FCC Test Report
(BT-EDR)

Report No.:	RFBEOA-WTW-P21031188-1
FCC ID:	BYG-MMR99
Test Model:	MMR-99
Received Date:	Mar. 31, 2021
Test Date:	Jun. 12 to Jul. 23, 2021 & Jan. 26, 2022
Issued Date:	Feb. 15, 2022
Applicant:	Sangean Electronics Inc.
Address:	No. 18, Lane 7, Li-De Street, Chung Ho District, New Taipei City, 235, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
FCC Registration / Designation Number:	198487 / TW2021

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Release Control Record

Issue No.	Description	Date Issued
RFBEOA-WTW-P21031188-1	Original release.	Feb. 15, 2022

1 Certificate of Conformity

Product:	AM/FM/WX/BLUETOOTH/AUX IN QUAD-POWER EMERGENCY RADIO
Brand:	SANGEAN
Test Model:	MMR-99
Sample Status:	Engineering sample
Applicant:	Sangean Electronics Inc.
Test Date:	Jun. 12 to Jul. 23, 2021 & Jan. 26, 2022
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Jessica Cheng , **Date:** Feb. 15, 2022

Jessica Cheng / Senior Specialist

Approved by : Jeremy Lin , **Date:** Feb. 15, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -4.18dB at 0.44297MHz.
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.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -9.63dB at 599.47MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

NOTE:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.
3. For 2.4GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.

2.1 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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Conducted Emissions	9kHz ~ 40GHz	2.63 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1GHz	5.70 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.14 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	AM/FM/WX/BLUETOOTH/AUX IN QUAD-POWER EMERGENCY RADIO
Brand	SANGEAN
Test Model	MMR-99
Status of EUT	Engineering sample
Power Supply Rating	3.65Vdc from battery or 5V from adapter or host equipment
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	1.476mW
Antenna Type	PCB Antenna with 1.927dBi gain
Antenna Connector	N/A
Accessory Device	FM Antenna
Data Cable Supplied	Shielded USB A to Type C cable (1.0m)

Note:

1. The EUT consumes power from the Built-in battery.

Built-in battery	18650 (3.65Vdc / 2600mAh)

2. For Radiated Emissions test, following modes were pre-tested:
   - ✧ Operating Mode (EUT + Battery)
   - ✧ Operating Mode (EUT + Adapter)
   - ✧ Operating Mode (EUT + Notebook)

   The worst emission level was found when the EUT tested under **Operating Mode (EUT + Notebook),** therefore, only its test data was recorded in this report.

3. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	√	√	Operating Mode (EUT + Notebook)
B	-	-	√	-	Operating Mode (EUT + Adapter)

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

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ 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

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ 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	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, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ 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 & B	0 to 78	0	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, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

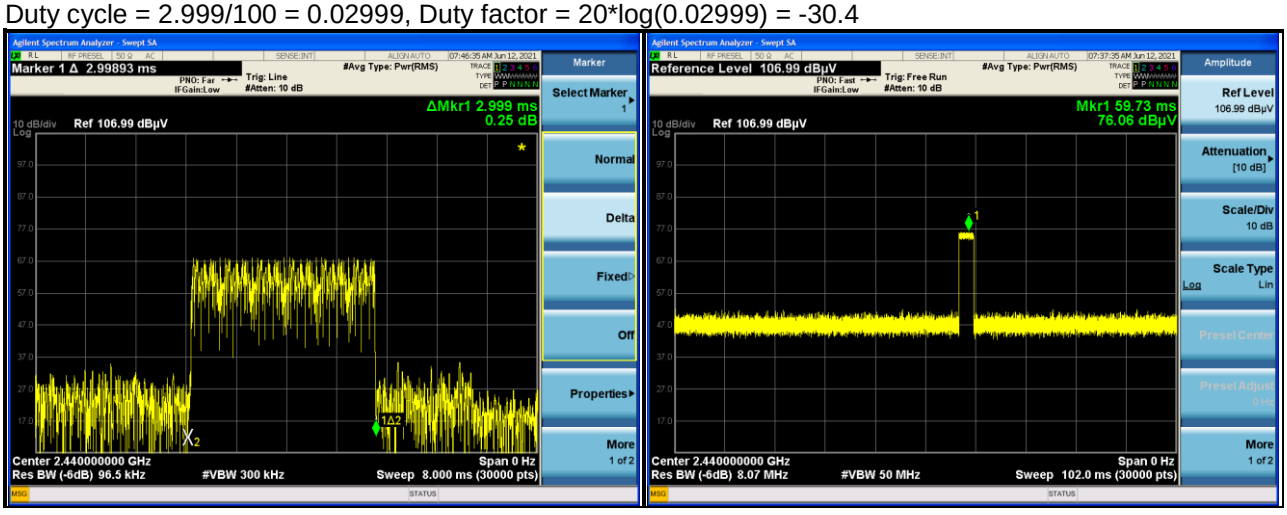
EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5
A	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Test Condition:

Applicable To	EUT Configure Mode	Environmental Conditions	Input Power	Tested By
RE≥1G	A	25deg. C, 55%RH	120Vac, 60Hz (System)	Jed Wu
RE<1G	A	25deg. C, 55%RH	120Vac, 60Hz (System)	Jed Wu
PLC	A	25deg. C, 75%RH	120Vac, 60Hz (System)	Ian Chang
	B	25deg. C, 75%RH	120Vac, 60Hz (Adapter)	Ian Chang
APCM	A	25deg. C, 76%RH	120Vac, 60Hz (System)	Pirar Hsieh

3.3 Duty Cycle of Test Signal

Duty cycle = 2.999/100 = 0.02999, Duty factor = 20*log(0.02999) = -30.4



3.4 Description of Support Units

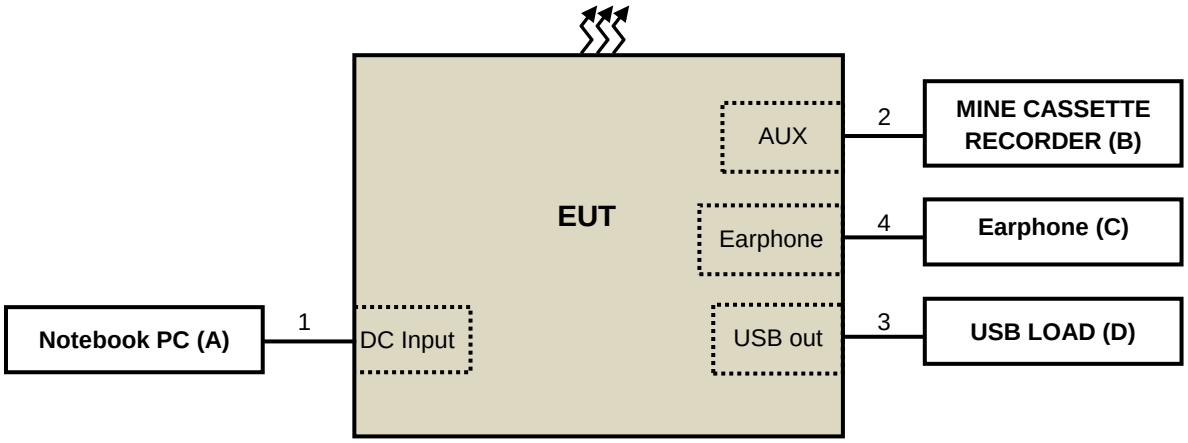
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook PC	SONY	SVS151A12P	275548477000760	NA	Provided by Lab
B.	MINE CASSETTE RECORDER	PANASONIC	RQ-L11	JE012031	NA	Provided by Lab
C.	EARPHONE	PHILIPS	SBC HL145	N/A	NA	Provided by Lab
D.	USB Load	N/A	N/A	N/A	N/A	Provided by Lab
E.	Adapter	Apple	A1385	N/A	N/A	Provided by Lab

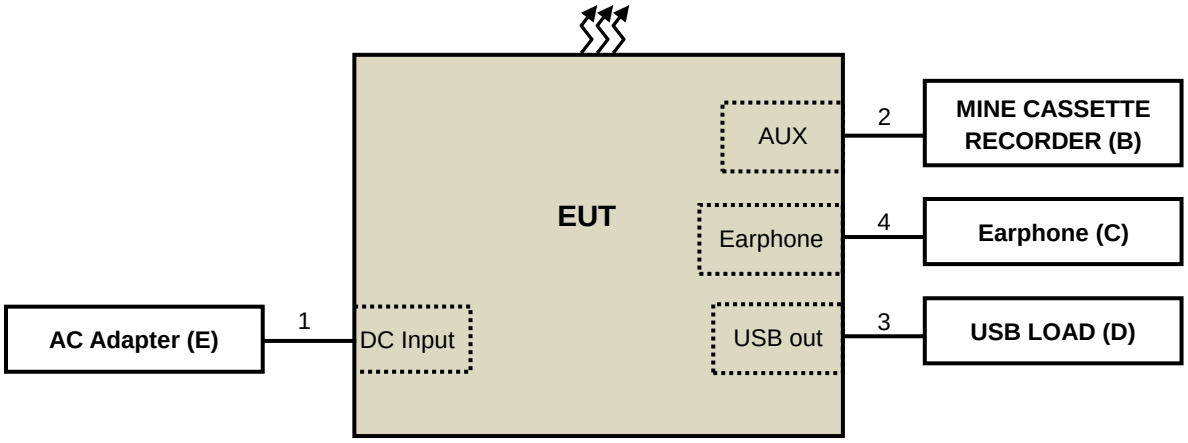
ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB A to Type C cable	1	1.0	Y	0	Supplied by applicant
2.	Audio cable	1	1.2	N	0	Provided by Lab
3.	USB cable	1	1	Y	0	Provided by Lab
4.	Earphone cable	1	1.0	N	0	Provided by Lab

3.4.1 Configuration of System under Test

Mode A:



Mode B:



3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013
All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02
All test items have been performed as a reference to the above KDB test guidance.

