

TEST REPORT

Applicant	ARKON ELECTRONICS(HUIZHOU)CO., LIMITED
Address	No.4 Taihao Road, High-tech Industrial Park, Sandong Town, Huicheng District, Huizhou, Guangdong, China

Manufacturer or Supplier	ARKON ELECTRONICS(HUIZHOU)CO., LIMITED
Address	No.4 Taihao Road, High-tech Industrial Park, Sandong Town, Huicheng District, Huizhou, Guangdong, China
Product	Bluetooth Headphone
Brand Name	ARKON, ARTISTE
Model	BH682F
Additional Model & Model Difference	B20, CKs1913, CMG1, BH782F, BH882F, B21;(See 3.1 section)
Date of tests	Aug. 02, 2019 ~ Aug. 27, 2019

the tests have been carried out according to the requirements of the following standards:

☒ **FCC Part 15, Subpart C, Section 15.247**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Ryan Lu Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	
	Date: Sep. 18, 2019

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Test Report No.: RF190722N071

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF190722N071	Original release	Sep. 18, 2019

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Powered by battery
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)	Maximum Peak 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 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:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.66 dB
Radiated emissions	9KHz ~ 30MHz	2.90dB
	30MHz ~ 1GMHz	3.47 dB
	1GHz ~ 18GHz	4.84 dB
	18GHz ~ 40GHz	4.62 dB

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

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Bluetooth Headphone
BRAND NAME	ARKON, ARTISTE
MODEL NO.	BH682F
ADDITIONAL MODELS	B20, CKs1913, CMG1, BH782F, BH882F, B21
FCC ID	2APBSBH682F-001R
POWER SUPPLY	DC 3.7V by battery(Charging from USB)
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, $\pi/4$ DQPSK, 8DPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
PEAK OUTPUT POWER	1.698mW (Max. Measured)
ANTENNA TYPE	PCB Antenna, 0dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	USB Line: Unshielded, Detachable 0.6m no core

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 190722N071) for detailed product photo.
4. All of the models: BH682F, B20, CKs1913, CMG1, BH782F, BH882F, B21 models are identical in circuitry and construction; just different of their appearance color and Paired Name.
5. When the EUT in charging mode that RF function can't working.

3.2 DESCRIPTION OF TEST MODES

79 channels are provided to this EUT:

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		

3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph of the test configuration for reference.

3.2.2. 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 X axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
A	√	√	-	√	Powered By Fully Battery with BT link

Where **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission

RE≥1G: Radiated Emission above 1GHz
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

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 3.7V from Battery	Tank
RE≥1G	25deg. C, 55%RH	DC 3.7V from Battery	Tank
PLC	-	-	-
APCM	25deg. C, 60%RH	DC 3.7V from Battery	Tank

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, 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.

3.4 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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Notebook	Lenovo	E430	010934269	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Line: Unshielded, Detachable 1.5m, DC Line: Unshielded, Detachable 1.0m

4 TEST TYPES AND RESULTS

4.1. RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

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

4.1.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Broadband antenna Schwarzbeck	VULB 9168	00937	2018-11-18	2019-11-17
3m Semi-anechoic Chamber MAORUI	9m*6m*6m	NSEMC003	2018-10-20	2019-10-19
Signal Amplifier Com-power	PAM-103	18020051	2018-11-29	2019-11-28
Attenuator Rohde&Schwarz	TS2GA-6dB	18101101	N/A	N/A
Test software FARAD	FARAD	EZ_EMCV1.1.4.2	N/A	N/A
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	2018-10-17	2019-10-16
Loop Antenna	HLA 6121	45745	2018-10-19	2019-10-18
Preamplifier EMCI	EMC001340	980201	2017-10-22	2019-10-21
Digital Multimeter FLUKE	15B+	43512617WS	2018-11-10	2019-11-09
Horn Antenna Schwarzbeck	BBHA 9170	01959	2018-11-18	2019-11-17
Spectrum Analyzer Rohde&Schwarz	FSV-40N	101783	2018-12-11	2019-12-10
Broadband Coaxial Preamplifier Schwarzbeck	BBV 9718	00025	2018-10-29	2019-10-28
Horn Antenna Schwarzbeck	BBHA 9170	BBHA9170242	2018-5-5	2019-5-4
Pre-Amplifier EMCI	EMC 184045	980102	2018-11-20	2019-11-19
Spectrum Keysight	N9020A	MY51240612	2018-10-29	2019-10-28
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower&Turn Table Controller MF	MF-7802	NA	NA	NA

- Note** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Chamber 1
3. The test was witness in Hwa-Hsing (Dongguan) Testing Co., Ltd.

4.1.3 TEST PROCEDURES

- a. 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.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. 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:

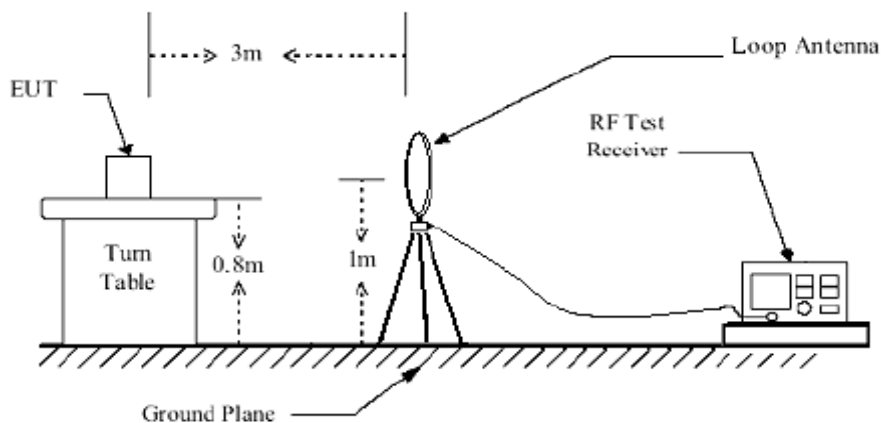
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution 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.

4.1.4 DEVIATION FROM TEST STANDARD

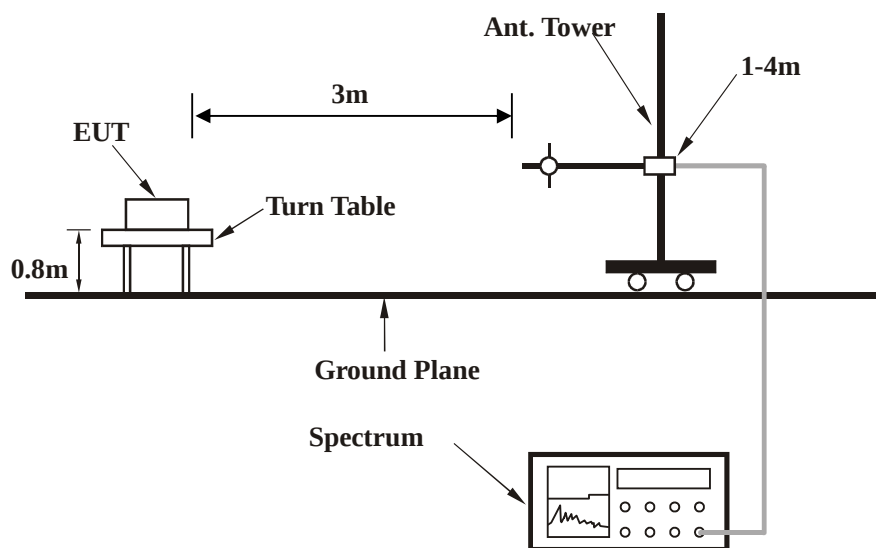
No deviation.

