FCC Test Report

Report No.: RF160428C07-3 R1

FCC ID: VPYLB1FD

Test Model: LBEE6ZZ1FD

Received Date: Apr. 28, 2016

Test Date: May 19 ~ Jul. 07, 2016

Issued Date: Jul. 25, 2016

Applicant: Murata Manufacturing Co., Ltd.

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Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF160428C07-3	Original release.	May 27, 2016
RF160428C07-3 R1	1. Revised product name 2. Added Bluetooth Config File (hcd file) : BCM4349B1_002.002.014.0077.0091.hcd test	Jul. 25, 2016

1 Certificate of Conformity

Product: Communication Module

Brand: MURATA

Test Model: LBEE6ZZ1FD

Sample Status: Engineering sample

Applicant: Murata Manufacturing Co., Ltd.

Test Date: May 19 ~ Jul. 07, 2016

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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Jul. 25, 2016
Pettie Chen / Senior Specialist

Approved by : _____ , **Date:** Jul. 25, 2016
Ken Liu / Senior Manager

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 -29.10dB at 0.60737, 1.46767MHz.
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 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -6.0dB at 2483.5MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA(M) Reverse not a standard connector.

Note: 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.

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	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Communication Module
Brand	MURATA
Test Model	LBEE6ZZ1FD
Status of EUT	Engineering sample
Power Supply Rating	3.6Vdc (Host)
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1/2/3Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	79
Output Power	6.577 mW
Antenna Type	Dipole antenna with 2.37dBi gain
Antenna Connector	SMA(M) Reverse
Accessory Device	NA
Data Cable Supplied	NA

Note:
1. The EUT doesn't support diversity function in Bluetooth transmitter part.
   The Bluetooth function of EUT was fixed in chain 1.
2. The BT parameter has 2 firmware versions, it will not affect for WiFi parameter.
3. 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 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 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	√	√	Bluetooth Config File (hcd file) : BCM4349B1_002.002.014.0077.0083.hcd
B	√	√	√	√	Bluetooth Config File (hcd file) : BCM4349B1_002.002.014.0077.0091.hcd

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Note: 1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-axis**.

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, B	0 to 78	0, 39, 78	FHSS	GFSK	DH5
A, B	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

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, B	0 to 78	39	FHSS	8DPSK	DH5

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	39	FHSS	8DPSK	DH5

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, 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, 39, 78	FHSS	GFSK	DH5
A, B	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	21deg. C, 66%RH	120Vac, 60Hz	Nick Hsu Jones Chang
RE<1G	21deg. C, 66%RH	120Vac, 60Hz	Jones Chang
PLC	20deg. C, 70%RH 18deg. C, 70%RH	120Vac, 60Hz	Jones Chang Nick Hsu
APCM	25deg. C, 60%RH 24deg. C, 64%RH	120Vac, 60Hz	Ted Chang Match Tsui

3.3 Description of Support Units

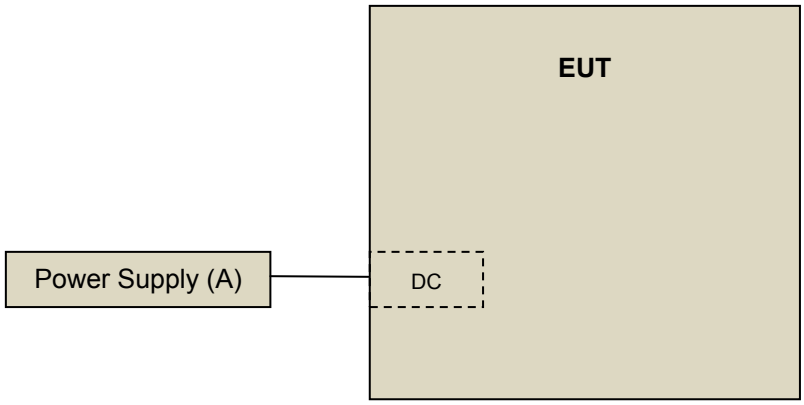
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	DC Power Supply	TOPWARD	6303D	802236	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).

3.3.1 Configuration of System under Test



3.4 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 (15.247)

FCC Public Notice DA 00-705

ANSI C63.10-2013

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

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

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 18, 2016	Apr. 17, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100979	Feb. 19, 2016	Feb. 18, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	9120D	209	Jan. 20, 2016	Jan. 19, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Jan. 18, 2016	Jan. 17, 2017
Preamplifier Agilent	8447D	2944A10738	Oct.18, 2015	Oct. 17, 2016
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (214378)	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03 (309224+12738)	Aug. 22, 2015	Aug. 21, 2016
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
High Speed Peak Power Meter	ML2495A	0824011	Jul. 09, 2015	Jul. 08, 2016
Power Sensor	MA2411B	0738171	Jul. 09, 2015	Jul. 08, 2016

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 HwaYa Chamber 3.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. The IC Site Registration No. is IC 7450F-3.

4.1.3 Test Procedures

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

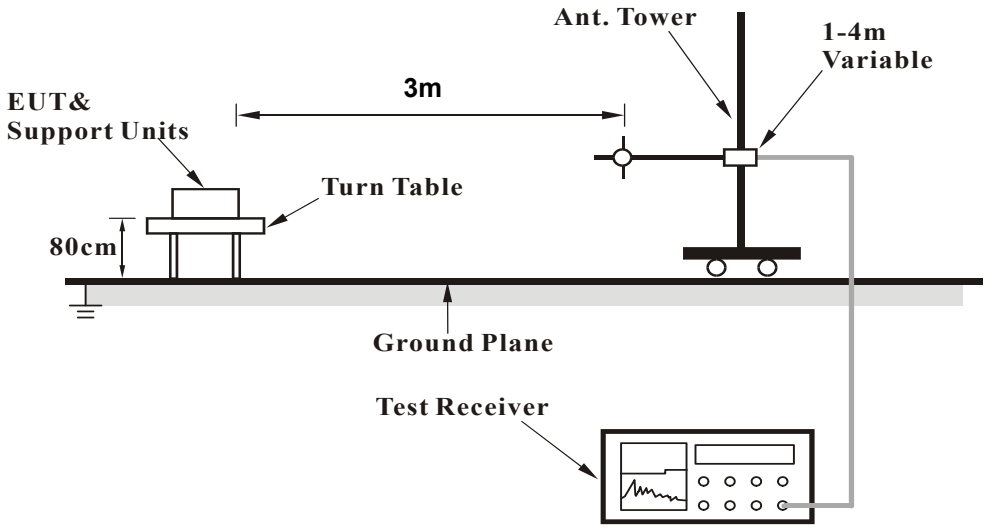
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. For Average measurement, due to the DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB, therefore Average value = peak reading + 20log(duty cycle).
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

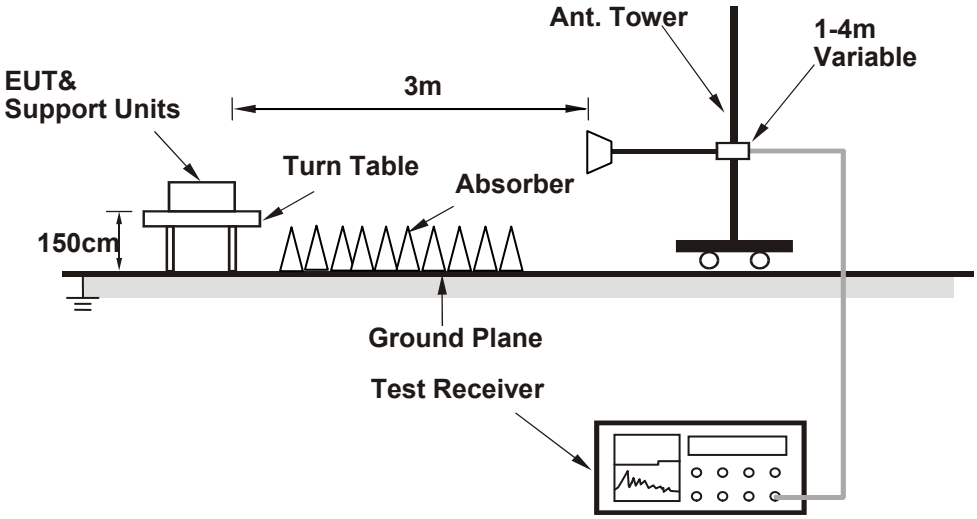
No deviation.

