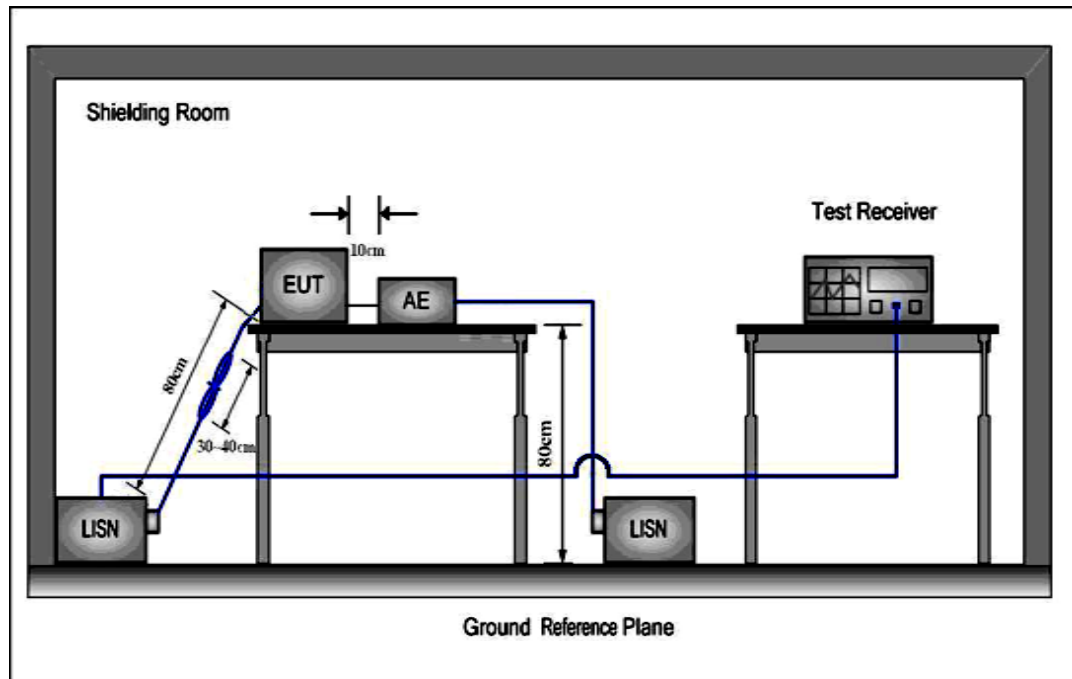
Pass

Date of testing : August 06, 2026
 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

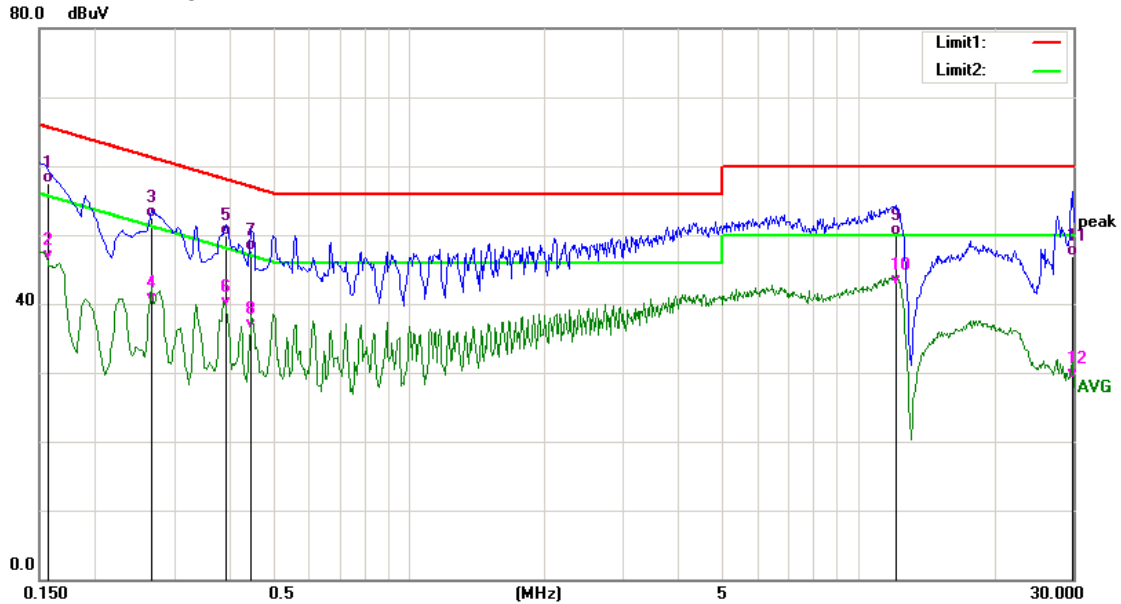
Test setup

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

Test Connection Diagram



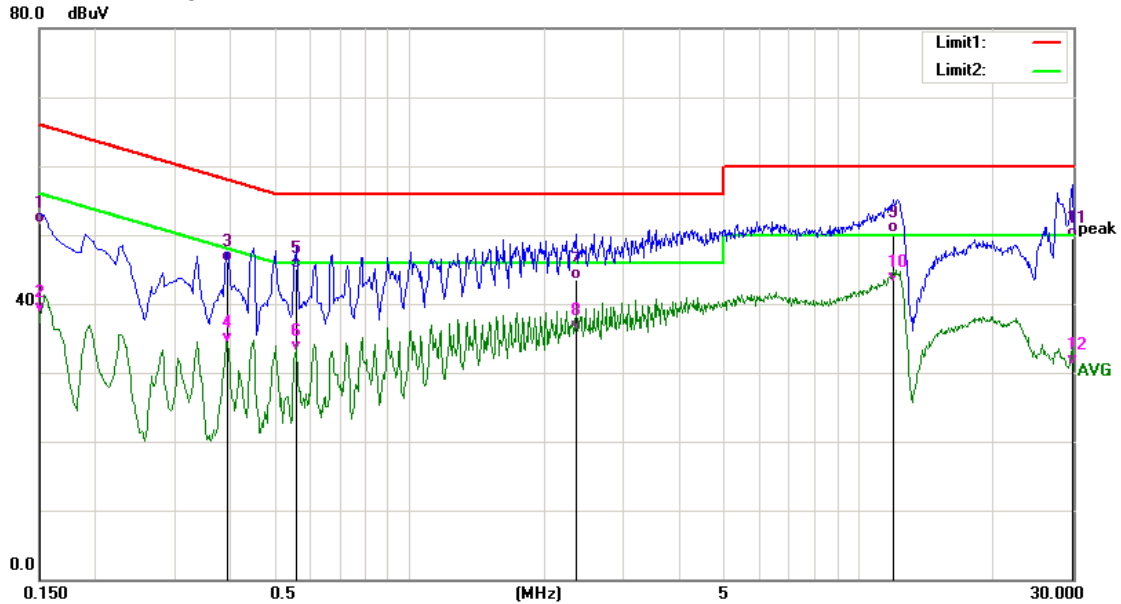
Power Source :120Vac, 60Hz
Terminal under Test: Live Line
Peak and Average Scan:



Quasi-peak and Average measurement:

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1582	57.84	-0.30	57.54	65.56	-8.02	QP
2	0.1582	46.55	-0.30	46.25	55.56	-9.31	AVG
3	0.2660	52.69	-0.23	52.46	61.24	-8.78	QP
4	0.2660	40.33	-0.23	40.10	51.24	-11.14	AVG
5	0.3900	50.00	-0.17	49.83	58.06	-8.23	QP
6	0.3900	39.67	-0.17	39.50	48.06	-8.56	AVG
7	0.4460	47.88	-0.13	47.75	56.95	-9.20	QP
8	0.4460	36.53	-0.13	36.40	46.95	-10.55	AVG
9	12.1420	48.18	1.71	49.89	60.00	-10.11	QP
10	12.1420	40.94	1.71	42.65	50.00	-7.35	AVG
11	29.9580	43.23	3.77	47.00	60.00	-13.00	QP
12	29.9580	25.27	3.77	29.04	50.00	-20.96	AVG

