

Test Report No.:
FCC2020-0037-R

RF Test Report

EUT	:	Galaxy Lite Star Projector Speaker
MODEL	:	POLT01B
BRAND NAME	:	N/A
CLIENT	:	Shenzhen LUBANG Technology Co . , Ltd.
Classification Of Test	:	Commission Test

VkanCertification & Testing Co., Ltd.



Vkan Certification & Testing Co., Ltd.

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Client		Name : Shenzhen LUBANG Technology Co . , Ltd. Address : 2103, Block A, Building 6, Shenzhen International Innovation Valley, Dashi Road,Xili Street, Nanshan District, Shenzhen,China	
Manufacturer		Name : Shenzhen LUBANG Technology Co . , Ltd. Address : 2103, Block A, Building 6, Shenzhen International Innovation Valley, Dashi Road,Xili Street, Nanshan District, Shenzhen,China	
Equipment Under Test		Name : Galaxy Lite Star Projector Speaker Model/Type:POLT01B Trade mark :N/A SerialNO.:N/A Sampe NO.:1-1	
Date of Receipt.	2020.12.28	Date of Testing	2020.12.28~2021.01.26
Test Specification		Test Result	
FCC Part 15, Subpart C, Section 15.247		PASS	
Evaluation of Test Result		The equipment under test was found to comply with the requirements of the standards applied. Issue Date: 2021.01.26	
Tested by: <u>RobertCheng</u> Name Signature		Reviewed by: <u>Andy Zhu</u> Name Signature	Approved by: <u>Sam Tung</u> Name Signature
Other Aspects: NONE.			
Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested			
This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC.			



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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCC2020-0037-R	Original release	2021.01.26

1 GENERAL INFORMATION

1.1 GENERAL PRODUCT INFORMATION

PRODUCT	Galaxy Lite Star Projector Speaker
BRAND	N/A
MODEL	POLT01B
ADDITIONAL MODEL	N/A
FCC ID	2AZCBPOLT01B202102
POWER SUPPLY	DC 5V From USB Host Unitor DC 3.7V From Li-ion Battery
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, $\pi/4$ DQPSK, 8DPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
PEAK OUTPUT POWER	1.052mW (Max. Measured)
ANTENNA TYPE	PCB Antenna, -0.58dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	USB Line: Unshielded Detachable 0.8m
Remark: - For more detailed features description, please refer to the manufacturer's specifications or the User's Manual. - For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report. - Please refer to the EUT photo document (Reference No.: FCC2020-0037) for detailed product photo. - For trading purposes, the product is available in three different exterior colors	

1.2 OTHER INFORMATION

Operation Frequency Each of Channel							
For BT (GFSK, $\pi/4$ DQPSK, 8 DPSK)							
CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

1.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, xyz axis and antenna ports

The worst case was found when positioned on xaxis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TEST ITEMS				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
A	√	√	√	√	BT Function

Where **RE<1G**: Radiated Emission below 1GHz **RE≥1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

**RADIATED EMISSION TEST (BELOW 1 GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0 to 78	39	FHSS	GFSK	DH5

For the test results, only the worst case was shown in test report.

RADIATED EMISSION TEST (ABOVE 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

POWER LINE CONDUCTED EMISSION TEST:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0 to 78	39	FHSS	GFSK	DH5

ANTENNA PORT CONDUCTED MEASUREMENT:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RE<1G	25deg. C, 55%RH	DC 5V From Adapter	Robert Cheng
RE□1G	25deg. C, 55%RH	DC 5V From Adapter	Robert Cheng
PLC	25deg. C, 55%RH	DC 3.7V From Full Battery	Robert Cheng
APCM	25deg. C, 60%RH	DC 3.7V From Full Battery	Robert Cheng

1.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC PART 15, Subpart C. Section 15.247
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards

1.5 DESCRIPTION OF SUPPORT UNITS

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.

During the tests.

Support Equipment							
NO	Description	Brand	Model No.	Serial Number	Supplied by		
1	Adapter	Apple	A1443	N/A	Lab		
Support Cable							
NO	Description	Quantity (Number)	Length (m)	Detachable (Yes/ No)	Shielded (Yes/ No)	Cores (Number)	Supplied by
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

PPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(d)&15.209	Transmitter Radiated Emission	PASS	Meet the requirement of limit.
15.247(d)	Out of band Emission Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

2.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

Refer to Appendix A.

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

No.	ITEM	FREQUENCY	UNCERTAINTY
1	Conducted emissions	9kHz~30MHz	2.7dB
2	Radiated emissions	9KHz ~ 30MHz	5.6dB
		30MHz ~ 1GMHz	4.6dB
		1GHz ~ 18GHz	4.4dB
		18GHz ~ 40GHz	4.6dB

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

2.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of Vkan Certification & Testing Co., Ltd.

Address: No.3,TiantaiyiRoad,KaitaiAvenue,ScienceCity,Guangzhou,China

Post Code: 510663

Tel: 020-32293888

FAX: 020-32293889

E-mail: office@cvc.org.cn

3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 Limit

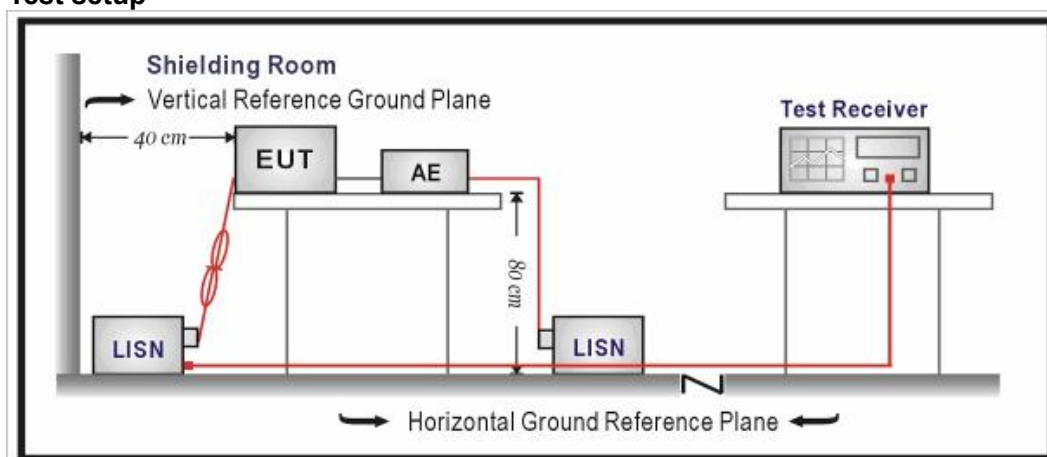
Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.
NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3.1.2 Measurement procedure

- The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the Test photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source. The equipment under test shall be placed on a support of non-metallic material, the height of which shall be 1.5m above the ground,
- The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
- Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

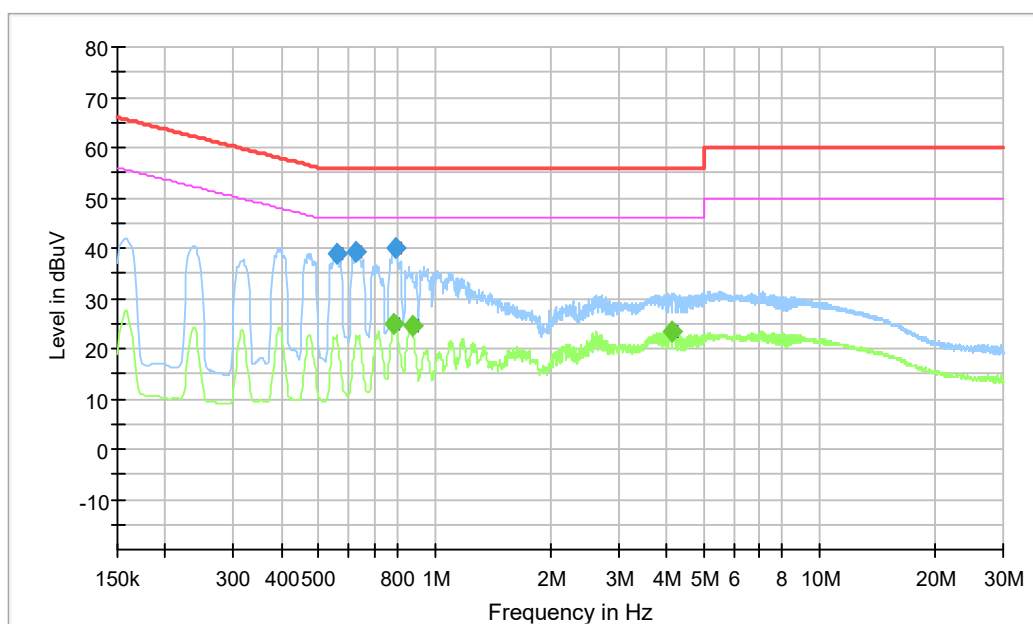
3.1.3 Test setup



3.1.4 Test results

CONDUCTED WORST-CASE DATA:

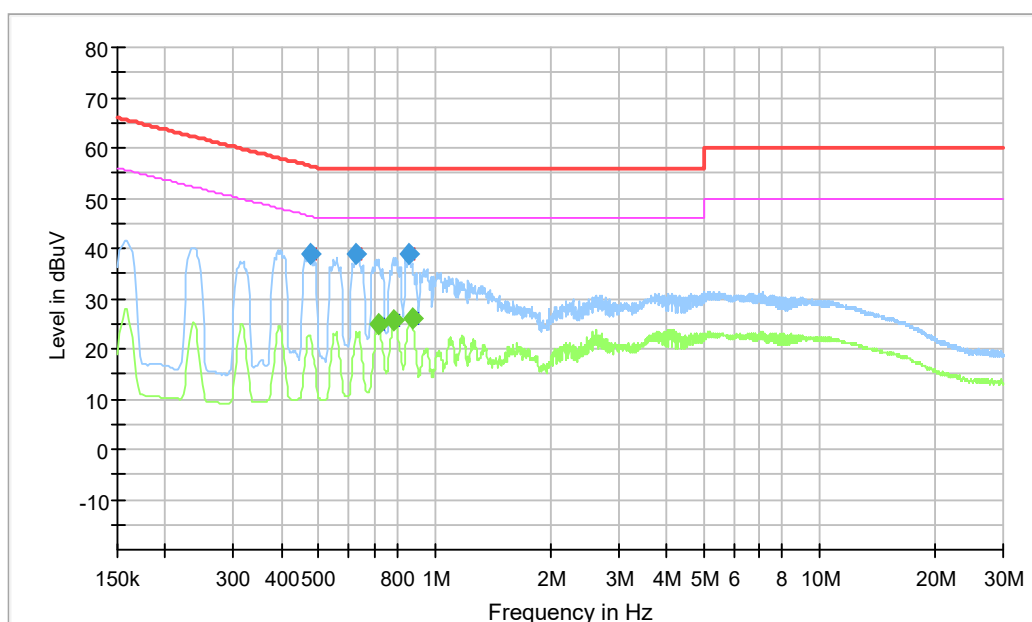
Worst Test Mode	DH5	Channel	CH 39
Frequency Range	150KHz ~ 30MHz	PHASE	Line (L)



NO.	Frequency (MHz)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Corr. (dB)	Remark
1	0.557	38.8	56.0	17.2	19.6	QP
2	0.625	39.3	56.0	16.7	19.6	QP
3	0.782	25.0	46.0	21.0	19.6	AVG
4	0.796	40.0	56.0	16.0	19.6	QP
5	0.875	24.5	46.0	21.5	19.6	AVG
6	4.119	23.5	46.0	22.5	19.6	AVG

Remark: The emission levels of other frequencies were very low against the limit.