4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

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

4.1.7 Test Results

Above 1GHz Data:

Test Mode A

GFSK

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

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	55.9 PK	74.0	-18.1	2.13 H	39	23.10	32.80
2	2390.00	45.3 AV	54.0	-8.7	2.13 H	39	12.50	32.80
3	#2400.00	44.8 PK	74.0	-29.2	1.25 H	235	46.10	-1.30
4	#2400.00	14.7 AV	54.0	-39.3	1.25 H	235	16.00	-1.30
5	*2402.00	89.5 PK			1.25 H	235	56.70	32.80
6	*2402.00	59.4 AV			1.25 H	235	26.60	32.80
7	4804.00	47.4 PK	74.0	-26.6	1.24 H	137	41.50	5.90
8	4804.00	17.3 AV	54.0	-36.7	1.24 H	137	11.40	5.90
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	55.4 PK	74.0	-18.6	1.35 V	286	22.60	32.80
2	2390.00	44.9 AV	54.0	-9.1	1.35 V	286	12.10	32.80
3	#2400.00	45.9 PK	74.0	-28.1	1.35 V	286	47.20	-1.30
4	#2400.00	15.8 AV	54.0	-38.2	1.35 V	286	17.10	-1.30
5	*2402.00	100.4 PK			1.35 V	286	67.60	32.80
6	*2402.00	70.3 AV			1.35 V	286	37.50	32.80
7	4804.00	54.9 PK	74.0	-19.1	2.47 V	200	49.00	5.90
8	4804.00	24.8 AV	54.0	-29.2	2.47 V	200	18.90	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
8. Average value = peak reading + 20log(duty cycle).

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

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	90.8 PK			1.49 H	189	57.80	33.00
2	*2441.00	60.7 AV			1.49 H	189	27.70	33.00
3	4882.00	48.1 PK	74.0	-25.9	1.63 H	89	42.20	5.90
4	4882.00	18.0 AV	54.0	-36.0	1.63 H	89	12.10	5.90
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	101.9 PK			1.23 V	286	68.90	33.00
2	*2441.00	71.8 AV			1.23 V	286	38.80	33.00
3	4882.00	48.1 PK	74.0	-25.9	1.83 V	151	42.20	5.90
4	4882.00	18.0 AV	54.0	-36.0	1.83 V	151	12.10	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

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

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	88.3 PK			1.45 H	232	55.30	33.00
2	*2480.00	58.2 AV			1.45 H	232	25.20	33.00
3	2483.50	56.8 PK	74.0	-17.2	1.85 H	168	23.80	33.00
4	2483.50	45.1 AV	54.0	-8.9	1.85 H	168	12.10	33.00
5	4960.00	47.8 PK	74.0	-26.2	1.74 H	105	41.70	6.10
6	4960.00	17.7 AV	54.0	-36.3	1.74 H	105	11.60	6.10
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	100.1 PK			1.60 V	284	67.10	33.00
2	*2480.00	70.0 AV			1.60 V	284	37.00	33.00
3	2483.50	57.1 PK	74.0	-16.9	1.45 V	222	24.10	33.00
4	2483.50	45.0 AV	54.0	-9.0	1.45 V	222	12.00	33.00
5	4960.00	47.4 PK	74.0	-26.6	1.97 V	258	41.30	6.10
6	4960.00	17.3 AV	54.0	-36.7	1.97 V	258	11.20	6.10

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

8DPSK

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

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	39.1 PK	74.0	-34.9	1.19 H	184	40.40	-1.30
2	2390.00	27.1 AV	54.0	-26.9	1.19 H	184	28.40	-1.30
3	#2400.00	44.1 PK	74.0	-29.9	1.33 H	170	45.40	-1.30
4	#2400.00	14.0 AV	54.0	-40.0	1.33 H	170	15.30	-1.30
5	*2402.00	88.4 PK			1.33 H	170	55.60	32.80
6	*2402.00	58.3 AV			1.33 H	170	25.50	32.80
7	4804.00	47.6 PK	74.0	-26.4	1.38 H	284	41.70	5.90
8	4804.00	17.5 AV	54.0	-36.5	1.38 H	284	11.60	5.90
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	49.0 PK	74.0	-25.0	1.81 V	304	50.30	-1.30
2	2390.00	36.9 AV	54.0	-17.1	1.81 V	304	38.20	-1.30
3	#2400.00	45.2 PK	74.0	-28.8	2.08 V	282	46.50	-1.30
4	#2400.00	15.1 AV	54.0	-38.9	2.08 V	282	16.40	-1.30
5	*2402.00	99.9 PK			2.08 V	282	67.10	32.80
6	*2402.00	69.8 AV			2.08 V	282	37.00	32.80
7	4804.00	48.7 PK	74.0	-25.3	1.53 V	224	42.80	5.90
8	4804.00	18.6 AV	54.0	-35.4	1.53 V	224	12.70	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
8. Average value = peak reading + 20log(duty cycle).

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

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	89.5 PK			1.48 H	151	56.50	33.00
2	*2441.00	59.4 AV			1.48 H	151	26.40	33.00
3	4882.00	47.6 PK	74.0	-26.4	1.24 H	86	41.70	5.90
4	4882.00	17.5 AV	54.0	-36.5	1.24 H	86	11.60	5.90
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	100.8 PK			1.74 V	282	67.80	33.00
2	*2441.00	70.7 AV			1.74 V	282	37.70	33.00
3	4882.00	48.1 PK	74.0	-25.9	1.65 V	242	42.20	5.90
4	4882.00	18.0 AV	54.0	-36.0	1.65 V	242	12.10	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

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

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	88.2 PK			1.36 H	151	55.20	33.00
2	*2480.00	58.1 AV			1.36 H	151	25.10	33.00
3	2483.50	43.9 PK	74.0	-30.1	1.36 H	151	45.00	-1.10
4	2483.50	13.8 AV	54.0	-40.2	1.36 H	151	14.90	-1.10
5	4960.00	47.7 PK	74.0	-26.3	1.17 H	105	41.60	6.10
6	4960.00	17.6 AV	54.0	-36.4	1.17 H	105	11.50	6.10
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	99.4 PK			1.91 V	279	66.40	33.00
2	*2480.00	69.3 AV			1.91 V	279	36.30	33.00
3	2483.50	44.5 PK	74.0	-29.5	1.91 V	279	45.60	-1.10
4	2483.50	14.4 AV	54.0	-39.6	1.91 V	279	15.50	-1.10
5	4960.00	47.7 PK	74.0	-26.3	1.38 V	211	41.60	6.10
6	4960.00	17.6 AV	54.0	-36.4	1.38 V	211	11.50	6.10

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

Test Mode B

GFSK

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

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	57.5 PK	74.0	-16.5	1.87 H	175	24.70	32.80
2	2390.00	46.0 AV	54.0	-8.0	1.87 H	175	13.20	32.80
3	#2400.00	51.5 PK	74.0	-22.5	1.87 H	175	52.80	-1.30
4	#2400.00	21.4 AV	54.0	-32.6	1.87 H	175	22.70	-1.30
5	*2402.00	95.5 PK			1.87 H	175	62.70	32.80
6	*2402.00	65.4 AV			1.87 H	175	32.60	32.80
7	4804.00	46.6 PK	74.0	-27.4	2.12 H	250	40.70	5.90
8	4804.00	16.5 AV	54.0	-37.5	2.12 H	250	10.60	5.90
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	57.2 PK	74.0	-16.8	1.72 V	285	24.40	32.80
2	2390.00	46.2 AV	54.0	-7.8	1.72 V	285	13.40	32.80
3	#2400.00	62.1 PK	74.0	-11.9	1.72 V	285	63.40	-1.30
4	#2400.00	32.0 AV	54.0	-22.0	1.72 V	285	33.30	-1.30
5	*2402.00	106.1 PK			1.72 V	285	73.30	32.80
6	*2402.00	76.0 AV			1.72 V	285	43.20	32.80
7	4804.00	47.1 PK	74.0	-26.9	2.00 V	83	41.20	5.90
8	4804.00	17.0 AV	54.0	-37.0	2.00 V	83	11.10	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
8. Average value = peak reading + 20log(duty cycle).

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

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	94.7 PK			1.82 H	175	61.70	33.00
2	*2441.00	64.6 AV			1.82 H	175	31.60	33.00
3	4882.00	46.8 PK	74.0	-27.2	2.30 H	222	40.90	5.90
4	4882.00	16.7 AV	54.0	-37.3	2.30 H	222	10.80	5.90
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	106.5 PK			1.75 V	283	73.50	33.00
2	*2441.00	76.4 AV			1.75 V	283	43.40	33.00
3	4882.00	47.1 PK	74.0	-26.9	1.88 V	0	41.20	5.90
4	4882.00	17.0 AV	54.0	-37.0	1.88 V	0	11.10	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

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

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	93.3 PK			1.72 H	176	60.30	33.00
2	*2480.00	63.2 AV			1.72 H	176	30.20	33.00
3	2483.50	56.1 PK	74.0	-17.9	1.72 H	176	23.10	33.00
4	2483.50	45.8 AV	54.0	-8.2	1.72 H	176	12.80	33.00
5	4960.00	47.1 PK	74.0	-26.9	1.60 H	201	41.00	6.10
6	4960.00	17.0 AV	54.0	-37.0	1.60 H	201	10.90	6.10
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	105.4 PK			1.92 V	283	72.40	33.00
2	*2480.00	75.3 AV			1.92 V	283	42.30	33.00
3	2483.50	58.5 PK	74.0	-15.5	1.92 V	283	25.50	33.00
4	2483.50	47.5 AV	54.0	-6.5	1.92 V	283	14.50	33.00
5	4960.00	47.6 PK	74.0	-26.4	2.03 V	303	41.50	6.10
6	4960.00	17.5 AV	54.0	-36.5	2.03 V	303	11.40	6.10