4.1.5 TEST SETUP

Below 30MHz test setup

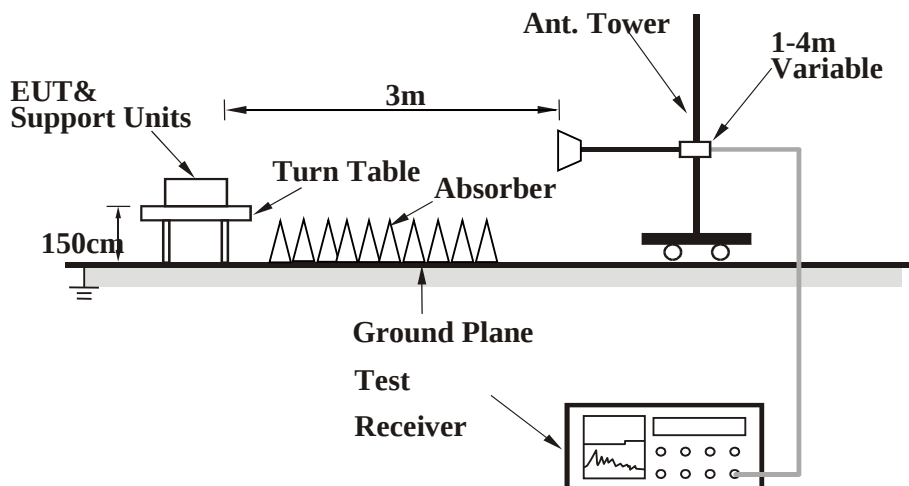


Below 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

Above 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.

4.1.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA:

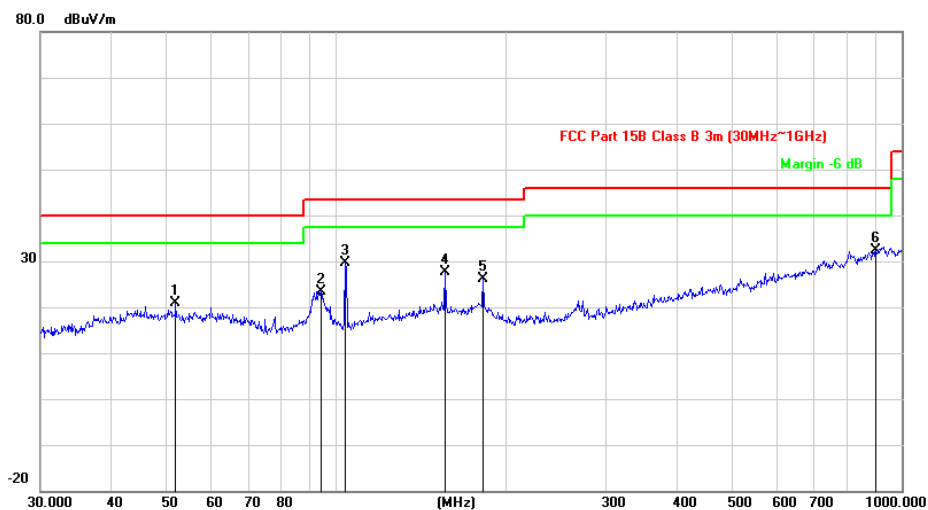
GFSK DH5

CHANNEL	Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTIO N FACTOR (dB/m)
1	52.0251	20.79	40.00	-19.21	200	360	35.06	-14.27
2	94.0979	23.50	43.50	-20.00	186	303	42.88	-19.38
3	103.8055	29.69	43.50	-13.81	195	278	47.19	-17.50
4	155.9101	27.74	43.50	-15.76	204	231	40.42	-12.68
5	181.9202	26.06	43.50	-17.44	173	265	40.71	-14.65
6	900.1474	32.27	46.00	-13.73	200	284	31.16	1.11

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

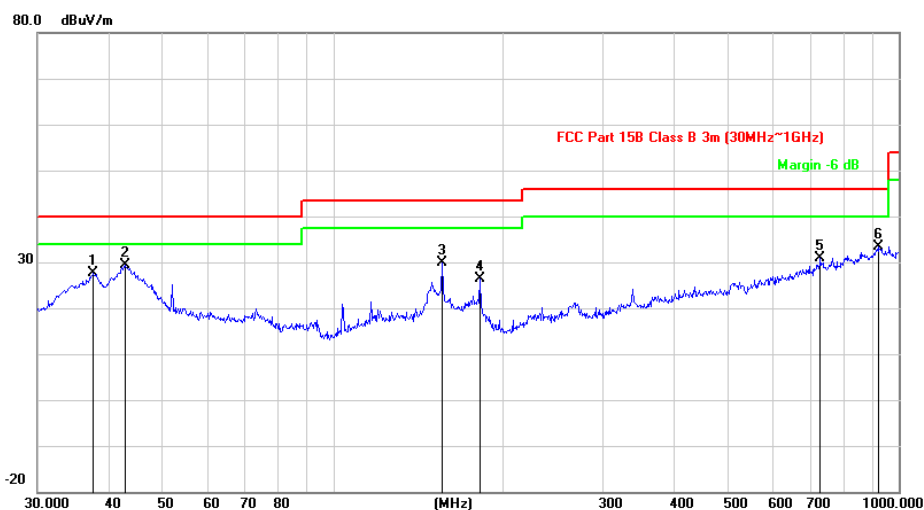


CHANNEL	Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTIO N FACTOR (dB/m)
1	37.6798	27.64	40.00	-12.36	100	263	43.79	-16.15
2	42.8998	29.27	40.00	-10.73	100	117	44.04	-14.77
3	155.9101	29.84	43.50	-13.66	100	152	42.52	-12.68
4	181.9202	26.33	43.50	-17.17	100	184	40.98	-14.65
5	726.8052	30.90	46.00	-15.10	100	257	32.41	-1.51
6	919.2866	33.33	46.00	-12.67	100	296	31.46	1.87

