

TEST REPORT

Applicant	NINGBO SC-STARMAX IMP. & EXP. CO., LTD.
Address	MU Group, Floor 4th, Building 6A, No.98, Chuangyuan Road, Yinzhou District, NINGBO Zhejiang Province, China. 315048

Manufacturer or Supplier	NINGBO SC-STARMAX IMP. & EXP. CO., LTD.
Address	MU Group, Floor 4th, Building 6A, No.98, Chuangyuan Road, Yinzhou District, NINGBO Zhejiang Province, China. 315048
Product	WIRELESS SPEAKER
Brand Name	N/A
Model	01-WM-51429
Additional Model & Model Difference	NV-108810-00 01-WM-51430, NV-108811-00 01-WM-51431, NV-108812-00 01-WM-51432, NV-108813-00 01-WM-52381, NV-112935-00, See items 3.1
Date of tests	Dec. 07, 2023 ~ Dec. 21, 2023

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 Loren Luo Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	 Date: Dec. 25, 2023

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Test Report No.: RF2312WDG0051

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF2312WDG0051	Original release	Dec. 25, 2023

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	Power 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)	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 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
Radiated emissions	9KHz ~ 30MHz	2.72dB
	30MHz ~ 1GMHz	4.24dB
	1GHz ~ 18GHz	4.78dB
	18GHz ~ 40GHz	4.50dB

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	WIRELESS SPEAKER
MODEL NO.	01-WM-51429
ADDITIONAL MODEL	NV-108810-00 01-WM-51430, NV-108811-00 01-WM-51431, NV-108812-00 01-WM-51432, NV-108813-00 01-WM-52381, NV-112935-00
FCC ID	2A2WN-NVSP
POWER SUPPLY	DC 5V from USB host unit or DC 3.7 V from battery
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, $\pi/4$ DQPSK, 8DPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
PEAK OUTPUT POWER	1.059mW (Max. Measured)
ANTENNA TYPE	PCB Antenna, -0.58dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

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.: 2312WDG0051) for detailed product photo.
4. When the EUT in charging mode that RF function can't working.
5. Additional models (see above table) are identical with the test model 01-WM-51429 except the color of the appearance, product name and model number for trading purpose.

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, power supply voltage range 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 Battery with BT function

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

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.

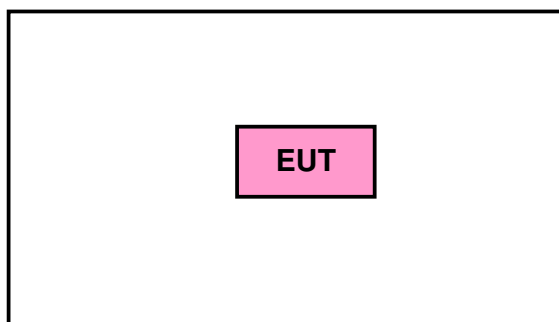
3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit without any other necessary accessory 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	N/A	N/A	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

3.5 CONFIGURATION OF SYSTEM UNDER TEST

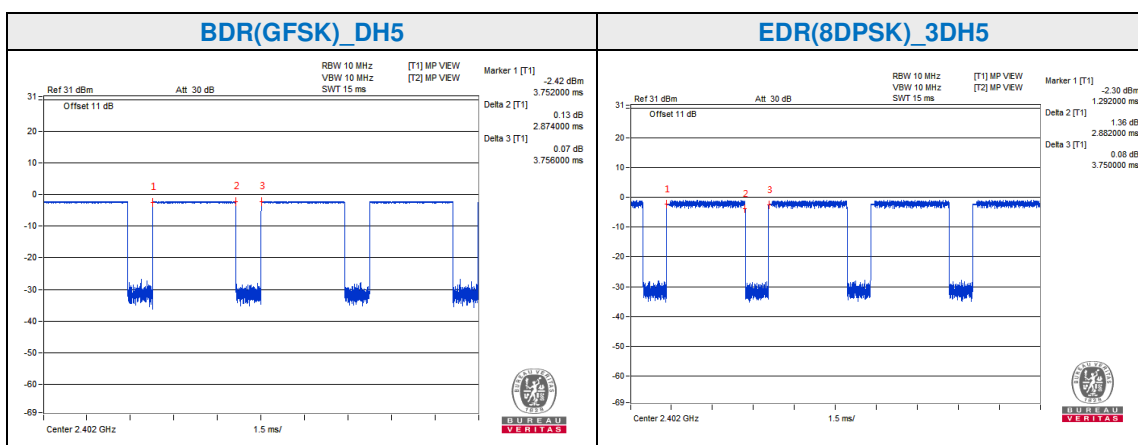


3.6 DUTY CYCLE OF TESET SIGNAL

Test Mode	Packet Type	On Time (ms)	Period (ms)	Duty Cycle (%)	1/T Min. VBW (KHz)	VBW Setting (Hz)
BDR(GFSK)	DH5	2.874	3.756	76.5	0.348	500
EDR(8DPSK)	3DH5	2.882	3.75	76.9	0.347	500

GFSK: Duty Cycle= On Time/ Period=2.874/3.756=0.765

8-DPSK: Duty Cycle= On Time/ Period=2.882/3.75=0.769



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

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Spectrum Analyzer	Rohde&Schwarz	FSV3044	101326	July 13, 24
EMI Test Receiver	Rohde&Schwarz	ESU8	100372	Apr. 06, 24
Bilog Antenna	SCHWARZBECK	VULB 9168	9168-555	Jan. 08, 24
Pre-Amplifier	Agilent	8447D	2944A10488	July. 26, 24
3m Semi-anechoic Chamber	ETS-Lindgren	9m*6m*6m	D3040003DG-1	July 30, 24
Coaxial RF Cable	Joinfront	JFAA6-NMNM-8000	2100033742	July 10, 24
Coaxial RF Cable	Joinfront	JFAR-NMBNCM-2000	2100033742	July 10, 24
Coaxial RF Cable	Joinfront	JFAR-BNCMSMM-500	2100033742	July 10, 24
Test software	ADT	ADT Radiated V7.6.15.9.2	N/A	N/A
Horn Antenna	ETS-Lindgren	3117	00240041	May 06, 24
Horn Antenna	SCHWARZBECK	BBHA 9170	01024	Oct. 16, 25
Pre-Amplifier (1GHz-18GHz)	Rohde&Schwarz	SCU18	102265	Apr. 01, 24
Pre-Amplifier (18GHz-40GHz)	Rohde&Schwarz	SCU40	100437	Oct. 10, 24
Coaxial RF Cable	Joinfront	JFAA6-NMNM-8000	2100033742	July 10, 24
Coaxial RF Cable	Joinfront	JFAA6-NMSMM-2000	2100033742	July 10, 24
Coaxial RF Cable	Joinfront	JFAA6-NMSMM-800	2100033742	July 10, 24

NOTE:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GREGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 749762.
5. Test site: No. 122, Houjie Avenue West Houjie Town, Dongguan City Guangdong Province, 523960, People's Republic of China.

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 placed 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 1.3m 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 performed using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

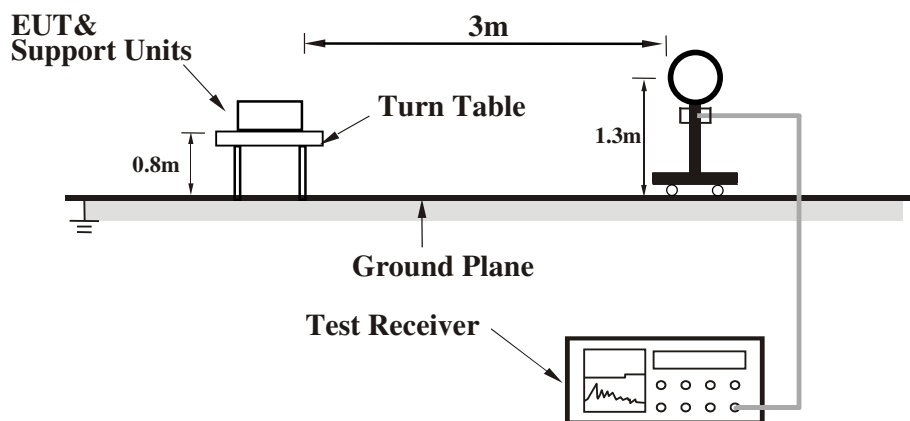
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) 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

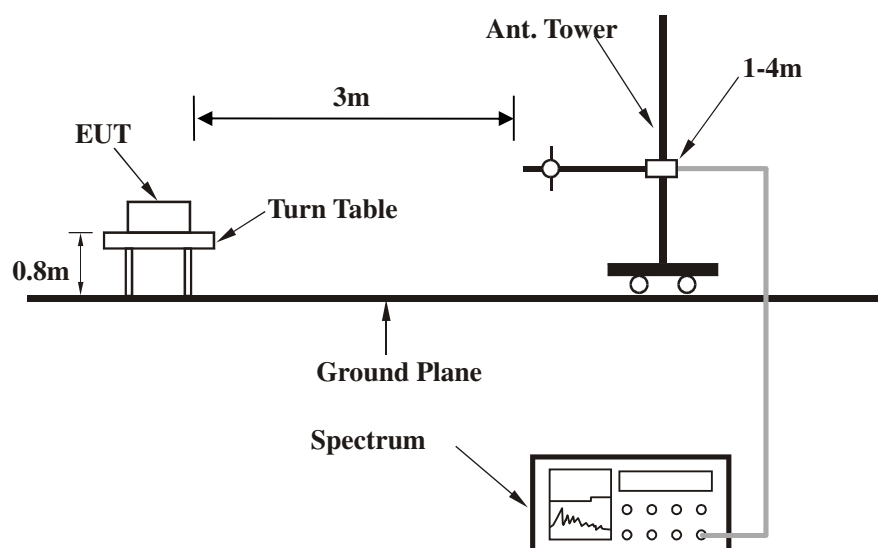
No deviation.