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

8DPSK

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

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	55.6 PK	74.0	-18.4	1.87 H	175	22.80	32.80
2	2390.00	45.2 AV	54.0	-8.8	1.87 H	175	12.40	32.80
3	#2400.00	51.4 PK	74.0	-22.6	1.87 H	175	52.70	-1.30
4	#2400.00	21.2 AV	54.0	-32.8	1.87 H	175	22.50	-1.30
5	*2402.00	95.6 PK			1.87 H	175	62.80	32.80
6	*2402.00	65.5 AV			1.87 H	175	32.70	32.80
7	4804.00	46.9 PK	74.0	-27.1	1.90 H	256	41.00	5.90
8	4804.00	16.8 AV	54.0	-37.2	1.90 H	256	10.90	5.90
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	55.7 PK	74.0	-18.3	2.09 V	281	22.90	32.80
2	2390.00	45.1 AV	54.0	-8.9	2.09 V	281	12.30	32.80
3	#2400.00	62.0 PK	74.0	-12.0	2.09 V	281	63.30	-1.30
4	#2400.00	31.9 AV	54.0	-22.1	2.09 V	281	33.20	-1.30
5	*2402.00	106.2 PK			2.09 V	281	73.40	32.80
6	*2402.00	76.1 AV			2.09 V	281	43.30	32.80
7	4804.00	48.3 PK	74.0	-25.7	1.81 V	81	42.40	5.90
8	4804.00	18.2 AV	54.0	-35.8	1.81 V	81	12.30	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.
7. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
8. Average value = peak reading + 20log(duty cycle).

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

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	94.4 PK			1.76 H	176	61.40	33.00
2	*2441.00	64.3 AV			1.76 H	176	31.30	33.00
3	4882.00	46.5 PK	74.0	-27.5	1.60 H	305	40.60	5.90
4	4882.00	16.4 AV	54.0	-37.6	1.60 H	305	10.50	5.90
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	105.9 PK			1.91 V	282	72.90	33.00
2	*2441.00	75.8 AV			1.91 V	282	42.80	33.00
3	4882.00	48.4 PK	74.0	-25.6	1.57 V	190	42.50	5.90
4	4882.00	18.3 AV	54.0	-35.7	1.57 V	190	12.40	5.90

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

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

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	93.3 PK			1.72 H	175	60.30	33.00
2	*2480.00	63.2 AV			1.72 H	175	30.20	33.00
3	2483.50	56.7 PK	74.0	-17.3	1.72 H	175	23.70	33.00
4	2483.50	46.1 AV	54.0	-7.9	1.72 H	175	13.10	33.00
5	4960.00	46.6 PK	74.0	-27.4	1.60 H	23	40.50	6.10
6	4960.00	16.5 AV	54.0	-37.5	1.60 H	23	10.40	6.10
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	105.3 PK			1.92 V	281	72.30	33.00
2	*2480.00	75.2 AV			1.92 V	281	42.20	33.00
3	2483.50	58.3 PK	74.0	-15.7	1.92 V	280	25.30	33.00
4	**2483.50**	**48.0 AV**	**54.0**	**-6.0**	**1.92 V**	**280**	**15.00**	**33.00**
5	4960.00	48.2 PK	74.0	-25.8	1.66 V	339	42.10	6.10
6	4960.00	18.1 AV	54.0	-35.9	1.66 V	339	12.00	6.10

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB
7. Average value = peak reading + 20log(duty cycle).

Below 1GHz worst-case data:

Test Mode A

8DPSK

CHANNEL	TX Channel 39	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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)**	**CORRECTION FACTOR (dB/m)**
1	31.20	24.3 QP	40.0	-15.7	1.51 H	54	40.50	-16.20
2	62.80	28.5 QP	40.0	-11.5	2.00 H	150	43.60	-15.10
3	86.20	20.2 QP	40.0	-19.8	2.00 H	75	39.90	-19.70
4	286.55	18.3 QP	46.0	-27.7	1.00 H	226	30.80	-12.50
5	585.97	24.3 QP	46.0	-21.7	1.49 H	159	30.60	-6.30
6	897.05	37.8 QP	46.0	-8.2	1.00 H	132	37.90	-0.10
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	30.20	26.4 QP	40.0	-13.6	1.50 V	149	42.60	-16.20
2	43.66	24.2 QP	40.0	-15.8	1.00 V	199	38.90	-14.70
3	99.89	19.8 QP	43.5	-23.7	1.49 V	174	38.60	-18.80
4	195.33	22.6 QP	43.5	-20.9	1.01 V	266	39.00	-16.40
5	714.29	28.2 QP	46.0	-17.8	1.00 V	245	32.10	-3.90
6	836.78	32.1 QP	46.0	-13.9	1.49 V	16	33.60	-1.50

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

Test Mode B

8DPSK

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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)	CORRECTION FACTOR (dB/m)
1	29.90	21.4 QP	40.0	-18.6	1.49 H	16	37.71	-16.31
2	57.12	30.2 QP	40.0	-9.8	1.99 H	279	44.78	-14.62
3	70.73	19.9 QP	40.0	-20.1	1.99 H	103	36.49	-16.57
4	84.34	19.1 QP	40.0	-20.9	1.99 H	336	38.51	-19.40
5	107.67	17.4 QP	43.5	-26.1	1.99 H	4	34.98	-17.61
6	286.55	17.6 QP	46.0	-28.4	1.00 H	5	30.13	-12.52
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	29.90	21.1 QP	40.0	-18.9	1.51 V	191	37.30	-16.20
2	57.12	30.6 QP	40.0	-9.4	2.00 V	177	45.20	-14.60
3	70.73	19.9 QP	40.0	-20.1	2.00 V	140	36.50	-16.60
4	84.34	19.5 QP	40.0	-20.5	2.00 V	177	38.90	-19.40
5	189.33	19.0 QP	43.5	-24.5	2.00 V	189	35.20	-16.20
6	204.89	18.9 QP	43.5	-24.6	1.51 V	287	35.30	-16.40

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 other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

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.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 16, 2015	Nov. 15, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2016	Feb. 25, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 24, 2015	Jul. 23, 2016
Software ADT	BV ADT_Cond_ V7.3.7.3	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 HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.

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.

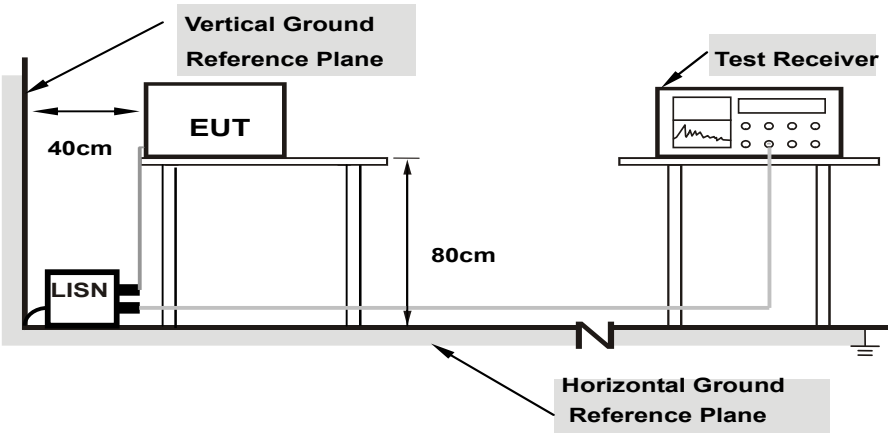
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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 Conditions

Same as 4.1.6.

4.2.7 Test Results

Test Mode A

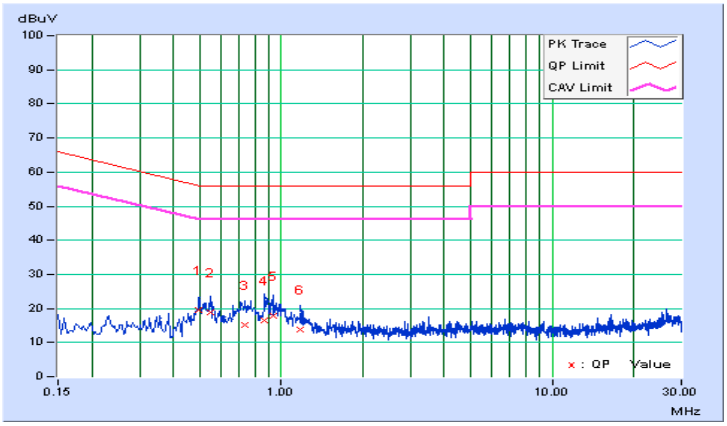
8DPSK

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 39		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.49800	10.13	9.39	2.39	19.52	12.52	56.03	46.03	-36.51	-33.51
2	0.54975	10.14	8.61	2.93	18.75	13.07	56.00	46.00	-37.25	-32.93
3	0.73400	10.16	5.09	0.03	15.25	10.19	56.00	46.00	-40.75	-35.81
4	0.87000	10.18	6.38	1.60	16.56	11.78	56.00	46.00	-39.44	-34.22
5	0.93000	10.19	7.60	2.90	17.79	13.09	56.00	46.00	-38.21	-32.91
6	1.18200	10.21	3.76	0.45	13.97	10.66	56.00	46.00	-42.03	-35.34

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.