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 must comply with the radiated emission limits specified as below table. 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. 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

Radiated Emission Test (Below 1GHz):

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210129	Mar. 12, 2021	Mar. 11, 2022
Software BVADT	ADT_Radiated_V8.7.08	NA	NA	NA
Software BVADT	ADT_RF Test Software V6.6.5.4	NA	NA	NA
Auto Control System(Antenna Tower Table Controller) ADT	SC100+AT100+TT100	0306	NA	NA
Pre_Amplifier EMCI	EMC001340	980269	June 29, 2021	June 28, 2022
LOOP ANTENNA EMCI	LPA600	270	Sep. 2, 2021	Sep. 1, 2023
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	July 13, 2021	July 12, 2022
Pre_Amplifier HP	8447D	2432A03504	Feb. 18, 2021	Feb. 17, 2022
Bi-log Broadband Antenna Schwarzbeck	VULB9168	139	Nov. 1, 2021	Oct. 31, 2022
Attenuator Mini-Circuits	UNAT-5+	PAD-CH6-01	July 13, 2021	July 12, 2022
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	July 13, 2021	July 12, 2022

NOTE: 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in LK - 966 chamber 1
3. Tested Date: Jan. 26, 2022

Rdiated Emission Test (Above 1GHz):

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210129	Mar. 12, 2021	Mar. 11, 2022
Software BVADT	ADT_Radiated_V8.7.08	NA	NA	NA
Software BVADT	ADT_RF Test Software V6.6.5.4	NA	NA	NA
Auto Control System(Antenna Tower, Table, Controller) ADT	SC100+AT100+TT100	0306	NA	NA
Antenna(Horn) EMCO	3115	00028257	Nov. 22, 2020	Nov. 21, 2021
Test Receiver Agilent	N9038A	MY51210129	Mar. 12, 2021	Mar. 11, 2022
Pre-amplifier HP	8449B	3008A01201	Feb. 19, 2021	Feb. 18, 2022
RF Coaxial Cable HUBER SUHNER	SF-102	Cable-CH6-01	Jul. 9, 2020	Jul. 8, 2021
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	May 28, 2021	May 27, 2022
Fix tool for Boresight	BAF-01	5	NA	NA
Pre_Amplifier MITEQ	AMF-6F-260400-33-8P	892164	Feb. 19, 2021	Feb. 18, 2022
Antenna(Horn) Schwarzbeck	BBHA-9170	BBHA9170190	Nov. 22, 2020	Nov. 21, 2021
Spectrum Analyzer KEYSIGHT	N9030A	MY54490260	July 22, 2020	July 21, 2021
Spectrum Analyzer R&S	FSV40	101042	Sep. 8, 2020	Sep. 7, 2021
RF Coaxial Cable WOKEN	WC01	Cable-CH10-03	July 9, 2020	July 8, 2021
RF Coaxial Cable Rosnol	K1K50-UP0279-K1K50-3000	Cable-CH10(3m)-04	July 9, 2020	July 8, 2021
Highpass filter SUHNER	11SH10-7000/T18000-O/OP	SN 4	May 28, 2021	May 27, 2022

NOTE: 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in LK - 966 chamber 1.
4. Tested Date: Jun. 12, 2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case 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 Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. 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. The height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

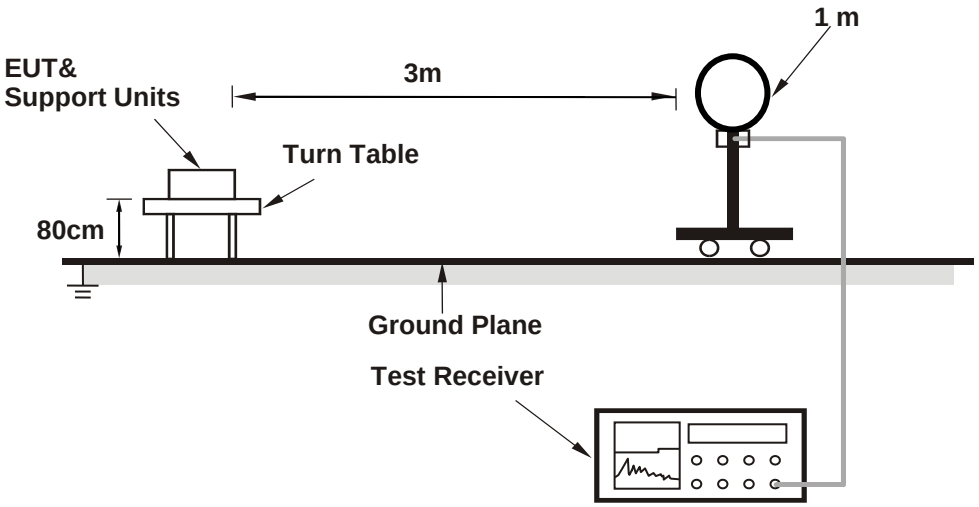
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection at frequency above 1GHz. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty cycle correction factor. The duty cycle correction factor refer to Chapter 3.3 of this report.
3. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

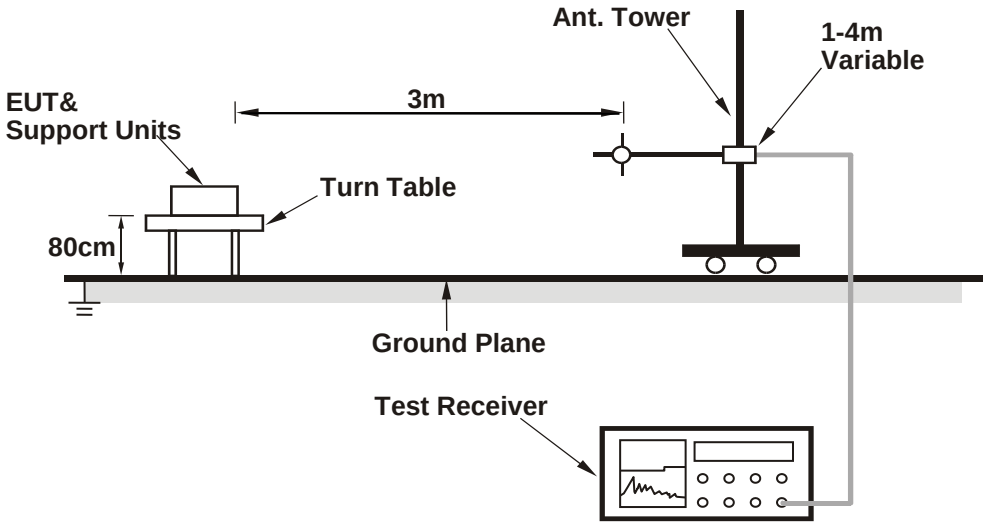
No deviation.

4.1.5 Test Setup

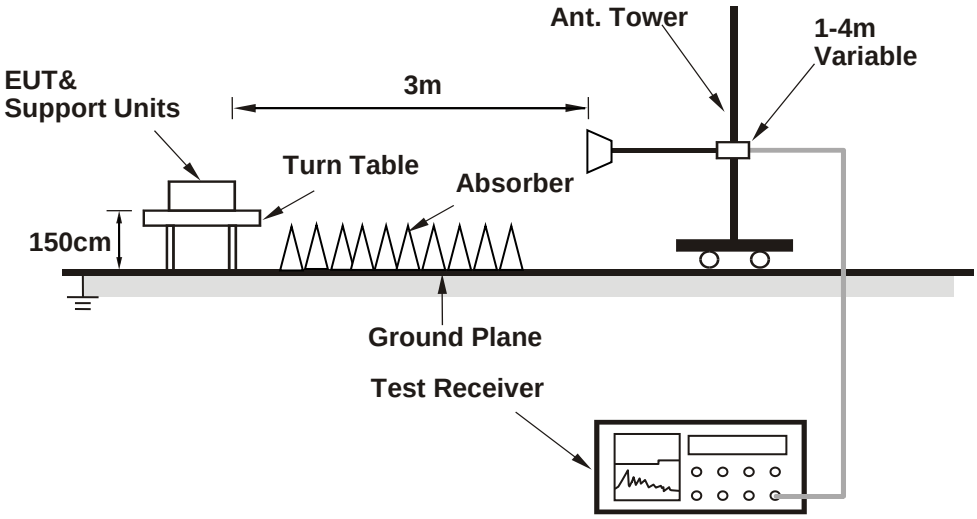
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Connected the EUT to Notebook.

b. Set the EUT under transmission condition continuously at specific channel frequency continuously.

4.1.7 Test Results

Mode A

ABOVE 1GHz DATA

RF Mode	TX BT_GFSK	**Channel**	CH 0：2402 MHz
Frequency Range	1GHz ~ 25GHz	**Detector Function**	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (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	45.91 PK	74.00	-28.09	1.52 H	115	44.03	1.88
2	2390.00	34.56 AV	54.00	-19.44	1.52 H	115	32.68	1.88
3	*2402.00	90.93 PK			1.52 H	115	88.99	1.94
4	*2402.00	60.53 AV			1.52 H	115	58.59	1.94
5	4804.00	54.38 PK	74.00	-19.62	1.97 H	169	44.15	10.23
6	4804.00	23.98 AV	54.00	-30.02	1.97 H	169	13.75	10.23
Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (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	45.58 PK	74.00	-28.42	1.32 V	60	43.70	1.88
2	2390.00	34.65 AV	54.00	-19.35	1.32 V	60	32.77	1.88
3	*2402.00	92.18 PK			1.32 V	60	90.24	1.94
4	*2402.00	61.78 AV			1.32 V	60	59.84	1.94
5	4804.00	52.80 PK	74.00	-21.20	2.13 V	181	42.57	10.23
6	4804.00	22.40 AV	54.00	-31.60	2.13 V	181	12.17	10.23

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

RF Mode	TX BT_GFSK	Channel	CH 39：2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	89.37 PK			1.54 H	118	87.34	2.03
2	*2441.00	58.97 AV			1.54 H	118	56.94	2.03
3	4882.00	54.04 PK	74.00	-19.96	2.03 H	172	43.89	10.15
4	4882.00	23.64 AV	54.00	-30.36	2.03 H	172	13.49	10.15
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	91.70 PK			1.30 V	65	89.67	2.03
2	*2441.00	61.30 AV			1.30 V	65	59.27	2.03
3	4882.00	52.40 PK	74.00	-21.60	2.10 V	178	42.25	10.15
4	4882.00	22.00 AV	54.00	-32.00	2.10 V	178	11.85	10.15