Worst Test Mode	DH5	Channel	CH 39
Frequency Range	150KHz ~ 30MHz	PHASE	Line (N)



NO.	Frequency (MHz)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Corr. (dB)	Remark
1	0.479	38.9	56.4	17.5	19.6	QP
2	0.625	38.7	56.0	17.3	19.6	QP
3	0.715	25.0	46.0	21.0	19.6	AVG
4	0.782	25.6	46.0	20.4	19.6	AVG
5	0.859	38.7	56.0	17.3	19.6	QP
6	0.875	26.0	46.0	20.0	19.6	AVG

Remark: The emission levels of other frequencies were very low against the limit.

3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

3.2.1 Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB below the highest level of the desired power.

FREQUENCIES (MHz)	FIELD STRENGTH (Microvolts/Meter)	MEASUREMENT DISTANCE (Meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE: 1. The lower limit shall apply at the transition frequencies.

NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

NOTE: 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

3.2.2 Measurement procedure

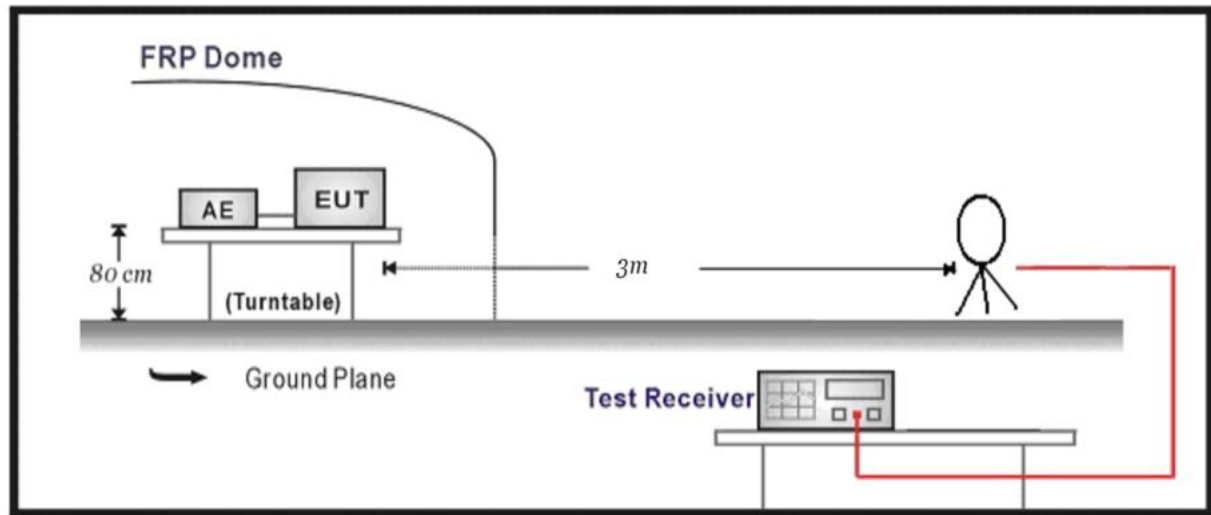
- The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its 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.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

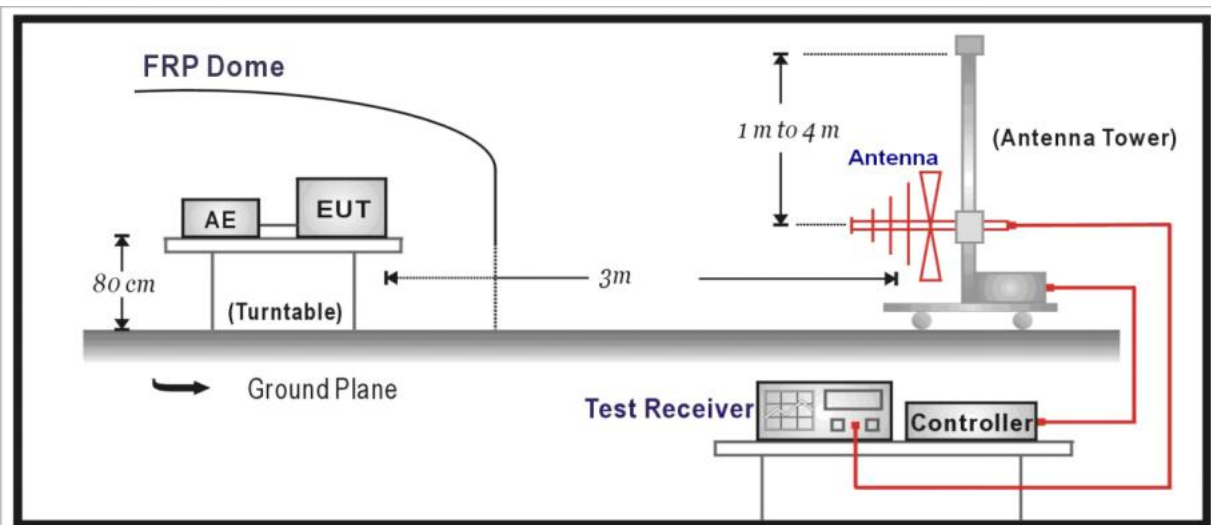
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

3.2.3 Test setup

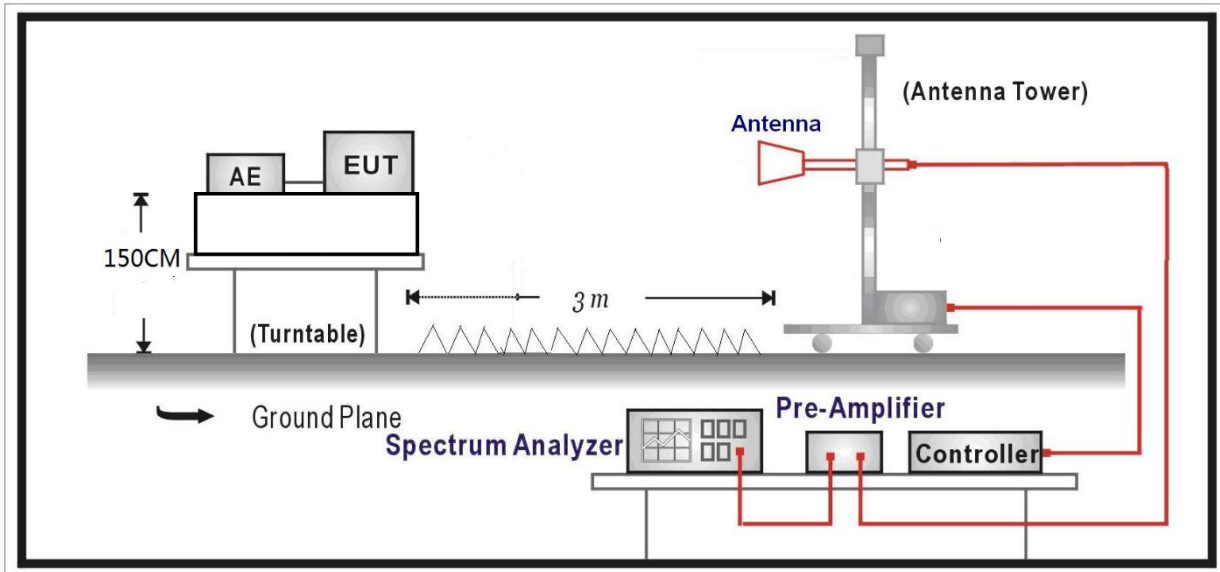
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:

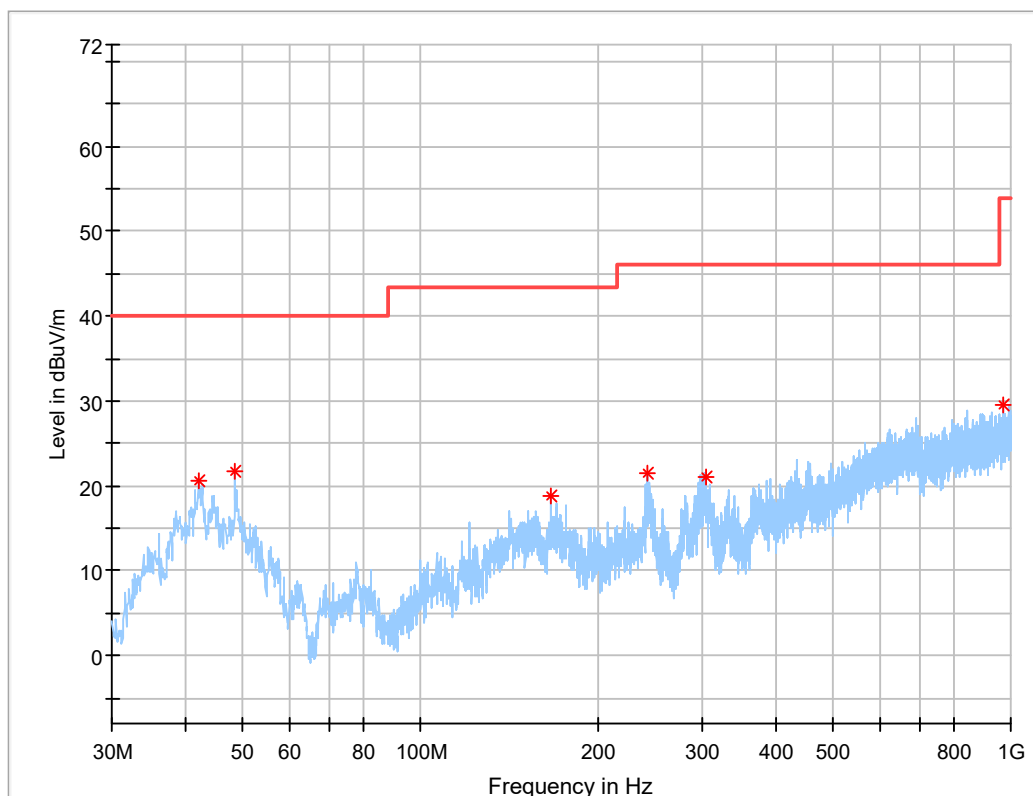


3.2.4 Test results

BELOW 1GHz WORST-CASE DATA:

Worst Test Mode	DH5	Channel	CH 39
Frequency Range	9KHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Horizontal



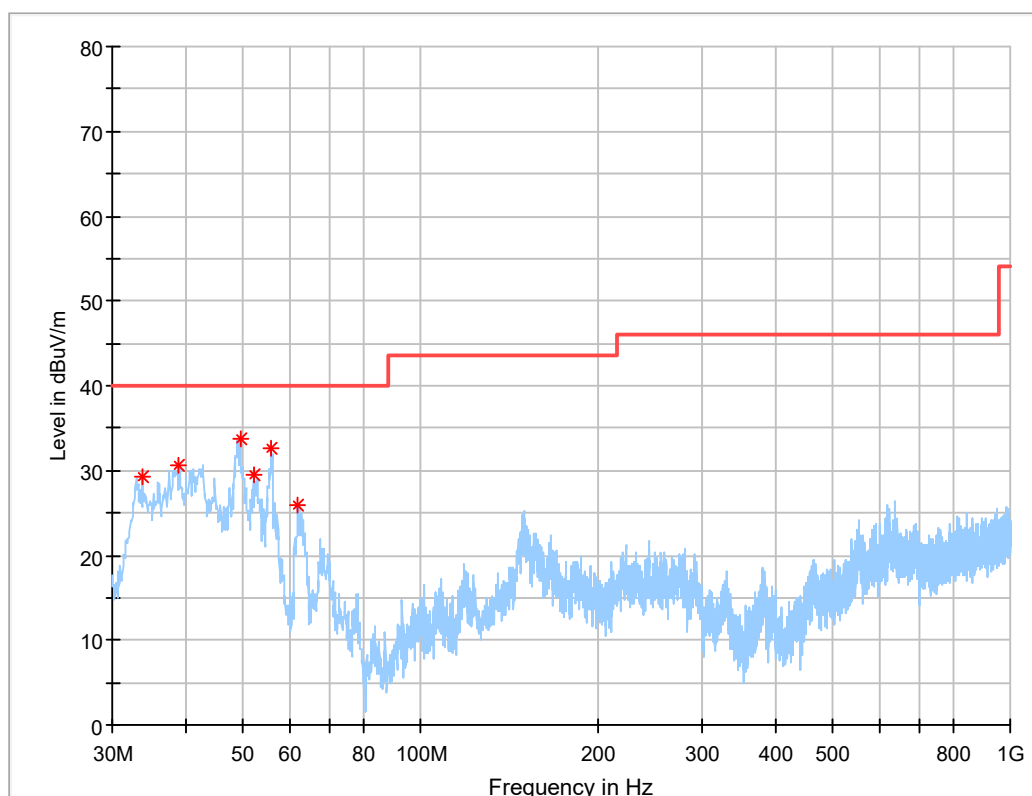
NO.	Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Azimuth (deg)	Remark
1	42.125	20.5	40.0	19.5	100.0	86.0	QP
2	48.527	21.8	40.0	18.2	100.0	56.0	QP
3	166.382	18.7	43.5	24.8	200.0	39.0	QP
4	242.139	21.6	46.0	24.4	300.0	129.0	QP
5	303.831	21.0	46.0	25.0	300.0	75.0	QP
6	971.288	29.5	54.0	24.5	200.0	0.0	QP

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.

2. The emission levels of other frequencies were greater than 20dB margin.

Worst Test Mode	DH5	Channel	CH 39
Frequency Range	9KHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Vertical



NO.	Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Height (cm)	Azimuth (deg)	Remark
1	62.010	25.9	40.0	14.1	100.0	86.0	QP
2	38.924	30.6	40.0	9.4	200.0	153.0	QP
3	33.783	29.2	40.0	10.8	100.0	212.0	QP
4	49.400	33.8	40.0	6.2	100.0	291.0	QP
5	55.705	32.6	40.0	7.4	200.0	317.0	QP
6	52.019	29.5	40.0	10.5	300.0	351.0	QP

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.

2. The emission levels of other frequencies were greater than 20dB margin.

ABOVE 1GHz DATA

BT_GFSK

Test Mode	DH5	Channel	CH 0
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Corr. (dB/m)	Remark
1	2390.00	44.91	74.00	-29.09	1.00 H	81	4.15	Peak
2	2390.00	33.55	54.00	-20.45	1.00 H	81	4.15	Avg
3	*2402.00	96.82			1.00 H	81	4.20	Peak
4	*2402.00	95.40			1.00 H	81	4.20	Avg
5	4804.00	52.63	74.00	-21.37	1.00 H	0	7.52	Peak
6	4804.00	39.76	54.00	-14.24	1.00 H	0	7.52	Avg
7	#7206.00	54.73	74.00	-19.27	1.00 H	0	12.36	Peak
8	#7206.00	40.14	54.00	-13.86	1.00 H	0	12.36	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	2390.00	46.12	74.00	-27.88	1.00 V	187	4.15	Peak
2	2390.00	33.52	54.00	-20.48	1.00 V	187	4.15	Avg
3	*2402.00	97.21			1.00 V	187	4.20	Peak
4	*2402.00	96.76			1.00 V	187	4.20	Avg
5	4804.00	53.80	74.00	-20.20	1.00 V	0	7.52	Peak
6	4804.00	40.65	54.00	-13.35	1.00 V	0	7.52	Avg
7	#7206.00	51.87	74.00	-22.13	1.00 V	0	12.36	Peak
8	#7206.00	41.12	54.00	-12.88	1.00 V	0	12.36	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency. 3. " # ": The radiated frequency is out of the restricted band.								

Test Mode	DH5	Channel	CH 39
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2441.00	96.11			1.00 H	95	4.36	Peak
2	*2441.00	95.73			1.00 H	95	4.36	Avg
3	4882.00	53.40	74.00	-20.60	1.00 H	0	7.69	Peak
4	4882.00	39.88	54.00	-14.12	1.00 H	0	7.69	Avg
5	7323.00	55.37	74.00	-18.63	1.00 H	0	12.49	Peak
6	7323.00	41.41	54.00	-12.59	1.00 H	0	12.49	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2441.00	96.19			1.00 V	236	4.36	Peak
2	*2441.00	95.74			1.00 V	236	4.36	Avg
3	4882.00	53.68	74.00	-20.32	1.00 V	0	7.69	Peak
4	4882.00	40.25	54.00	-13.75	1.00 V	0	7.69	Avg
5	7323.00	51.66	74.00	-22.34	1.00 V	0	12.49	Peak
6	7323.00	41.23	54.00	-12.77	1.00 V	0	12.49	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency.								

Test Mode	DH5	Channel	CH 78
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2480.00	92.28			1.00 H	140	4.52	Peak
2	*2480.00	91.19			1.00 H	140	4.52	Avg
3	2483.50	42.24	74.00	-31.76	1.00 H	140	4.54	Peak
4	2483.50	28.62	54.00	-25.38	1.00 H	140	4.54	Avg
5	4960.00	53.64	74.00	-20.36	1.00 H	0	7.84	Peak
6	4960.00	40.65	54.00	-13.35	1.00 H	0	7.84	Avg
7	7440.00	54.69	74.00	-19.31	1.00 H	0	12.62	Peak
8	7440.00	41.25	54.00	-12.75	1.00 H	0	12.62	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2480.00	96.95			1.00 V	214	4.52	Peak
2	*2480.00	96.16			1.00 V	214	4.52	Avg
3	2483.50	42.71	74.00	-31.29	1.00 V	214	4.54	Peak
4	2483.50	29.33	54.00	-24.67	1.00 V	214	4.54	Avg
5	4960.00	53.64	74.00	-20.36	1.00 V	0	7.84	Peak
6	4960.00	41.56	54.00	-12.44	1.00 V	0	7.84	Avg
7	7440.00	52.64	74.00	-21.36	1.00 V	0	12.62	Peak
8	7440.00	42.21	54.00	-11.79	1.00 V	0	12.62	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency.								

BT 8DPSK

Test Mode	3DH5	Channel	CH 0
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	2390.00	41.51	74.00	-32.49	1.00 H	130	4.15	Peak
2	2390.00	28.68	54.00	-25.32	1.00 H	130	4.15	Avg
3	*2402.00	91.52			1.00 H	130	4.20	Peak
4	*2402.00	87.34			1.00 H	130	4.20	Avg
5	4804.00	53.64	74.00	-20.36	1.00 H	0	7.52	Peak
6	4804.00	40.68	54.00	-13.32	1.00 H	0	7.52	Avg
7	#7206.00	55.64	74.00	-18.36	1.00 H	0	12.36	Peak
8	#7206.00	42.00	54.00	-12.00	1.00 H	0	12.36	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	2390.00	40.99	74.00	-33.01	1.00 V	109	4.15	Peak
2	2390.00	28.37	54.00	-25.63	1.00 V	109	4.15	Avg
3	*2402.00	97.72			1.00 V	109	4.20	Peak
4	*2402.00	93.56			1.00 V	109	4.20	Avg
5	4804.00	53.64	74.00	-20.36	1.00 V	0	7.52	Peak
6	4804.00	41.22	54.00	-12.78	1.00 V	0	7.52	Avg
7	#7206.00	51.92	74.00	-22.08	1.00 V	0	12.36	Peak
8	#7206.00	41.23	54.00	-12.77	1.00 V	0	12.36	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency. 3. " # ": The radiated frequency is out of the restricted band.								

Test Mode	3DH5	Channel	CH 39
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2441.00	91.33			1.00 H	112	4.36	Peak
2	*2441.00	87.05			1.00 H	112	4.36	Avg
3	4882.00	53.67	74.00	-20.33	1.00 H	0	7.69	Peak
4	4882.00	41.64	54.00	-12.36	1.00 H	0	7.69	Avg
5	7323.00	53.64	74.00	-20.36	1.00 H	0	12.49	Peak
6	7323.00	41.08	54.00	-12.92	1.00 H	0	12.49	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2441.00	94.73			1.00 V	169	4.36	Peak
2	*2441.00	90.26			1.00 V	169	4.36	Avg
3	4882.00	55.16	74.00	-18.84	1.00 V	0	7.69	Peak
4	4882.00	41.33	54.00	-12.67	1.00 V	0	7.69	Avg
5	7323.00	53.64	74.00	-20.36	1.00 V	0	12.49	Peak
6	7323.00	43.21	54.00	-10.79	1.00 V	0	12.49	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency.								