4.1.5 TEST SETUP

Below 30MHz test setup

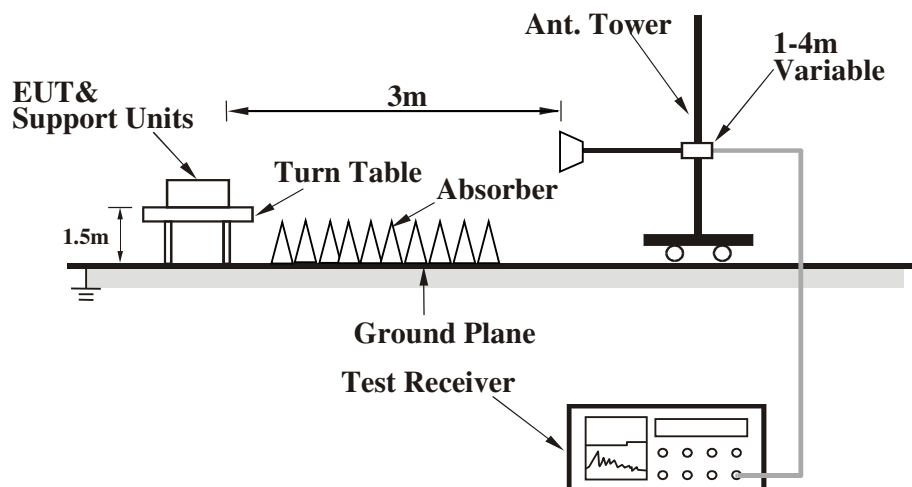


Below 1GHz test setup



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:

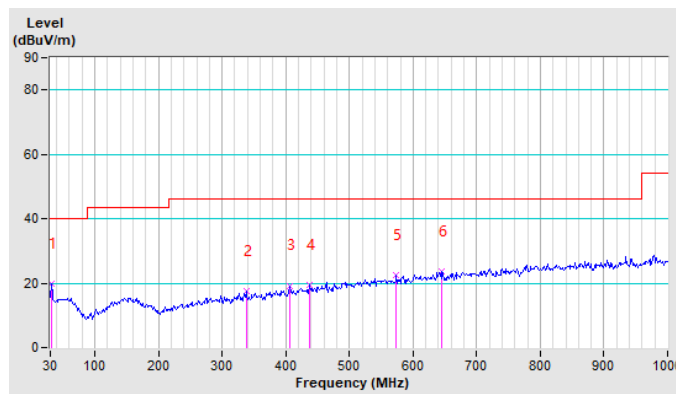
GFSK DH5

CHANNEL	Channel 39	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	31.55	19.97 QP	40.00	-20.03	1.47 H	205	32.75	-12.78
2	337.79	17.45 QP	46.00	-28.55	1.47 H	192	28.74	-11.29
3	406.19	19.22 QP	46.00	-26.78	1.47 H	179	29.20	-9.98
4	437.28	19.57 QP	46.00	-26.43	1.47 H	167	28.95	-9.38
5	574.07	22.51 QP	46.00	-23.49	1.47 H	143	29.21	-6.70
6	644.02	23.57 QP	46.00	-22.43	1.47 H	129	29.09	-5.52

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 greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value

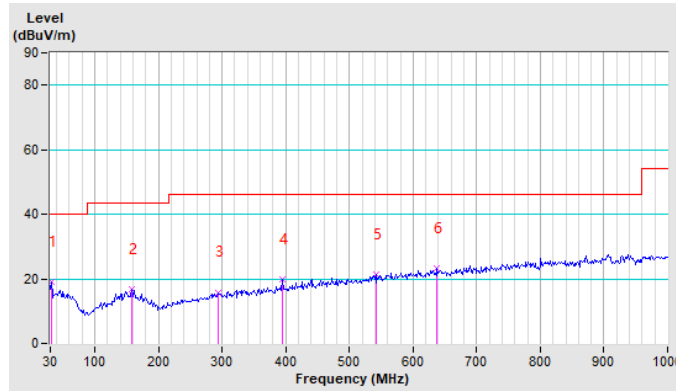


CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

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	31.55	19.18 QP	40.00	-20.82	1.05 V	103	31.96	-12.78
2	157.47	16.90 QP	43.50	-26.60	1.00 V	194	28.98	-12.08
3	294.26	15.79 QP	46.00	-30.21	1.00 V	138	27.92	-12.13
4	395.30	19.72 QP	46.00	-26.28	1.00 V	179	29.92	-10.20
5	541.43	21.29 QP	46.00	-24.71	1.00 V	152	28.59	-7.30
6	637.80	23.39 QP	46.00	-22.61	1.00 V	165	29.01	-5.62

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 greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. 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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	44.52 PK	74.00	-29.48	1.00 H	125	47.77	-3.25
2	2390.00	36.17 AV	54.00	-17.83	1.00 H	125	39.42	-3.25
3	*2402.00	89.40 PK			1.00 H	125	92.62	-3.22
4	*2402.00	87.26 AV			1.00 H	125	90.48	-3.22
5	4804.00	52.19 PK	74.00	-21.81	2.00 H	185	54.41	-2.22
6	4804.00	46.79 AV	54.00	-7.21	2.00 H	185	49.01	-2.22
7	7206.00	51.75 PK	74.00	-22.25	1.53 H	236	50.38	1.37
8	7206.00	41.35 AV	54.00	-12.65	1.53 H	236	39.98	1.37
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)	CORRECTION FACTOR (dB/m)
1	2390.00	45.71 PK	74.00	-28.29	1.20 V	130	48.96	-3.25
2	2390.00	35.55 AV	54.00	-18.45	1.20 V	130	38.80	-3.25
3	*2402.00	82.59 PK			1.20 V	130	85.81	-3.22
4	*2402.00	80.97 AV			1.20 V	130	84.19	-3.22
5	4804.00	49.99 PK	74.00	-24.01	1.00 V	155	52.21	-2.22
6	4804.00	44.10 AV	54.00	-9.90	1.00 V	155	46.32	-2.22
7	7206.00	51.89 PK	74.00	-22.11	2.00 V	125	50.52	1.37
8	7206.00	41.37 AV	54.00	-12.63	2.00 V	125	40.00	1.37

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 greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	89.72 PK			2.00 H	140	92.84	-3.12
2	*2441.00	86.31 AV			2.00 H	140	89.43	-3.12
3	4882.00	51.33 PK	74.00	-22.67	1.20 H	150	53.52	-2.19
4	4882.00	48.20 AV	54.00	-5.80	1.20 H	150	50.39	-2.19
5	7323.00	53.19 PK	74.00	-20.81	1.20 H	180	52.33	0.86
6	7323.00	43.62 AV	54.00	-10.38	1.20 H	180	42.76	0.86
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)	CORRECTION FACTOR (dB/m)
1	*2441.00	86.17 PK			1.00 V	152	89.29	-3.12
2	*2441.00	83.82 AV			1.00 V	152	86.94	-3.12
3	4882.00	51.87 PK	74.00	-22.13	1.00 V	120	54.06	-2.19
4	4882.00	44.25 AV	54.00	-9.75	1.00 V	120	46.44	-2.19
5	7323.00	51.90 PK	74.00	-22.10	1.60 V	236	51.04	0.86
6	7323.00	39.76 AV	54.00	-14.24	1.60 V	236	38.90	0.86

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 greater than 20dB margin.
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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	92.12 PK			1.00 H	130	95.14	-3.02
2	*2480.00	89.70 AV			1.00 H	130	92.72	-3.02
3	2483.50	47.89 PK	74.00	-26.11	1.00 H	130	50.89	-3.00
4	2483.50	35.47 AV	54.00	-18.53	1.00 H	130	38.47	-3.00
5	4960.00	49.25 PK	74.00	-24.75	1.00 H	125	51.40	-2.15
6	4960.00	40.67 AV	54.00	-13.33	1.00 H	125	42.82	-2.15
7	7440.00	52.34 PK	74.00	-21.66	2.00 H	175	52.01	0.33
8	7440.00	42.29 AV	54.00	-11.71	2.00 H	175	41.96	0.33
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)	CORRECTION FACTOR (dB/m)
1	*2480.00	85.90 PK			1.20 V	130	88.92	-3.02
2	*2480.00	83.60 AV			1.20 V	130	86.62	-3.02
3	2483.50	45.89 PK	74.00	-28.11	1.20 V	130	48.89	-3.00
4	2483.50	34.00 AV	54.00	-20.00	1.20 V	130	37.00	-3.00
5	4960.00	50.13 PK	74.00	-23.87	1.20 V	155	52.28	-2.15
6	4960.00	42.31 AV	54.00	-11.69	1.20 V	155	44.46	-2.15
7	7440.00	51.45 PK	74.00	-22.55	1.00 V	256	51.12	0.33
8	7440.00	38.57 AV	54.00	-15.43	1.00 V	256	38.24	0.33