Power Source :120Vac, 60Hz
Terminal under Test: Neutral Line
Peak and Average Scan:

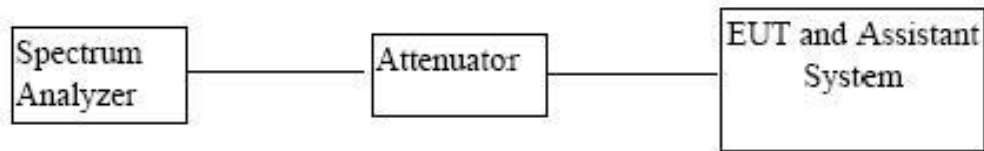


Quasi-peak and Average measurement:

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1516	51.97	-0.31	51.66	65.91	-14.25	QP
2	0.1516	39.03	-0.31	38.72	55.91	-17.19	AVG
3	0.3940	46.26	-0.16	46.10	57.98	-11.88	QP
4	0.3940	34.56	-0.16	34.40	47.98	-13.58	AVG
5	0.5620	45.15	-0.05	45.10	56.00	-10.90	QP
6	0.5620	33.15	-0.05	33.10	46.00	-12.90	AVG
7	2.3540	43.48	0.01	43.49	56.00	-12.51	QP
8	2.3540	36.01	0.01	36.02	46.00	-9.98	AVG
9	11.9860	48.65	1.74	50.39	60.00	-9.61	QP
10	11.9860	41.46	1.74	43.20	50.00	-6.80	AVG
11	29.9900	45.76	3.78	49.54	60.00	-10.46	QP
12	29.9900	27.29	3.78	31.07	50.00	-18.93	AVG

4.3 Conducted Peak Output Power

Test Connection Diagram



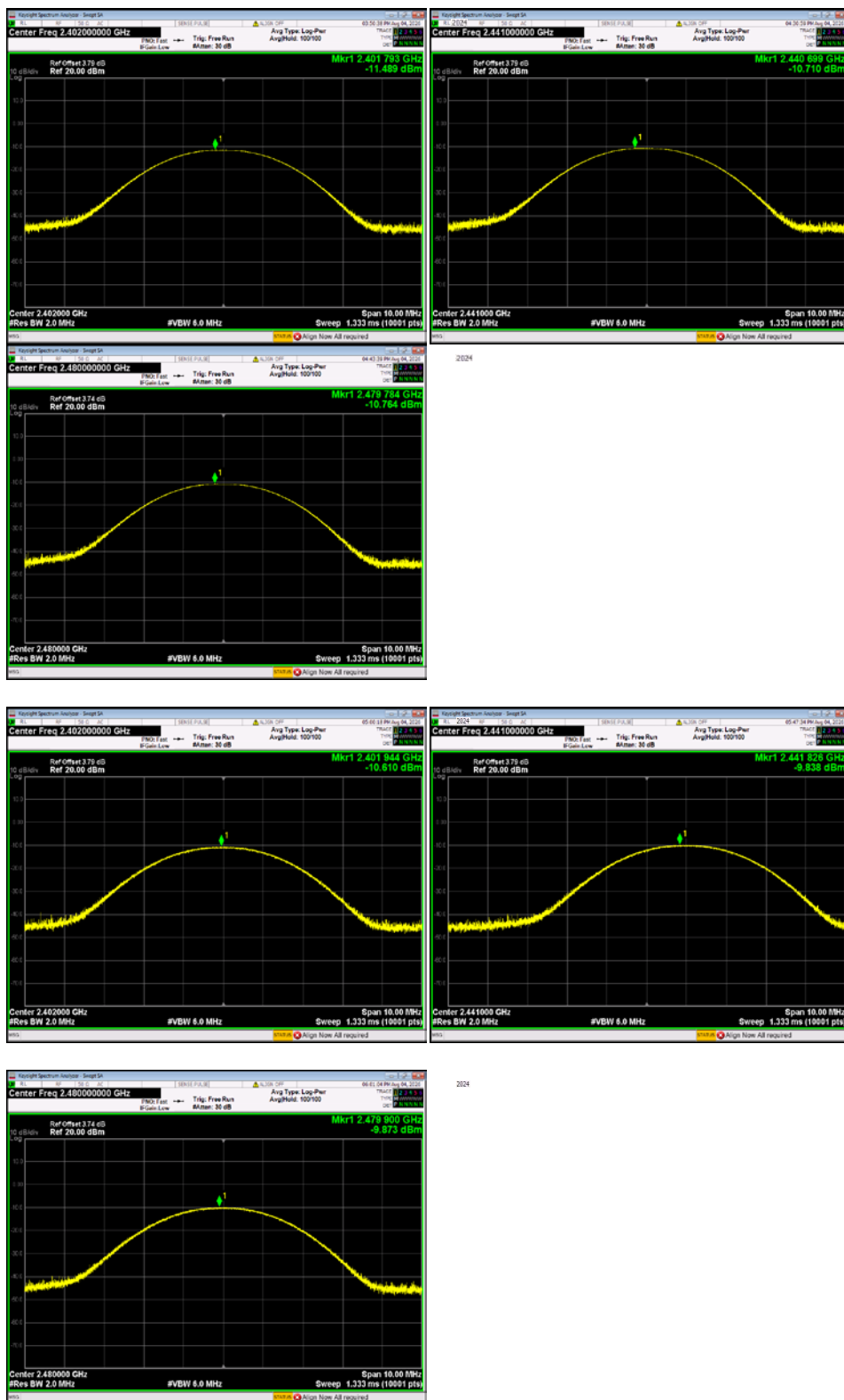
Test Procedure

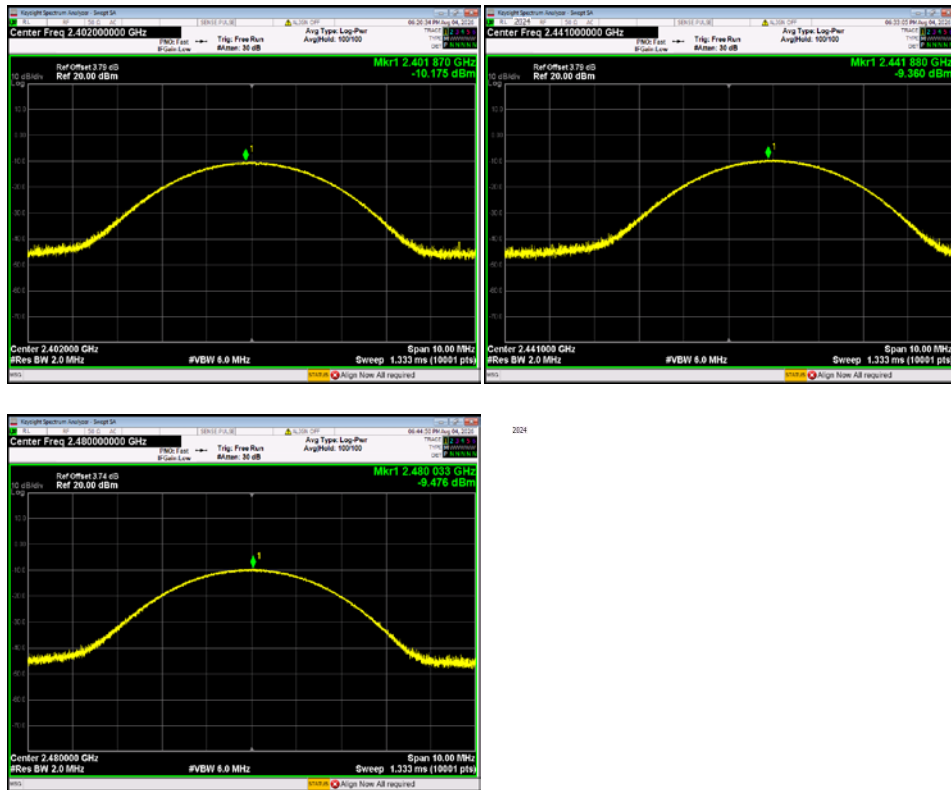
- (1) Configure EUT and assistant system according clause 2.3 and 3.2
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (3) Configure EUT work in test mode as stated in clause 2.3.
- (4) Measure the maximum output power of EUT by spectrum analyzer with PK detector and RBW=2MHz(above 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	-11.49	≤30	PASS
DH5	Ant1	2441	-10.71	≤30	PASS
DH5	Ant1	2480	-10.76	≤30	PASS
2DH5	Ant1	2402	-10.61	≤20.97	PASS
2DH5	Ant1	2441	-9.84	≤20.97	PASS
2DH5	Ant1	2480	-9.87	≤20.97	PASS
3DH5	Ant1	2402	-10.18	≤20.97	PASS
3DH5	Ant1	2441	-9.36	≤20.97	PASS
3DH5	Ant1	2480	-9.48	≤20.97	PASS