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



ABOVE 1GHz DATA

BT_GFSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1	2390.000	47.85	-0.77	47.08	74.00	-26.92	peak	132	180
2	2390.000	17.75	-0.77	16.98	54.00	-37.02	AVG	132	180
3*	2402.000	101.71	-0.75	100.96			peak	132	180
4*	2402.000	71.61	-0.75	70.86			AVG	132	180
5	4804.000	61.72	5.36	67.08	74.00	-6.92	peak	102	190
6	4804.000	31.62	5.36	36.98	54.00	-17.02	AVG	102	190
7 #	7206.000	42.51	11.75	54.26	74.00	-19.74	peak	150	0
8 #	7206.000	12.41	11.75	24.16	54.00	-29.84	AVG	150	0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1	2390.000	42.88	-0.77	42.11	74.00	-31.89	peak	260	156
2	2390.000	12.78	-0.77	12.01	54.00	-41.99	AVG	260	156
3*	2402.000	93.46	-0.75	92.71			peak	260	156
4*	2402.000	63.36	-0.75	62.61			AVG	260	156
5	4804.000	57.63	5.36	62.99	74.00	-11.01	peak	119	198
6	4804.000	27.53	5.36	32.89	54.00	-21.11	AVG	119	198
7 #	7206.000	42.91	11.75	54.66	74.00	-19.34	peak	150	360
8 #	7206.000	12.69	11.75	24.44	54.00	-29.56	AVG	150	360

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2440.000	101.81	-0.64	101.17			peak	178	180
2 *	2440.000	71.71	-0.64	71.07			AVG	178	180
3	4880.000	60.60	6.24	66.84	74.00	-7.16	peak	205	148
4	4880.000	30.50	6.24	36.74	54.00	-17.26	AVG	205	148
5	7320.000	42.49	12.13	54.62	74.00	-19.38	peak	150	360
6	7320.000	12.39	12.13	24.52	54.00	-29.48	AVG	150	360
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2440.000	92.17	-0.64	91.53			peak	288	158
2 *	2440.000	62.07	-0.64	61.43			AVG	288	158
3	4880.000	58.99	6.24	65.23	74.00	-8.77	peak	184	237
4	4880.000	28.89	6.24	35.13	54.00	-18.87	AVG	184	237
5	7320.000	43.46	12.13	55.59	74.00	-18.41	peak	150	0
6	7320.000	13.36	12.13	25.49	54.00	-28.51	AVG	150	0

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2480.000	100.57	-0.52	100.05			peak	166	180
2 *	2480.000	70.47	-0.52	69.95			AVG	166	180
3	2483.500	70.52	-0.51	70.01	74.00	-3.99	peak	166	180
4	2483.500	40.42	-0.51	39.91	54.00	-14.09	AVG	166	180
5	4960.000	59.56	6.09	65.65	74.00	-8.35	peak	178	256
6	4960.000	29.57	6.09	35.66	54.00	-18.34	AVG	178	256
7	7440.000	42.86	12.53	55.39	74.00	-18.61	peak	150	360
8	7440.000	13.26	12.53	25.79	54.00	-28.21	AVG	150	360
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2480.000	93.58	-0.52	93.06			peak	100	141
2 *	2480.000	63.48	-0.52	62.96			AVG	100	141
3	2483.500	63.06	-0.51	62.55	74.00	-11.45	peak	100	141
4	2483.500	32.96	-0.51	32.45	54.00	-21.55	AVG	100	141
5	4960.000	55.66	6.09	61.75	74.00	-12.25	peak	193	177
6	4960.000	25.56	6.09	31.65	54.00	-22.35	AVG	193	177
7	7440.000	42.61	12.53	55.14	74.00	-18.86	peak	150	0
8	7440.000	12.51	12.53	25.04	54.00	-28.96	AVG	150	0

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1	2390.000	50.21	-0.77	49.44	74.00	-24.56	peak	185	180
2	2390.000	20.11	-0.77	19.34	54.00	-34.66	AVG	185	180
3 *	2402.000	103.85	-0.75	103.10			peak	185	180
4 *	2402.000	73.75	-0.75	73.00			AVG	185	180
5	4804.000	64.29	5.36	69.65	74.00	-4.35	peak	137	188
6	4804.000	34.19	5.36	39.55	54.00	-14.45	AVG	137	188
7 #	7206.000	47.29	11.75	59.04	74.00	-14.96	peak	150	263
8 #	7206.000	17.19	11.75	28.94	54.00	-25.06	AVG	150	263
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1	2390.000	44.39	-0.77	43.62	74.00	-30.38	peak	203	157
2	2390.000	14.29	-0.77	13.52	54.00	-40.48	AVG	203	157
3 *	2402.000	94.74	-0.75	93.99			peak	203	157
4 *	2402.000	64.64	-0.75	63.89			AVG	203	157
5	4804.000	58.14	5.36	63.50	74.00	-10.50	peak	105	203
6	4804.000	28.04	5.36	33.40	54.00	-20.60	AVG	105	203
7 #	7206.000	43.44	11.75	55.19	74.00	-18.81	peak	150	0
8 #	7206.000	13.34	11.75	25.09	54.00	-28.91	AVG	150	0

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2440.000	105.22	-0.64	104.58			peak	151	163
2 *	2440.000	75.12	-0.64	74.48			AVG	151	163
3	4880.000	53.87	6.24	60.11	74.00	-13.89	peak	163	184
4	4880.000	23.77	6.24	30.01	54.00	-23.99	AVG	163	184
5	7320.000	42.50	12.13	54.63	74.00	-19.37	peak	150	0
6	7320.000	12.40	12.13	24.53	54.00	-29.47	AVG	150	0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2440.000	96.66	-0.64	96.02			peak	136	220
2 *	2440.000	66.56	-0.64	65.92			AVG	136	20
3	4880.000	56.78	6.24	63.02	74.00	-10.98	peak	144	296
4	4880.000	26.68	6.24	32.92	54.00	-21.08	AVG	144	296
5	7320.000	42.55	12.13	54.68	74.00	-19.32	peak	150	360
6	7320.000	12.45	12.13	24.58	54.00	-29.42	AVG	150	360

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2480.000	104.71	-0.52	104.19			peak	172	165
2 *	2480.000	74.61	-0.52	74.09			AVG	172	165
3	2483.500	71.52	-0.51	71.01	74.00	-2.99	peak	172	165
4	2483.500	41.42	-0.51	40.91	54.00	-13.09	AVG	172	165
5	4960.000	58.74	6.09	64.83	74.00	-9.17	peak	127	263
6	4960.000	28.64	6.09	34.73	54.00	-19.27	AVG	127	263
7	7440.000	42.76	12.53	55.29	74.00	-18.71	peak	150	360
8	7440.000	12.66	12.53	25.19	54.00	-28.81	AVG	150	360
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	Det.	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)
1 *	2480.000	95.37	-0.52	94.85			peak	170	221
2 *	2480.000	65.27	-0.52	64.75			AVG	170	221
3	2483.500	65.16	-0.51	64.65	74.00	-9.35	peak	170	221
4	2483.500	35.06	-0.51	34.55	54.00	-19.45	AVG	170	221
5	4960.000	55.14	6.09	61.23	74.00	-12.77	peak	174	135
6	4960.000	25.04	6.09	31.13	54.00	-22.87	AVG	174	135
7	7440.000	41.09	12.53	53.62	74.00	-20.38	peak	174	135
8	7440.000	10.99	12.53	23.52	54.00	-30.48	AVG	174	135

REMARKS:

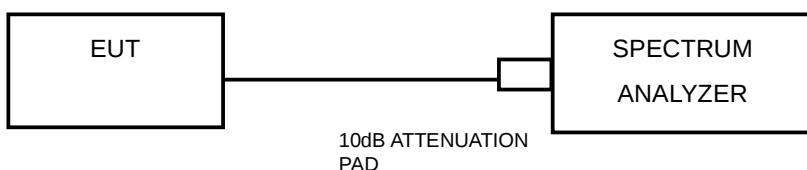
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

4.2 NUMBER OF HOPPING FREQUENCY USED

4.2.1 LIMIT OF HOPPING FREQUENCY USED

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

4.2.2 TEST SETUP



4.2.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum (10kHz~26.5GHz)	Keysight	N9020A	MY51240612	2018/10/29	2019/10/28
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2018/12/11	2019/12/10
Power Meter 10Hz~18GHz	Tonscend	JS0806-2	188060126	2018-11-10	2019-11-09
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2018-12-11	2019-12-10
Signal generator	Keysight	N5182A	GB40051020	2018/10/29	2019/10/28
Signal generator	Keysight	N5182A	MY47420944	2018/10/29	2019/10/28
Test Software	Tonscend	JS0806-2	NA	NA	NA
hygrothermograph	Yuhuaze	HTC-1	NA	2018/10/30	2019/10/29
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A	N/A
DC Source	Keysight	E3642A	MY56146098	N/A	N/A

NOTE:

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The test was witness in Hwa-Hsing (Dongguan) Testing Co., Ltd.

4.2.4 TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. 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.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were completed.

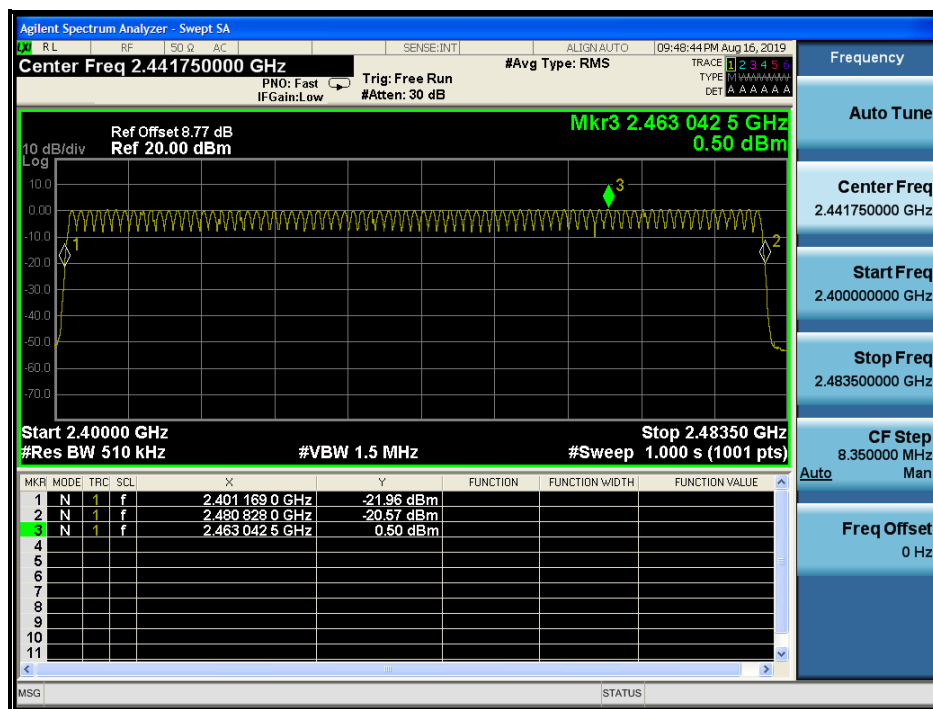
4.2.5 DEVIATION FROM TEST STANDARD

No deviation.

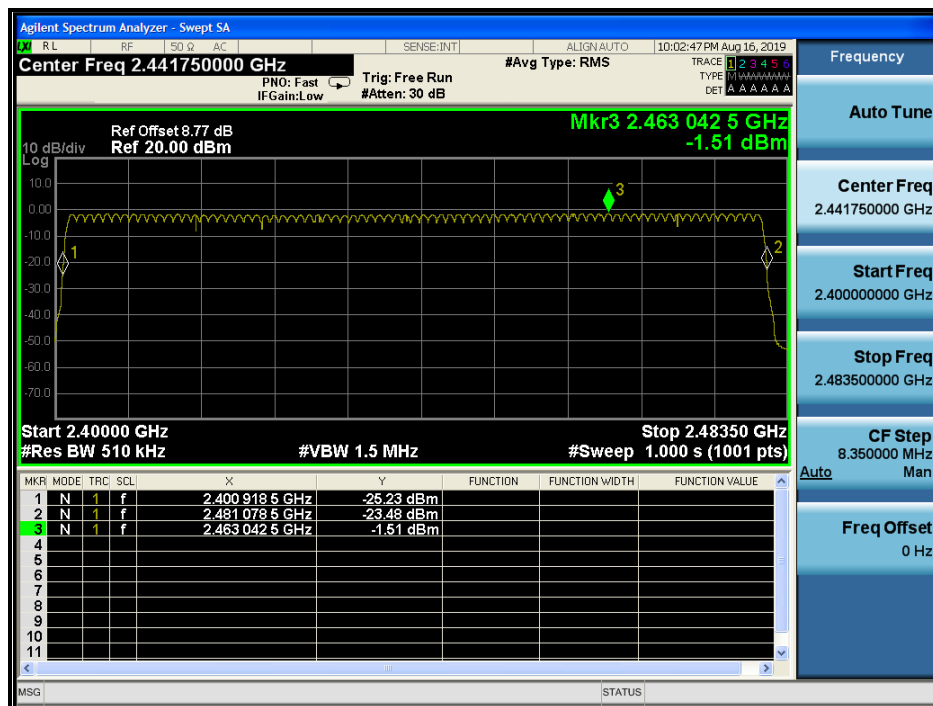
4.2.6 TEST RESULTS

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.

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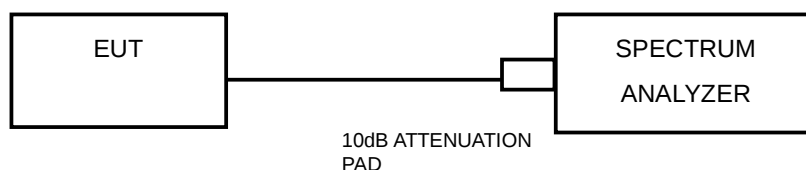


4.3 DWELL TIME ON EACH CHANNEL

4.3.1 LIMIT OF DWELL TIME USED

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.

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

4.3.4 TEST PROCEDURES

- 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.