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 greater than 20dB margin.
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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	45.40 PK	74.00	-28.60	1.00 H	125	48.65	-3.25
2	2390.00	37.80 AV	54.00	-16.20	1.00 H	125	41.05	-3.25
3	*2402.00	79.84 PK			1.00 H	125	83.06	-3.22
4	*2402.00	74.33 AV			1.00 H	125	77.55	-3.22
5	4804.00	51.84 PK	74.00	-22.16	1.00 H	200	54.06	-2.22
6	4804.00	43.81 AV	54.00	-10.19	1.00 H	200	46.03	-2.22
7	7206.00	51.97 PK	74.00	-22.03	1.00 H	147	50.60	1.37
8	7206.00	38.64 AV	54.00	-15.36	1.00 H	147	37.27	1.37
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)	CORRECTION FACTOR (dB/m)
1	2390.00	44.61 PK	74.00	-29.39	1.20 V	130	47.86	-3.25
2	2390.00	36.89 AV	54.00	-17.11	1.20 V	130	40.14	-3.25
3	*2402.00	80.53 PK			1.20 V	130	83.75	-3.22
4	*2402.00	75.61 AV			1.20 V	130	78.83	-3.22
5	4804.00	49.90 PK	74.00	-24.10	1.00 V	125	52.12	-2.22
6	4804.00	40.53 AV	54.00	-13.47	1.00 V	125	42.75	-2.22
7	7206.00	52.54 PK	74.00	-21.46	1.00 V	360	51.17	1.37
8	7206.00	38.74 AV	54.00	-15.26	1.00 V	360	37.37	1.37

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 greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	81.26 PK			1.00 H	120	84.38	-3.12
2	*2441.00	78.12 AV			1.00 H	120	81.24	-3.12
3	4882.00	52.14 PK	74.00	-21.86	1.20 H	185	54.33	-2.19
4	4882.00	47.66 AV	54.00	-6.34	1.20 H	185	49.85	-2.19
5	7323.00	54.17 PK	74.00	-19.83	2.00 H	136	53.31	0.86
6	7323.00	40.85 AV	54.00	-13.15	2.00 H	136	39.99	0.86
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)	CORRECTION FACTOR (dB/m)
1	*2441.00	79.68 PK			1.56 V	320	82.80	-3.12
2	*2441.00	75.22 AV			1.56 V	320	78.34	-3.12
3	4882.00	50.39 PK	74.00	-23.61	1.20 V	182	52.58	-2.19
4	4882.00	46.89 AV	54.00	-7.11	1.20 V	182	49.08	-2.19
5	7323.00	52.23 PK	74.00	-21.77	1.26 V	245	51.37	0.86
6	7323.00	38.12 AV	54.00	-15.88	1.26 V	245	37.26	0.86

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 greater than 20dB margin.
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)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	81.33 PK			1.30 H	150	84.35	-3.02
2	*2480.00	76.29 AV			1.30 H	150	79.31	-3.02
3	2483.50	48.16 PK	74.00	-25.84	1.30 H	150	51.16	-3.00
4	2483.50	38.12 AV	54.00	-15.88	1.30 H	150	41.12	-3.00
5	4960.00	50.38 PK	74.00	-23.62	2.00 H	320	52.53	-2.15
6	4960.00	46.25 AV	54.00	-7.75	2.00 H	320	48.40	-2.15
7	7440.00	52.14 PK	74.00	-21.86	1.00 H	185	51.81	0.33
8	7440.00	38.44 AV	54.00	-15.56	1.00 H	185	38.11	0.33
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)	CORRECTION FACTOR (dB/m)
1	*2480.00	82.14 PK			1.20 V	130	85.16	-3.02
2	*2480.00	80.11 AV			1.20 V	130	83.13	-3.02
3	2483.50	46.25 PK	74.00	-27.75	1.20 V	130	49.25	-3.00
4	2483.50	35.99 AV	54.00	-18.01	1.20 V	130	38.99	-3.00
5	4960.00	51.28 PK	74.00	-22.72	1.00 V	250	53.43	-2.15
6	4960.00	47.66 AV	54.00	-6.34	1.00 V	250	49.81	-2.15
7	7323.00	53.21 PK	74.00	-20.79	2.00 V	54	52.35	0.86
8	7323.00	36.82 AV	54.00	-17.18	2.00 V	54	35.96	0.86

REMARKS:

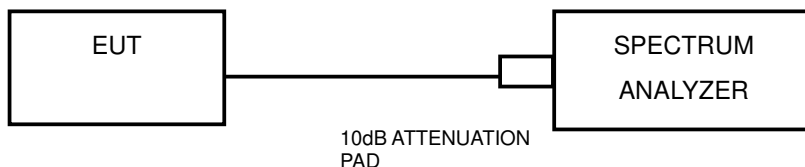
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency.

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.	Next Cal.
Wireless Connectivity Tester	Rohde&Schwarz	CMW270	101601	Oct. 15, 24
Spectrum Analyzer	Rohde&Schwarz	FSV40	101003	Jan. 15, 24
Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Jan. 11, 24
Frequency Analyzer	Keysight	N9010B	MY60240432	Oct. 10, 24
Power Meter	Anritsu	ML2495A	1139001	Jul. 11, 24
Power Sensor	Anritsu	MA2411B	1531155	Jul. 11, 24
Programmable Temperature&Humidity Chamber	Hongjin	HYC-TH-225DH	DG-180746	Jan. 11, 24
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A
DC Source	Agilent	E3640A	MY40004013	Feb. 08, 24
Test software	ADT	ADT_RF Test Software V6.6.5.3	N/A	N/A
Test software	ADT	ADT_RF Test Software V6.6.5.4	N/A	N/A

NOTE:

1. The test was performed in RF Test Shielded 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. Test site: No. 122, Houjie Avenue West Houjie Town, Dongguan City Guangdong Province, 523960, People's Republic of China.

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.

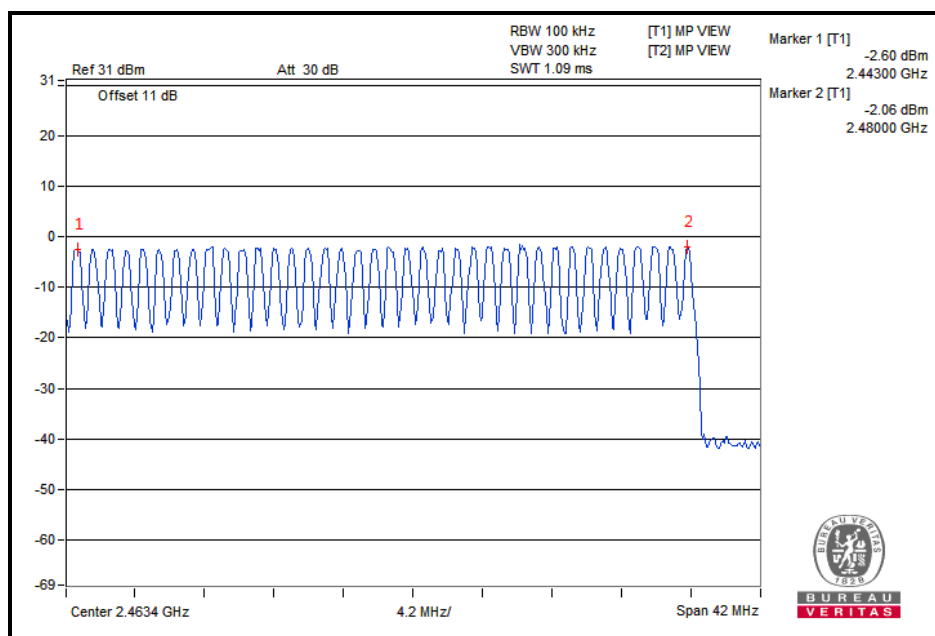
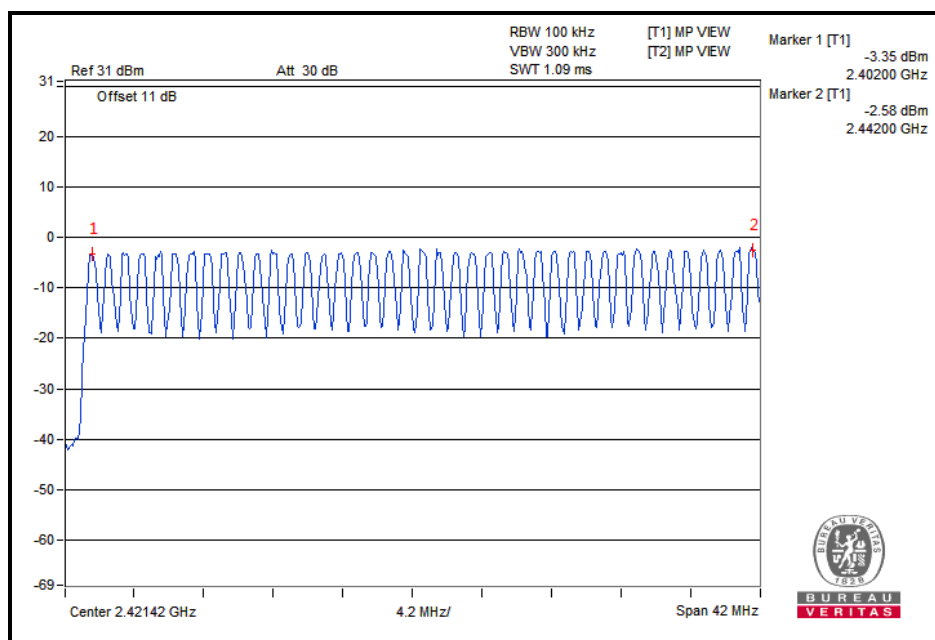
4.2.5 DEVIATION FROM TEST STANDARD