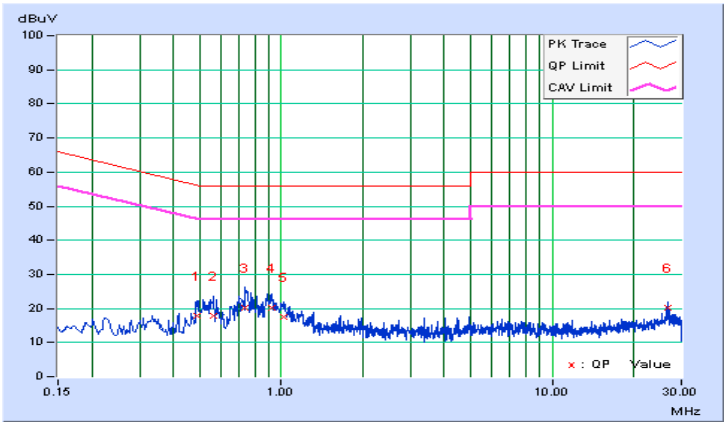


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 39		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.48600	10.14	7.63	2.20	17.77	12.34	56.24	46.24	-38.46	-33.89
2	0.56200	10.15	7.81	2.28	17.96	12.43	56.00	46.00	-38.04	-33.57
3	0.73843	10.18	10.04	4.67	20.22	14.85	56.00	46.00	-35.78	-31.15
4	0.91800	10.20	9.88	3.62	20.08	13.82	56.00	46.00	-35.92	-32.18
5	1.01836	10.21	7.44	3.67	17.65	13.88	56.00	46.00	-38.35	-32.12
6	26.61000	11.94	8.24	5.18	20.18	17.12	60.00	50.00	-39.82	-32.88

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.



Test Mode B

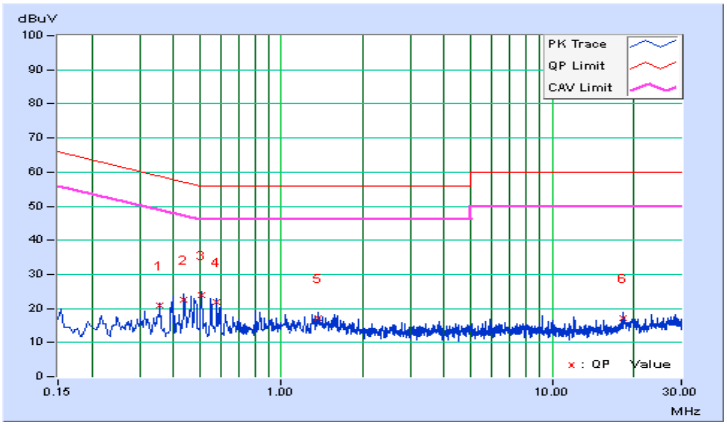
8DPSK

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 39		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.35723	10.10	10.64	7.30	20.74	17.40	58.79	48.79	-38.05	-31.39
2	0.43579	10.12	12.58	6.96	22.70	17.08	57.14	47.14	-34.44	-30.06
3	0.50581	10.13	13.87	4.53	24.00	14.66	56.00	46.00	-32.00	-31.34
4	0.57620	10.14	11.75	4.44	21.89	14.58	56.00	46.00	-34.11	-31.42
5	1.37383	10.23	6.91	4.62	17.14	14.85	56.00	46.00	-38.86	-31.15
6	18.30413	11.24	5.90	1.88	17.14	13.12	60.00	50.00	-42.86	-36.88

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.

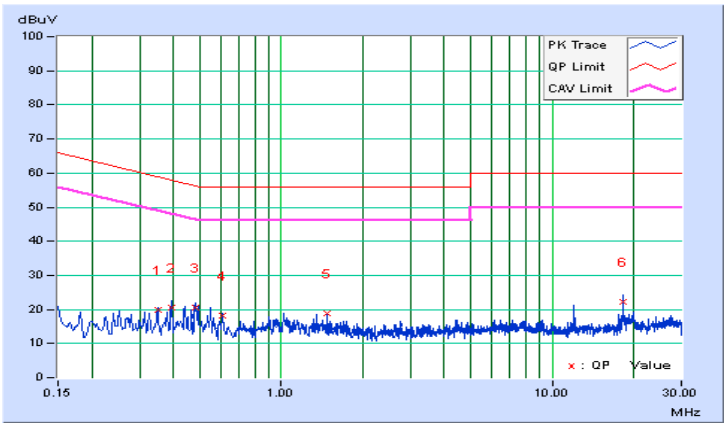


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 39		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.34941	10.11	9.60	5.20	19.71	15.31	58.98	48.98	-39.27	-33.67
2	0.39242	10.13	10.31	6.61	20.44	16.74	58.01	48.01	-37.57	-31.27
3	0.48235	10.14	10.27	5.98	20.41	16.12	56.30	46.30	-35.89	-30.18
4	**0.60737**	**10.16**	**8.15**	**6.74**	**18.31**	**16.90**	**56.00**	**46.00**	**-37.69**	**-29.10**
5	**1.46767**	**10.24**	**8.53**	**6.66**	**18.77**	**16.90**	**56.00**	**46.00**	**-37.23**	**-29.10**
6	18.24157	11.35	10.93	7.73	22.28	19.08	60.00	50.00	-37.72	-30.92

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

Refer to section 4.1.2 to get information of above instrument.

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 fromTest Standard

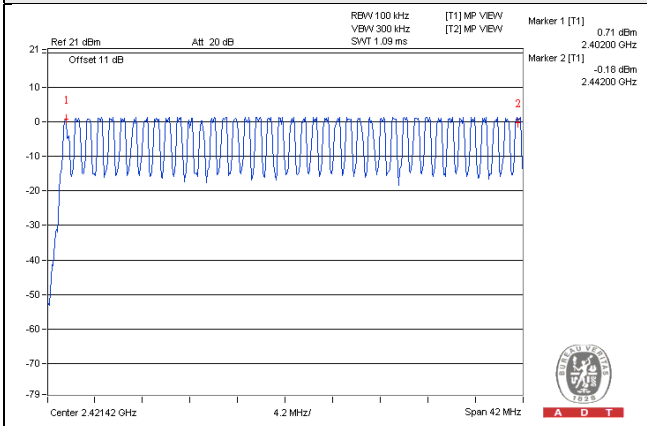
No deviation.

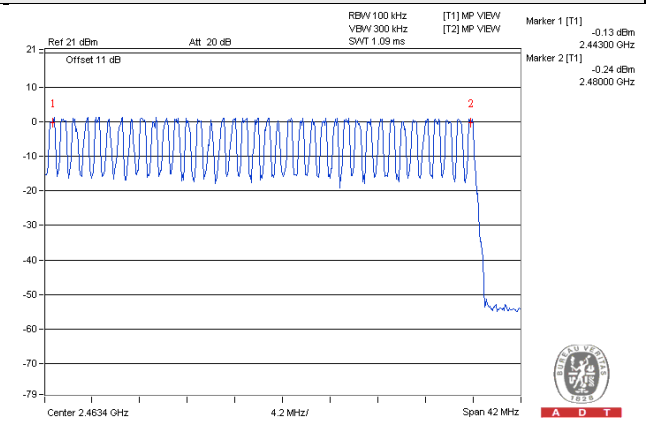
4.3.6 Test Results

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.