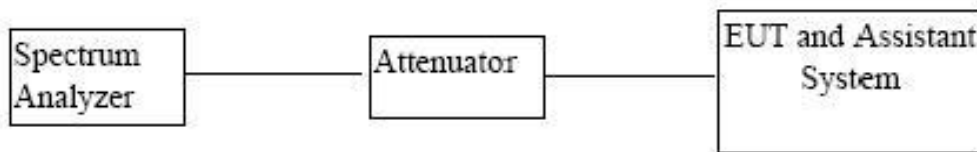


4.4 20dB Occupied Bandwidth

Limit:

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

Test setup:



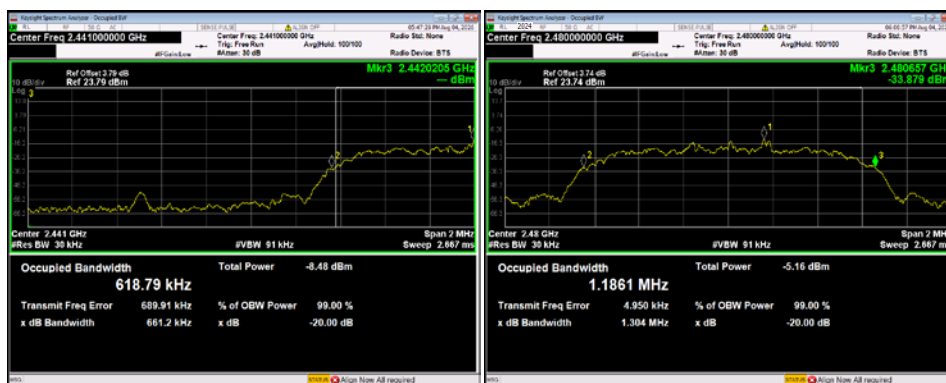
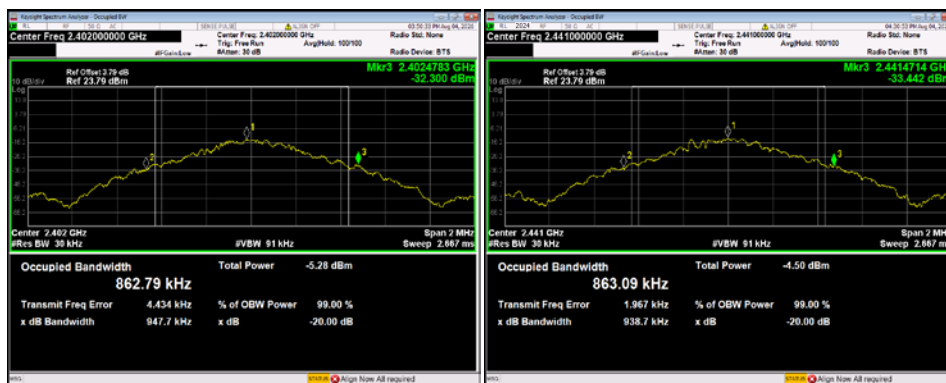
Test procedure:

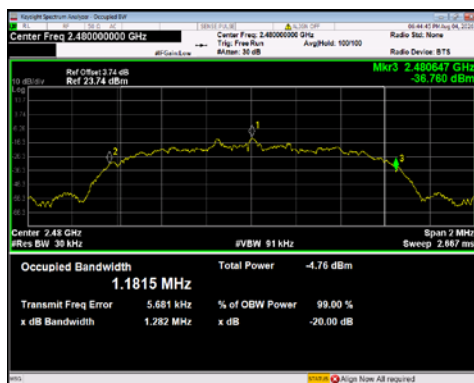
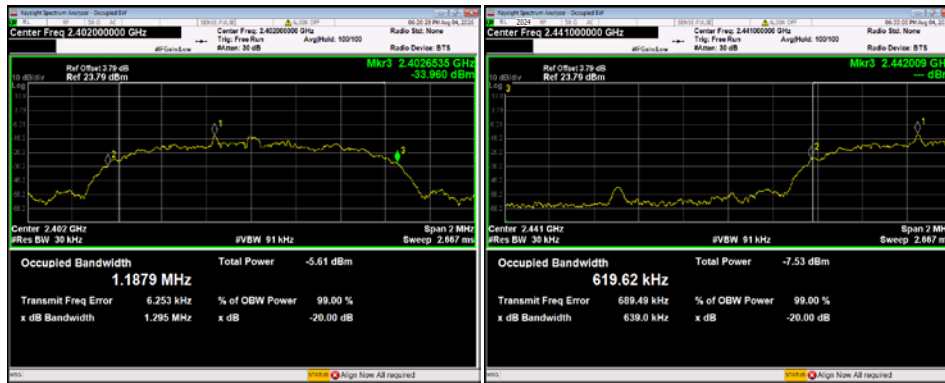
Set the spectrum analyzer:

- 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 results:

Test Mode	Antenna	Frequency (MHz)	20dB EBW (MHz)	Limit (MHz)	Verdict
DH5	Ant1	2402	0.9477	/	/
DH5	Ant1	2441	0.9387	/	/
DH5	Ant1	2480	0.9559	/	/
2DH5	Ant1	2402	1.321	/	/
2DH5	Ant1	2441	0.6612	/	/
2DH5	Ant1	2480	1.304	/	/
3DH5	Ant1	2402	1.295	/	/
3DH5	Ant1	2441	0.639	/	/
3DH5	Ant1	2480	1.282	/	/



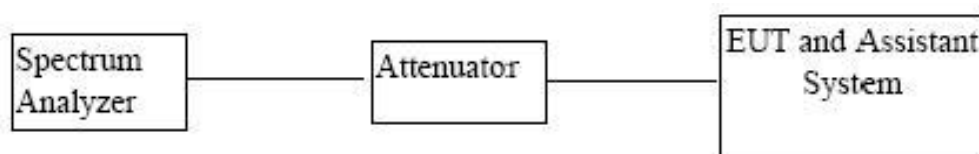


4.5 Carrier Frequencies Separation

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:



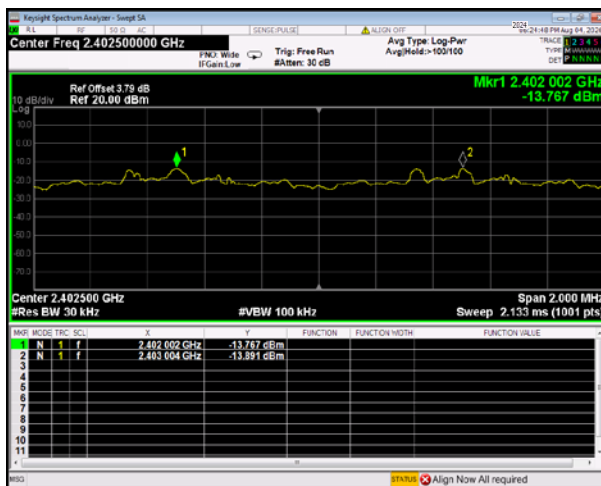
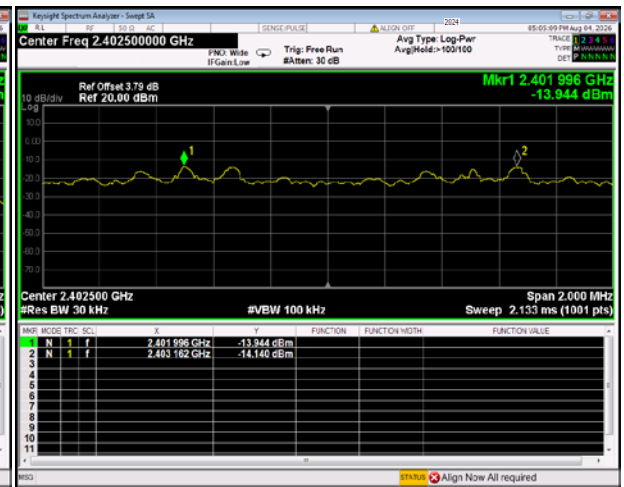
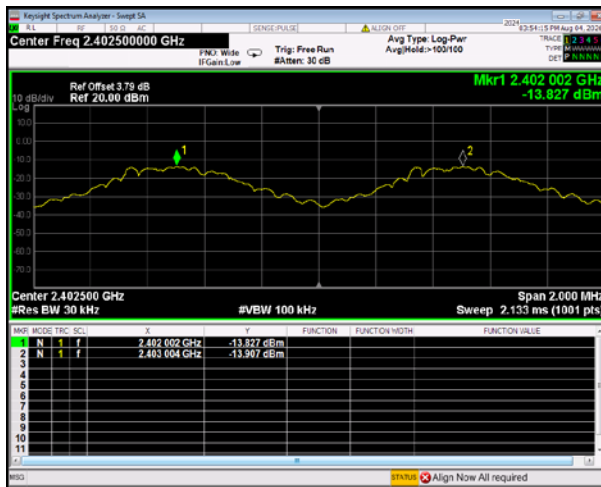
Test procedure:

Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= $1.5 \times$ 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	1.002	≥ 0.632	Pass
2DH5	Hop	1.166	≥ 0.881	Pass
3DH5	Hop	1.002	≥ 0.863	Pass

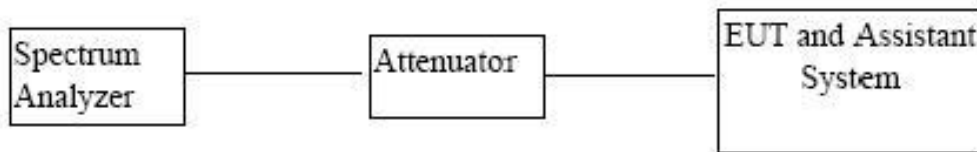


4.6 Hopping Channel Number

Limit:

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

Test setup:



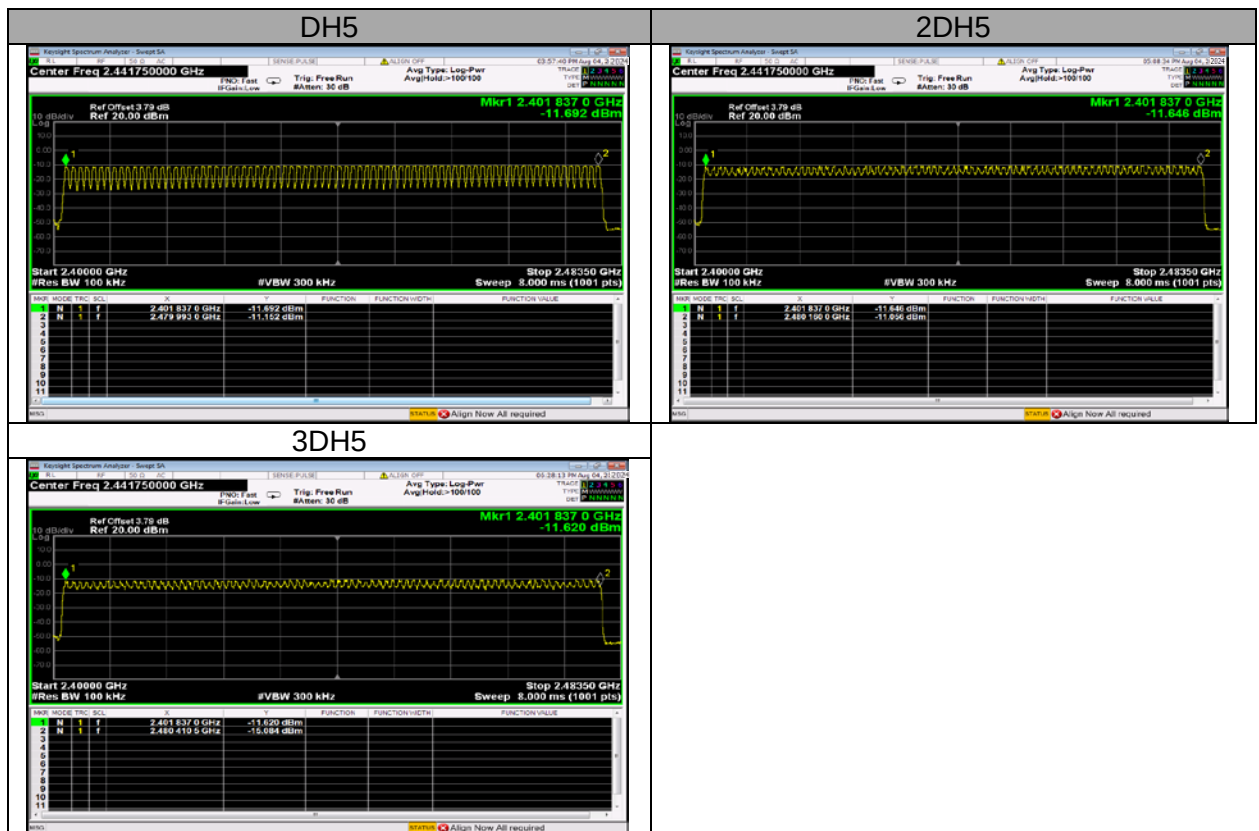
Test procedure:

Set the spectrum analyzer:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span= $1.5 \times \text{DTS bandwidth}$.
- 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

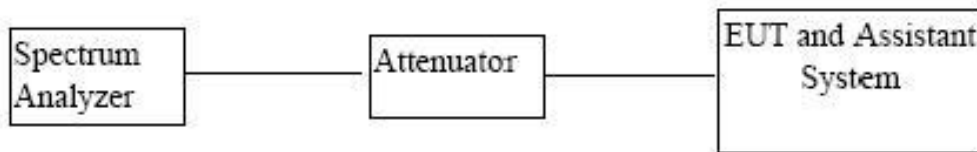


4.7 Dwell Time

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= $1.5 \times \text{DTS bandwidth}$.
- 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	2.880	106.67	0.307	≤0.4	PASS
DH1	Ant1	Hop	0.376	320	0.120	≤0.4	PASS
DH3	Ant1	Hop	1.632	160	0.261	≤0.4	PASS
2DH5	Ant1	Hop	2.884	106.67	0.308	≤0.4	PASS
2DH1	Ant1	Hop	0.386	320	0.123	≤0.4	PASS
2DH3	Ant1	Hop	1.637	160	0.262	≤0.4	PASS
3DH5	Ant1	Hop	2.888	106.67	0.307	≤0.4	PASS
3DH1	Ant1	Hop	0.386	320	0.123	≤0.4	PASS
3DH3	Ant1	Hop	1.636	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