No deviation.

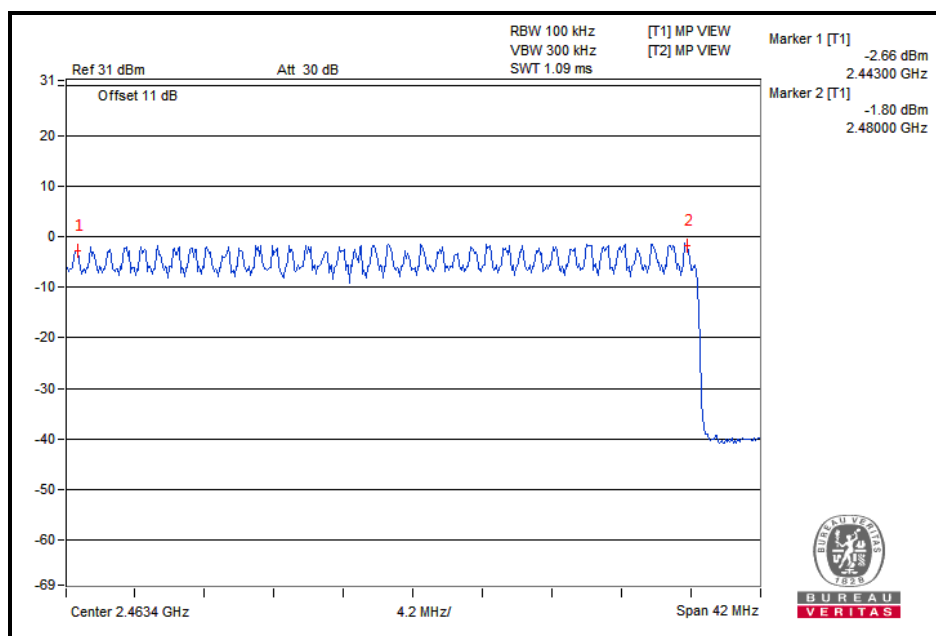
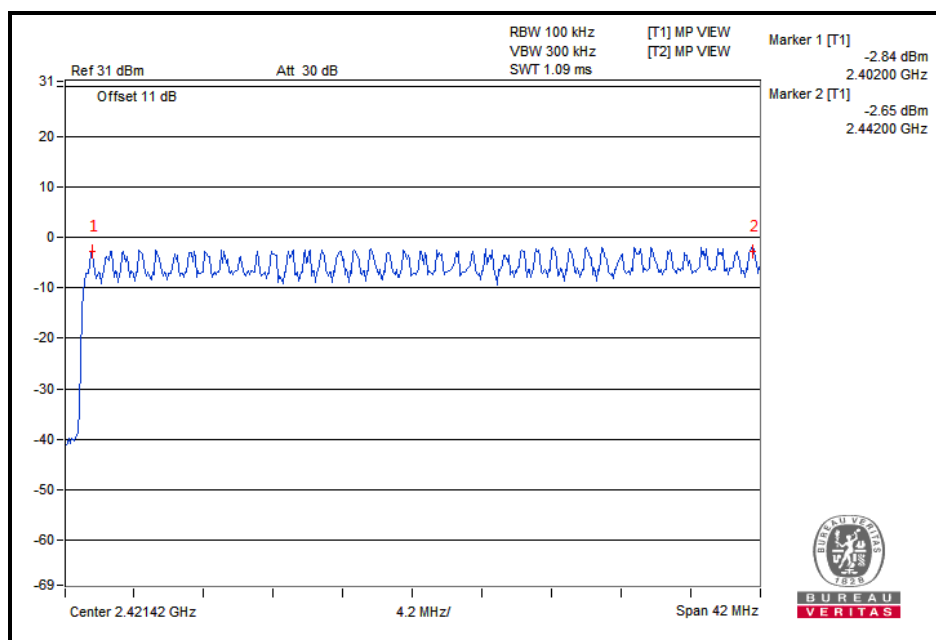
4.2.6 TEST RESULTS

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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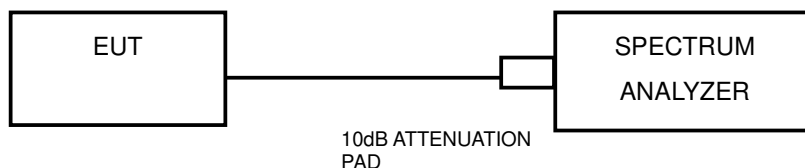


4.3 DWELL TIME ON EACH CHANNEL

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

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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)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
DH1	79	31.6	5	50	316.00	0.426	134.616	400	PASS
DH3	79	31.6	5	26	164.32	1.690	277.701	400	PASS
DH5	79	31.6	5	18	113.76	3.008	342.190	400	PASS

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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)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
3DH1	79	31.6	5	51	322.32	0.462	148.912	400	PASS
3DH3	79	31.6	5	26	164.32	1.670	274.414	400	PASS
3DH5	79	31.6	5	18	113.76	2.976	338.550	400	PASS

NOTE: Test plots of the transmitting time slot are shown on next page.

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8DPSK

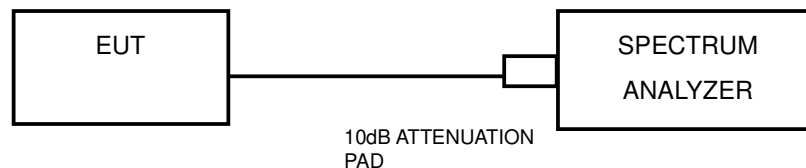


4.4 CHANNEL BANDWIDTH

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

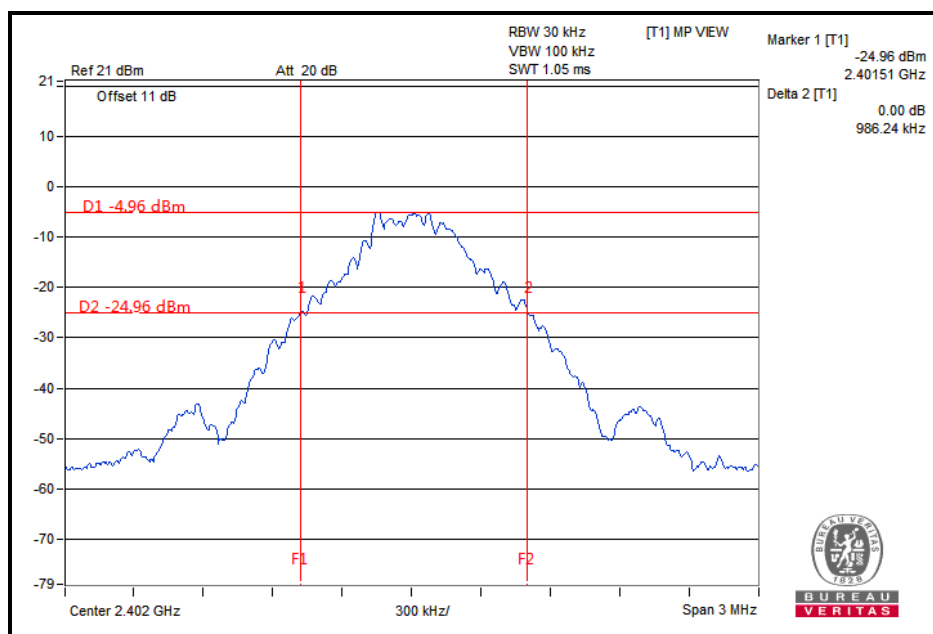
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 TEST RESULTS