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

RF Mode	TX BT_GFSK	Channel	CH 78：2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	90.02 PK			1.50 H	74	87.80	2.22
2	*2480.00	59.62 AV			1.50 H	74	57.40	2.22
3	2483.50	56.45 PK	74.00	-17.55	1.50 H	74	54.22	2.23
4	2483.50	36.49 AV	54.00	-17.51	1.50 H	74	34.26	2.23
5	4960.00	54.11 PK	74.00	-19.89	1.99 H	171	43.81	10.30
6	4960.00	23.71 AV	54.00	-30.29	1.99 H	171	13.41	10.30
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	90.63 PK			1.14 V	43	88.41	2.22
2	*2480.00	60.23 AV			1.14 V	43	58.01	2.22
3	2483.50	57.24 PK	74.00	-16.76	1.14 V	43	55.01	2.23
4	2483.50	37.24 AV	54.00	-16.76	1.14 V	43	35.01	2.23
5	4960.00	52.23 PK	74.00	-21.77	2.23 V	195	41.93	10.30
6	4960.00	21.83 AV	54.00	-32.17	2.23 V	195	11.53	10.30

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

RF Mode	TX BT_8DPSK	Channel	CH 0：2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	45.34 PK	74.00	-28.66	1.51 H	114	43.46	1.88
2	2390.00	34.81 AV	54.00	-19.19	1.51 H	114	32.93	1.88
3	*2402.00	91.41 PK			1.51 H	114	89.47	1.94
4	*2402.00	61.01 AV			1.51 H	114	59.07	1.94
5	4804.00	52.10 PK	74.00	-21.90	1.88 H	153	41.87	10.23
6	4804.00	21.70 AV	54.00	-32.30	1.88 H	153	11.47	10.23
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	45.96 PK	74.00	-28.04	1.48 V	59	44.08	1.88
2	2390.00	34.76 AV	54.00	-19.24	1.48 V	59	32.88	1.88
3	*2402.00	94.06 PK			1.48 V	59	92.12	1.94
4	*2402.00	63.66 AV			1.48 V	59	61.72	1.94
5	4804.00	53.39 PK	74.00	-20.61	2.33 V	196	43.16	10.23
6	4804.00	22.99 AV	54.00	-31.01	2.33 V	196	12.76	10.23

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

RF Mode	TX BT_8DPSK	Channel	CH 39：2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	90.06 PK			1.55 H	126	88.03	2.03
2	*2441.00	59.66 AV			1.55 H	126	57.63	2.03
3	4882.00	51.28 PK	74.00	-22.72	2.13 H	182	41.13	10.15
4	4882.00	20.88 AV	54.00	-33.12	2.13 H	182	10.73	10.15
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	91.88 PK			1.67 V	69	89.85	2.03
2	*2441.00	61.48 AV			1.67 V	69	59.45	2.03
3	4882.00	52.90 PK	74.00	-21.10	1.67 V	69	42.75	10.15
4	4882.00	22.50 AV	54.00	-31.50	1.67 V	69	12.35	10.15

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

RF Mode	TX BT_8DPSK	Channel	CH 78：2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	91.50 PK			1.49 H	55	89.28	2.22
2	*2480.00	61.10 AV			1.49 H	55	58.88	2.22
3	2483.50	57.85 PK	74.00	-16.15	1.49 H	55	55.62	2.23
4	2483.50	37.04 AV	54.00	-16.96	1.49 H	55	34.81	2.23
5	4960.00	51.71 PK	74.00	-22.29	1.95 H	158	41.41	10.30
6	4960.00	21.31 AV	54.00	-32.69	1.95 H	158	11.01	10.30
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	92.47 PK			1.93 V	43	90.25	2.22
2	*2480.00	62.07 AV			1.93 V	43	59.85	2.22
3	2483.50	58.37 PK	74.00	-15.63	1.93 V	43	56.14	2.23
4	2483.50	37.40 AV	54.00	-16.60	1.93 V	43	35.17	2.23
5	4960.00	52.86 PK	74.00	-21.14	2.41 V	185	42.56	10.30
6	4960.00	22.46 AV	54.00	-31.54	2.41 V	185	12.16	10.30

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the Duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(2.999 ms / 100 ms) = -30.4 dB
   Please refer to the plotted duty (see section 3.3)

Mode A

BELOW 1GHz WORST-CASE DATA

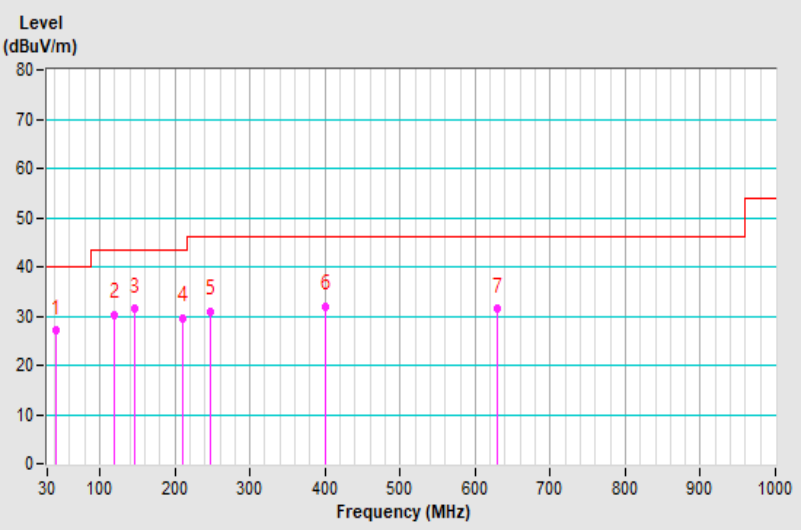
BT_8DPSK

RF Mode	TX BT_8DPSK	Channel	CH 0：2402 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.75	27.01 QP	40.00	-12.99	1.34 H	268	34.39	-7.38
2	118.35	30.09 QP	43.50	-13.41	1.53 H	248	39.12	-9.03
3	145.51	31.42 QP	43.50	-12.08	1.74 H	228	37.91	-6.49
4	209.53	29.66 QP	43.50	-13.84	1.93 H	208	38.14	-8.48
5	246.39	30.82 QP	46.00	-15.18	2.09 H	193	37.28	-6.46
6	399.65	31.95 QP	46.00	-14.05	2.32 H	171	34.18	-2.23
7	628.57	31.44 QP	46.00	-14.56	2.84 H	119	28.32	3.12

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

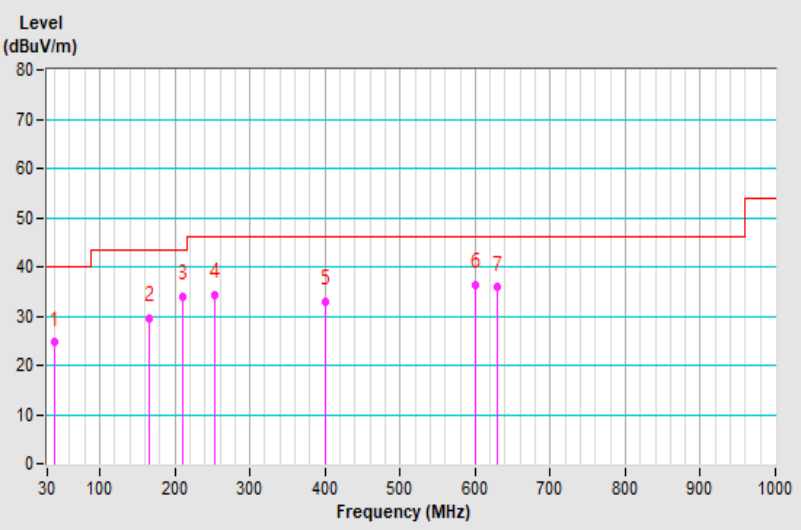


RF Mode	TX BT_8DPSK	Channel	CH 0：2402 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	38.81	24.64 QP	40.00	-15.36	3.71 V	96	32.35	-7.71
2	164.91	29.50 QP	43.50	-14.00	3.28 V	138	35.74	-6.24
3	209.53	33.83 QP	43.50	-9.67	3.06 V	161	42.31	-8.48
4	252.21	34.26 QP	46.00	-11.74	2.71 V	194	40.44	-6.18
5	399.65	32.94 QP	46.00	-13.06	2.16 V	249	35.17	-2.23
6	**599.47**	**36.37 QP**	**46.00**	**-9.63**	**2.46 V**	**220**	**34.14**	**2.23**
7	628.57	35.76 QP	46.00	-10.24	1.90 V	275	32.64	3.12

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

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

4.2.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver ESR3 R&S	ESR3	102412	Jan. 22, 2022	Jan. 21, 2023
LISN Schwarzbeck	NSLK 8128	8128-244	Nov. 11, 2021	Nov. 10, 2022
LISN Schwarzbeck	NNLK8129	8129229	May 20, 2021	May 19, 2022
DC LISN Schwarzbeck	NNLK 8121	8121-808	Apr. 18, 2021	Apr. 17, 2022
LISN Schwarzbeck	NNLK 8121	8121-731	Apr. 28, 2021	Apr. 27, 2022
LISN R&S	ENV216	101196	Apr. 26, 2021	Apr. 25, 2022
LISN R&S	ESH3-Z5	100220	Nov. 25, 2021	Nov. 24, 2022
LISN R&S	ESH3-Z6	844950/018	July 25, 2021	July 24, 2022
DC LISN R&S	ESH3-Z6	100219	July 25, 2021	July 24, 2022
High Voltage Probe Schwarzbeck	TK9420	00982	Dec. 24, 2021	Dec. 23, 2022
RF Coaxial Cable Commate	5D-FB	Cable-CO5-01	Jan. 29, 2021	Jan. 28, 2022
Attenuator STI	STI02-2200-10	NO.4	Sep. 3, 2021	Sep. 2, 2022
50 Ohms Terminator LYNICS	0900510	E1-01-305	Feb. 17, 2021	Feb. 16, 2022
Isolation Transformer Erika Fiedler	D-65396	017	Sep. 9, 2021	Sep. 8, 2022
Software BVADT	Cond_V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Linkou Conduction09
3. The VCCI Site Registration No. C-11312.
4. Tested Date: Jan. 26, 2022

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

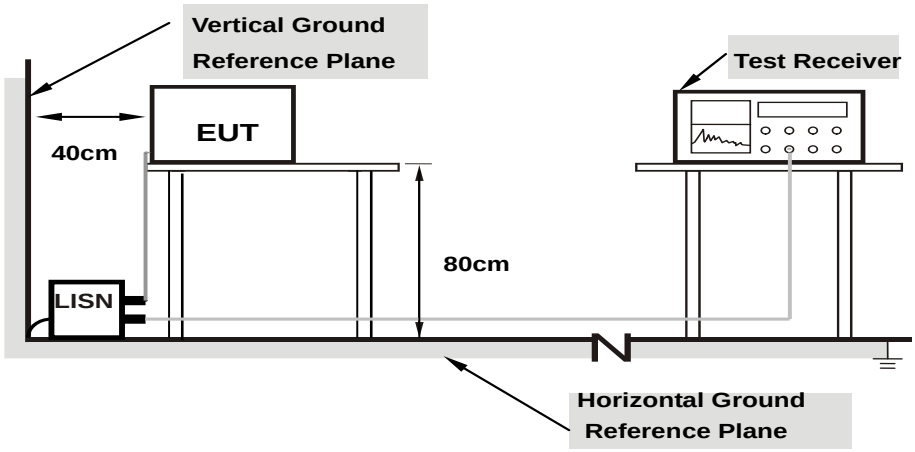
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation From Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Condition

a. Connected the EUT to Adapter or Notebook.

b. Set the EUT under transmission condition continuously at specific channel frequency continuously.