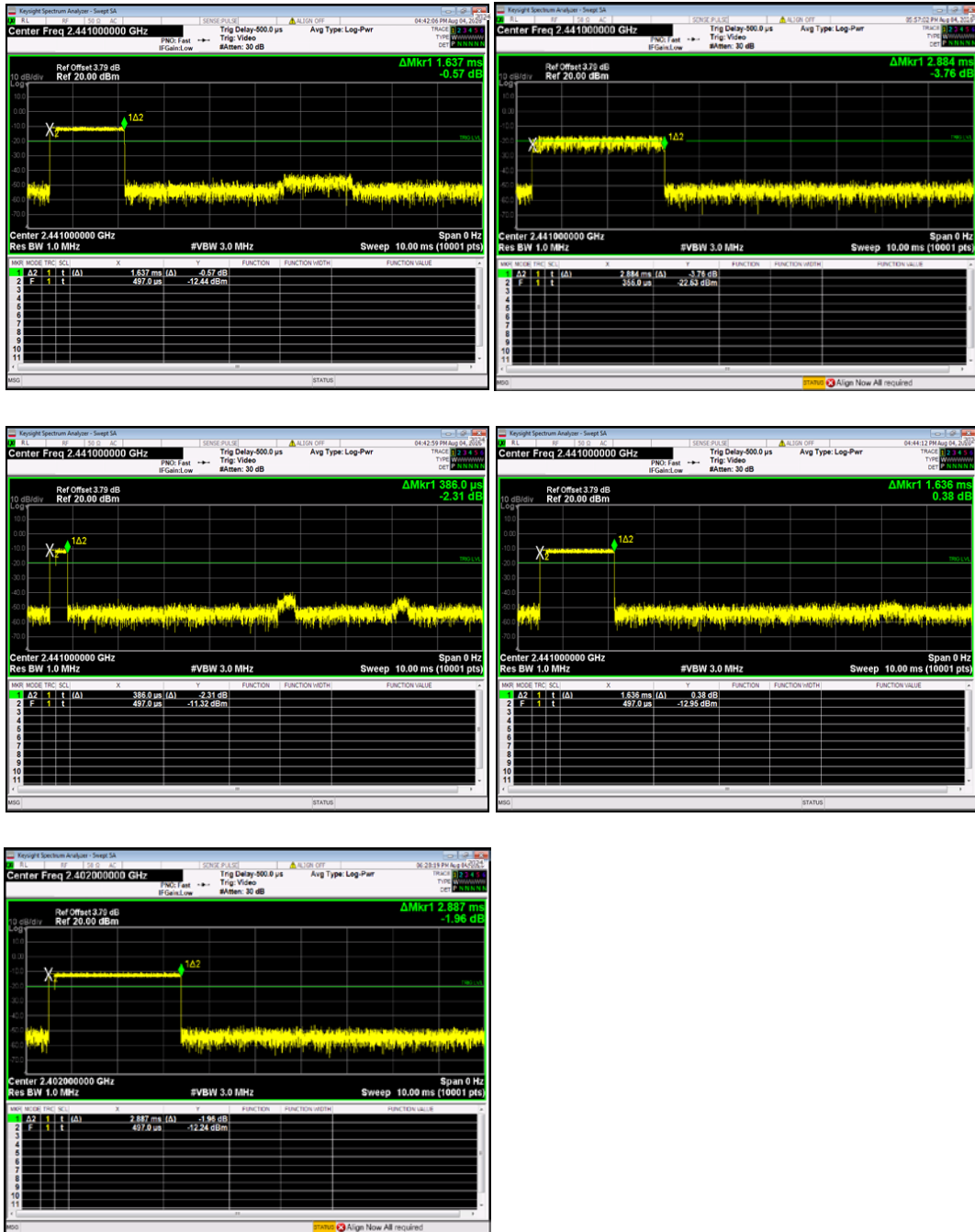
DH3/2DH3/3DH3: TotalHops=1600/79/4*0.4*79

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



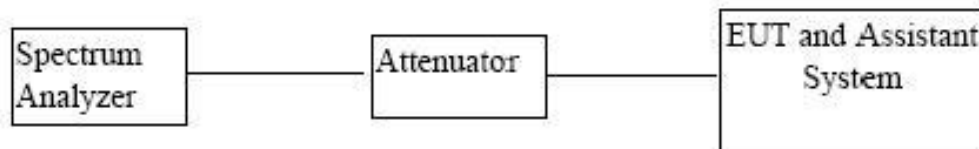


4.8 Band Edge

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:

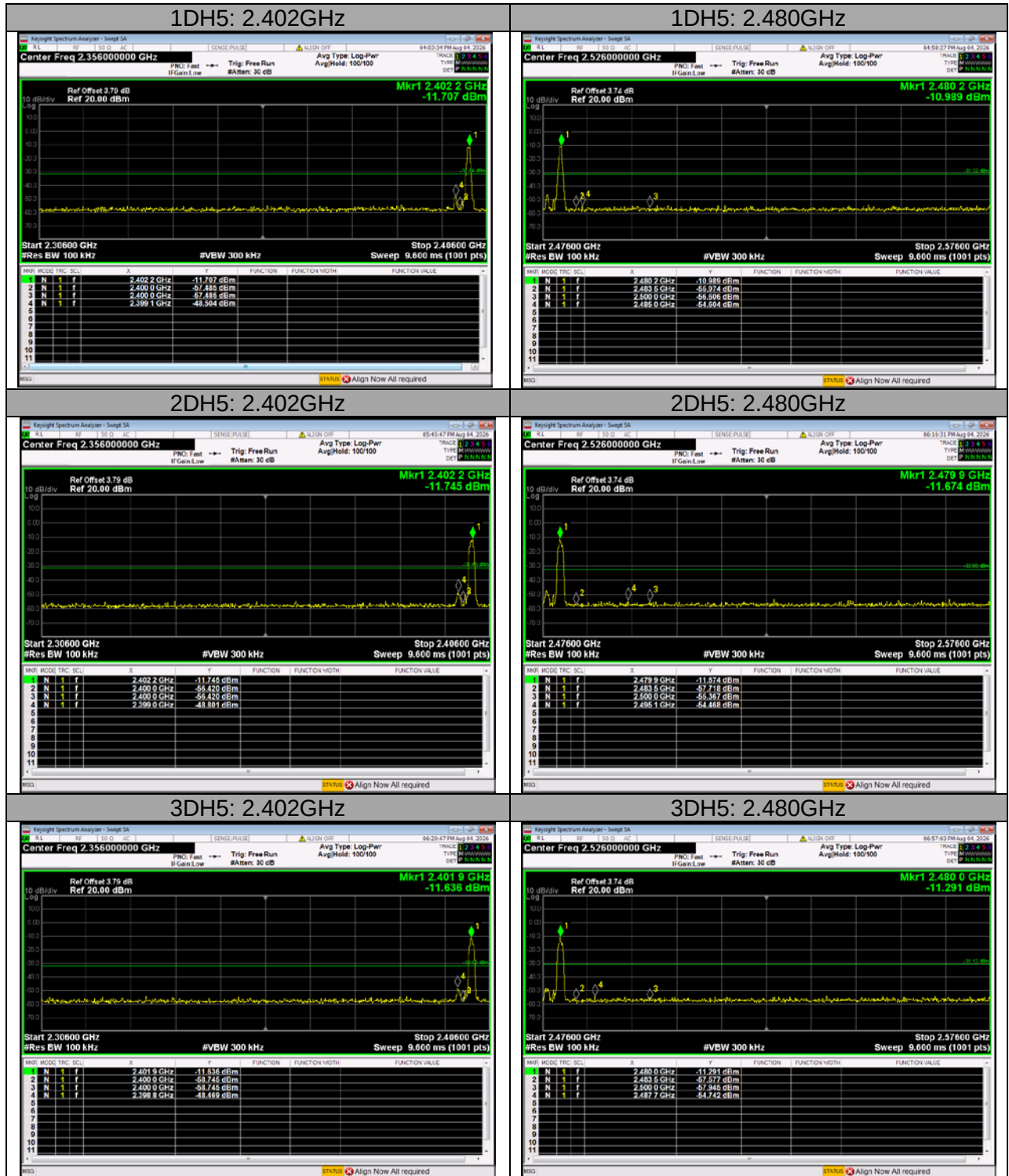


Test procedure:

Set the spectrum analyzer:

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

Test results:

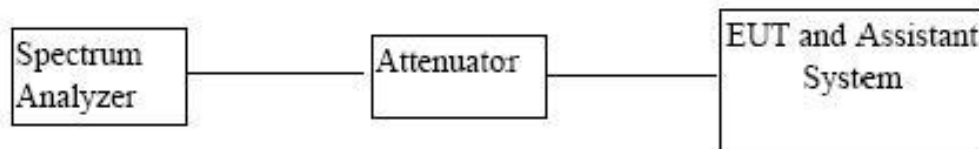


4.9 Spurious RF conducted emissions

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:

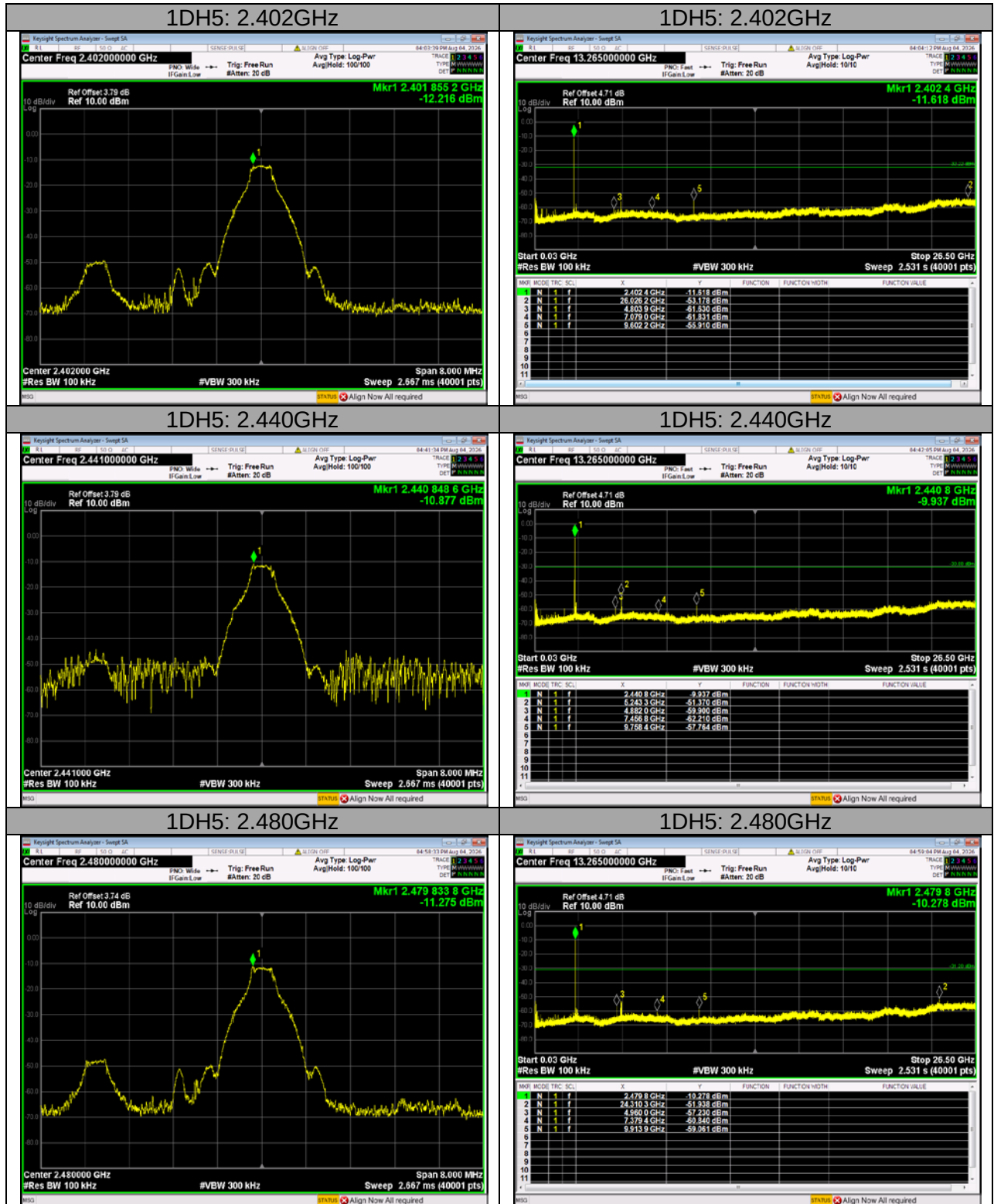


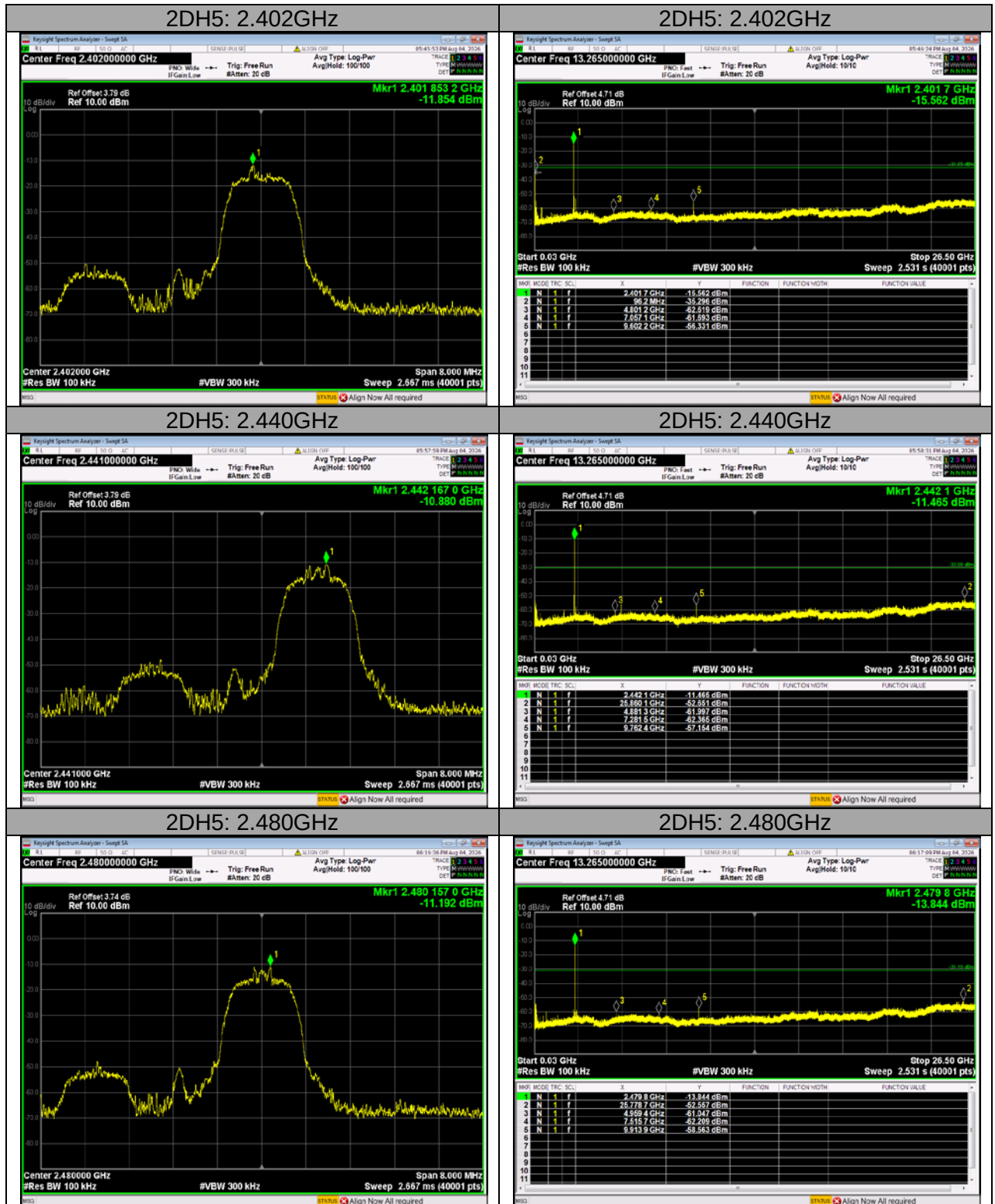
Test procedure:

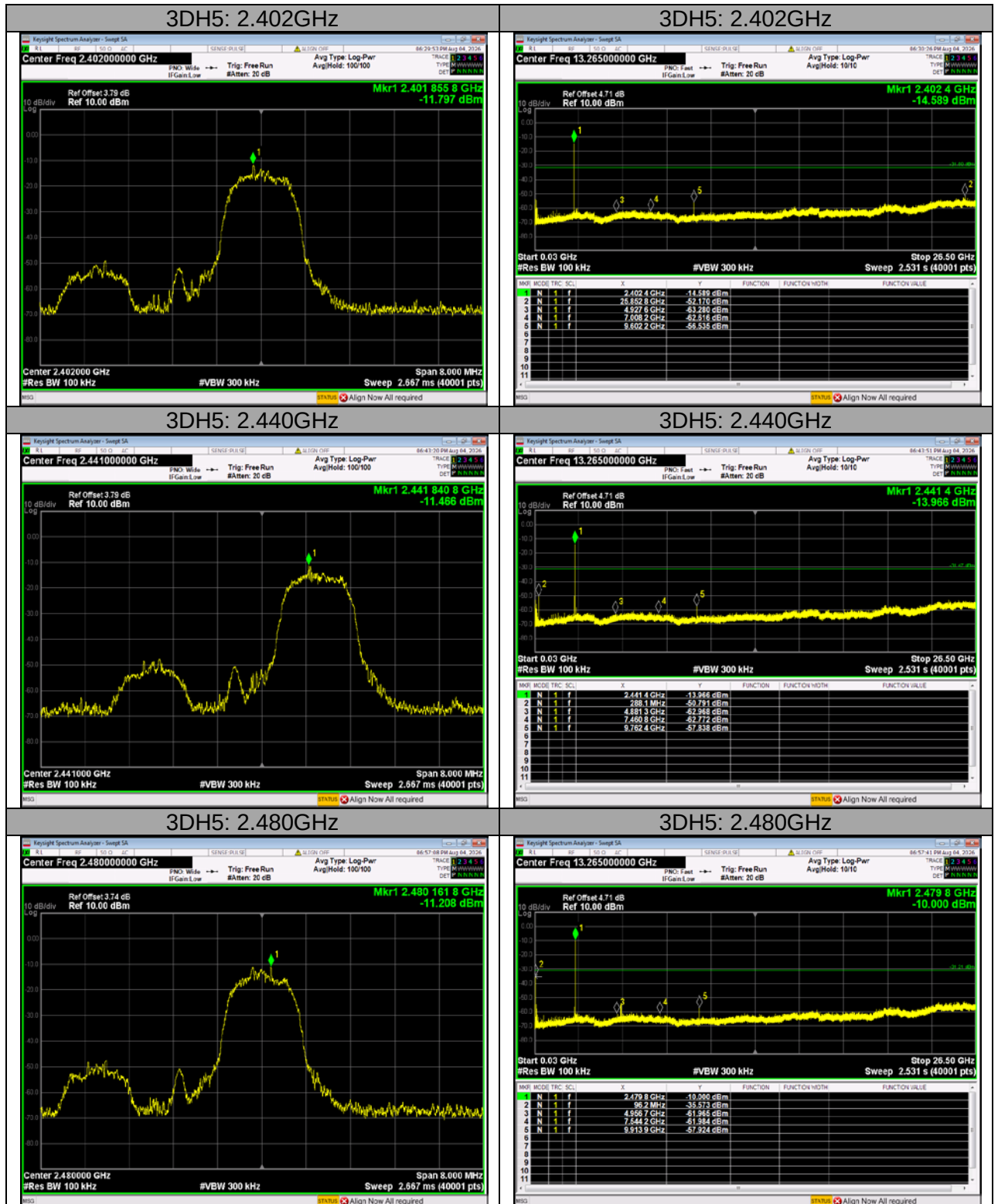
Set the spectrum analyzer:

- 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:



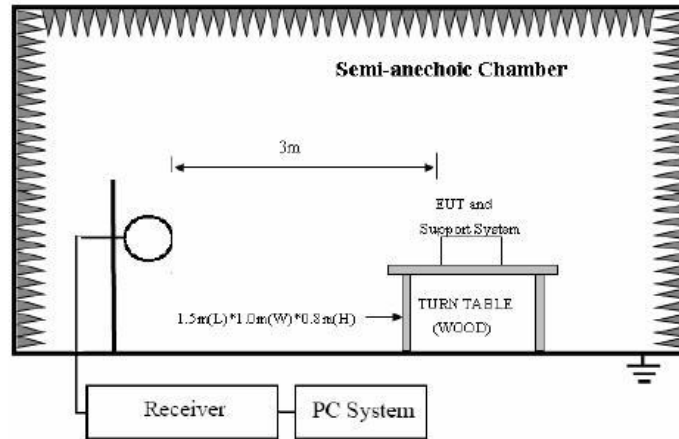




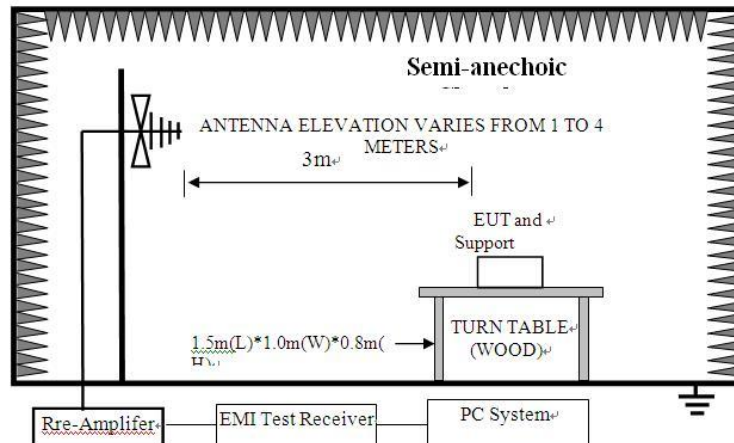
4.10 Spurious Radiated emission

Test setup:

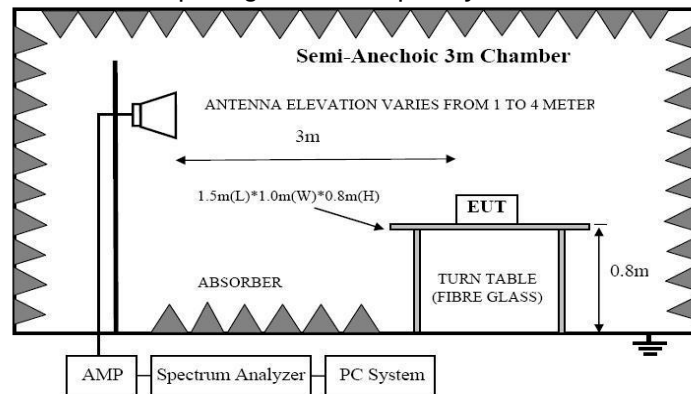
In 3m Anechoic Chamber Test Setup Diagram for 9KHz-30MHz



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
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	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 CISPRQP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz.Radiatedemissions 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 radiated emissions 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 produces highest 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 to ANSI C63.10:2020 clause 4.2.3.2.3 procedure for average measure). Both PK and AV level test, PK detector is used.

Test result

PASS. (See below detailed test result)

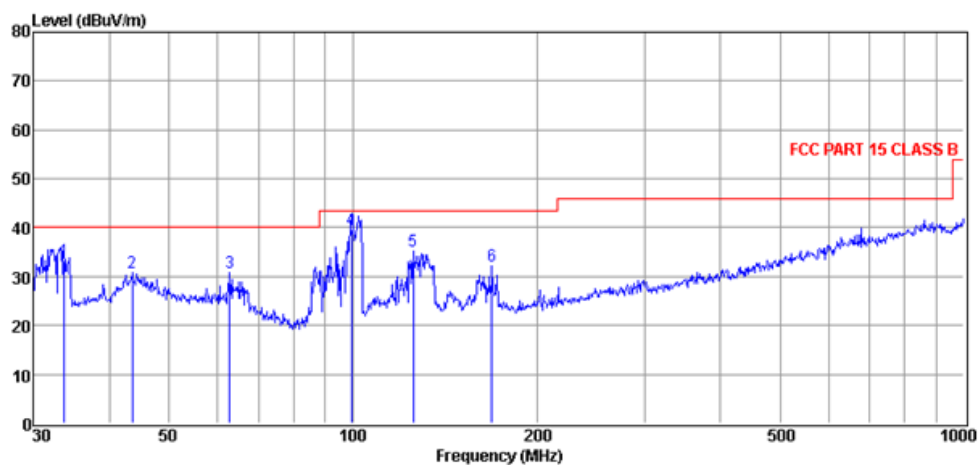
All the emissions except fundamental emission from 9 KHz to 25GHz were comply with 8.3.2 limit.