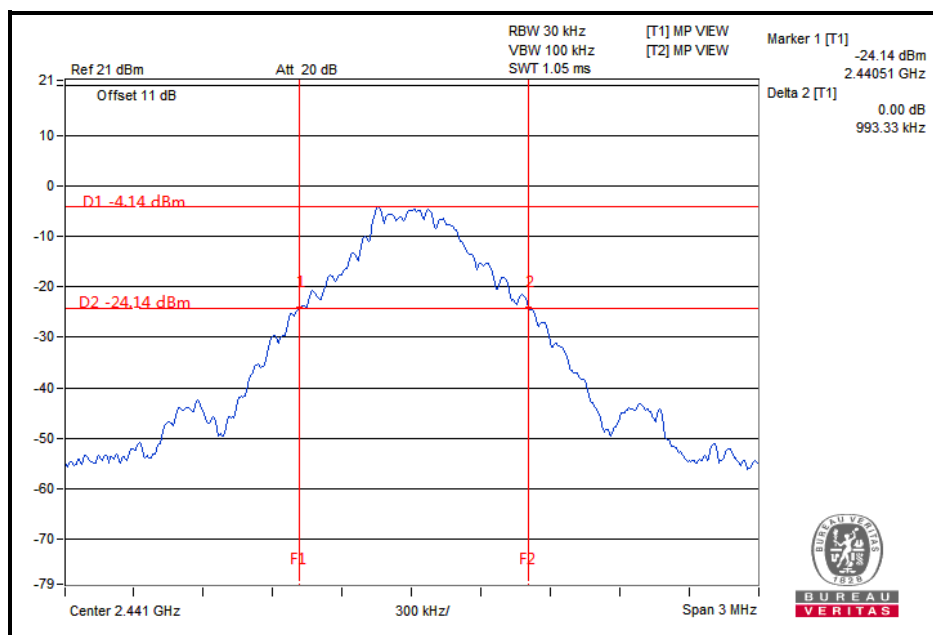
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CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.99
39	2441	0.99
78	2480	1.01

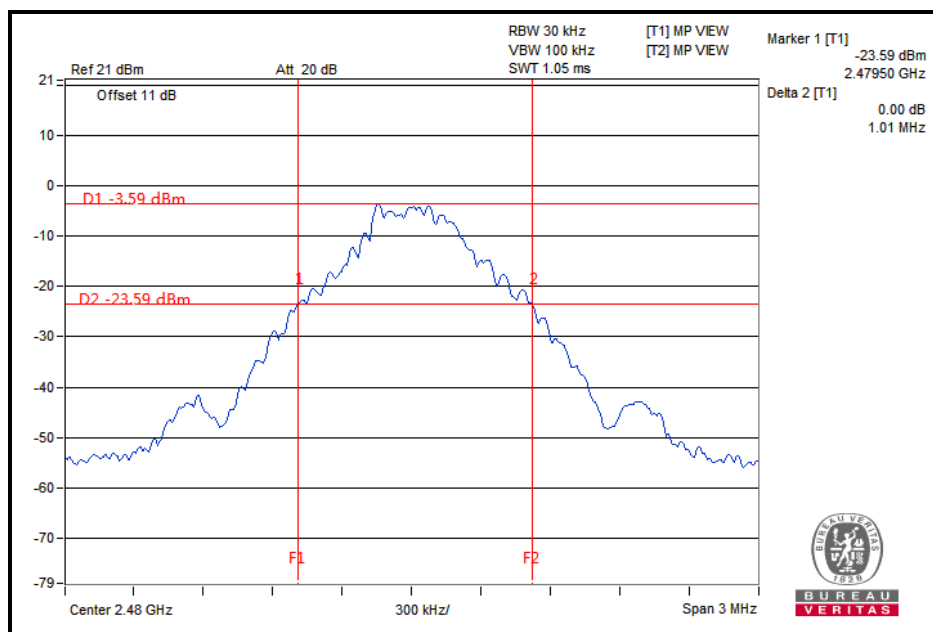
CH 0



CH 39



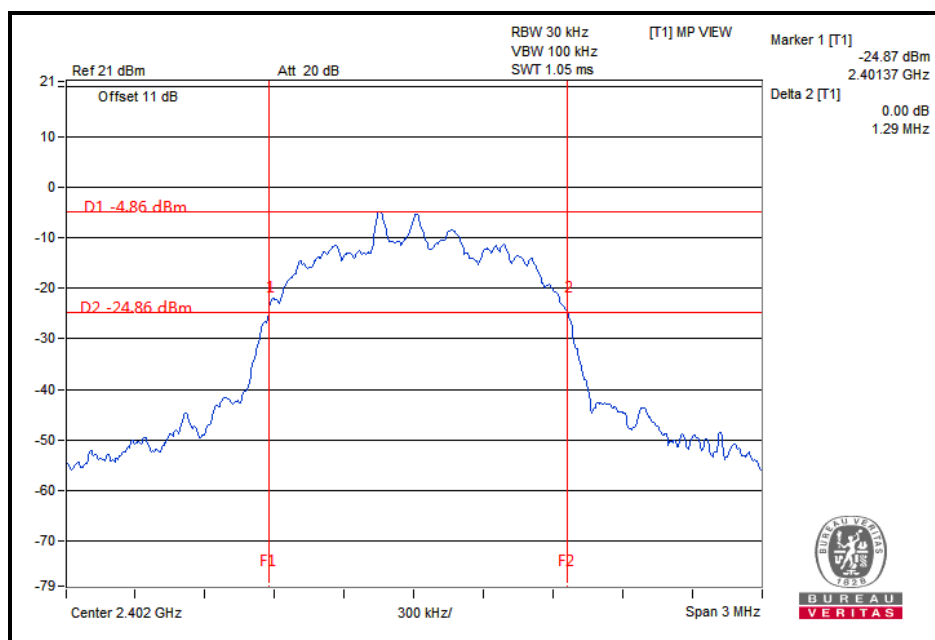
CH 78



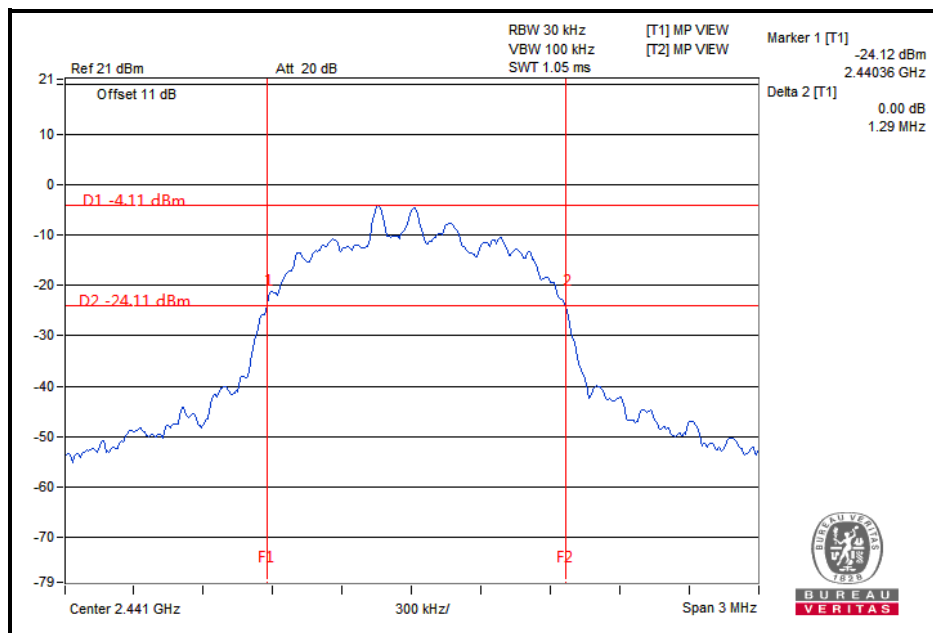
8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.29
39	2441	1.29
78	2480	1.29

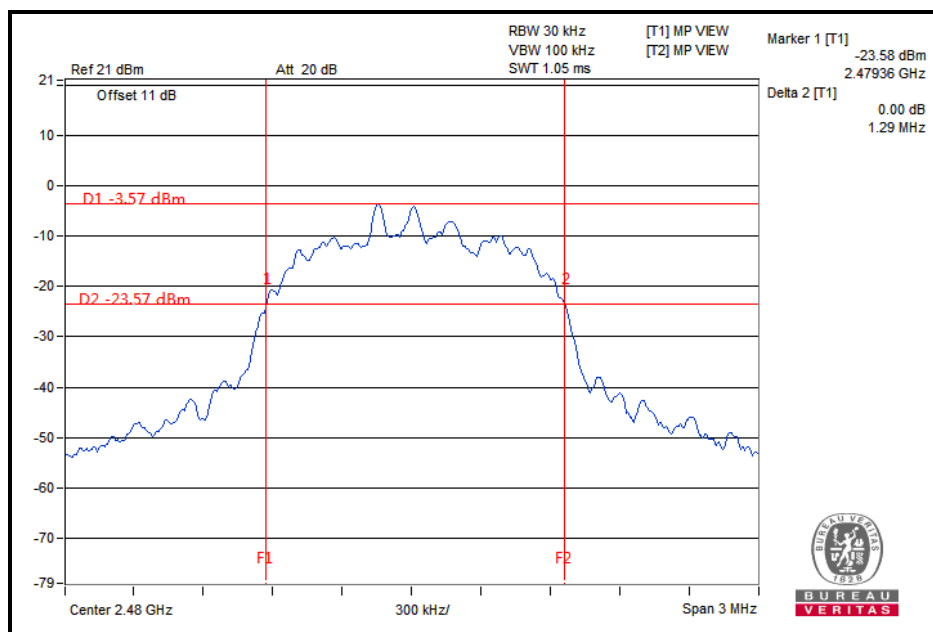
CH 0



CH 39



CH 78

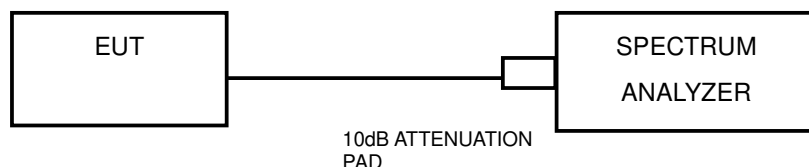


4.5 HOPPING CHANNEL SEPARATION

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.