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 TEST RESULTS

GFSK

Mode	Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	PASS / FAIL
DH1	79	31.6	380	0.371	141	400	PASS
DH3	79	31.6	170	1.653	281	400	PASS
DH5	79	31.6	130	2.923	380	400	PASS

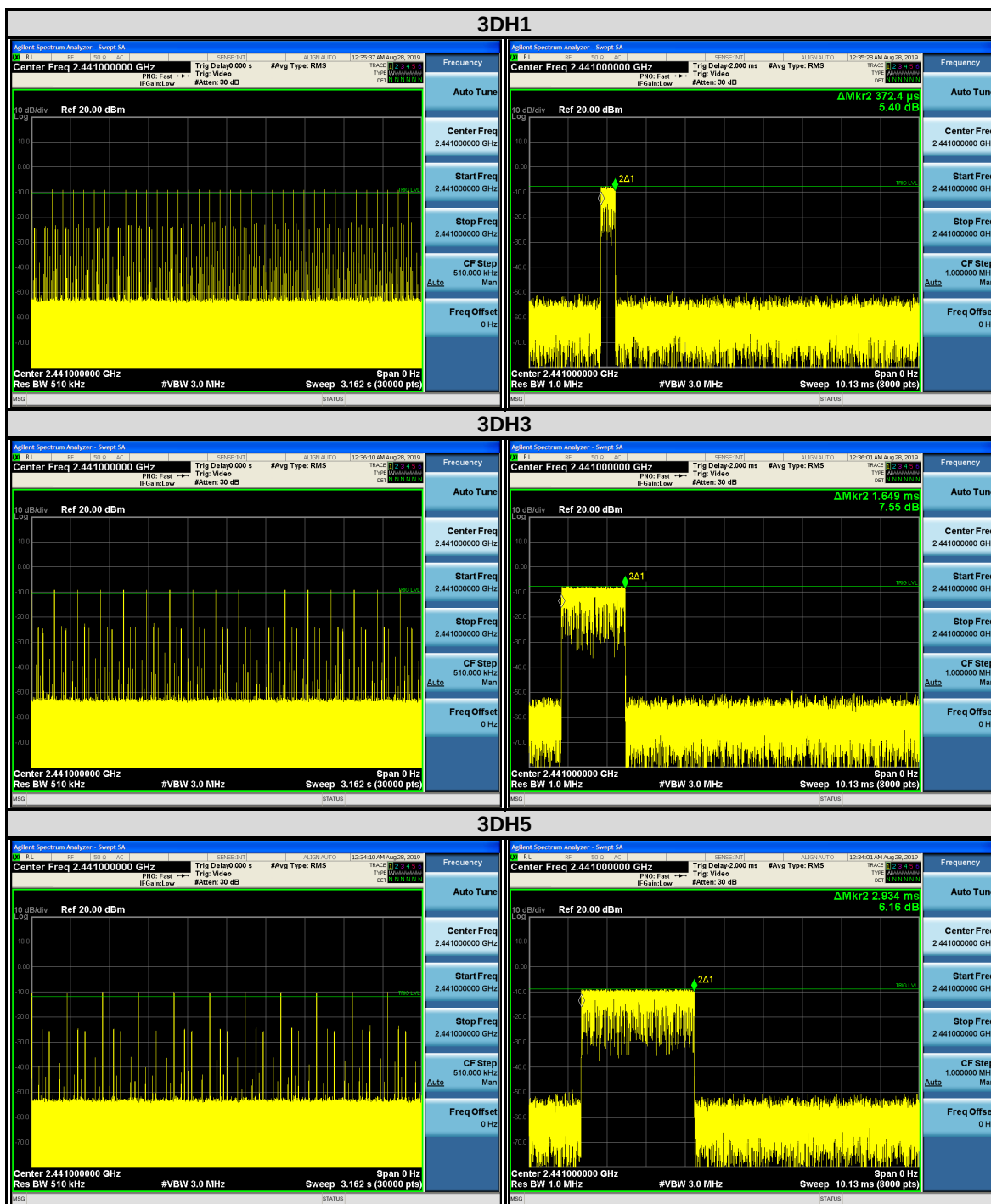
NOTE: The test plot see next page.



8DPSK

Mode	Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	PASS / FAIL
3DH1	79	31.6	400	0.372	148.80	400	PASS
3DH3	79	31.6	180	1.649	296.82	400	PASS
3DH5	79	31.6	120	2.934	352.08	400	PASS

NOTE: The test plot see next page.

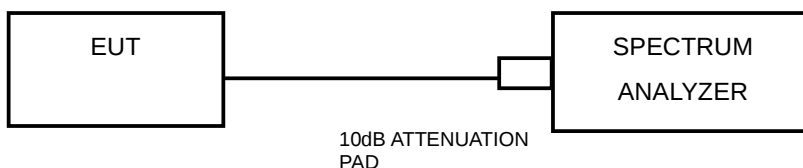


4.4 CHANNEL BANDWIDTH

4.4.1 LIMITS OF CHANNEL BANDWIDTH

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.

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

4.4.4 TEST 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.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 TEST RESULTS

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.107
39	2441	1.113
78	2480	1.083

CH 0



CH 39



CH 78



8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.407
39	2441	1.401
78	2480	1.407