Note1: According to 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 to exploratory 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.

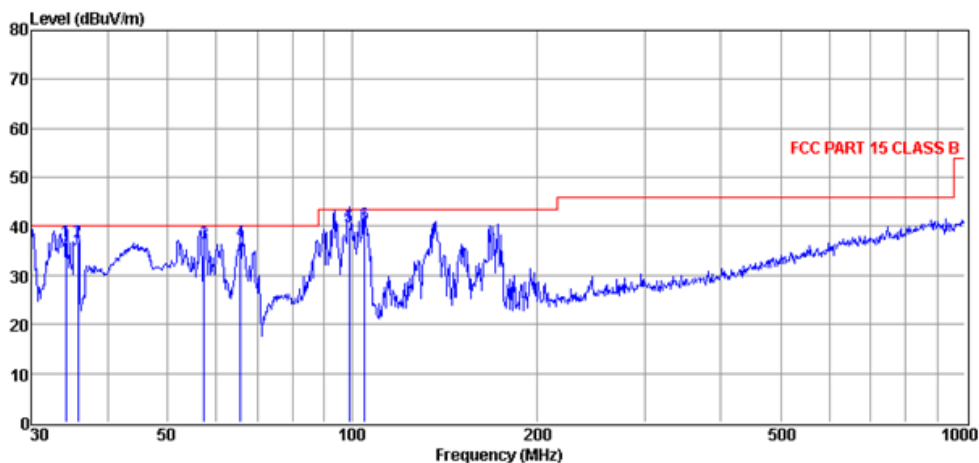
Note3: For emissions above 1GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

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 (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Detector	Polarization
1	33.68	21.28	11.37	0.00	0.57	33.22	40.00	-6.78	QP	HORIZONTAL
2	43.51	13.59	16.58	0.00	0.67	30.84	40.00	-9.16	Peak	HORIZONTAL
3	62.87	18.10	12.01	0.00	0.66	30.77	40.00	-9.23	Peak	HORIZONTAL
4	99.53	28.59	10.24	0.00	0.84	39.67	43.50	-3.83	QP	HORIZONTAL
5	125.45	25.59	8.58	0.00	1.05	35.22	43.50	-8.28	Peak	HORIZONTAL
6	169.01	19.83	10.92	0.00	1.42	32.17	43.50	-11.33	Peak	HORIZONTAL

Vertical:



Item (Mark)	Freq (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Detector	Polarization
1	34.16	24.88	11.43	0.00	0.59	36.90	40.00	-3.10	QP	VERTICAL
2	35.75	24.50	11.75	0.00	0.62	36.87	40.00	-3.13	QP	VERTICAL
3	57.39	21.64	14.12	0.00	0.80	36.56	40.00	-3.44	QP	VERTICAL
4	65.80	24.94	11.19	0.00	0.68	36.81	40.00	-3.19	QP	VERTICAL
5	98.83	28.80	10.27	0.00	0.83	39.90	43.50	-3.60	QP	VERTICAL
6	104.90	30.37	9.10	0.00	0.81	40.28	43.50	-3.22	QP	VERTICAL

Pre-scan all test modes, the test result only shows the worst mode. The worst mode is GFSK.

Above 1G:

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	Polari zation
1	2122	63.66	26.92	53.99	4.15	40.74	54.00	-13.26	Average	H
2	2122	70.66	26.92	53.99	4.15	47.74	74.00	-26.26	Peak	H
3	4804	56.75	32.43	53.30	5.00	40.88	54.00	-13.12	Average	H
4	4804	63.75	32.43	53.30	5.00	47.88	74.00	-26.12	Peak	H
5	3193	56.17	29.39	53.86	5.00	36.70	54.00	-17.30	Average	V
6	3193	63.17	29.39	53.86	5.00	43.70	74.00	-30.30	Peak	V
7	7052	51.45	36.11	52.99	6.06	40.63	54.00	-13.37	Average	V
8	7052	58.45	36.11	52.99	6.06	47.63	74.00	-26.37	Peak	V

2440MHz:

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	Polari zation
1	2343	60.77	27.42	53.97	4.39	38.61	54.00	-15.39	Average	H
2	2343	67.77	27.42	53.97	4.39	45.61	74.00	-28.39	Peak	H
3	8106	51.61	37.11	52.77	7.00	42.95	54.00	-11.05	Average	V
4	8106	58.61	37.11	52.77	7.00	49.95	74.00	-24.05	Peak	V

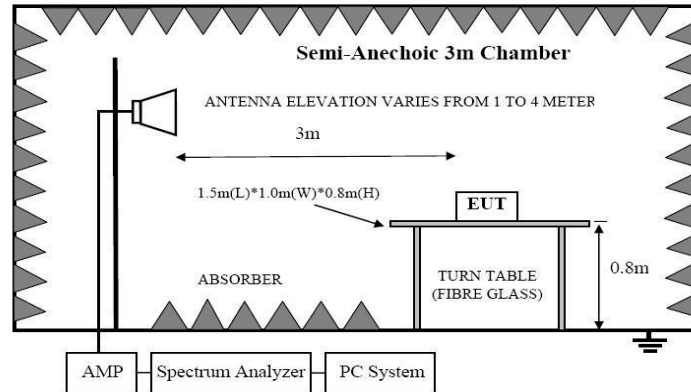
2480MHz:

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	Polari zation
1	2122	62.49	26.92	53.99	4.15	39.57	54.00	-14.43	Average	H
2	2122	69.49	26.92	53.99	4.15	46.57	74.00	-27.43	Peak	H
3	8123	50.62	37.13	52.76	7.00	41.99	54.00	-12.01	Average	H
4	8123	57.62	37.13	52.76	7.00	48.99	74.00	-25.01	Peak	H
5	7052	51.53	36.11	52.99	6.06	40.71	54.00	-13.29	Average	V
6	7052	58.53	36.11	52.99	6.06	47.71	74.00	-26.29	Peak	V

4.11 Band Edge Compliance

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)

Remark: All modes have been tested, only worse case is reported.

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	Polari zation
1	2310	60.22	27.35	53.97	4.36	37.96	54.00	-16.04	Average	H
2	2310	67.22	27.35	53.97	4.36	44.96	74.00	-29.04	Peak	H
3	2390	57.12	27.53	53.96	4.44	35.13	54.00	-18.87	Average	H
4	2390	64.12	27.53	53.96	4.44	42.13	74.00	-31.87	Peak	H
5	2310	54.89	27.35	53.97	4.36	32.63	54.00	-21.37	Average	V
6	2310	61.89	27.35	53.97	4.36	39.63	74.00	-34.37	Peak	V
7	2390	53.00	27.53	53.96	4.44	31.01	54.00	-22.99	Average	V
8	2390	60.00	27.53	53.96	4.44	38.01	74.00	-35.99	Peak	V

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	Polari zation
1	2483.5	54.98	27.74	53.95	4.53	33.30	54.00	-20.70	Average	H
2	2483.5	61.98	27.74	53.95	4.53	40.30	74.00	-33.70	Peak	H
3	2500	54.83	27.78	53.95	4.55	33.21	54.00	-20.79	Average	H
4	2500	61.83	27.78	53.95	4.55	40.21	74.00	-33.79	Peak	H
5	2483.5	53.39	27.74	53.95	4.53	31.71	54.00	-22.29	Average	V
6	2483.5	60.39	27.74	53.95	4.53	38.71	74.00	-35.29	Peak	V
7	2500	53.17	27.78	53.95	4.55	31.55	54.00	-22.45	Average	V
8	2500	60.17	27.78	53.95	4.55	38.55	74.00	-35.45	Peak	V

5 Test Setup Photo

Refer to <Setup Photos>

6 Test Setup of EUT

Refer to <External Photos and Internal Photos>

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