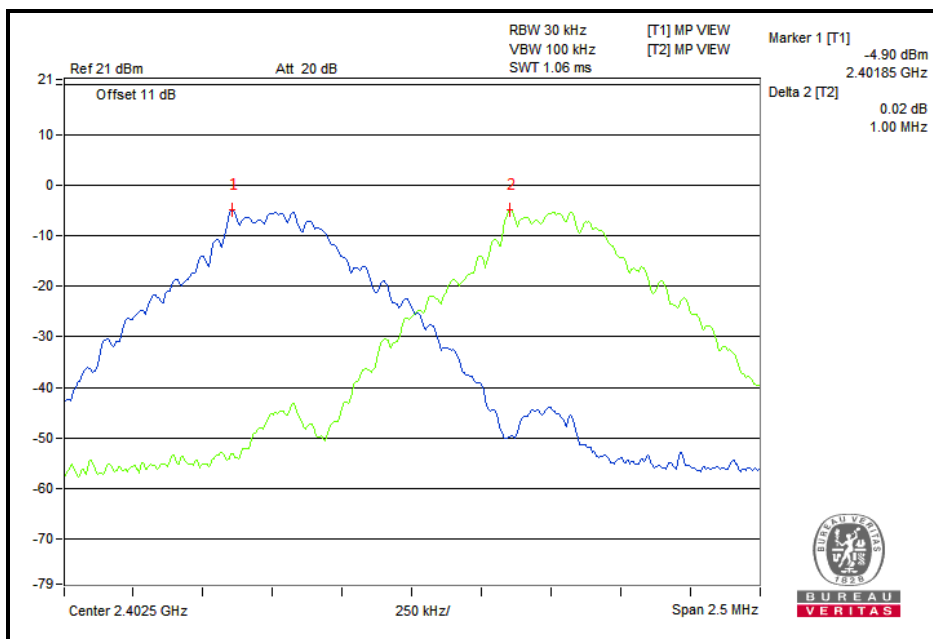
4.5.6 TEST RESULTS

GFSK

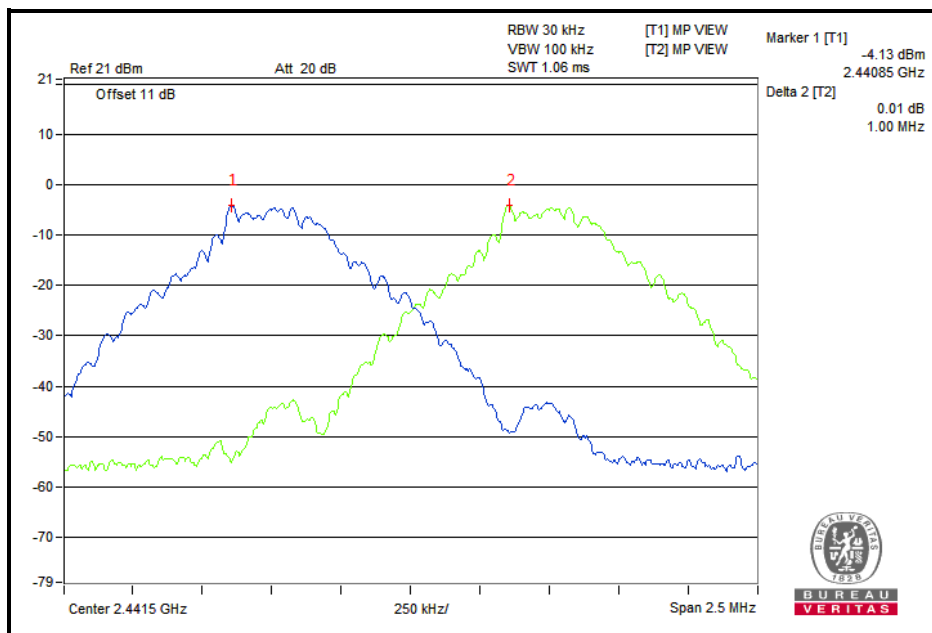
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.00	0.98	0.65	PASS
39	2441	1.00	0.99	0.66	PASS
78	2480	1.00	1.01	0.67	PASS