CH 0



CH 39



CH 78

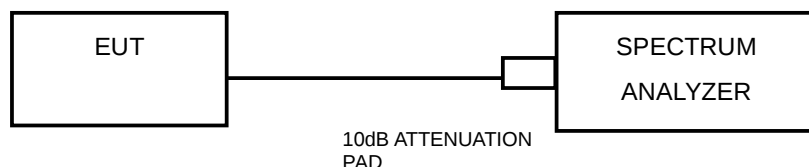


4.5 HOPPING CHANNEL SEPARATION

4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

4.5.4 TEST PROCEDURES

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

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

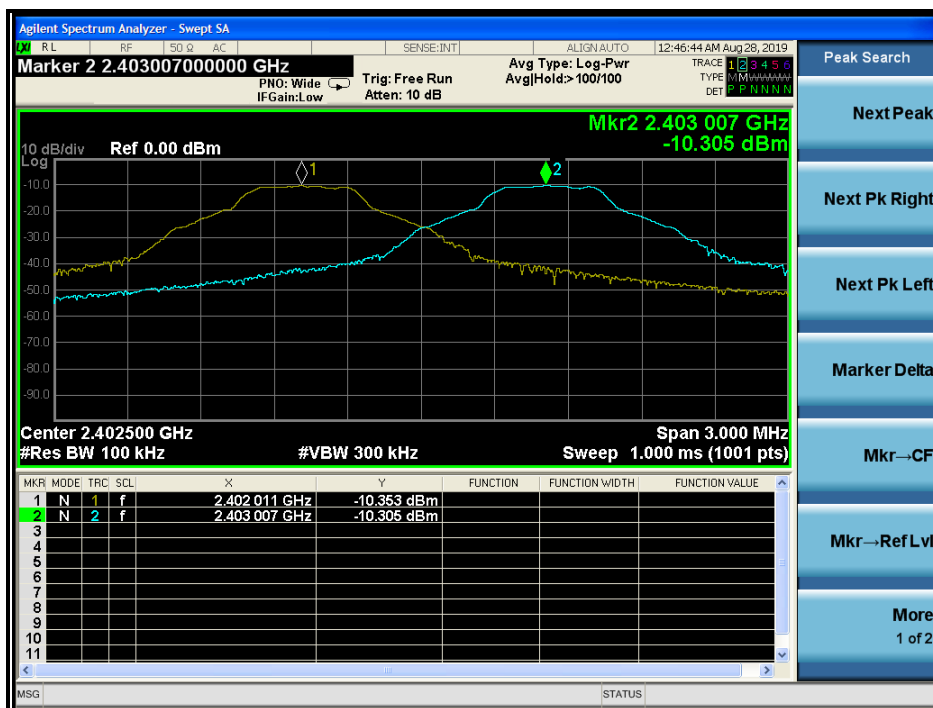
4.5.6 TEST RESULTS

GFSK

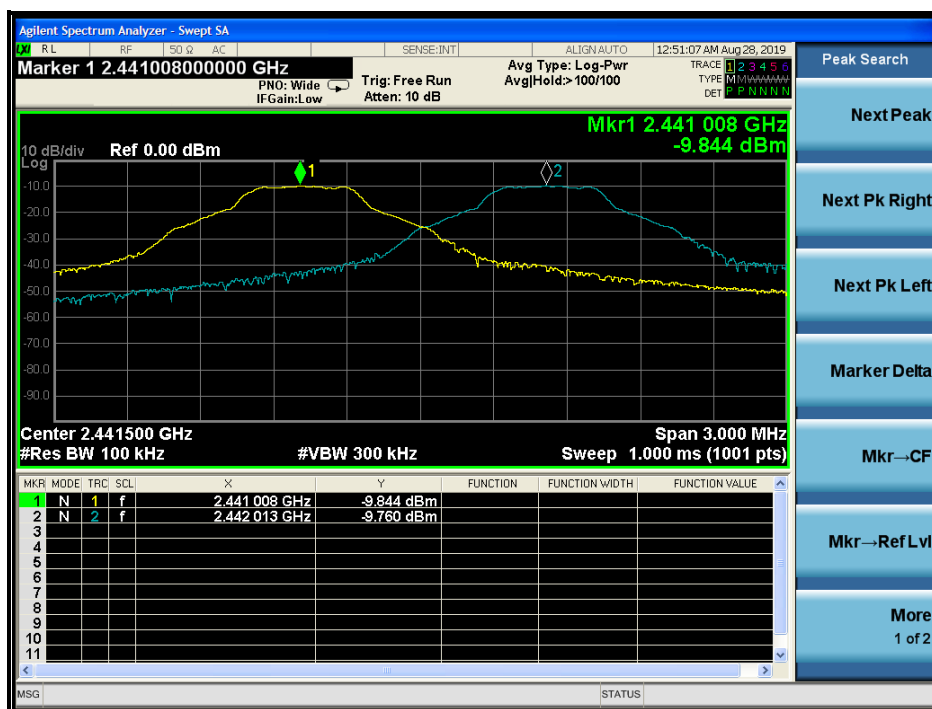
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.996	1.107	0.738	PASS
39	2441	1.005	1.113	0.742	PASS
78	2480	0.999	1.083	0.722	PASS

NOTE: The minimum limit is two-third 20dB bandwidth.

CH 0



CH 39



CH 78



8DPSK

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.002	1.407	0.938	PASS
39	2441	0.996	1.401	0.934	PASS
78	2480	0.999	1.407	0.938	PASS

NOTE: The minimum limit is two-third 20dB bandwidth.

CH 0



CH 39



CH 78

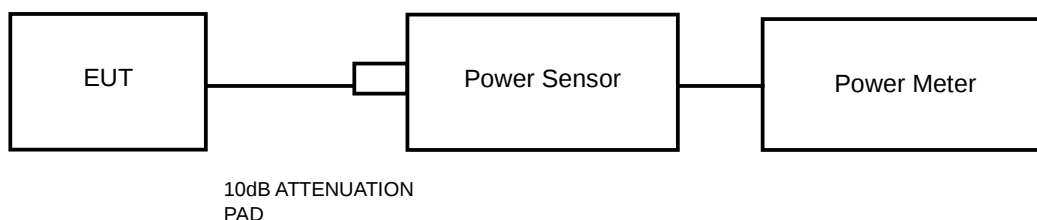


4.6 CONDUCTED OUTPUT POWER

4.6.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 125mW.

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

4.6.4 TEST PROCEDURES

A average power sensor was used on the output port of the EUT. A average power meter was used to read the response of the average power sensor. Record the average power level.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.6.7 TEST RESULTS

MAXIMUM AVERAGE OUTPUT POWER

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVERAGE POWER (mW)	AVERAGE POWER LIMIT (mW)	PASS/FAIL
0	2402	-0.84	0.8241	125	PASS
39	2441	-0.45	0.9016	125	PASS
78	2480	0.51	1.1246	125	PASS

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVERAGE POWER (mW)	AVERAGE POWER LIMIT (mW)	PASS/FAIL
0	2402	1.25	1.3335	125	PASS
39	2441	1.38	1.3740	125	PASS
78	2480	2.30	1.6982	125	PASS



4.7 OUT OF BAND EMISSION MEASUREMENT

4.7.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below -30dB of the highest emission level of operating band (in 100KHz RBW).

4.7.2 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

4.7.3 TEST 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.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation.