4.2.7 Test Results

Mode A

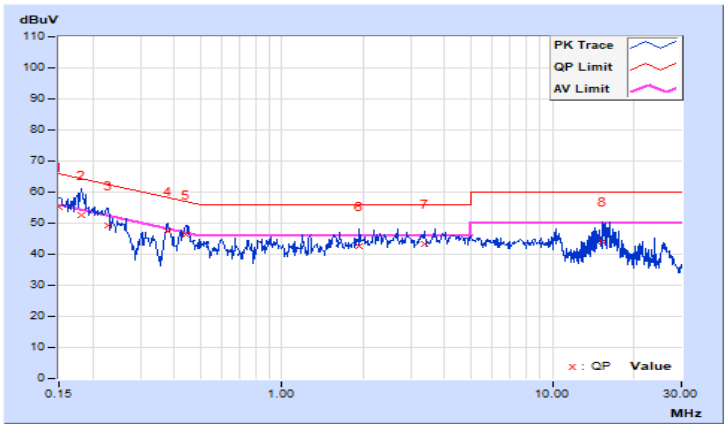
BT_8DPSK CH 0

Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.88	45.33	35.79	55.21	45.67	66.00	56.00	-10.79	-10.33
2	0.18125	9.88	42.81	34.02	52.69	43.90	64.43	54.43	-11.74	-10.53
3	0.22812	9.88	39.35	31.19	49.23	41.07	62.52	52.52	-13.29	-11.45
4	0.38047	9.90	37.56	31.44	47.46	41.34	58.27	48.27	-10.81	-6.93
5	0.44297	9.90	36.46	32.28	46.36	42.18	57.01	47.01	-10.65	-4.83
6	1.93750	9.98	32.70	26.99	42.68	36.97	56.00	46.00	-13.32	-9.03
7	3.37500	10.02	33.37	25.70	43.39	35.72	56.00	46.00	-12.61	-10.28
8	15.31641	10.37	33.62	26.27	43.99	36.64	60.00	50.00	-16.01	-13.36

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

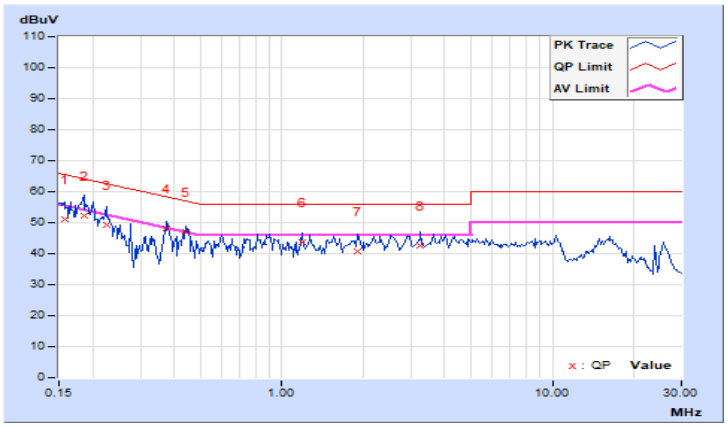


Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.89	41.31	31.91	51.20	41.80	65.58	55.58	-14.38	-13.78
2	0.18516	9.89	42.22	33.42	52.11	43.31	64.25	54.25	-12.14	-10.94
3	0.22422	9.89	39.55	30.62	49.44	40.51	62.66	52.66	-13.22	-12.15
4	0.37656	9.91	38.20	34.22	48.11	44.13	58.35	48.35	-10.24	-4.22
5	**0.44297**	**9.91**	**37.12**	**32.92**	**47.03**	**42.83**	**57.01**	**47.01**	**-9.98**	**-4.18**
6	1.18359	9.97	33.71	26.89	43.68	36.86	56.00	46.00	-12.32	-9.14
7	1.91406	10.00	30.86	24.06	40.86	34.06	56.00	46.00	-15.14	-11.94
8	3.26172	10.03	32.46	26.97	42.49	37.00	56.00	46.00	-13.51	-9.00

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



Mode B

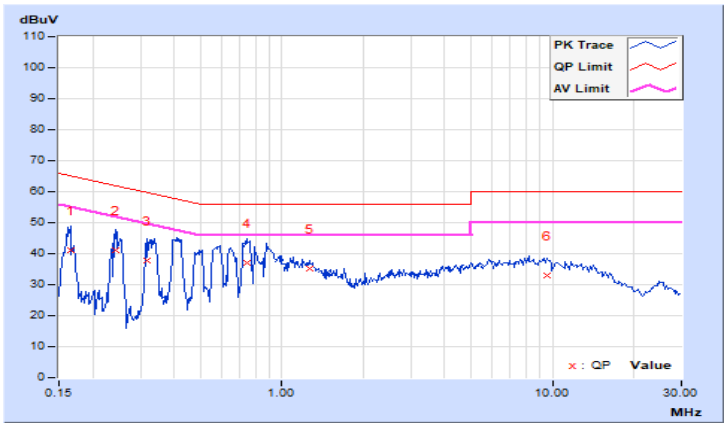
BT_8DPSK CH 0

Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	9.89	31.29	17.46	41.18	27.35	65.18	55.18	-24.00	-27.83
2	0.24375	9.89	31.37	16.89	41.26	26.78	61.97	51.97	-20.71	-25.19
3	0.31797	9.90	27.72	11.79	37.62	21.69	59.76	49.76	-22.14	-28.07
4	0.74766	9.95	26.93	13.39	36.88	23.34	56.00	46.00	-19.12	-22.66
5	1.26953	9.99	25.04	12.04	35.03	22.03	56.00	46.00	-20.97	-23.97
6	9.55078	10.36	22.43	15.37	32.79	25.73	60.00	50.00	-27.21	-24.27

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

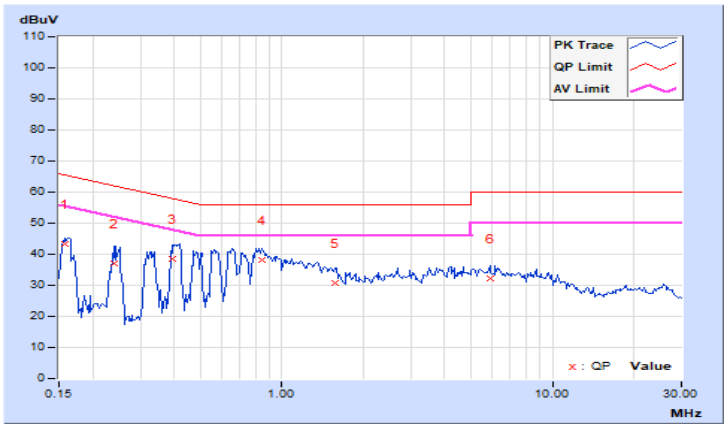


Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.91	33.39	18.61	43.30	28.52	65.58	55.58	-22.28	-27.06
2	0.23984	9.91	27.31	14.05	37.22	23.96	62.10	52.10	-24.88	-28.14
3	0.39219	9.93	28.49	8.95	38.42	18.88	58.02	48.02	-19.60	-29.14
4	0.84141	9.97	28.09	11.56	38.06	21.53	56.00	46.00	-17.94	-24.47
5	1.57031	10.02	20.91	9.28	30.93	19.30	56.00	46.00	-25.07	-26.70
6	5.87500	10.22	22.01	13.93	32.23	24.15	60.00	50.00	-27.77	-25.85

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

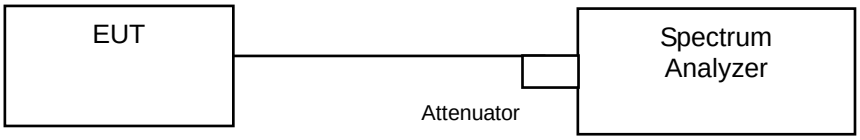


4.3 Number of Hopping Frequency Used

4.3.1 Limits of Hopping Frequency Used Measurement

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

4.3.2 Test Setup



4.3.3 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
MIMO Powermeasurement Test set (4X4) KEYSIGHT	U2021XA	U2021XA_001	Jun. 16, 2021	Jun. 15, 2022
Spectrum Analyzer R&S	FSV40	101042	Sep. 8, 2020	Sep. 7, 2021
Spectrum Analyzer R&S	FSV40	101544	May 24, 2021	May 23, 2022
Pulse Power Sensor Anritsu	MA2411B	0738404	Apr. 15, 2021	Apr. 14, 2022
Peak Power meter Anritsu	ML2495A	0842014	Apr. 15, 2021	Apr. 14, 2022
MXG Vector Signal Generator KEYSIGHT	N5182B	MY53052658	May 19, 2021	May 18, 2022
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Nov. 24, 2020	Nov. 23, 2021

NOTE: 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in LK - Oven
3. Tested Date: Jun. 16, 2021

4.3.4 Test Procedure

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 complete.

4.3.5 Deviation from Test Standard

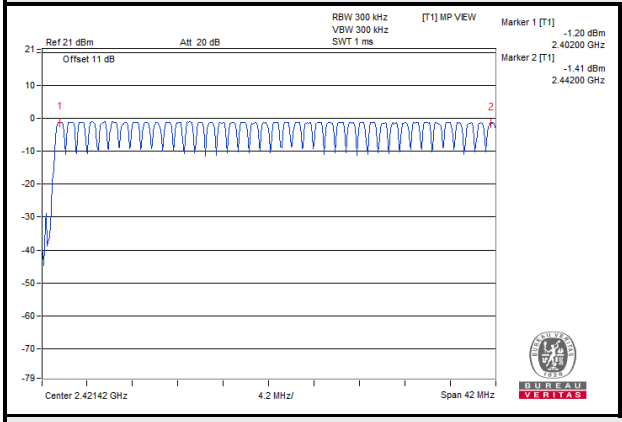
No deviation.