Test Mode	3DH5	Channel	CH 78
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2480.00	92.14			1.00 H	89	4.52	Peak
2	*2480.00	87.94			1.00 H	89	4.52	Avg
3	2483.50	41.18	74.00	-32.82	1.00 H	89	4.54	Peak
4	2483.50	28.51	54.00	-25.49	1.00 H	89	4.54	Avg
5	4960.00	50.31	74.00	-23.69	1.00 H	0	7.84	Peak
6	4960.00	37.68	54.00	-16.32	1.00 H	0	7.84	Avg
7	7440.00	53.37	74.00	-20.63	1.00 H	0	12.62	Peak
8	7440.00	39.52	54.00	-14.48	1.00 H	0	12.62	Avg
ANTENNA POLARITY & TEST DISTANCE: Vertical AT 3m								
NO.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB/m)	Remark
1	*2480.00	93.47			1.00 V	191	4.52	Peak
2	*2480.00	89.26			1.00 V	191	4.52	Avg
3	2483.50	42.48	74.00	-31.52	1.00 V	191	4.54	Peak
4	2483.50	29.07	54.00	-24.93	1.00 V	191	4.54	Avg
5	4960.00	52.13	74.00	-21.87	1.00 V	0	7.84	Peak
6	4960.00	39.47	54.00	-14.53	1.00 V	0	7.84	Avg
7	7440.00	50.36	74.00	-23.64	1.00 V	0	12.62	Peak
8	7440.00	38.45	54.00	-15.55	1.00 V	0	12.62	Avg
Remark: 1. The emission levels of other frequencies were greater than 20dB margin. 2. " * ": Fundamental frequency.								

3.3 NUMBER OF HOPPING FREQUENCY USED

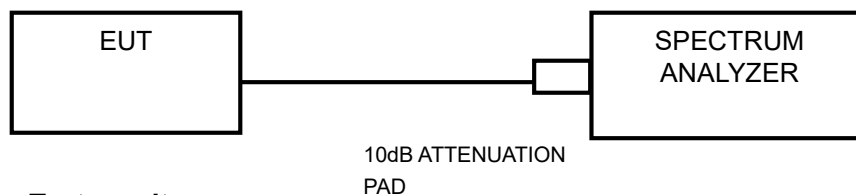
3.3.1 Limits

At least 15 channels frequencies, and should be equally spaced.

3.3.2 Measurement procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were completed.

3.3.3 Test setup

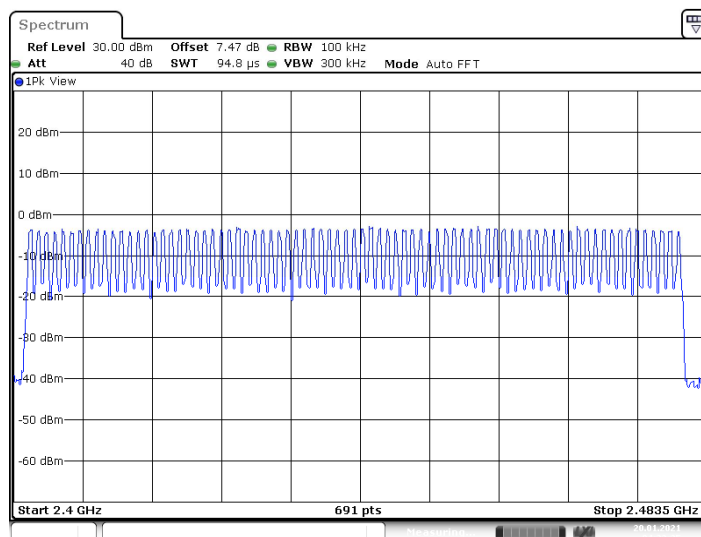


3.3.4 Test result

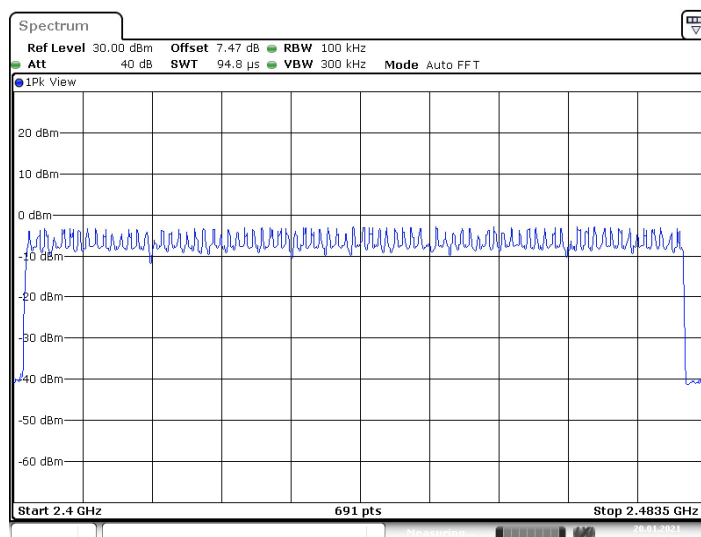
There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



Mode	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Hop	79	≥ 15	PASS



Mode	Channel	Result[Num]	Limit[Num]	Verdict
3DH5	Hop	79	≥ 15	PASS



3.4 DWELL TIME ON EACH CHANNEL

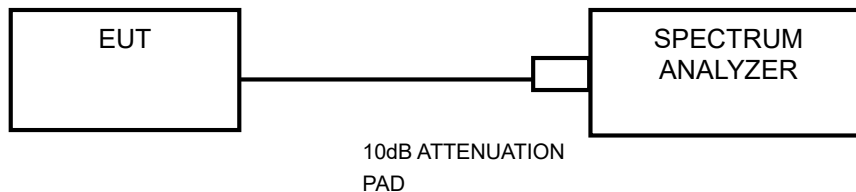
3.4.1 Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.4.2 Measurement procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

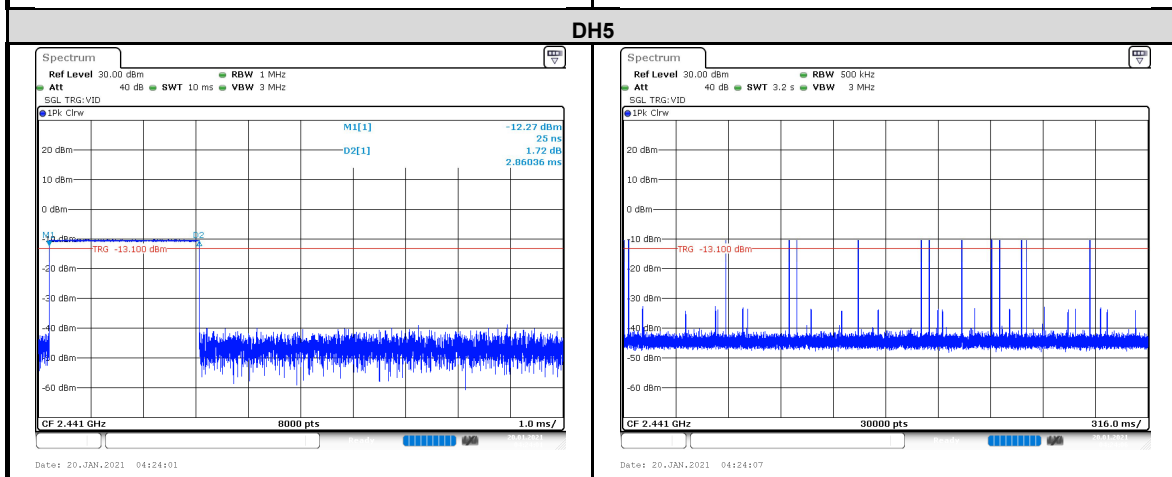
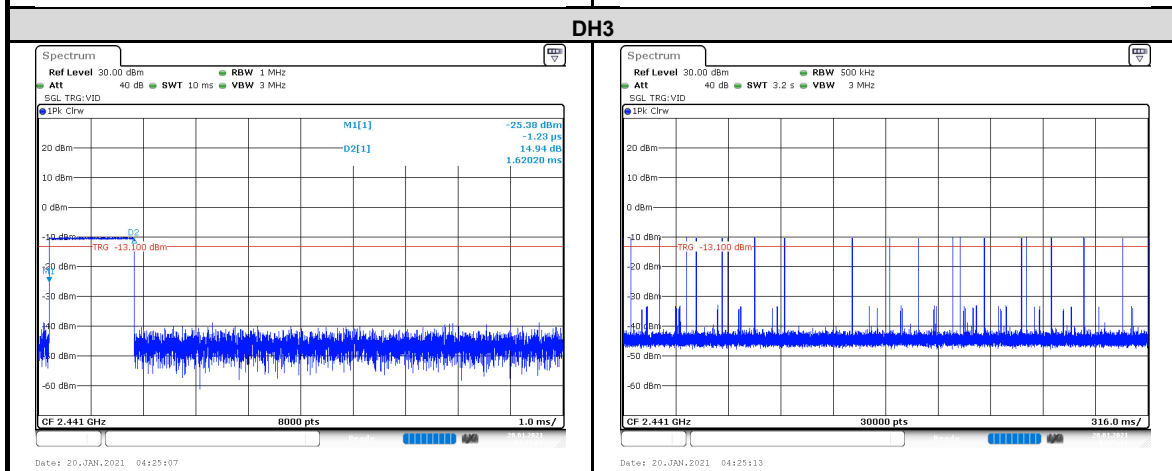
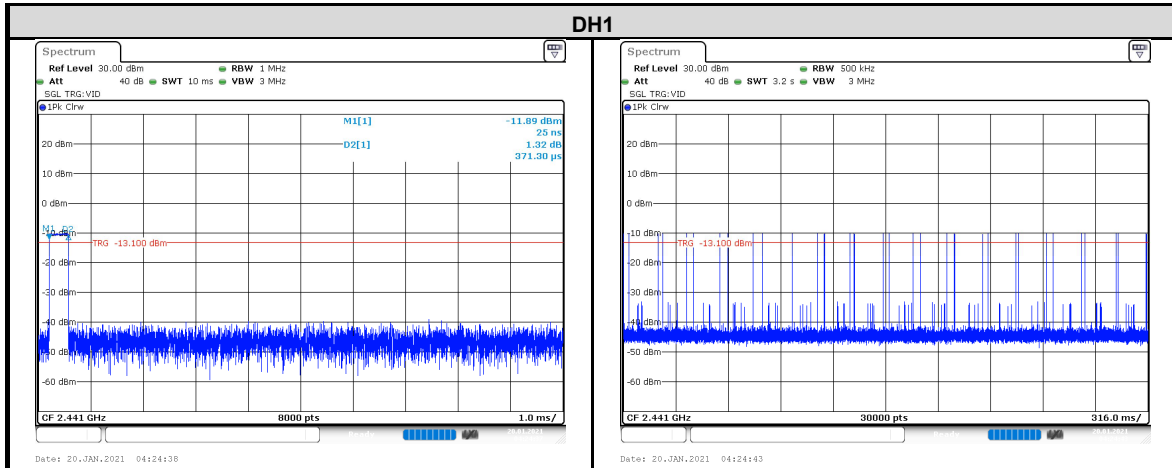
3.4.3 Test setup