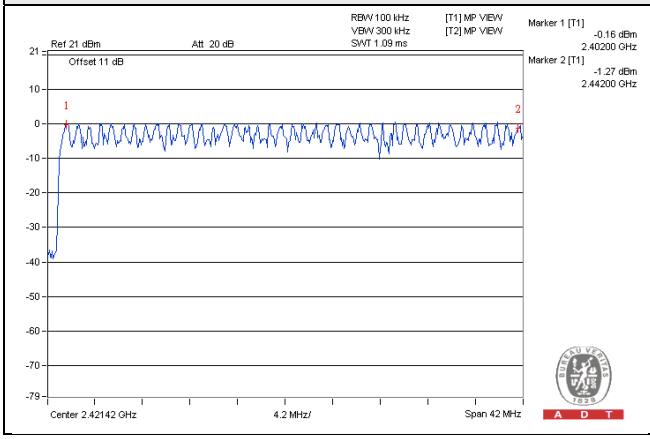
Test Mode A

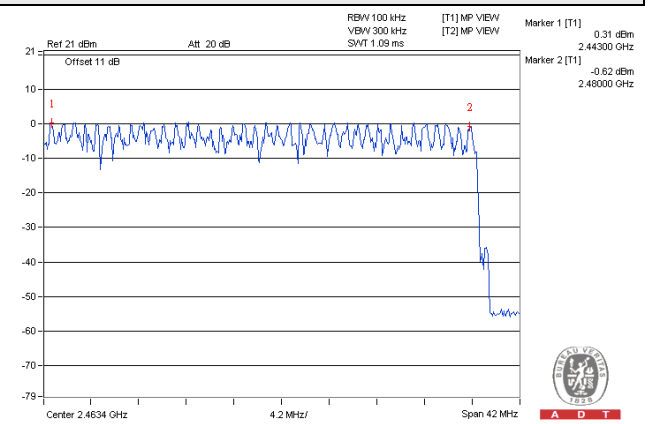
GFSK





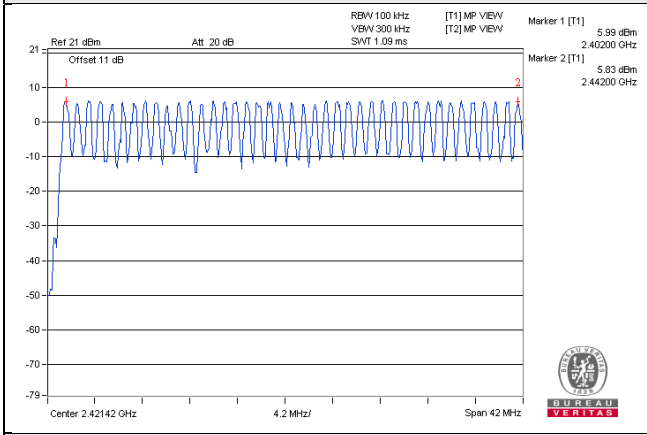
8DPSK

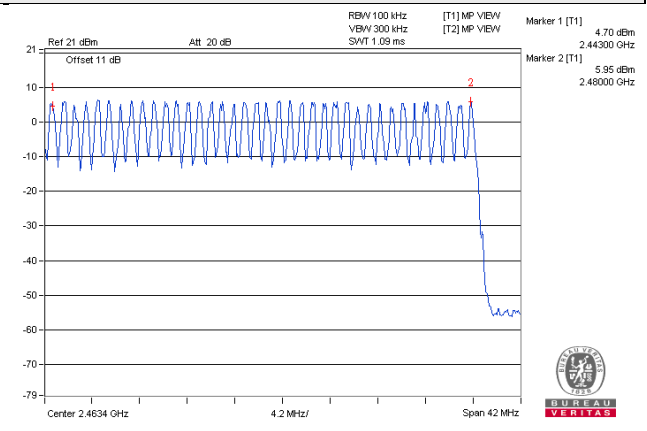




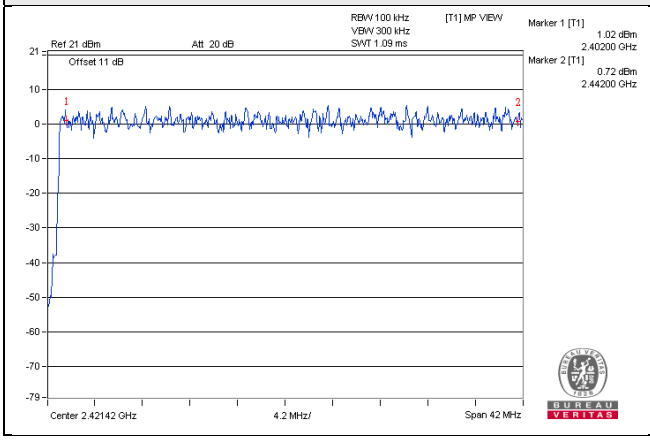
Test Mode B

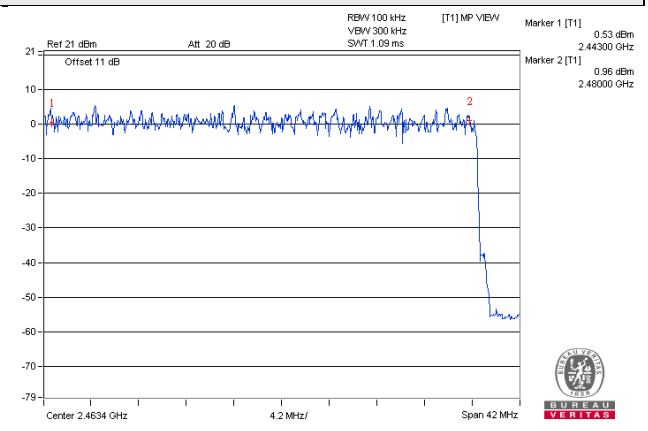
GFSK





8DPSK



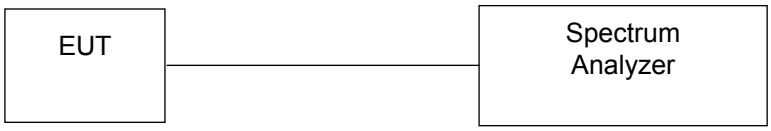


4.4 Dwell Time on Each Channel

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

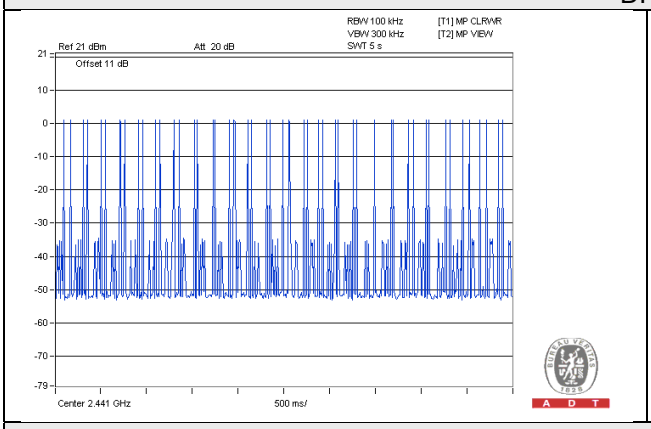
Test Mode A

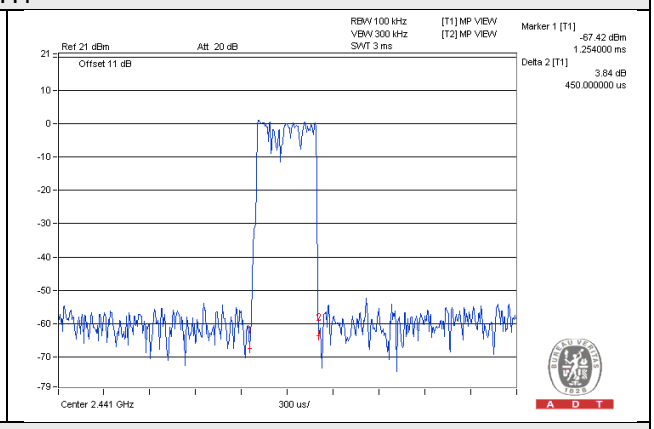
GFSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	49 (times / 5 sec) * 6.32 = 309.68 times	0.45	139.36	400
DH3	27 (times / 5 sec) * 6.32 = 170.64 times	1.74	296.91	400
DH5	17 (times / 5 sec) * 6.32 = 107.44 times	2.96	318.02	400

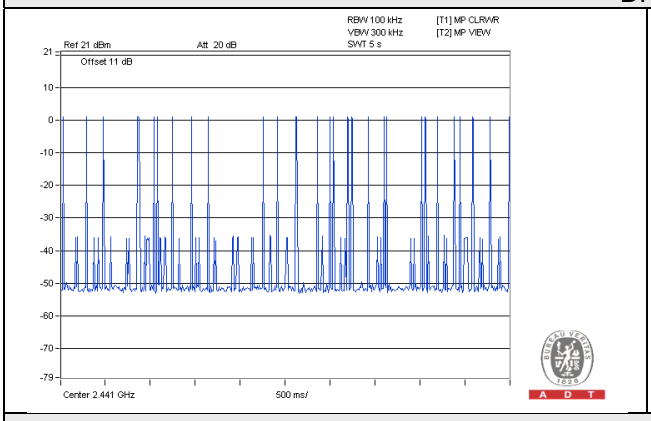
Note: Test plots of the transmitting time slot are shown as below.