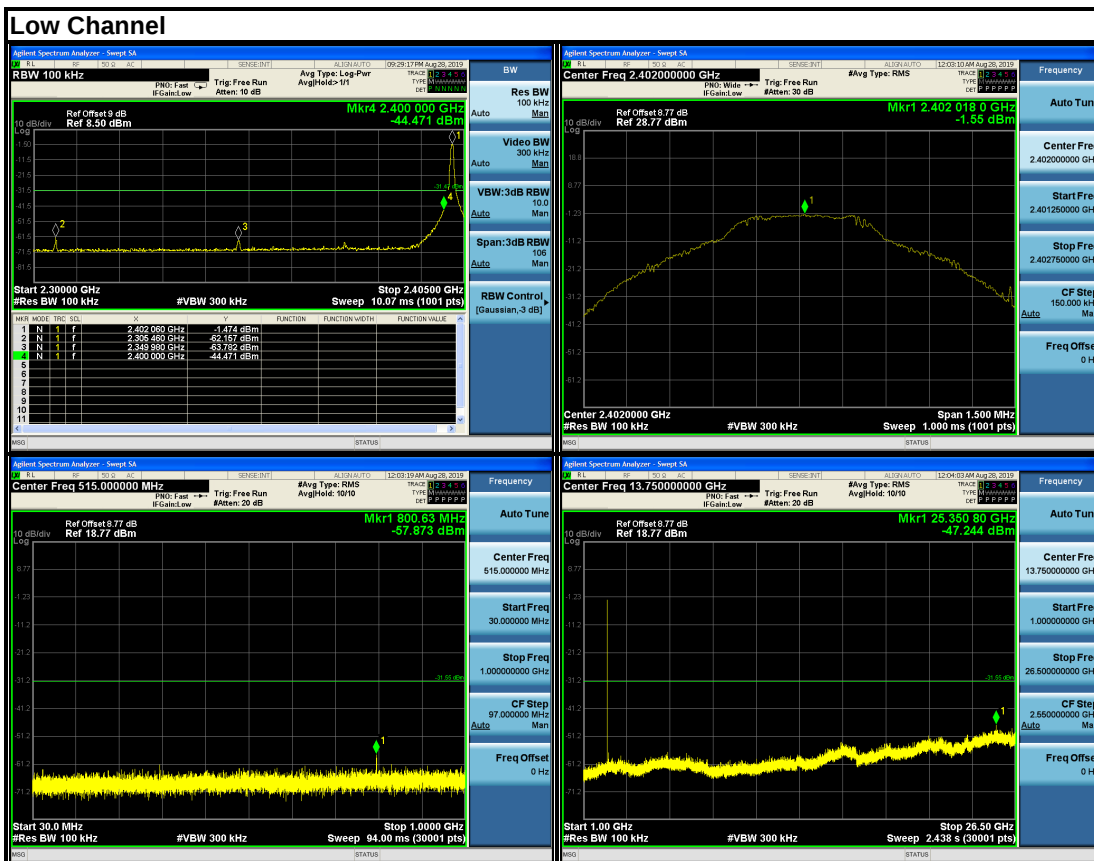
4.7.5 EUT OPERATING CONDITION

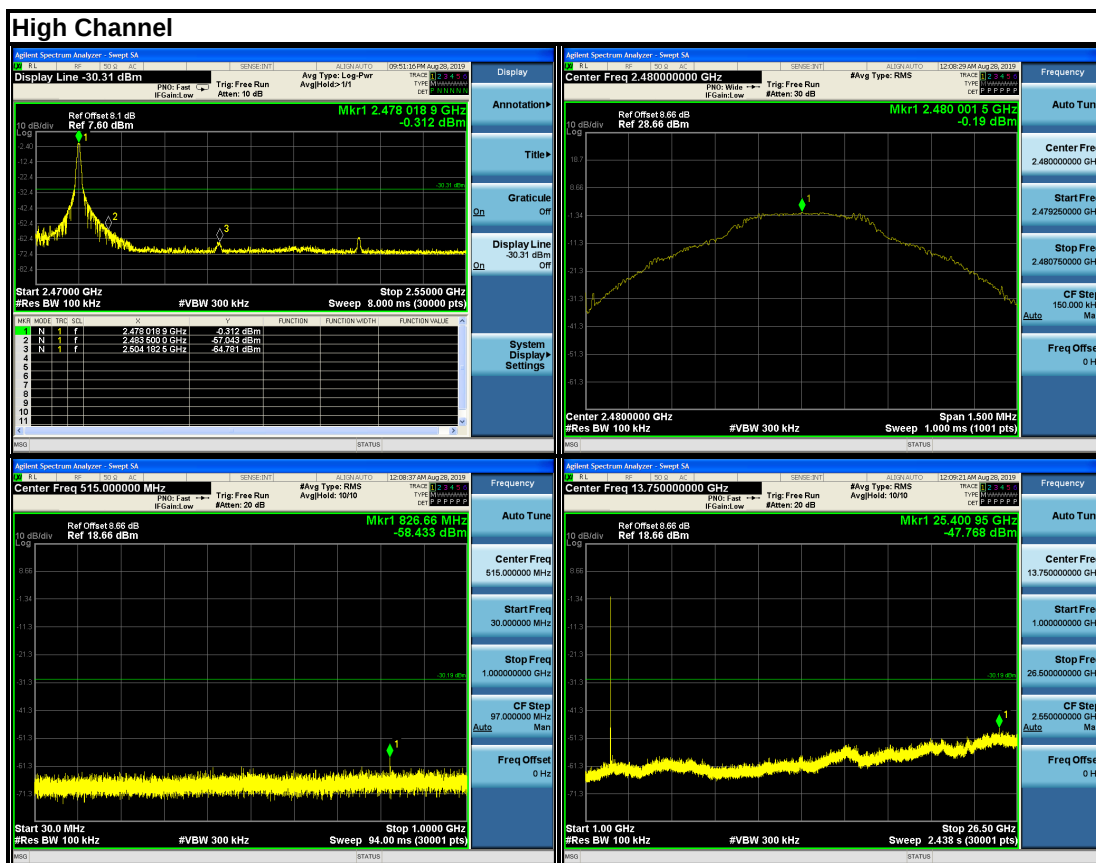
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.7.6 TEST RESULTS

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 30dB offset below D1. It shows compliance to the requirement.