3.4.4 Test result

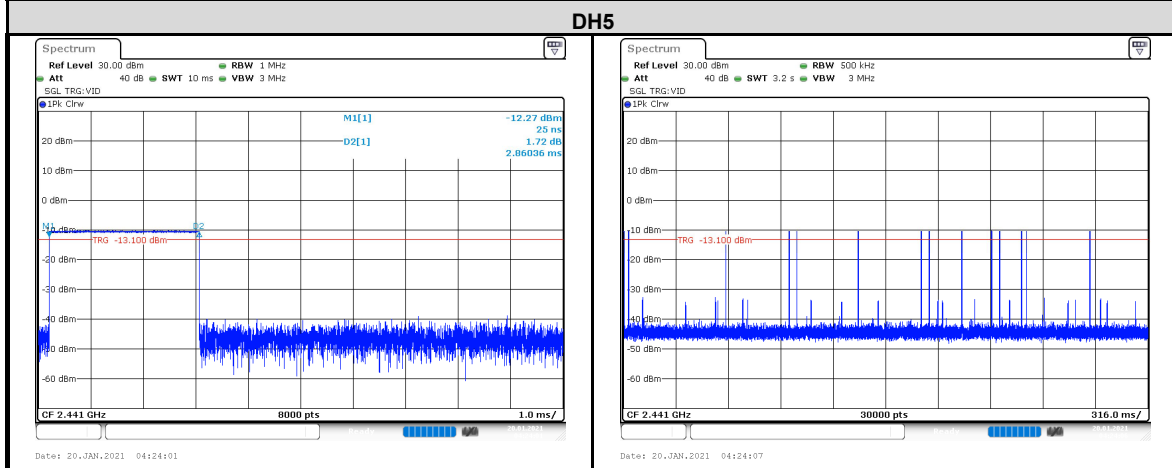
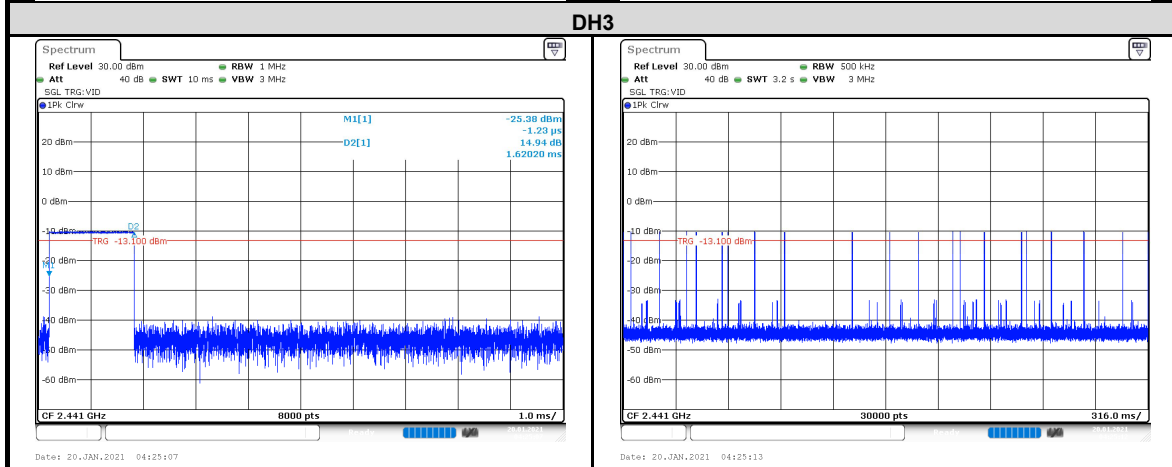
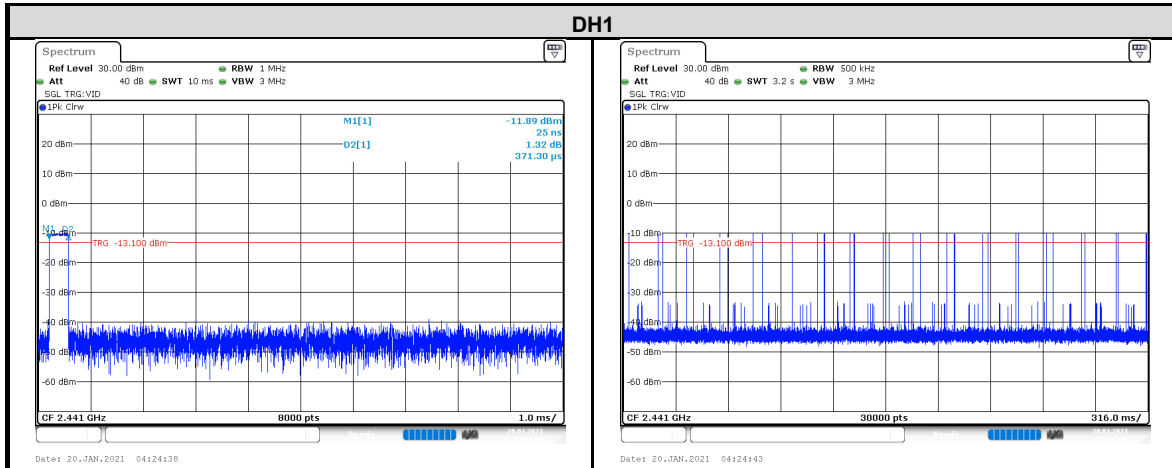


Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)	Length of transmission time (msec)	Result (msec)	Limit (msec)	Verdict
DH1	79	$79 \times 0.4 \div 3.16 \times 33 = 330$	0.37	0.123	≤ 0.4	PASS
DH3	79	$79 \times 0.4 \div 3.16 \times 20 = 200$	1.62	0.324	≤ 0.4	PASS
DH5	79	$79 \times 0.4 \div 3.16 \times 14 = 140$	2.86	0.400	≤ 0.4	PASS





Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)	Length of transmission time (msec)	Result (msec)	Limit (msec)	Verdict
3DH1	79	$79 \times 0.4 \div 3.16 \times 32 = 320$	0.38	0.122	≤ 0.4	PASS
3DH3	79	$79 \times 0.4 \div 3.16 \times 17 = 170$	1.63	0.276	≤ 0.4	PASS
3DH5	79	$79 \times 0.4 \div 3.16 \times 13 = 130$	2.87	0.373	≤ 0.4	PASS