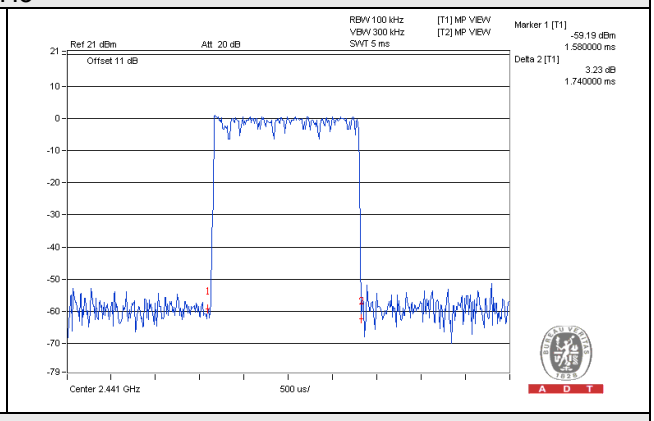
DH1



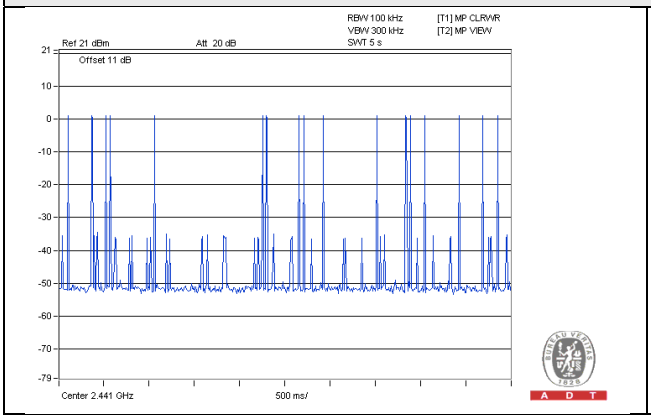


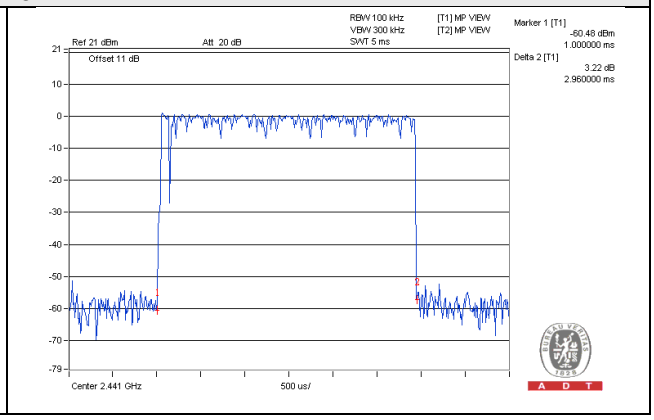
DH3





DH5



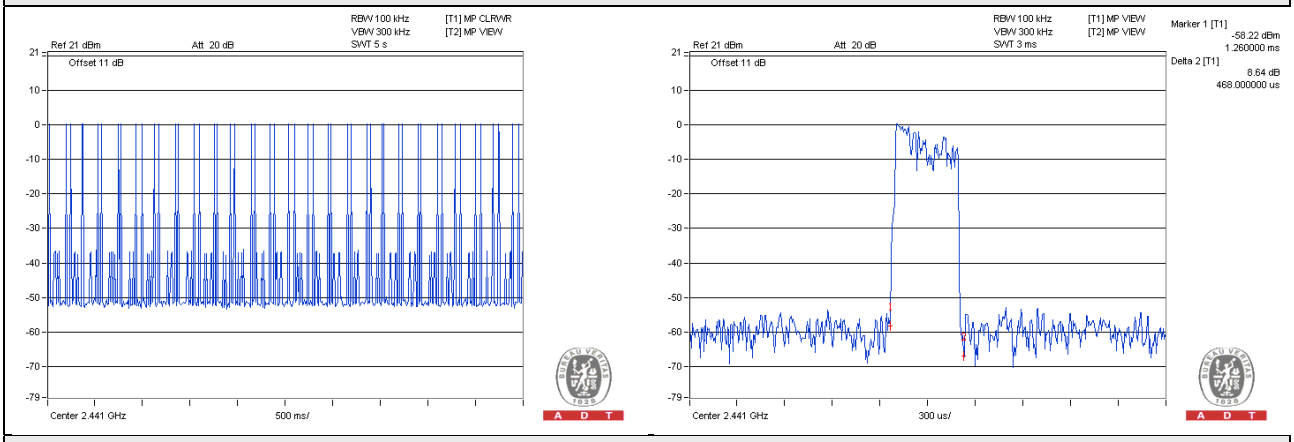


8DPSK

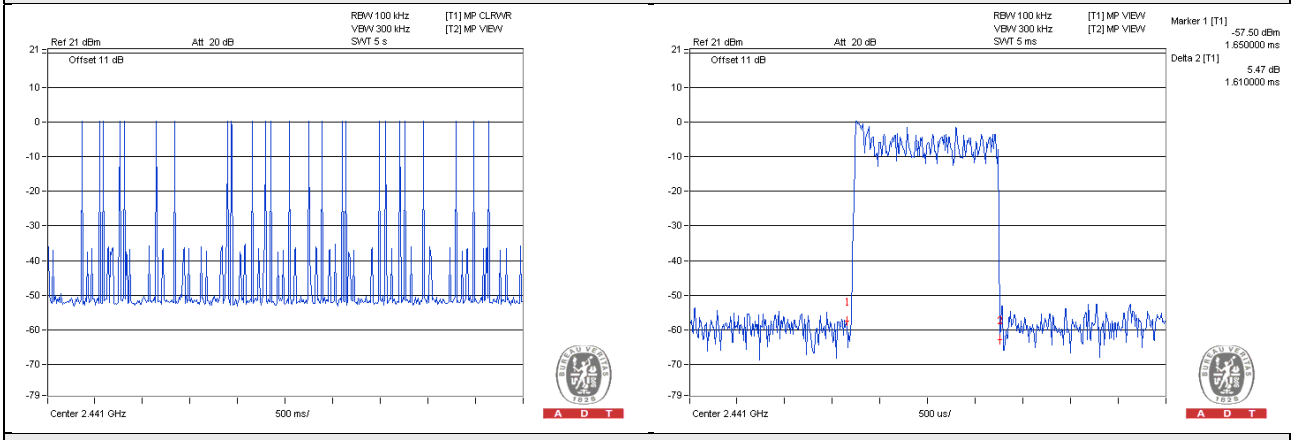
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316.00 times	0.468	147.89	400
DH3	25 (times / 5 sec) * 6.32 = 158.00 times	1.610	254.38	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	3.000	341.28	400

Note: Test plots of the transmitting time slot are shown as below.