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

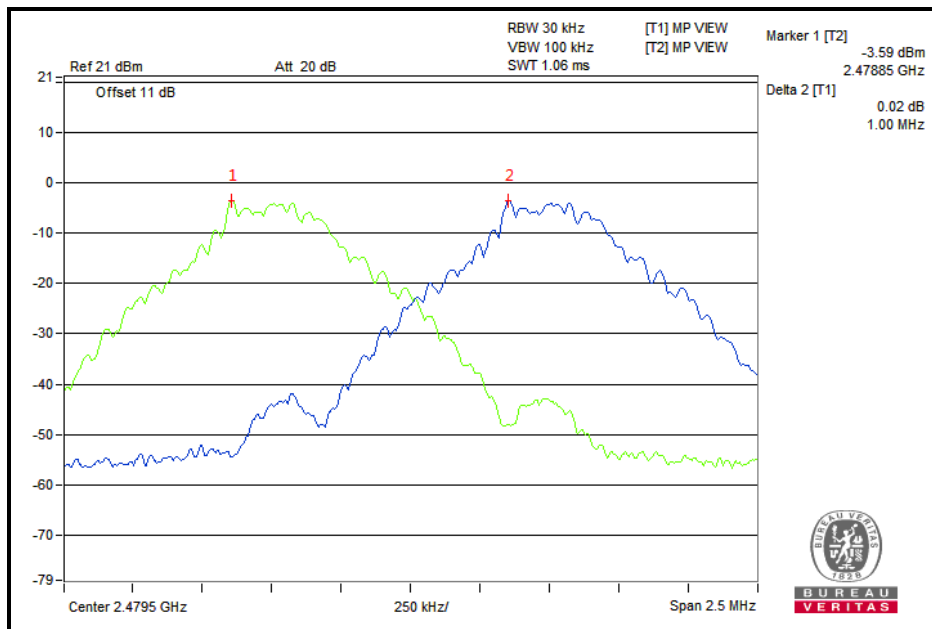
CH 0



CH 39



CH 78

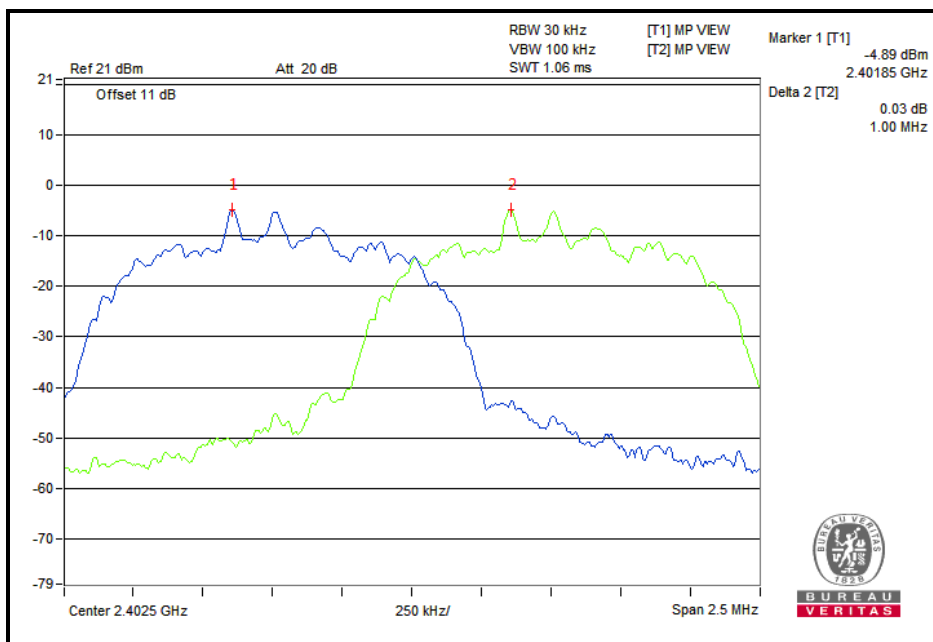


8DPSK

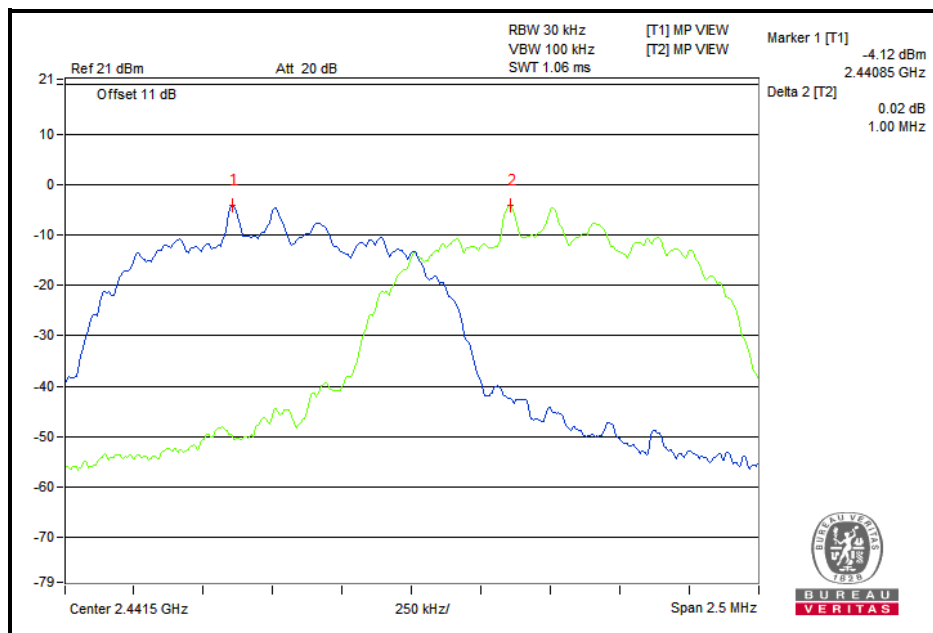
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.00	1.29	0.86	PASS
39	2441	1.00	1.29	0.86	PASS
78	2480	1.00	1.29	0.86	PASS

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

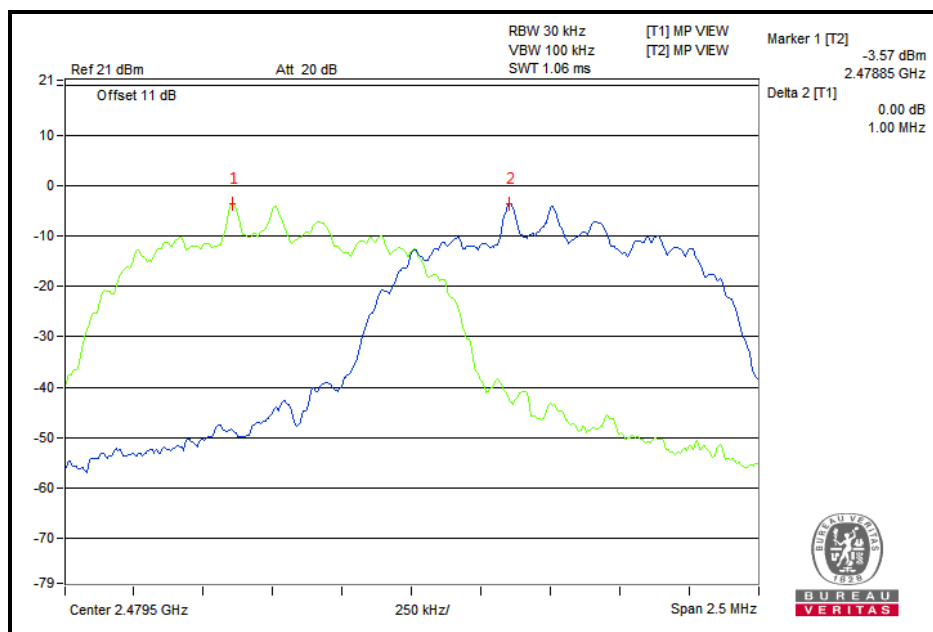
CH 0



CH 39



CH 78

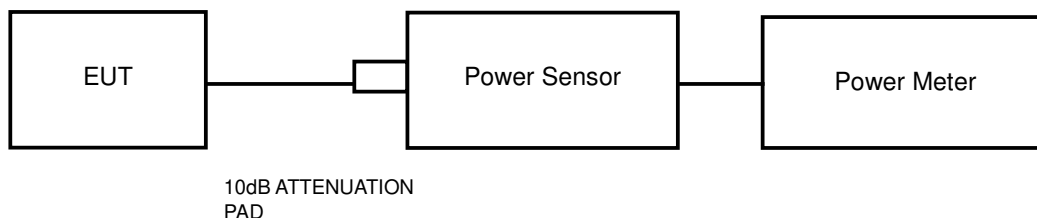


4.6 CONDUCTED OUTPUT POWER

4.6.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 0.125W.

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 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.

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 PEAK OUTPUT POWER

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-2.29	0.5902	0.125	PASS
39	2441	-1.57	0.6966	0.125	PASS
78	2480	-1.07	0.7816	0.125	PASS

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-0.97	0.7998	0.125	PASS
39	2441	-0.24	0.9462	0.125	PASS
78	2480	0.25	1.0590	0.125	PASS

AVERAGE OUTPUT POWER(FOR REFERENCE)

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVERAGE POWER (mW)
0	2402	-2.82	0.5224
39	2441	-2.05	0.6237
78	2480	-1.58	0.695

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVERAGE POWER (mW)
0	2402	-2.03	0.6266
39	2441	-1.34	0.7345
78	2480	-0.98	0.798

4.7 OUT OF BAND EMISSION MEASUREMENT

4.7.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below -20dB 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.