3.5 CHANNEL BANDWIDTH

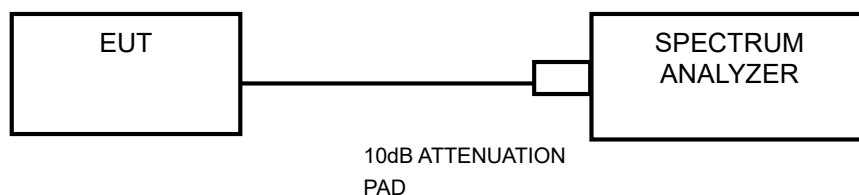
3.5.1 Limits

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

3.5.2 Measurement procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

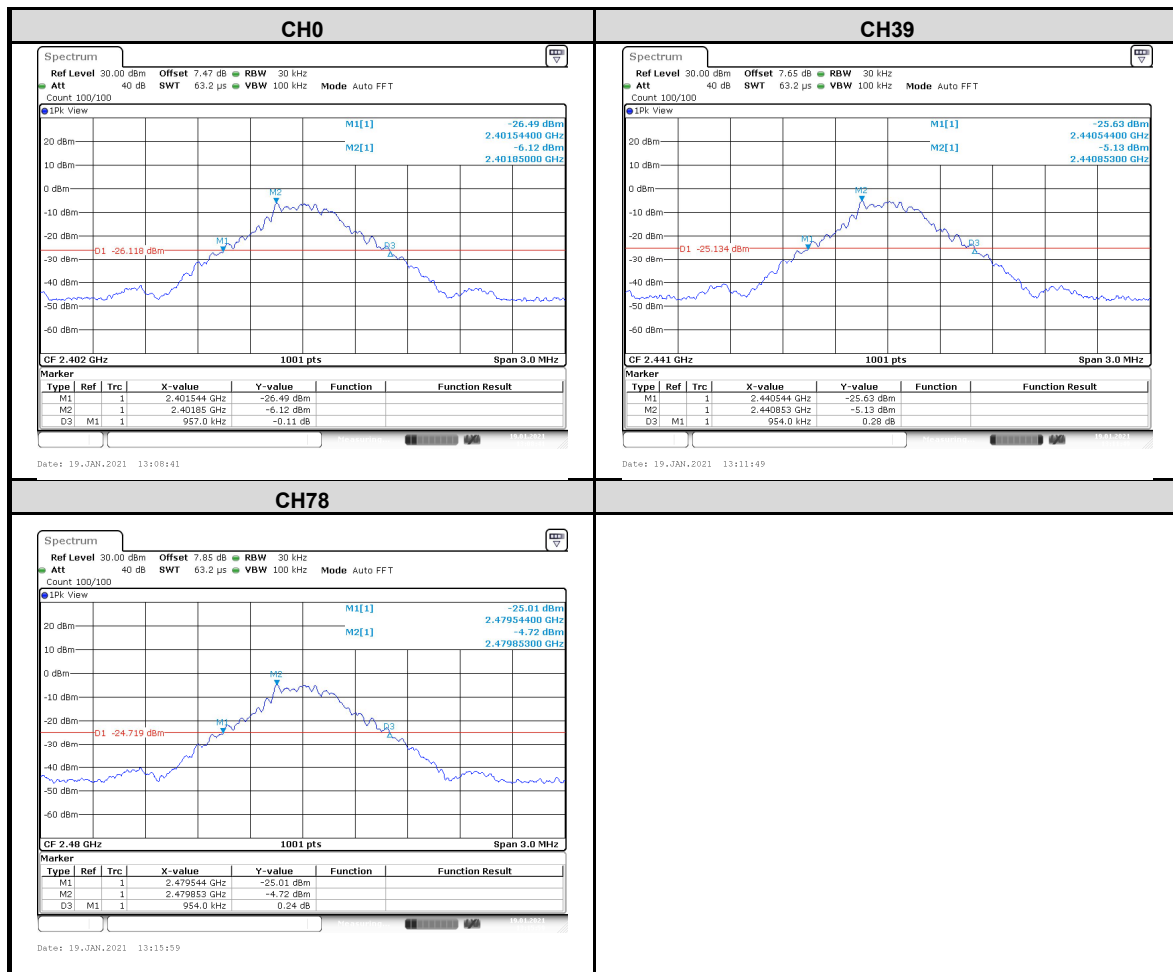
3.5.3 Test setup



3.5.4 Test result

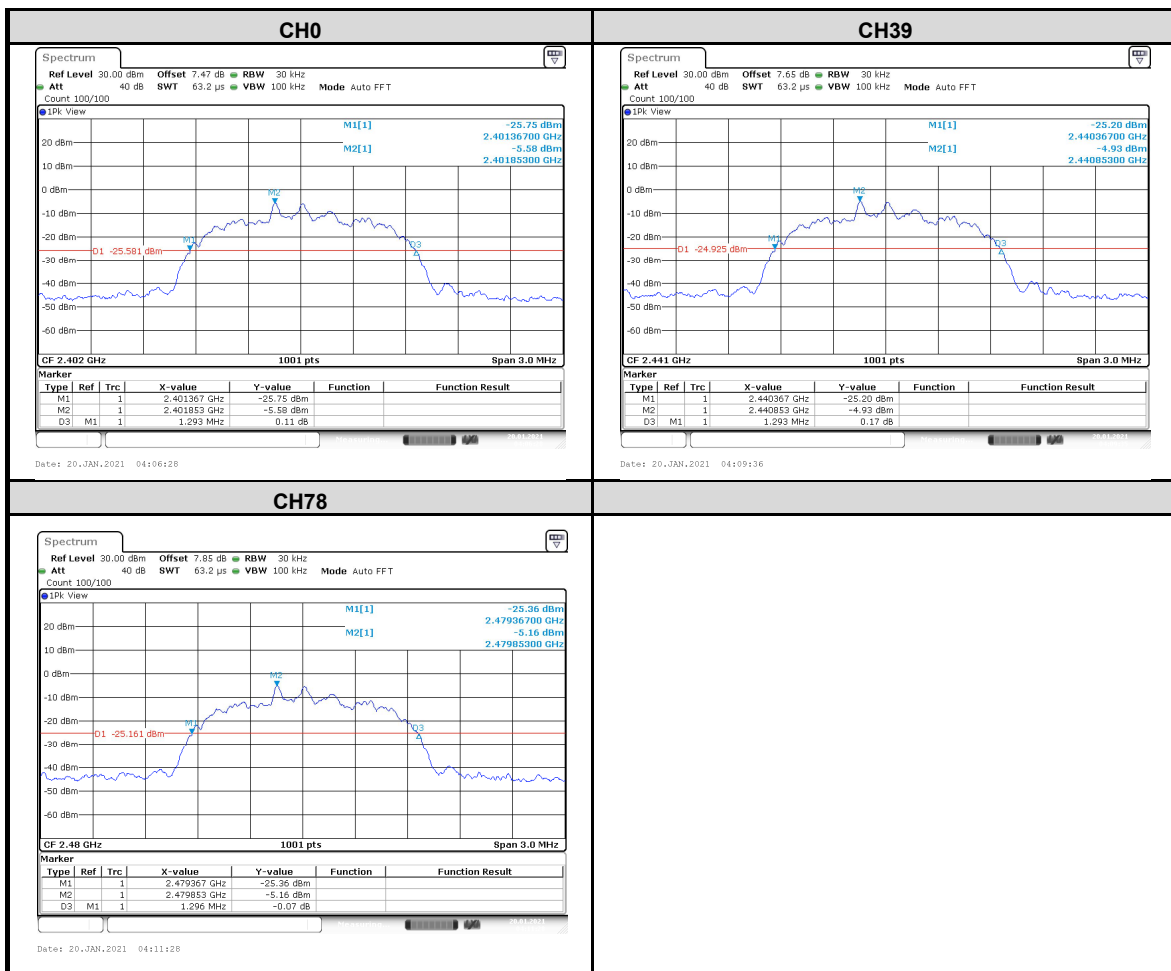


Mode	Channel	Channel Frequency (MHz)	20dB Bandwidth(MHz)
DH5	0	2402	0.957
	39	2441	0.954
	78	2480	0.954





Mode	Channel	Channel Frequency (MHz)	20dB Bandwidth(MHz)
3DH5	0	2402	1.293
	39	2441	1.293
	78	2480	1.296



3.6 HOPPING CHANNEL SEPARATION

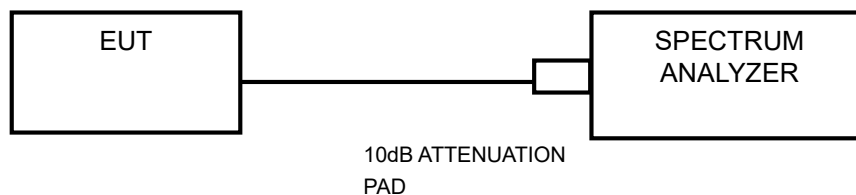
3.6.1 Limits

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

3.6.2 Measurement procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- By using the MaxHold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

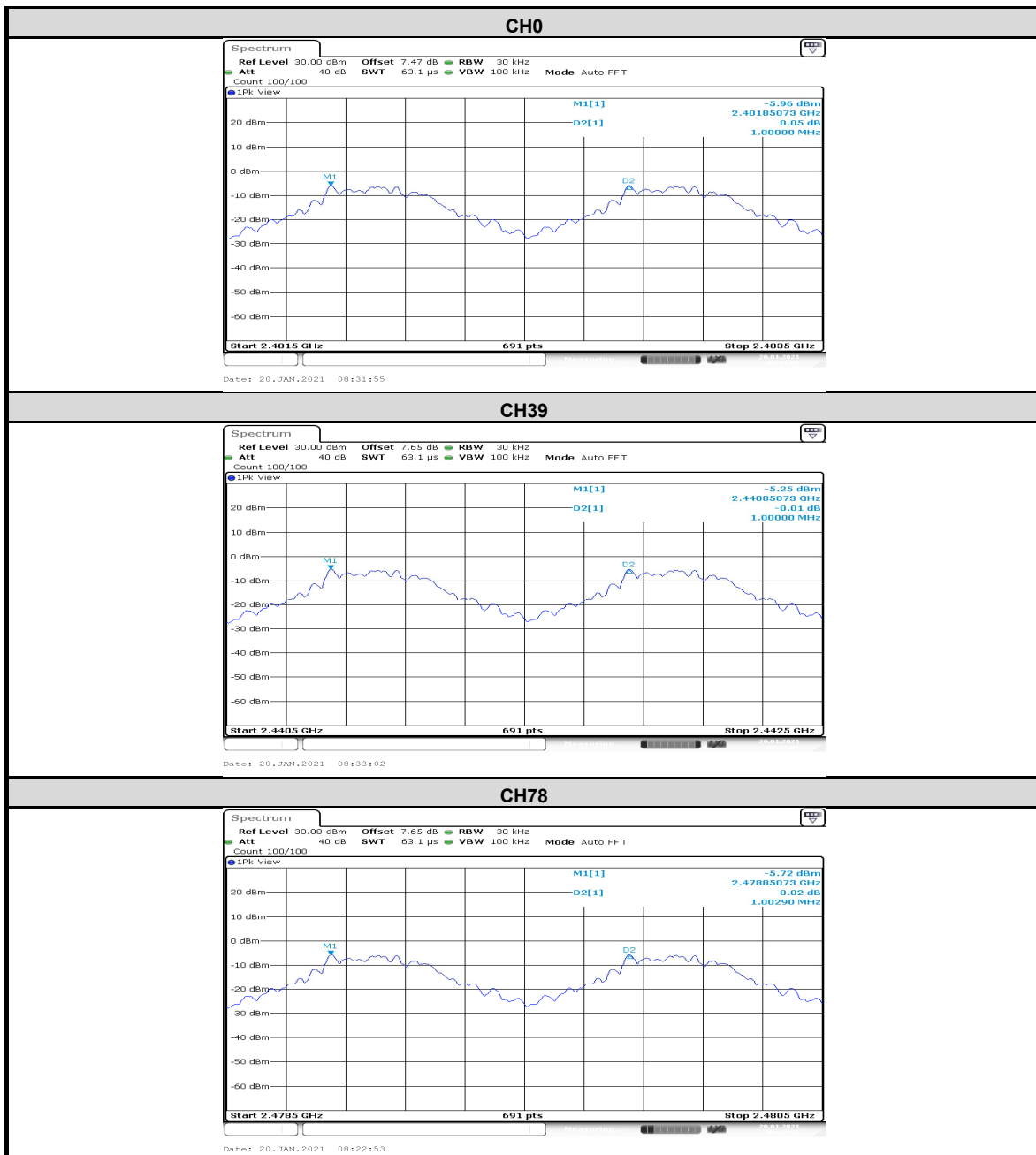
3.6.3 Test setup



3.6.4 Test result

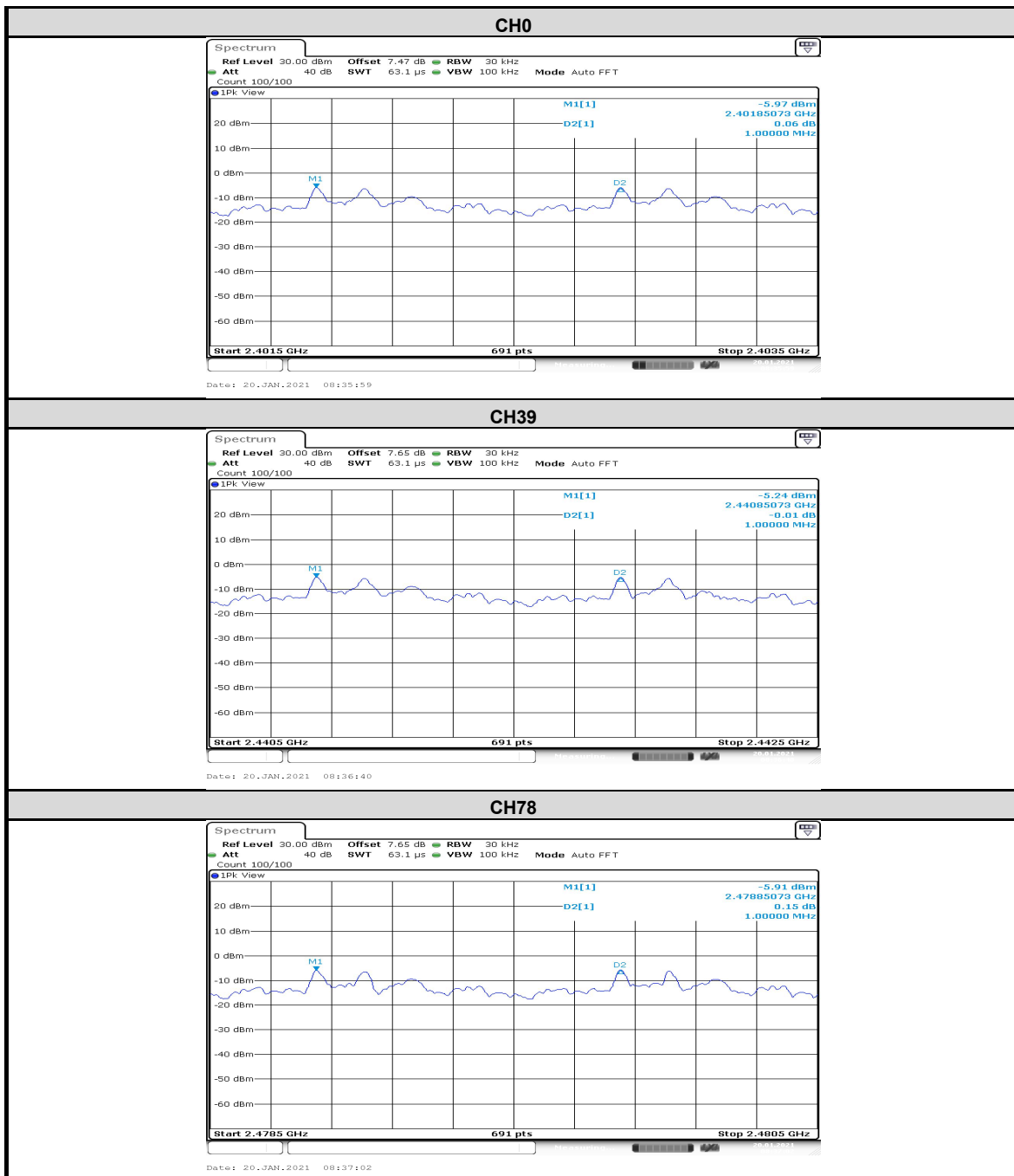


Mode	Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit 2/3 20dB Bandwidth (MHz)	Verdict
DH5	0	2402	1.00	0.638	PASS
	39	2441	1.00	0.636	PASS
	78	2480	1.00	0.636	PASS