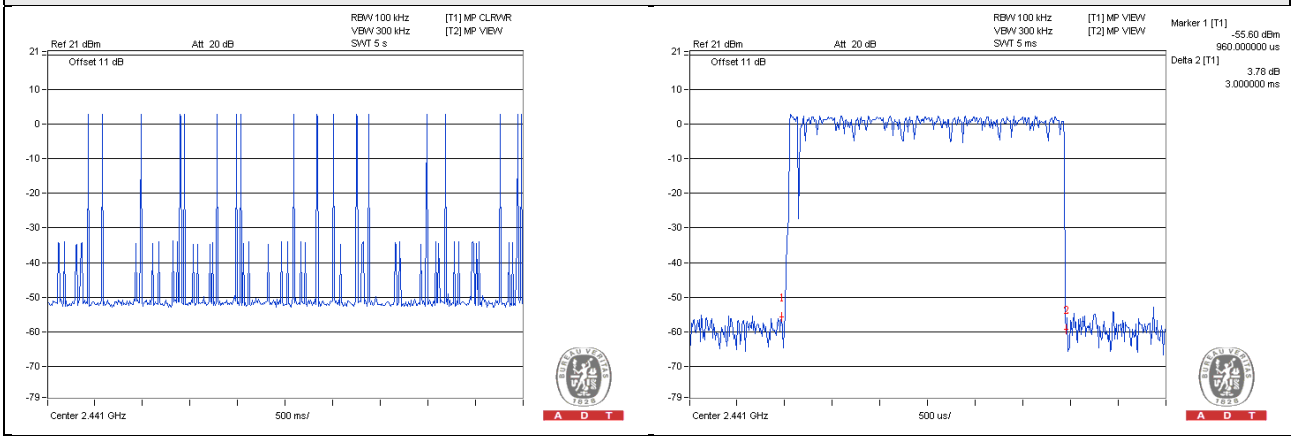
DH1



DH3



DH5



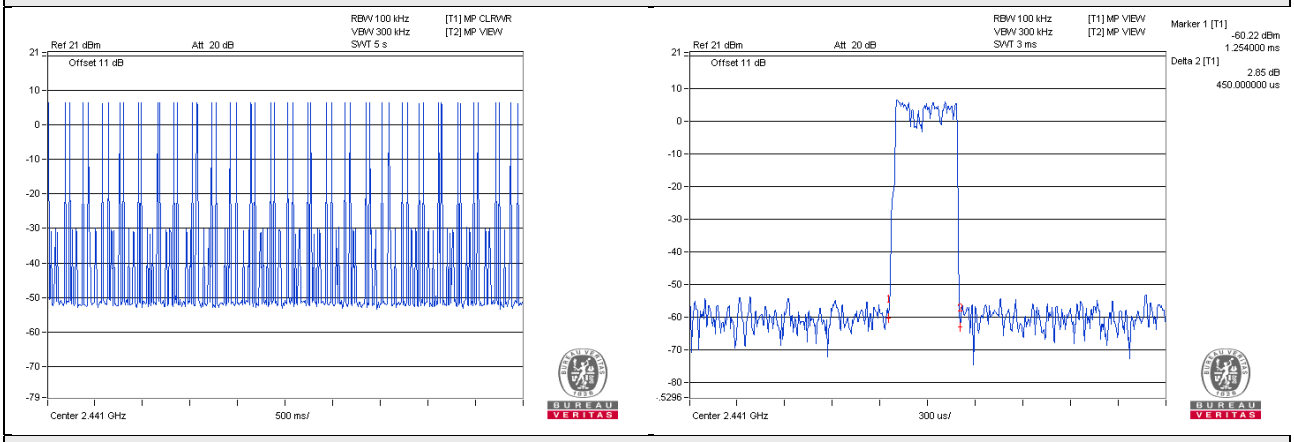
Test Mode B

GFSK

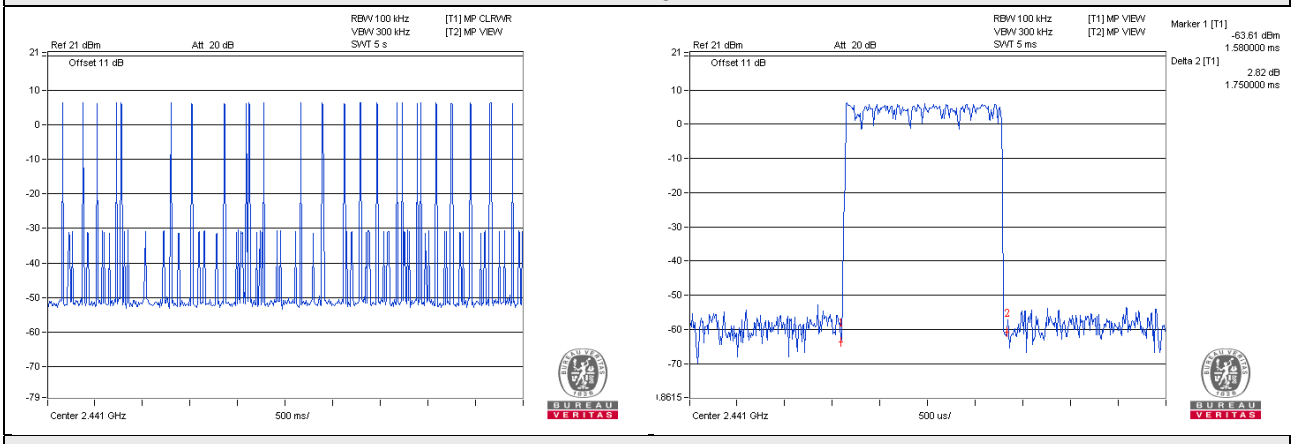
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316.00 times	0.45	142.20	400
DH3	25 (times / 5 sec) * 6.32 = 158.00 times	1.75	276.50	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	3.03	344.69	400

Note: Test plots of the transmitting time slot are shown as below.

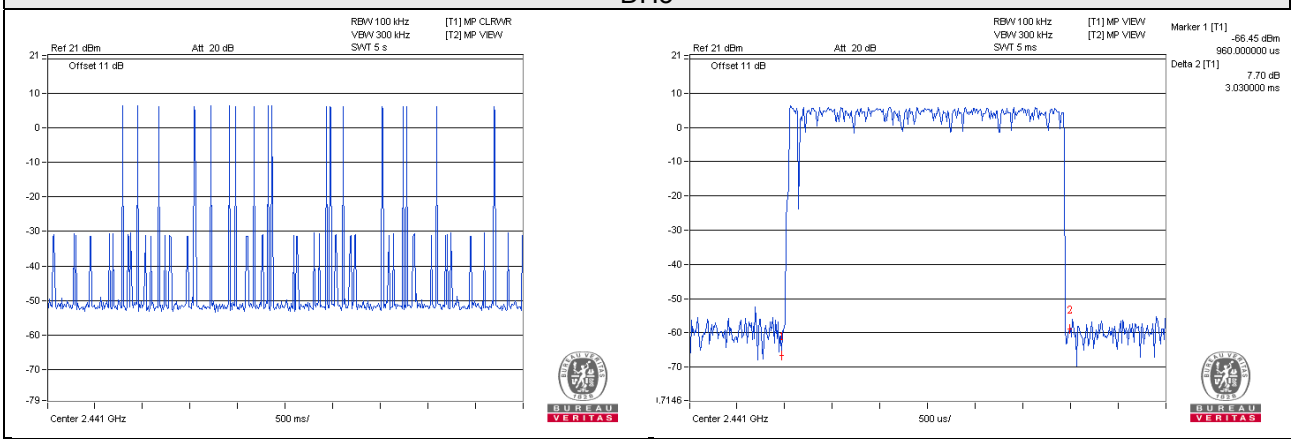
DH1



DH3



DH5

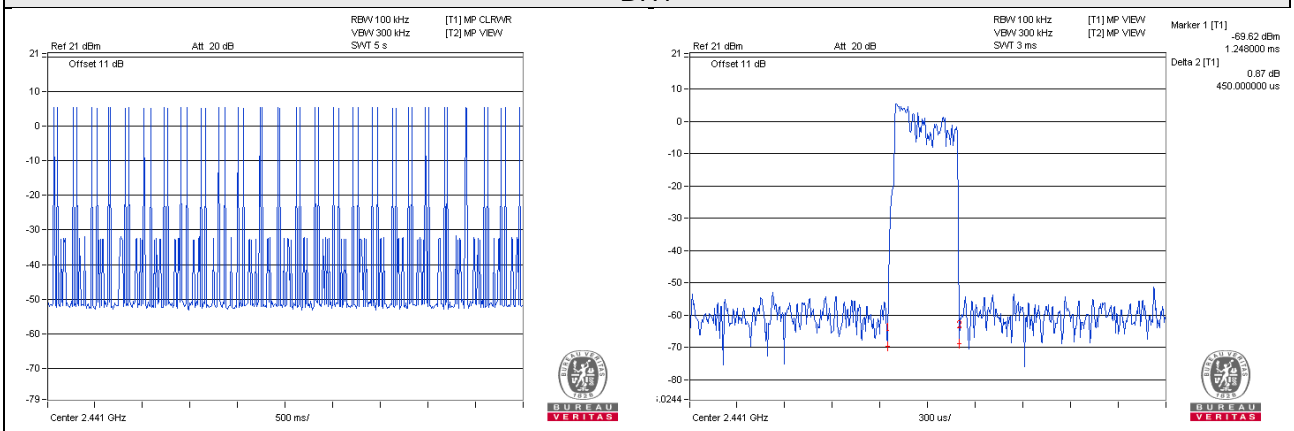


8DPSK

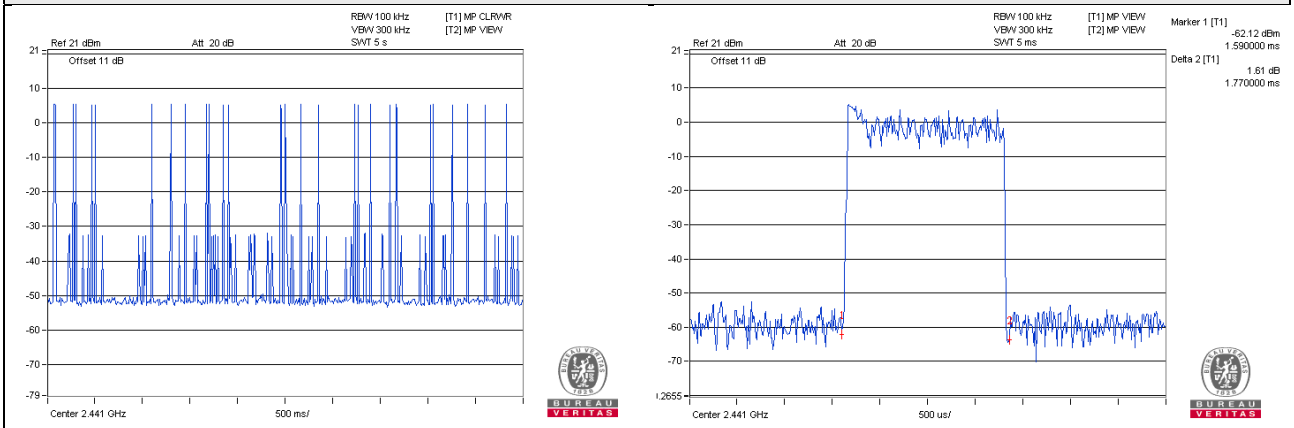
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316.00 times	0.45	142.20	400
DH3	27 (times / 5 sec) * 6.32 = 170.64 times	1.77	302.03	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	2.96	336.73	400

Note: Test plots of the transmitting time slot are shown as below.