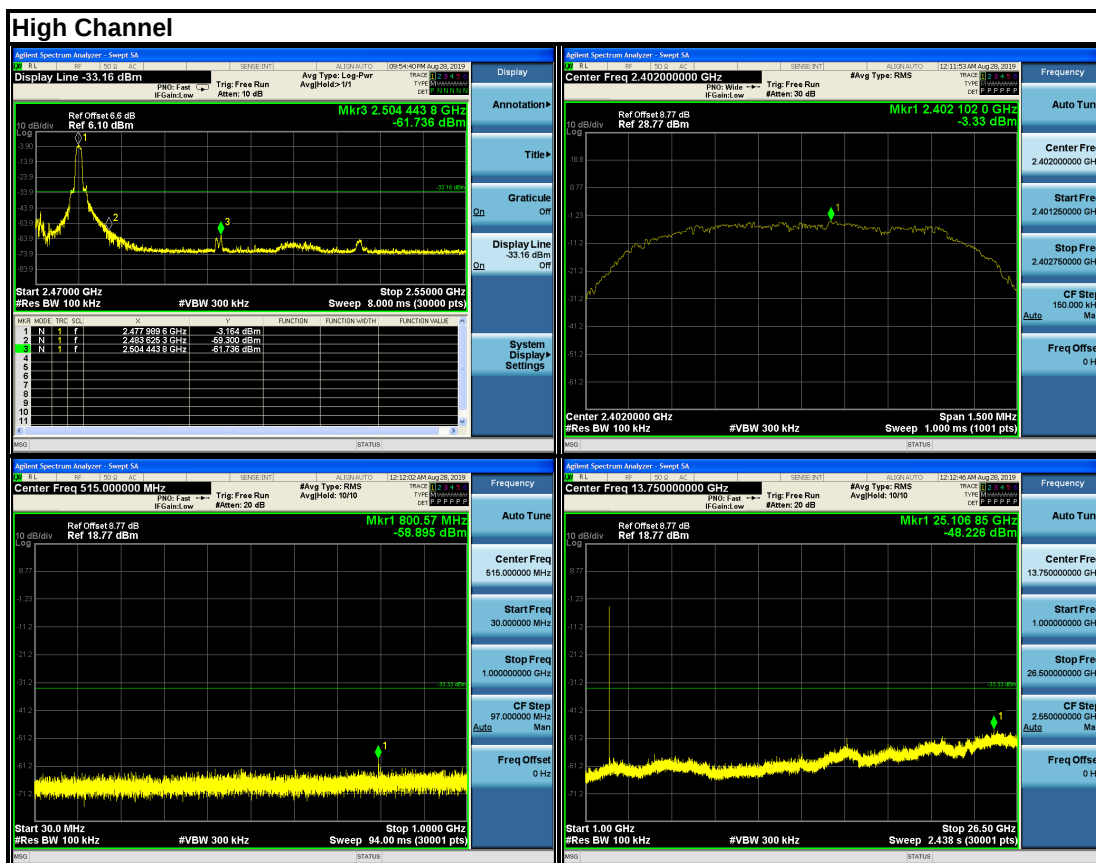
GFSK



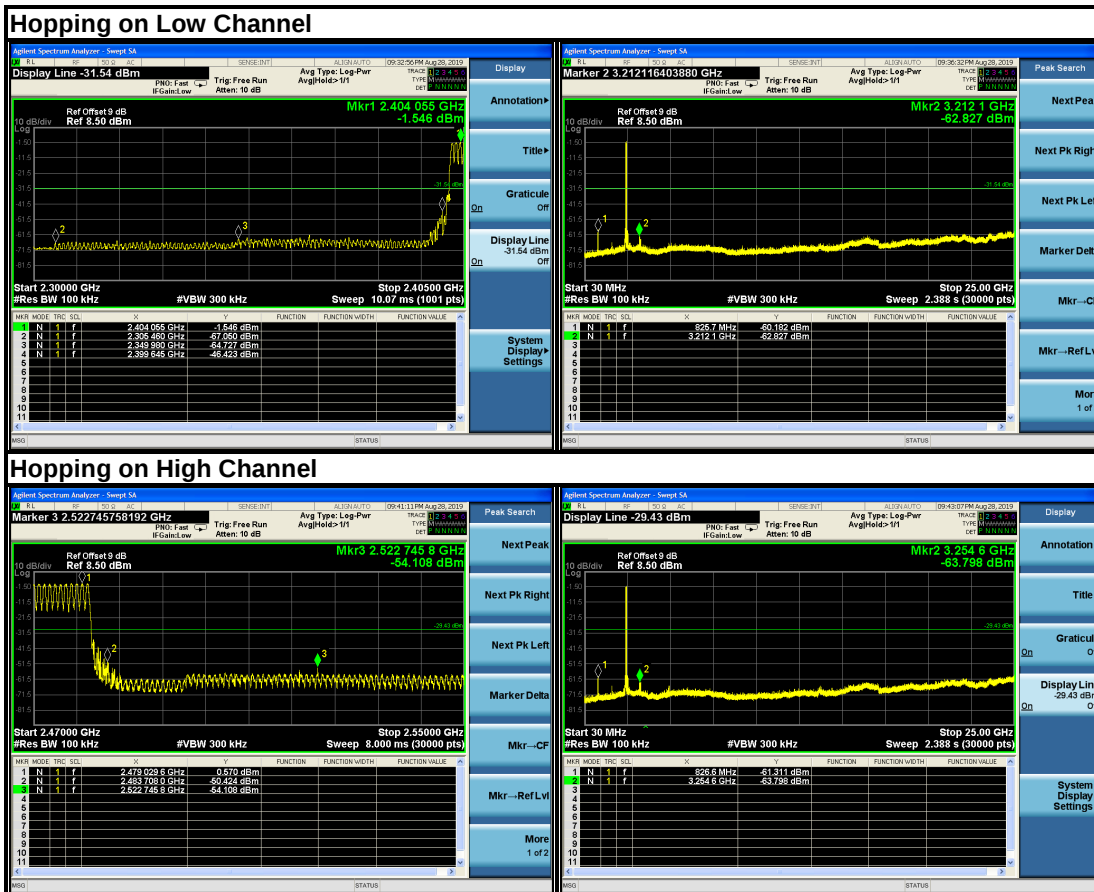


8DPSK



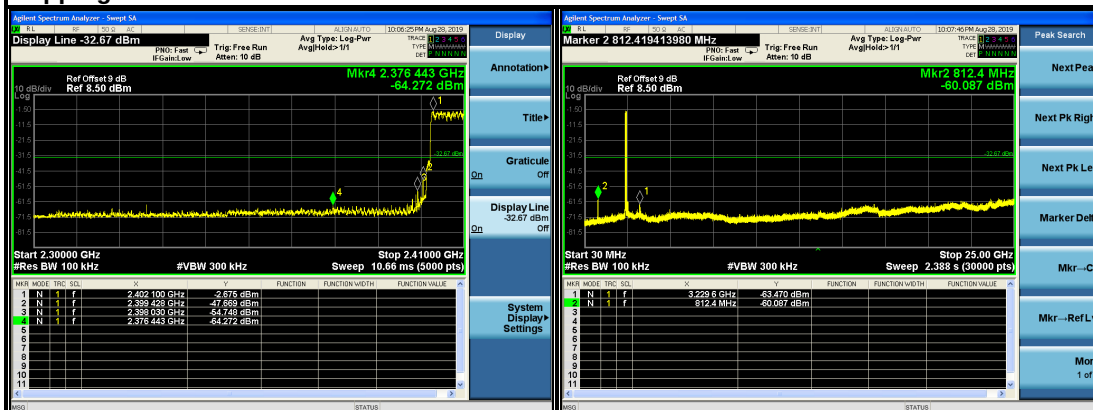


GFSK

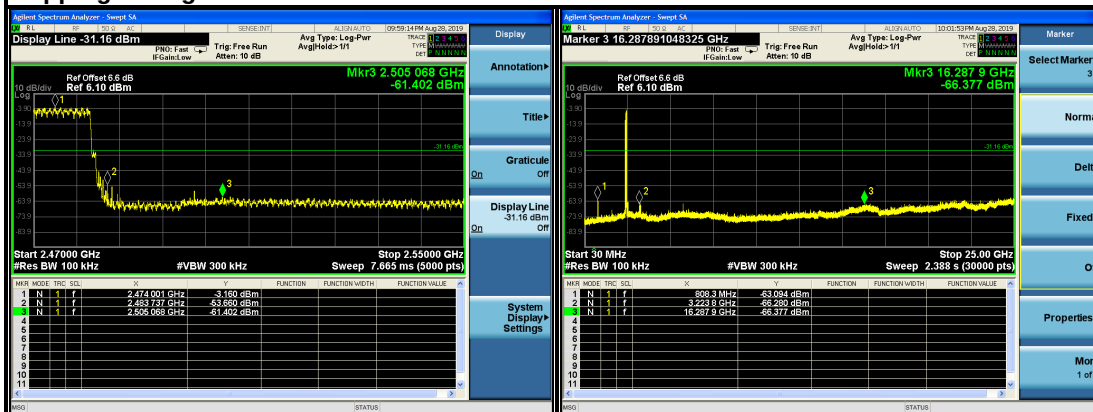


8DPSK

Hopping on Low Channel



Hopping on High Channel





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5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---