Mode	Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit 2/3 20dB Bandwidth (MHz)	Verdict
3DH5	0	2402	1.00	0.862	PASS
	39	2441	1.00	0.862	PASS
	78	2480	1.00	0.864	PASS



3.7 CONDUCTED OUTPUT POWER

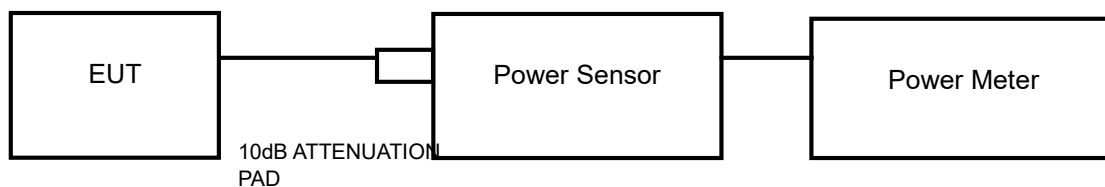
3.7.1 Limits

The Maximum Output Power Measurement is 125mW.

3.7.2 Measurement procedure

- A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor and set the detector to PEAK. Record the power level.
- An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor and set the detector to AVERAGE. Record the power level.

3.7.3 Test setup



3.7.4 Test result

MAXIMUM PEAK OUTPUT POWER

GFSK

Mode	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Peak Power Limit (mW)	Verdict
DH5	2402	-0.95	0.804	125	PASS
	2441	-0.72	0.847	125	PASS
	2480	-0.88	0.817	125	PASS

8DPSK

Mode	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Peak Power Limit (mW)	Verdict
3DH5	2402	0.04	1.009	125	PASS
	2441	0.22	1.052	125	PASS
	2480	0.13	1.030	125	PASS

Average OUTPUT POWER(FOR REFERENCE)

GFSK

Mode	Channel Frequency (MHz)	AVG Power (dBm)	AVG Power (mW)
DH5	2402	-2.42	0.573
	2441	-2.11	0.615
	2480	-2.45	0.569

8DPSK

Mode	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)
3DH5	2402	-3.72	0.425
	2441	-3.63	0.434
	2480	-3.87	0.410

3.8 OUT OF BAND EMISSION MEASUREMENT

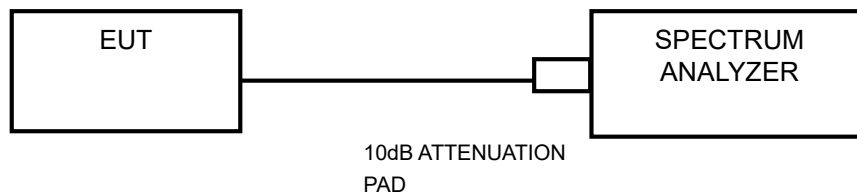
3.8.1 Limits

Below -20dB of the highest emission level of operating band (in 100KHz RBW).

3.8.2 Measurement procedure

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

3.8.3 Test setup

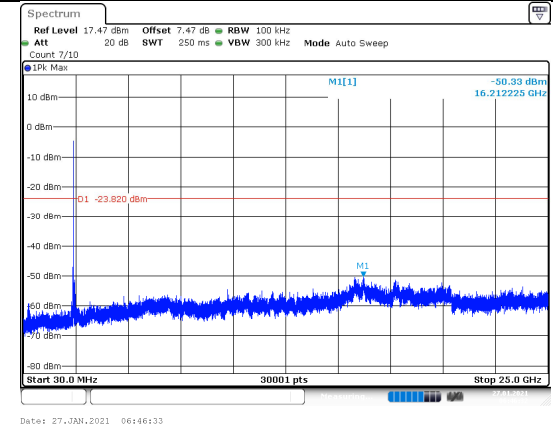
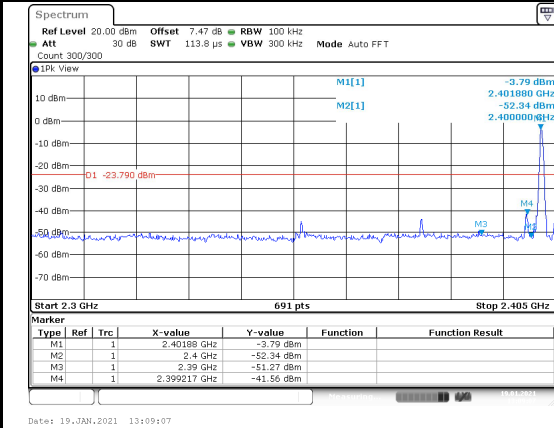


3.8.4 Test result

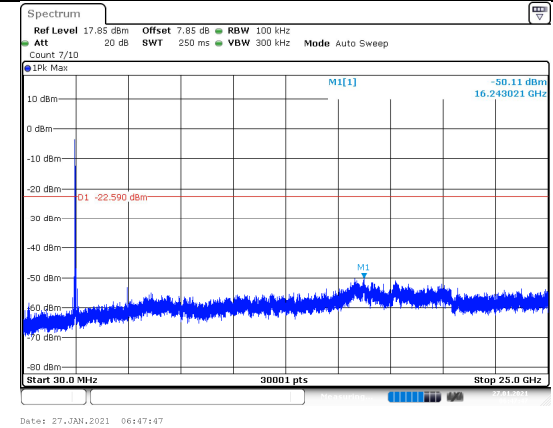
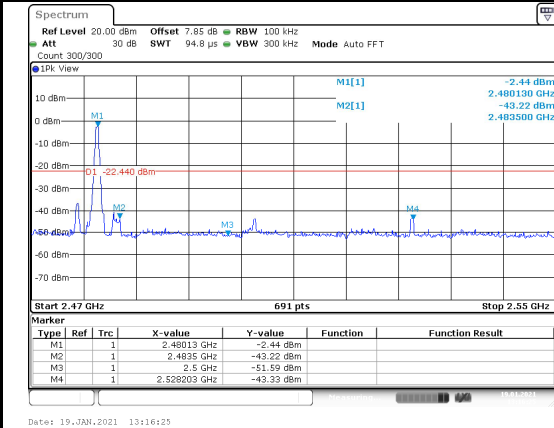
The spectrum plots are attached on the following images.