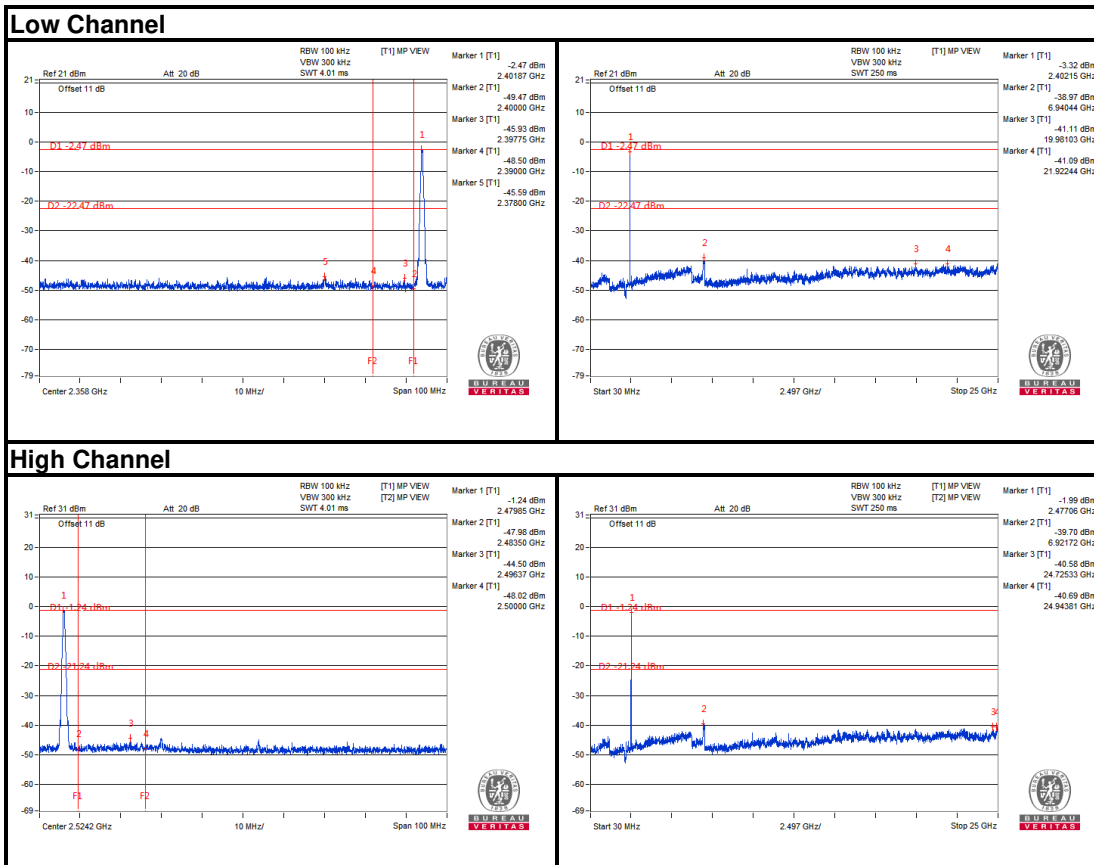
4.7.5 EUT OPERATING CONDITION

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

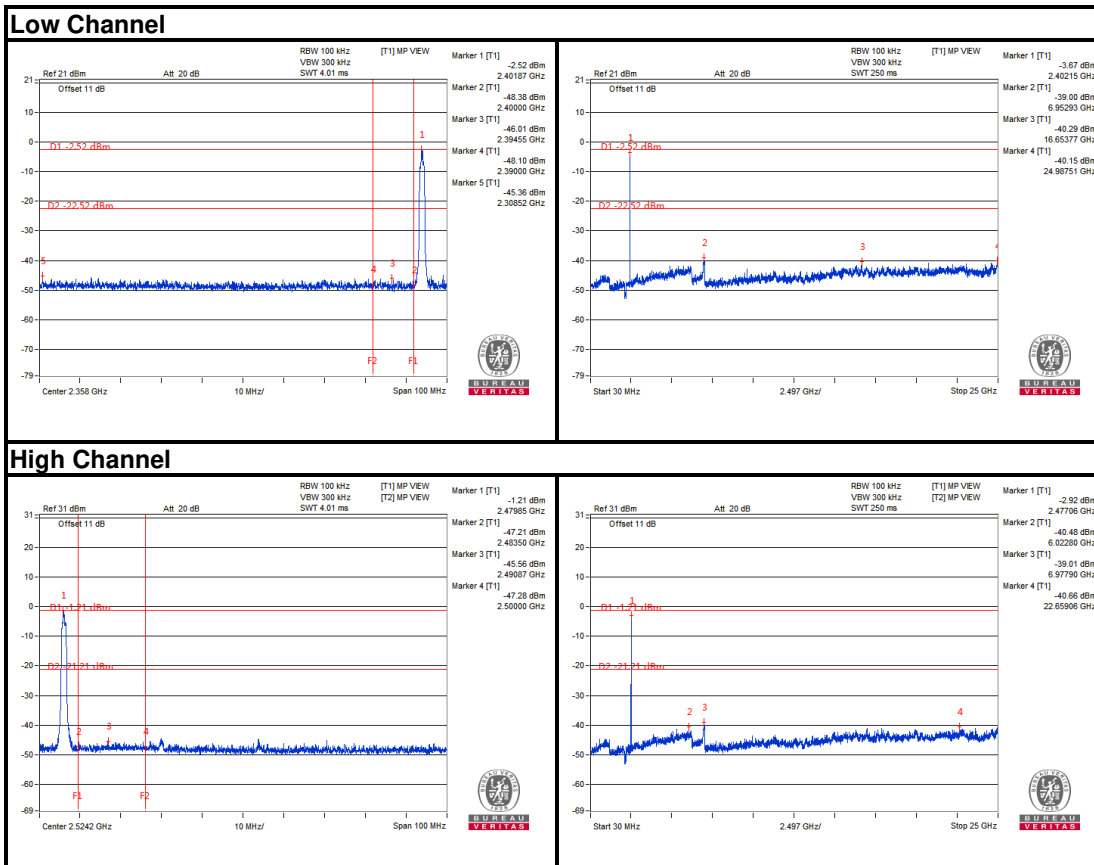
4.7.6 TEST RESULTS

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

GFSK

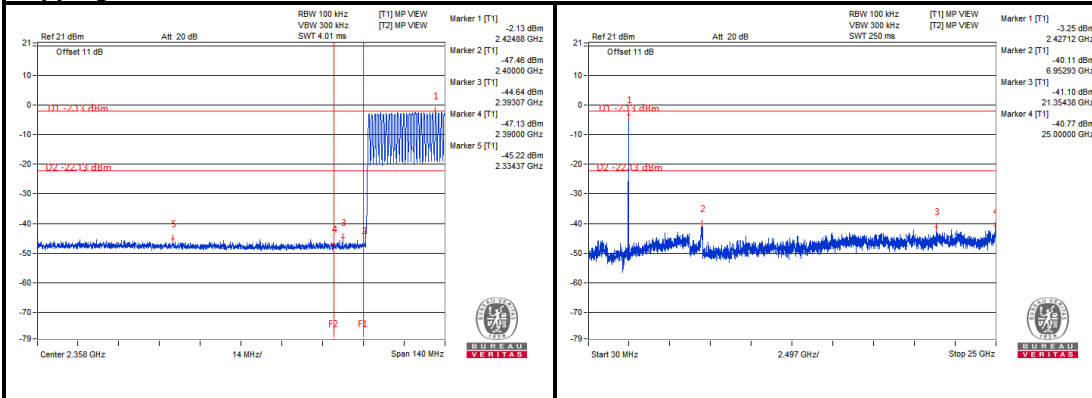


8DPSK

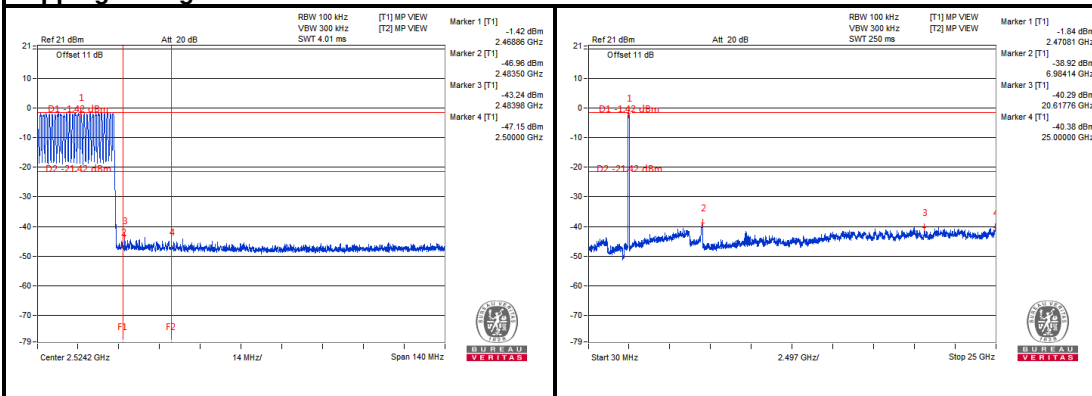


GFSK

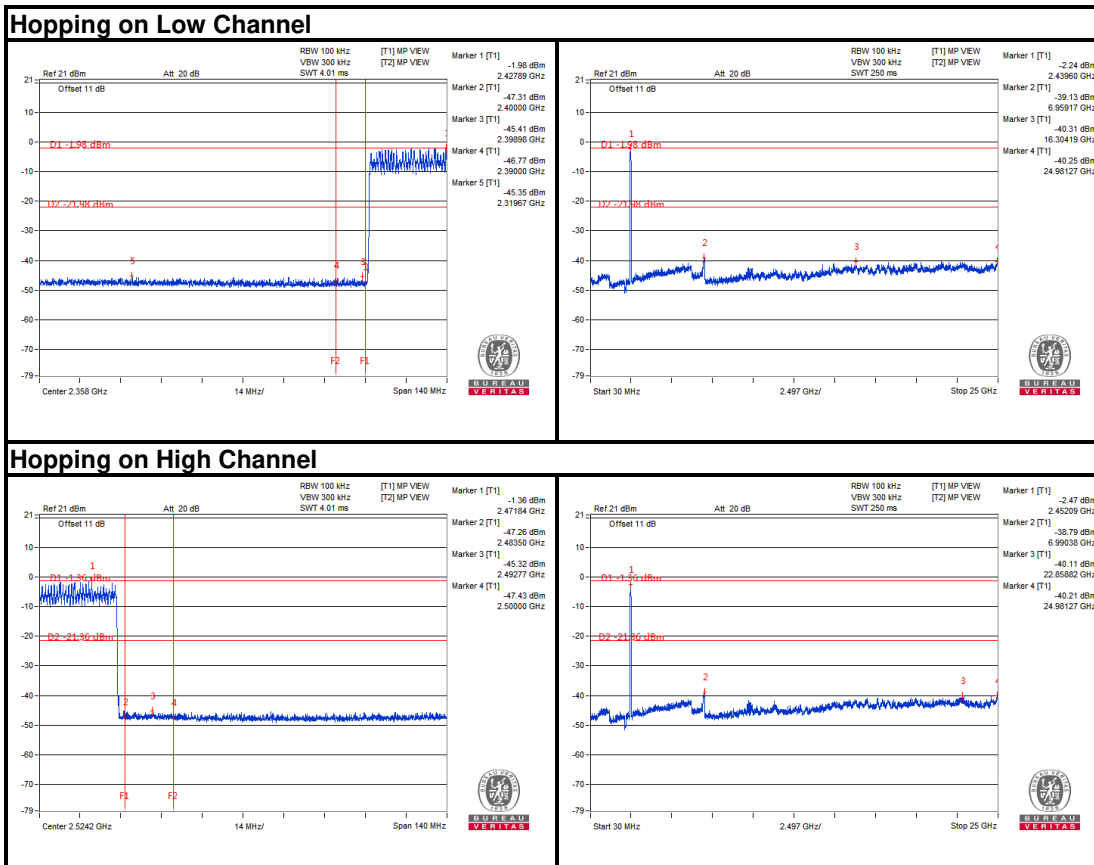
Hopping on Low Channel



Hopping on High Channel



8DPSK





Test Report No.: RF2312WDG0051

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



Test Report No.: RF2312WDG0051

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---