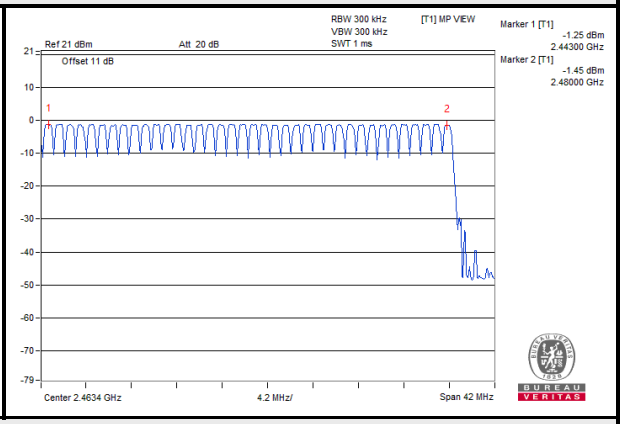
4.3.6 Test Results

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

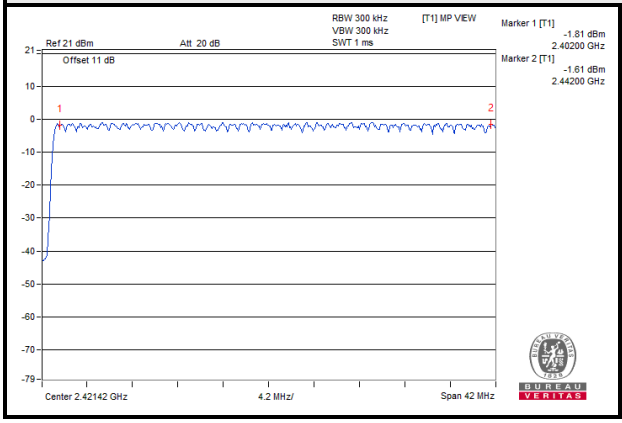
Mode A

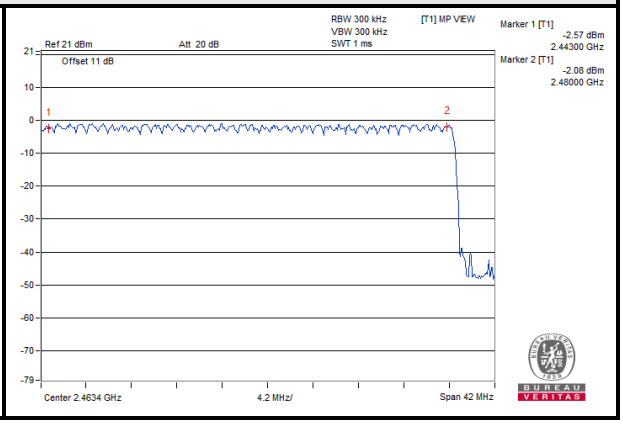
GFSK





8DPSK



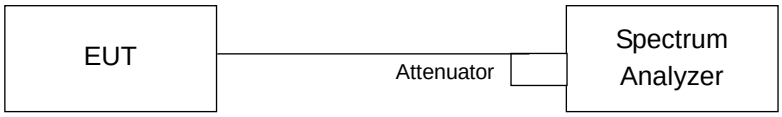


4.4 Dwell Time on Each Channel

4.4.1 Limits of Dwell Time on Each Channel Measurement

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.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 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. 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.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

.

4.4.5 Deviation from Test Standard

No deviation.

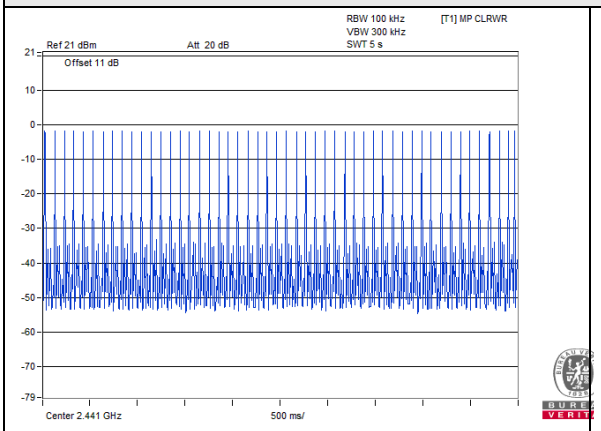
4.4.6 Test Results

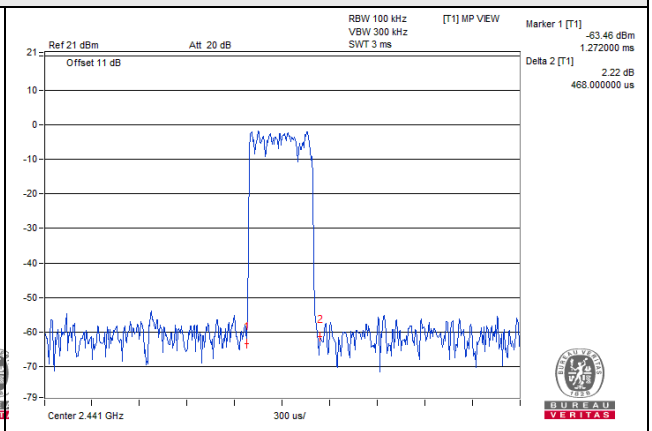
Mode A_GFSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316 times	0.468	147.89	400
DH3	25 (times / 5 sec) * 6.32 = 158 times	1.72	271.76	400
DH5	17 (times / 5 sec) * 6.32 = 108 times	2.97	320.76	400

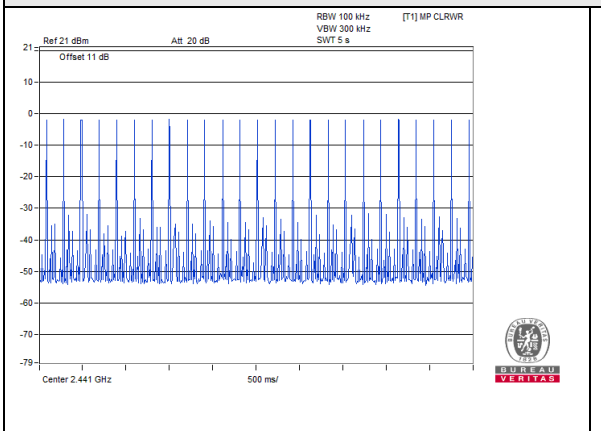
NOTE: Test plots of the transmitting time slot are shown as follows.

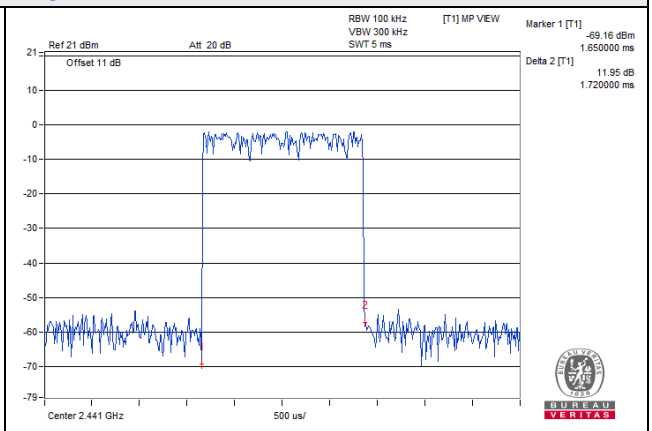
DH1



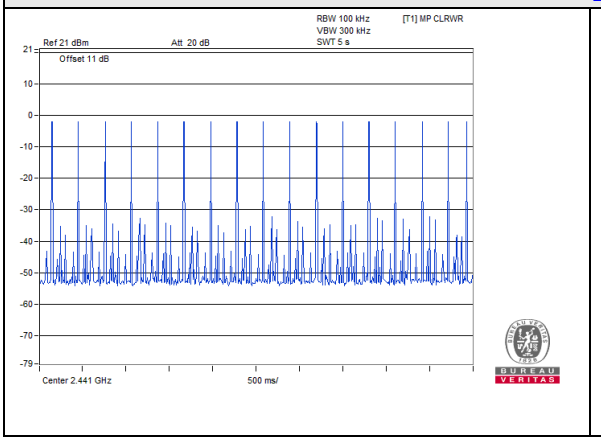


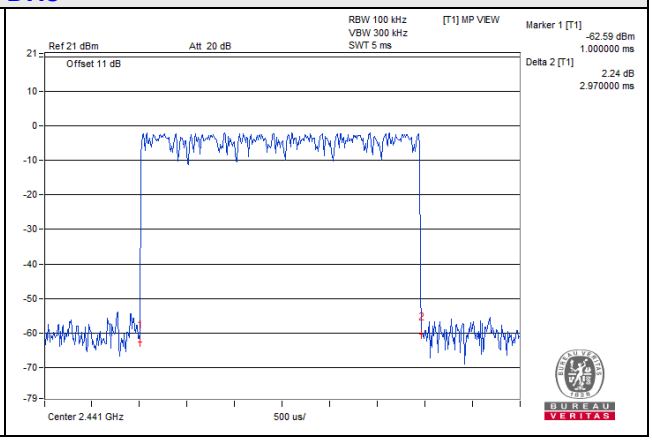
DH3





DH5



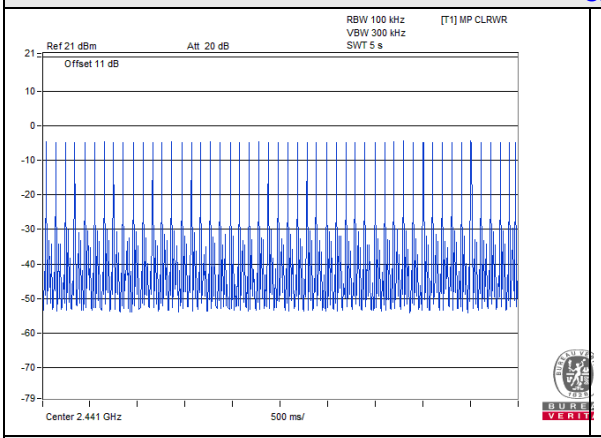


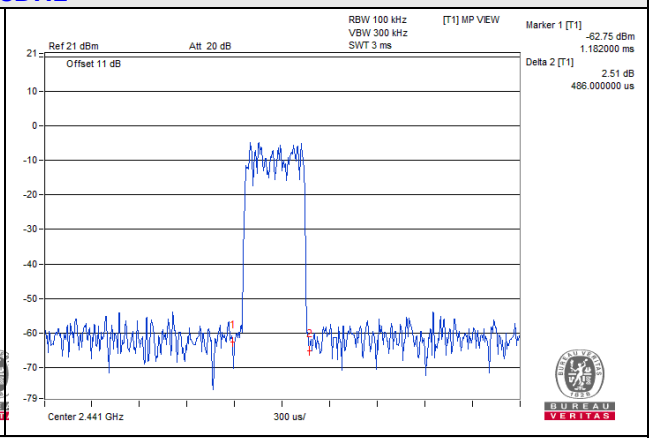
Mode A_8DPSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
3DH1	50 (times / 5 sec) * 6.32 = 316 times	0.486	153.58	400
3DH3	25 (times / 5 sec) * 6.32 = 158 times	1.69	267.02	400
3DH5	17 (times / 5 sec) * 6.32 = 108 times	2.999	323.89	400