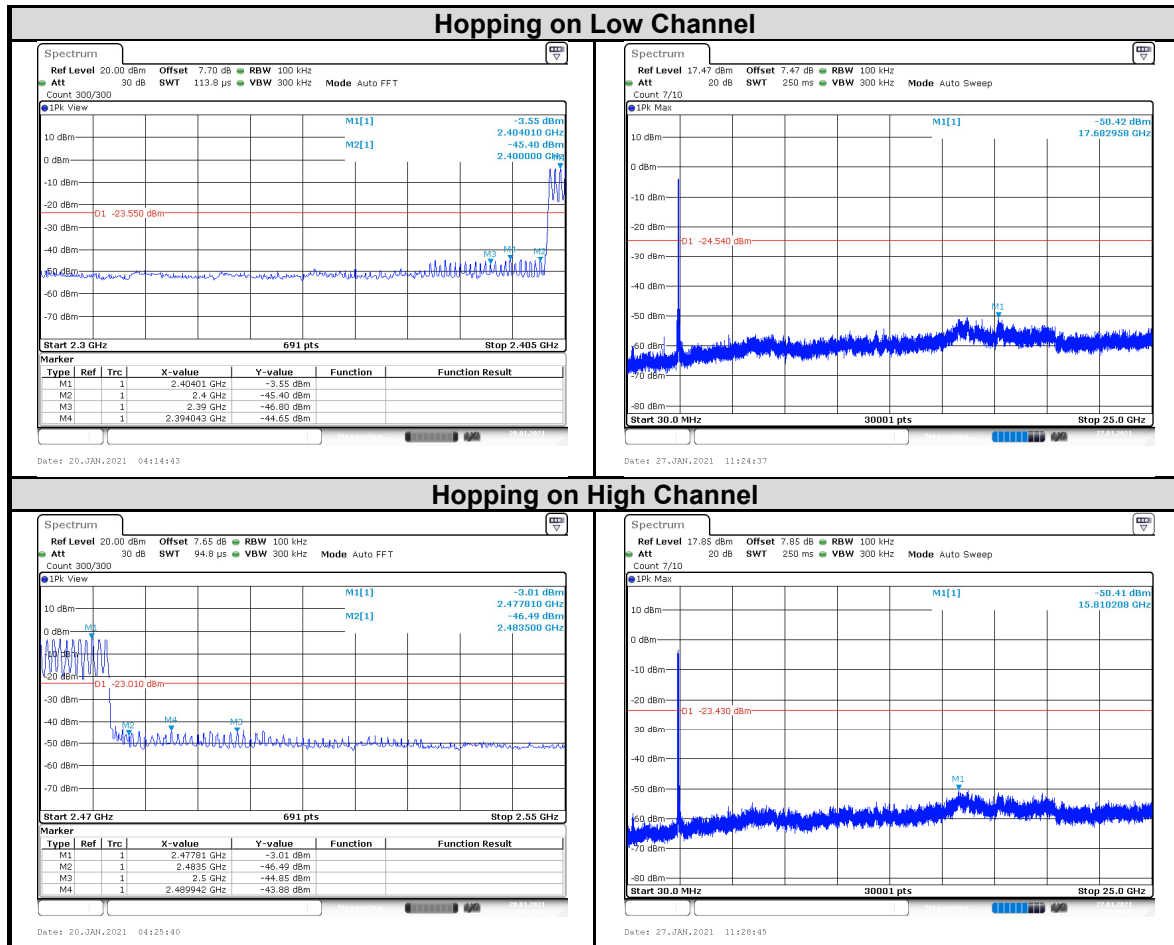
GFSK

Low Channel



High Channel

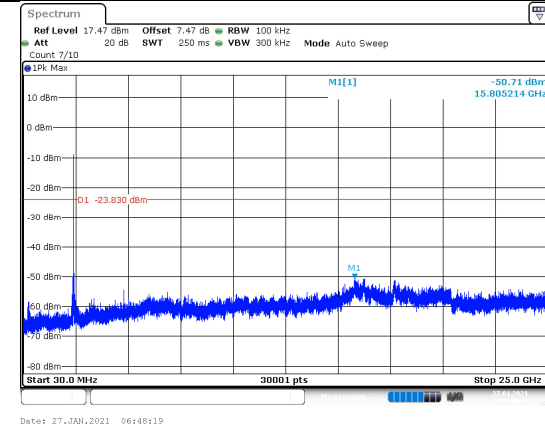
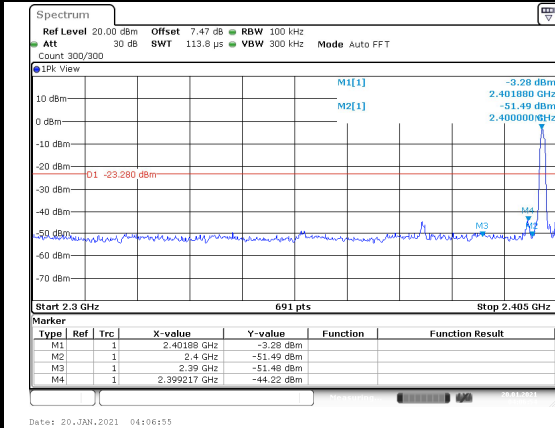




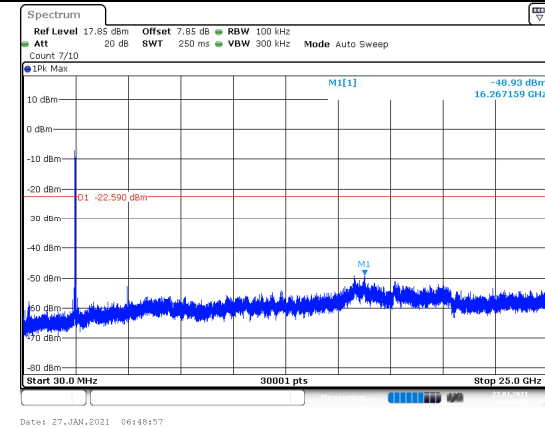
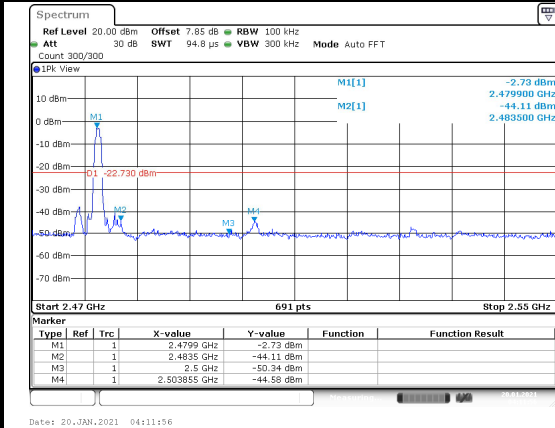


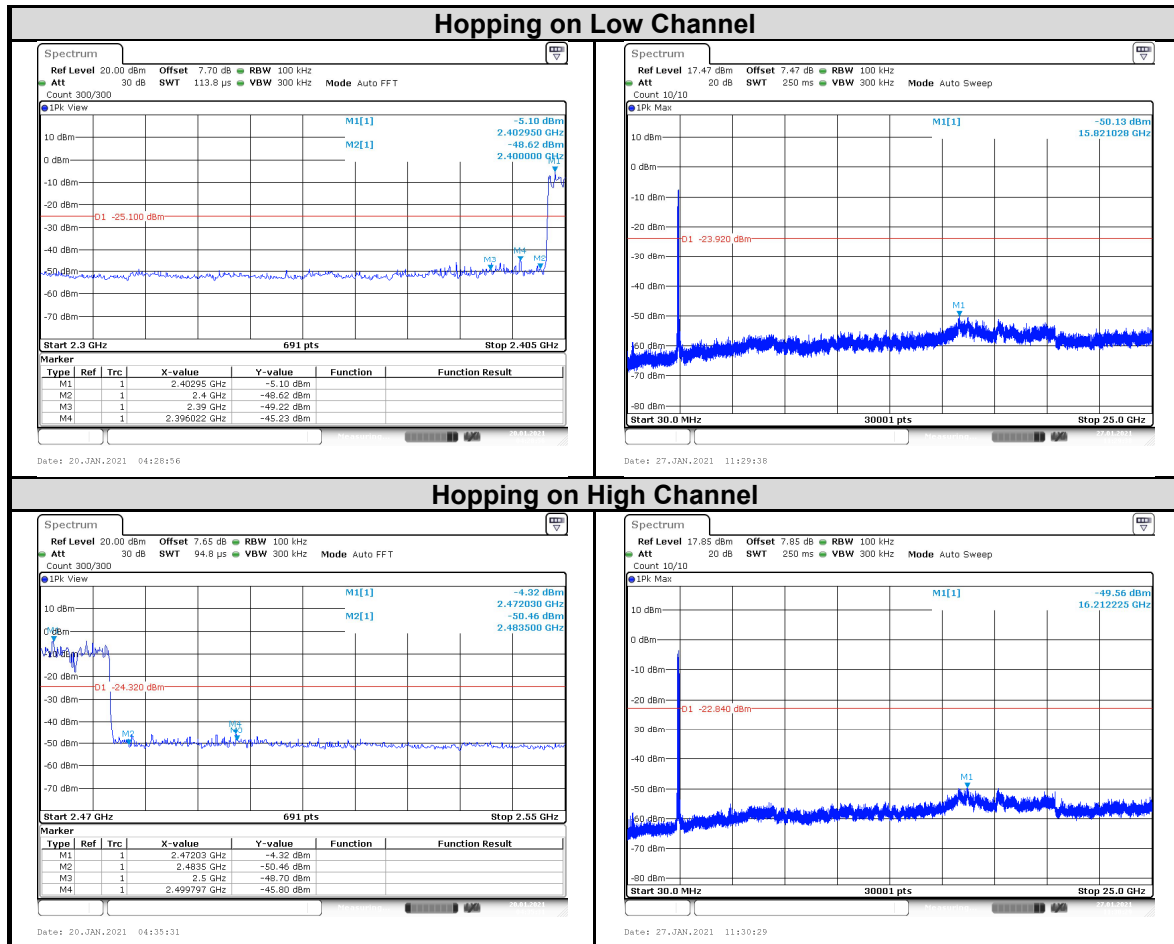
8DPSK

Low Channel



High Channel







4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Setup Photo).

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Appendix A

Conducted Emission Test					
Equipment	Manufacturer	Model No.	Serial Number	Cal. Due	Used
EMI Test Receiver	Rohde&Schwarz	ESR3	102694	2021-05-19	☒
LISN	Rohde&Schwarz	ENV216	102569	2021-05-21	☒
LISN	SCHWARZBECK	NSLK 8129	5021	2021-05-21	☐
ISN	Rohde&Schwarz	ENV 81	100401	2021-05-19	☐
ISN	Rohde&Schwarz	ENV 81 Cat6	101896	2021-05-19	☐
Plus Limiter	Rohde&Schwarz	ESH3-Z2	102824	2021-05-19	☒
Plus Limiter	AEROFLEX	37-10-34	CF3049	2021-11-08	☐
Impedance Stabilization Network	Rohde&Schwarz	MATCHING	/	2021-12-11	☐
Digital signal generator	TELEVIEW	DTV800	/	2021-05-19	☐
AudioSignalGenerator	GW	GAG-810	EK871591	2021-12-11	☐
Shielding Room(#1)	MORI	854	/	2023-05-19	☒

Radiated Emission Test					
Equipment	Manufacturer	Model No.	Serial Number	Cal. Due	Used
EMI Test Receiver	Rohde&Schwarz	ESR 26	101718	2021.5.19	☒
Loop antenna	Rohde&Schwarz	HFH2-Z2E	100951	2021.5.16	☒
Rod antenna	Rohde&Schwarz	HFH2-Z6E	101268	2021.5.24	☒
Double cone antenna	Rohde&Schwarz	HK116E	10359	2021.5.24	☒
Log periodic antenna	Rohde&Schwarz	HL223	100936	2021.5.24	☒
antenna(30MHz~1000MHz)	SCHWARZBECK	VULB 9168	1132	2021.5.16	☒
Horn antenna(1GHz-6GHz)	SCHWARZBECK	BBHA 9120E	947	2023.5.19	☒
Horn antenna(1GHz-18GHz)	ETS	3117	227634	2022.1.14	☒
Horn antenna(18GHz-40GHz)	SCHWARZBECK	BBHA 9170	1003	2021.5.16	☒
10m anechoic chamber	Albatross	P25904	P25904	2024.06.30	☒
LISN (single-phase)	Rohde&Schwarz	ESH3-Z6	102152/102156	2021.5.21	☒
Preamplifier	Rohde&Schwarz	SCU-01F	100298	2021.5.19	☒
Preamplifier	Rohde&Schwarz	SCU-18F	100799	2021.5.19	☒

Antenna Port Conducted Test					
Equipment	Manufacturer	Model No.	Serial Number	Cal. Due	Used
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 40	101898	2021.5.19	☒
Wideband radio communication tester	Rohde&Schwarz	CMW 500	168778	2021.5.19	☐
Automatic control unit(RSE)	Rohde&Schwarz	OSP220	101742	2021.5.19	☐
Filter group(RSE-BT/WiFi)	Rohde&Schwarz	WiFi /BT Variant 1	100820	2021.5.19	☒
Filter group(RSE-Cellular)	Rohde&Schwarz	Cellular Variant 1	100768	2021.5.19	☒
Signal&Spectrum Analyzer	Rohde&Schwarz	FSVA 3044	101013	2021.5.19	☒
signal Generator(100kHz~40GHz)	Rohde&Schwarz	SMB 100A	CS0300015	2021.05.19	☐
signal Generator(100kHz~12.75GHz)	Rohde&Schwarz	SMB 100A	CS0300016	2021.5.19	☐

Important

- (1) The test report is valid with the official seal of the laboratory and the signatures of Test engineer, Author and Reviewer simultaneously.
- (2) The test report is invalid if altered.
- (3) Any photocopies or part photocopies in the test report are forbidden without the written permission from the laboratory.
- (4) Objections to the test report must be submitted to the laboratory within 15 days.
- (5) Generally, commission test is responsible for the tested samples only.

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