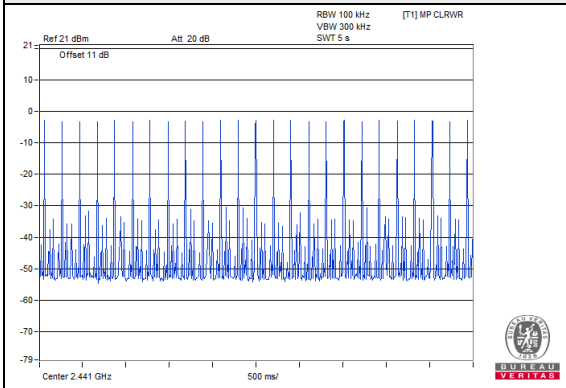
NOTE: Test plots of the transmitting time slot are shown as follows.

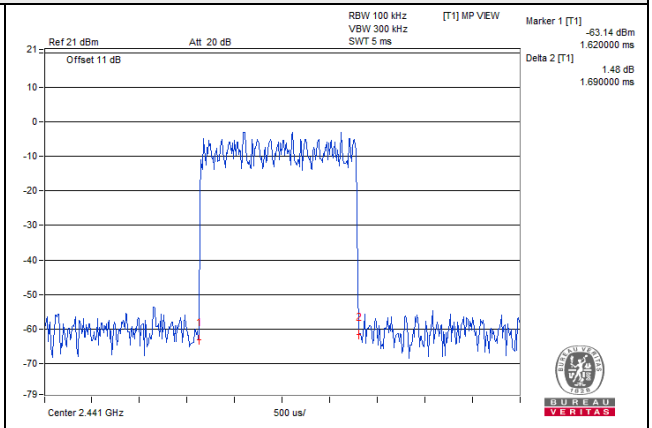
3DH1



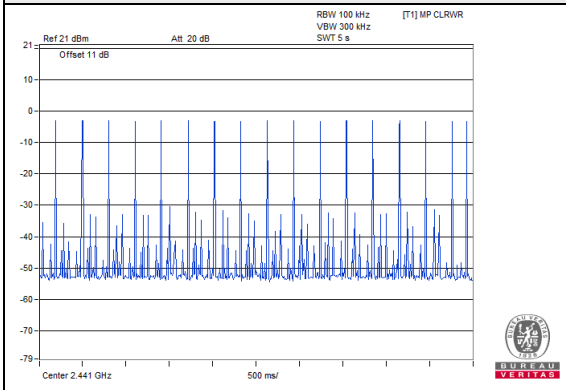


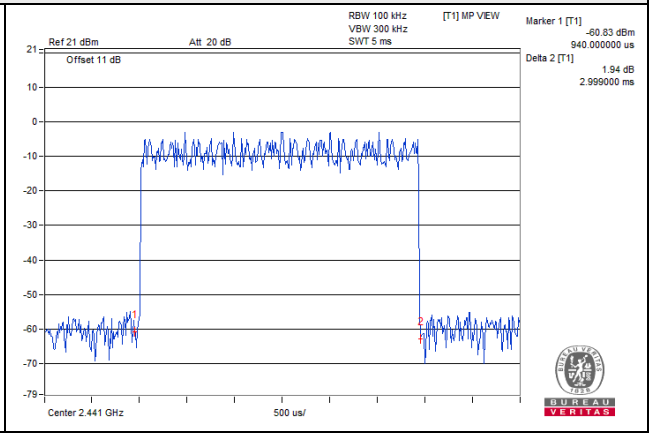
3DH3





3DH5



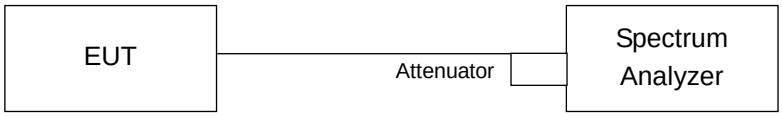


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. 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.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

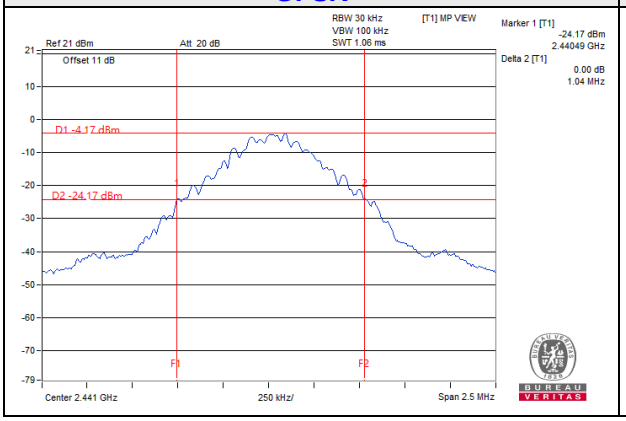
4.5.7 Test Results

Mode A

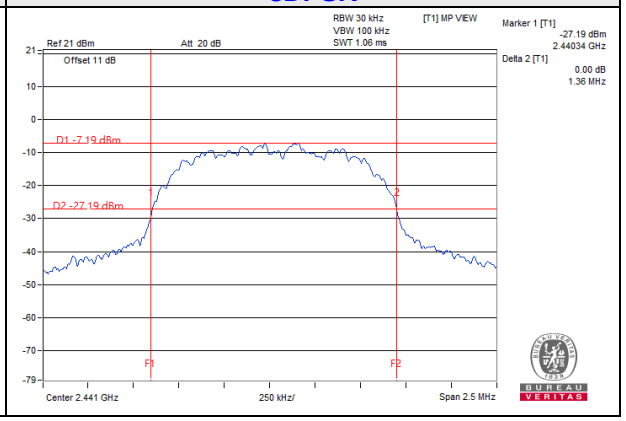
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	1.03	1.35
39	2441	1.04	1.36
78	2480	1.03	1.35

Spectrum Plot of Worst Value

GFSK



8DPSK

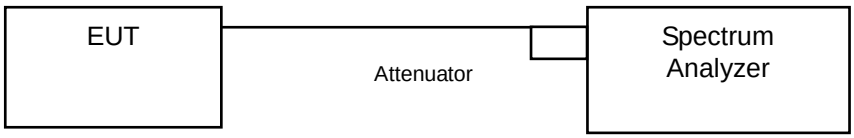


4.6 Hopping Channel Separation

4.6.1 Limits of Hopping Channel Separation Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

Measurement Procedure REF

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

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 Test Results

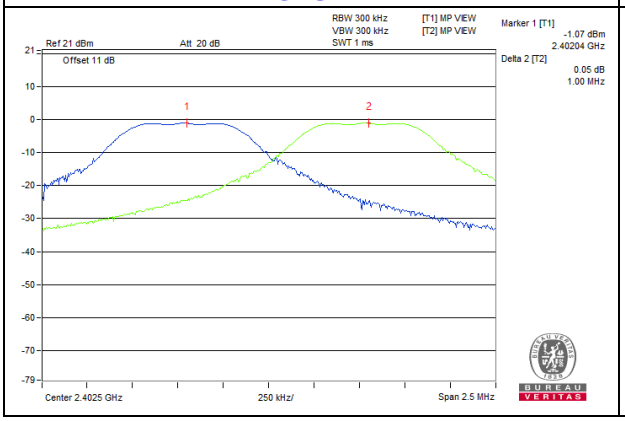
Mode A

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1	1	1.03	1.35	0.69	0.9	Pass
39	2441	1	1	1.04	1.36	0.7	0.91	Pass
78	2480	1	1	1.03	1.35	0.69	0.9	Pass

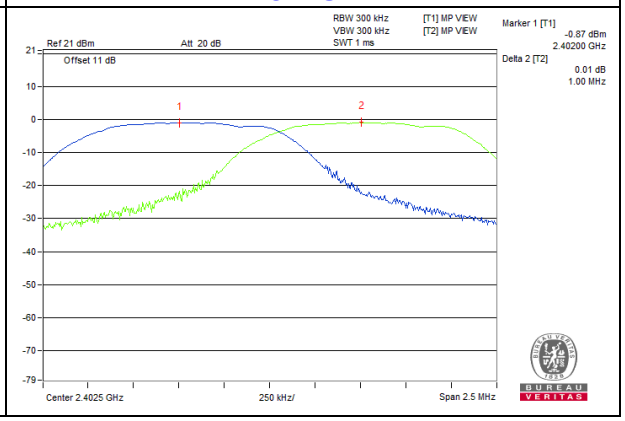
NOTE: The minimum limit is two-third 20dB bandwidth.

Spectrum Plot of Worst Value

GFSK



8DPSK

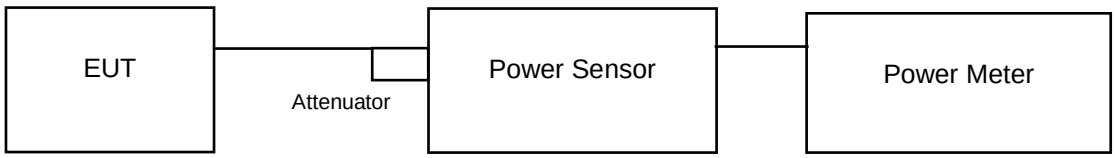


4.7 Maximum Output Power Measurement

4.7.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test 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. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty cycle correction factor is not added to measured value.

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.7.7 Test Results

Mode A

FOR PEAK POWER

Channel	Frequency (MHZ)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	0.8851	**1.476**	-0.53	1.69	125	Pass
39	2441	0.859	1.432	-0.66	1.56	125	Pass
78	2480	0.8492	1.419	-0.71	1.52	125	Pass

FOR AVERAGE POWER

Channel	Frequency (MHZ)	Output Power (mW)		Output Power (dBm)	
		GFSK	8DPSK	GFSK	8DPSK
0	2402	0.8433	0.8492	-0.74	-0.71
39	2441	0.8166	0.8147	-0.88	-0.89
78	2480	0.8072	0.811	-0.93	-0.91

4.8 Conducted Out of Band Emission Measurement

4.8.1 Limits of Conducted Out of Band Emission Measurement

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.8.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.8.3 Test Procedure

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

4.8.4 Deviation from Test Standard

No deviation.

4.8.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

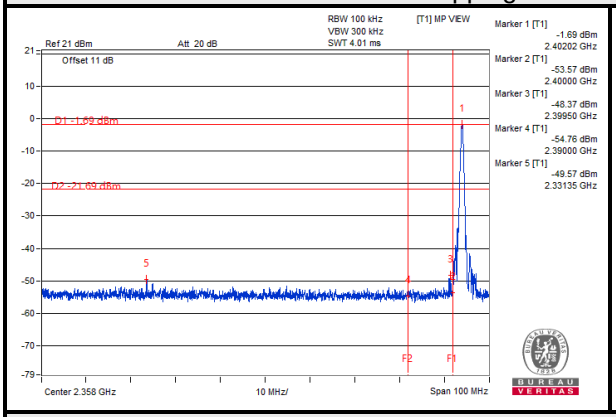
4.8.6 Test Results

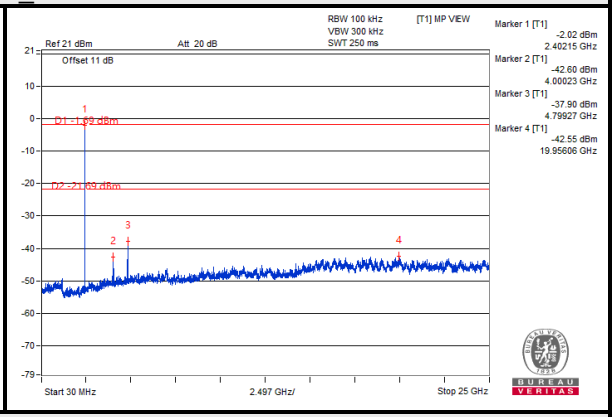
The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

Mode A

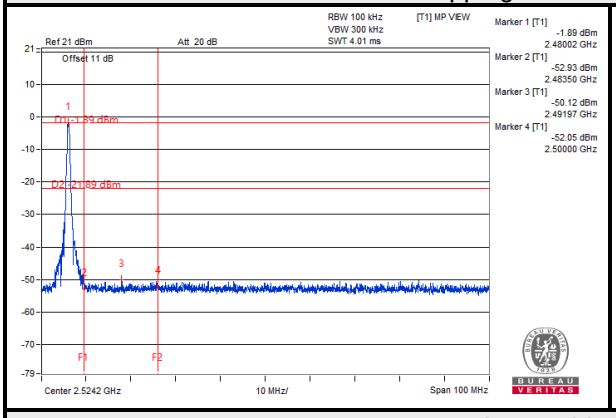
GFSK

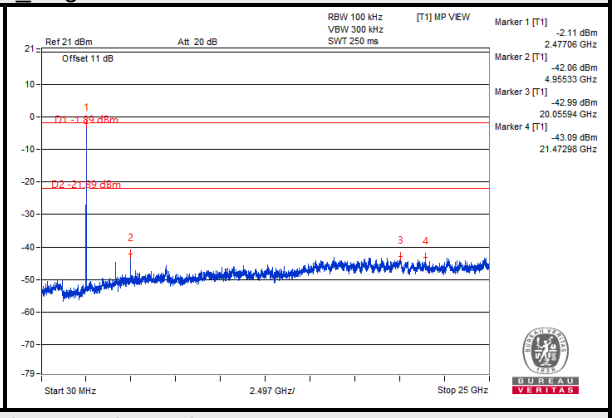
Hopping disabled_ Low Channel



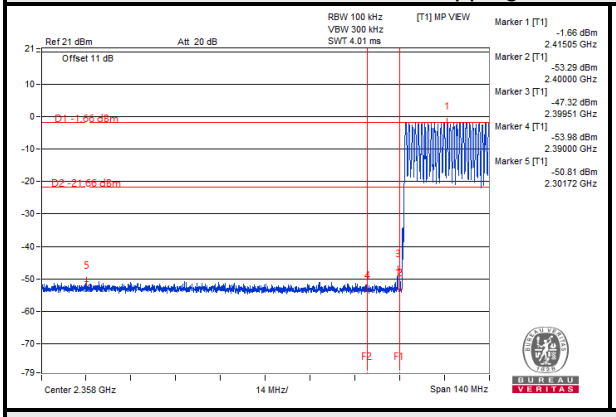


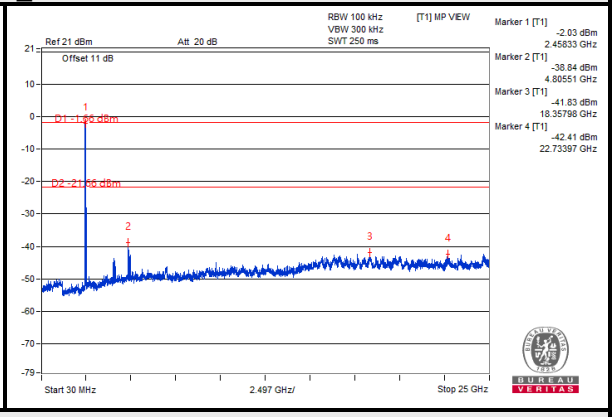
Hopping disabled_ High Channel



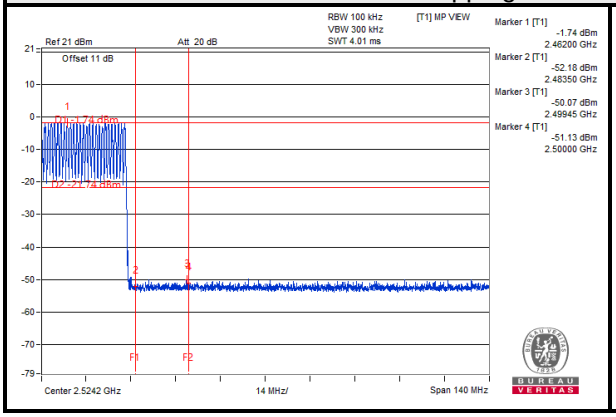


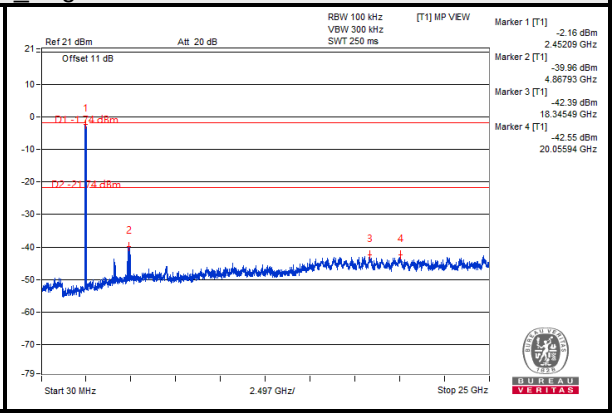
Hopping enabled_ Low Channel





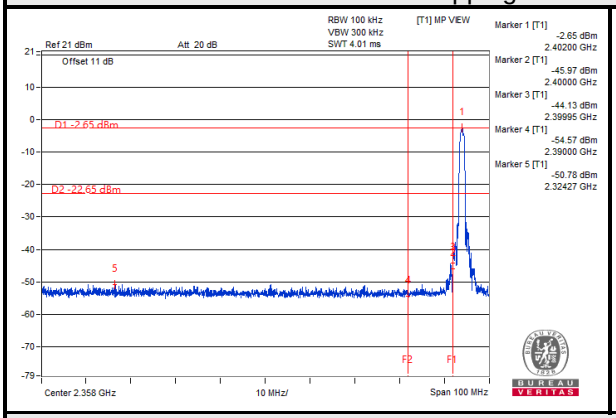
Hopping enabled_ High Channel

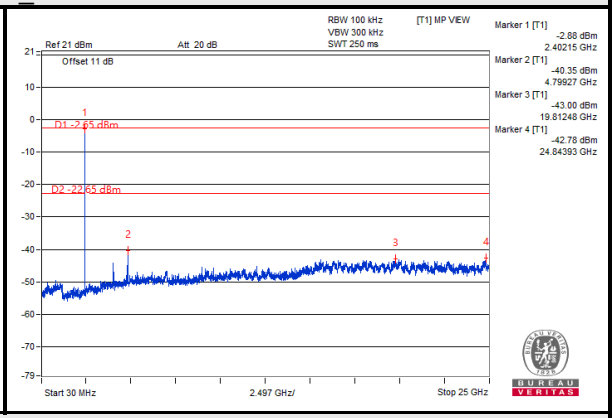




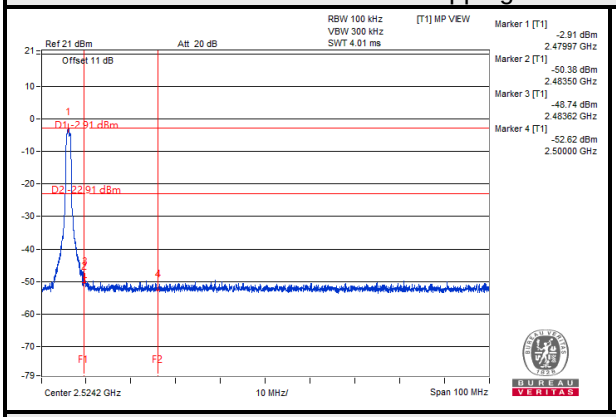
8DPSK

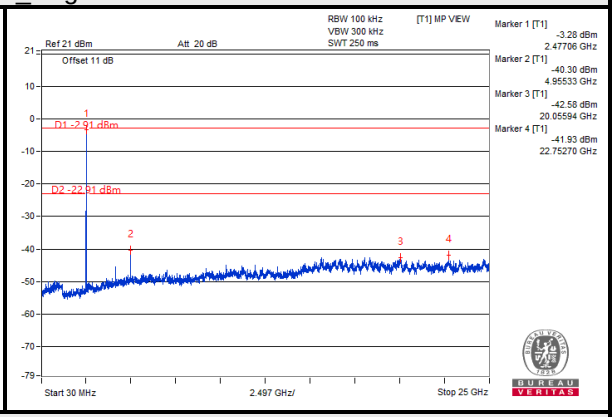
Hopping disabled_ Low Channel



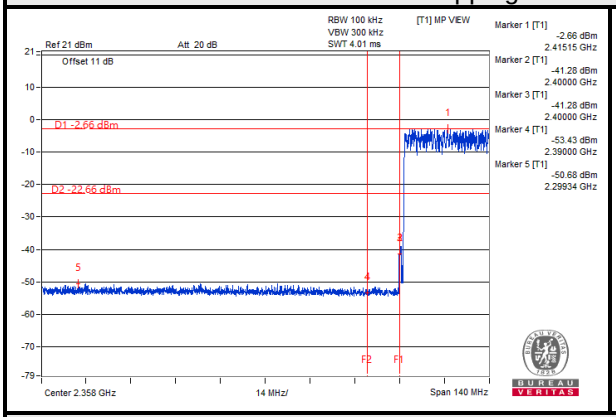


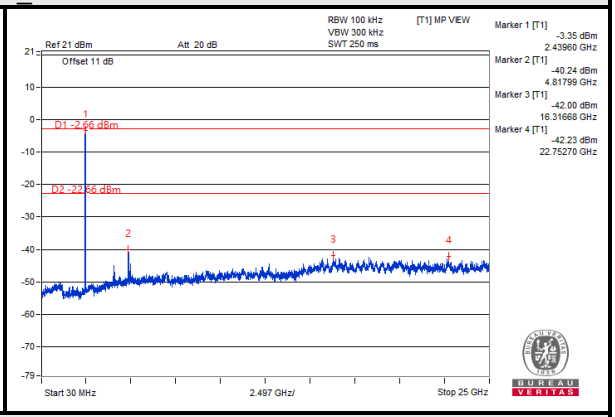
Hopping disabled_ High Channel



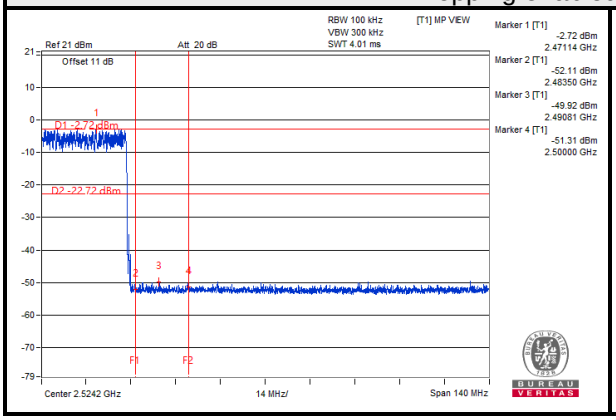


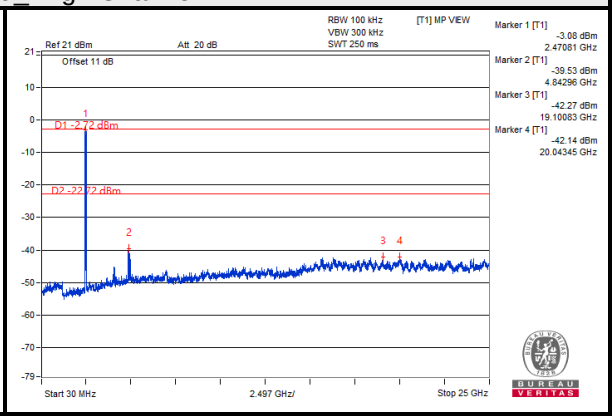
Hopping enabled_ Low Channel





Hopping enabled_ High Channel

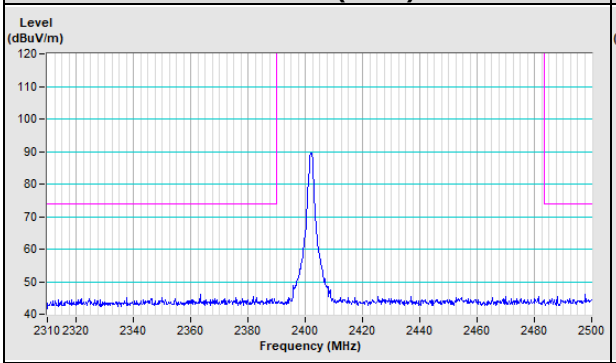
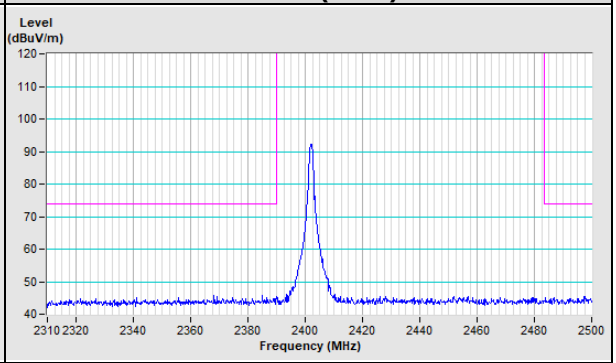
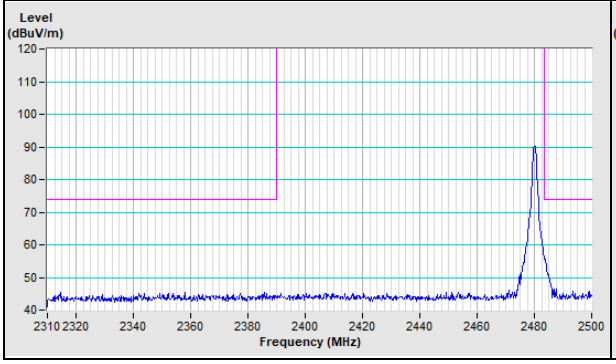
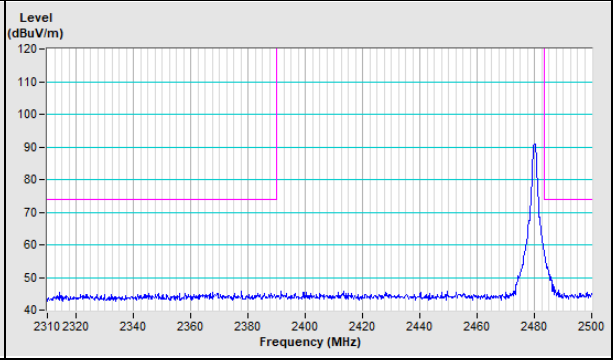


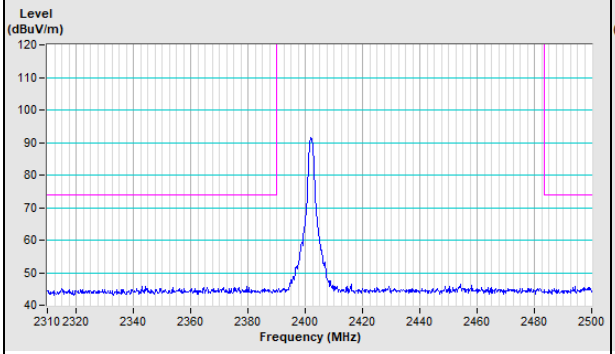
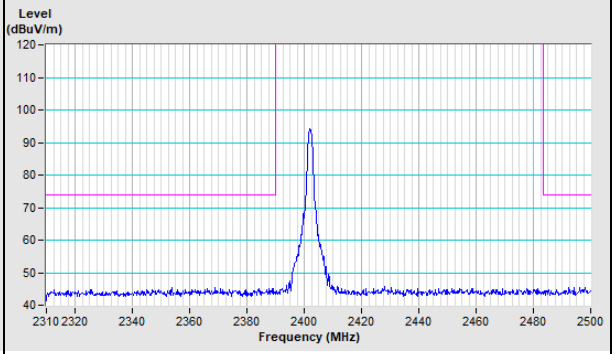
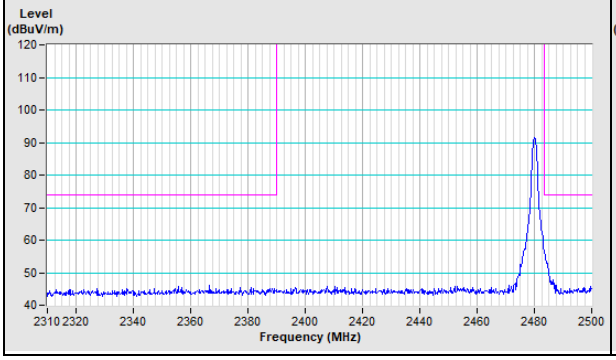
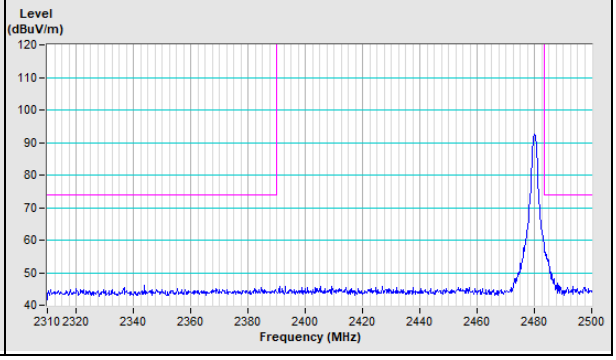


5 Pictures of Test Arrangements

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

Annex A - Bandedge Measurement

BT_GFSK Channel 0	
Horizontal (Peak)	**Vertical (Peak)**
	
BT_GFSK Channel 78	
Horizontal (Peak)	**Vertical (Peak)**
	

BT_8DPSK Channel 0	
Horizontal (Peak)	**Vertical (Peak)**
	
BT_8DPSK Channel 78	
Horizontal (Peak)	**Vertical (Peak)**
	

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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