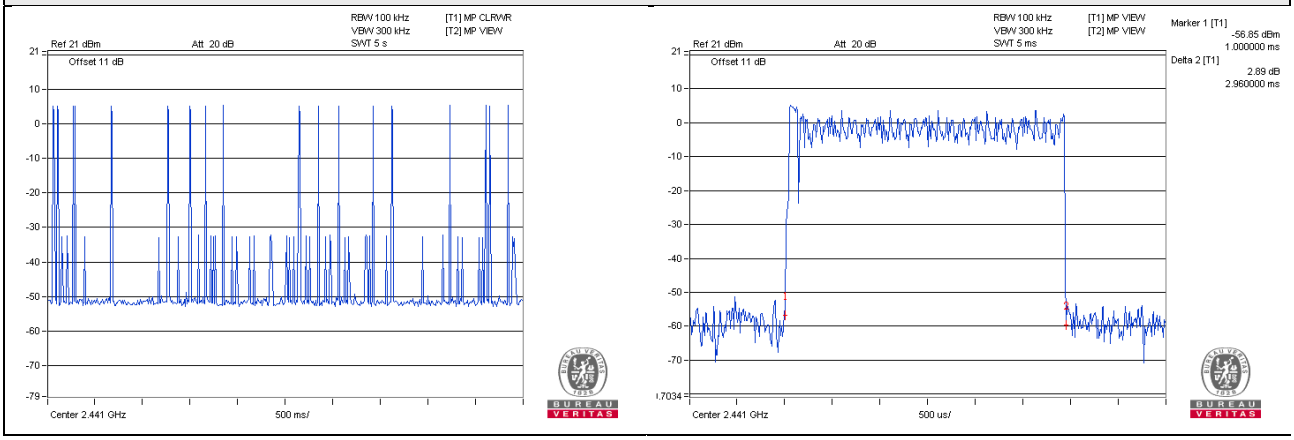
DH1



DH3



DH5

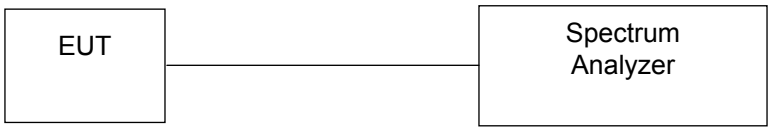


4.5 Channel Bandwidth

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.

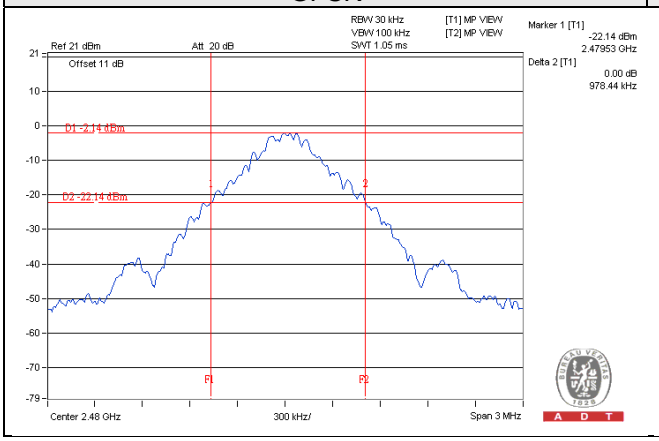
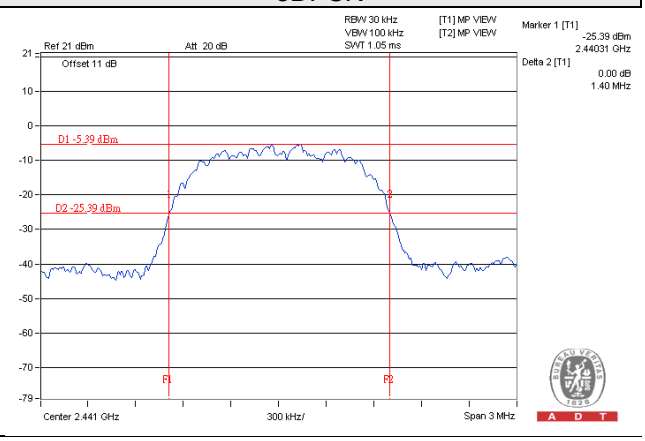
4.5.6 EUT Operating Condition

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

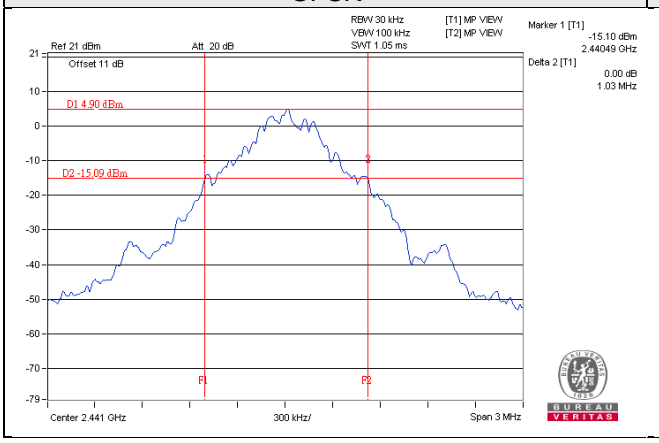
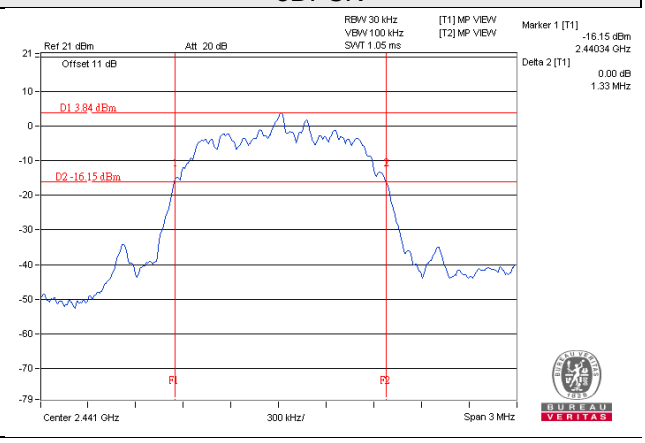
Test Mode A

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	0.96	1.39
39	2441	0.96	1.40
78	2480	0.97	1.39

SPECTRUM PLOT OF WORST VALUE	
GFSK	8DPSK
	

Test Mode B

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	1.02	1.32
39	2441	1.03	1.33
78	2480	1.02	1.32

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.

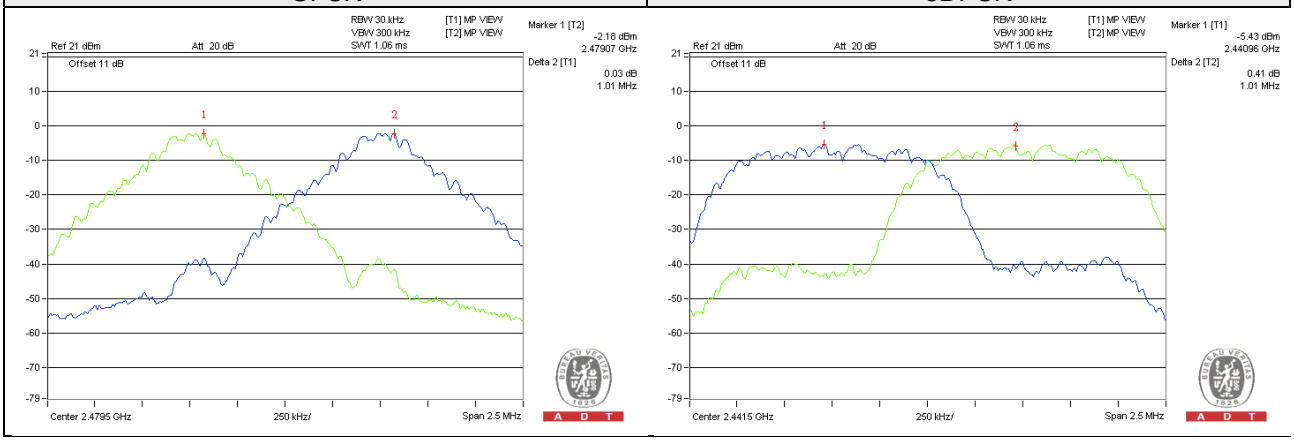
4.6.6 Test Results

Test 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	1.00	1.00	0.96	1.39	0.64	0.93	Pass
39	2441	1.00	1.01	0.96	1.40	0.64	0.94	Pass
78	2480	1.01	1.00	0.97	1.39	0.65	0.93	Pass

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

Spectrum Plot of Worst Value	
GFSK	8DPSK

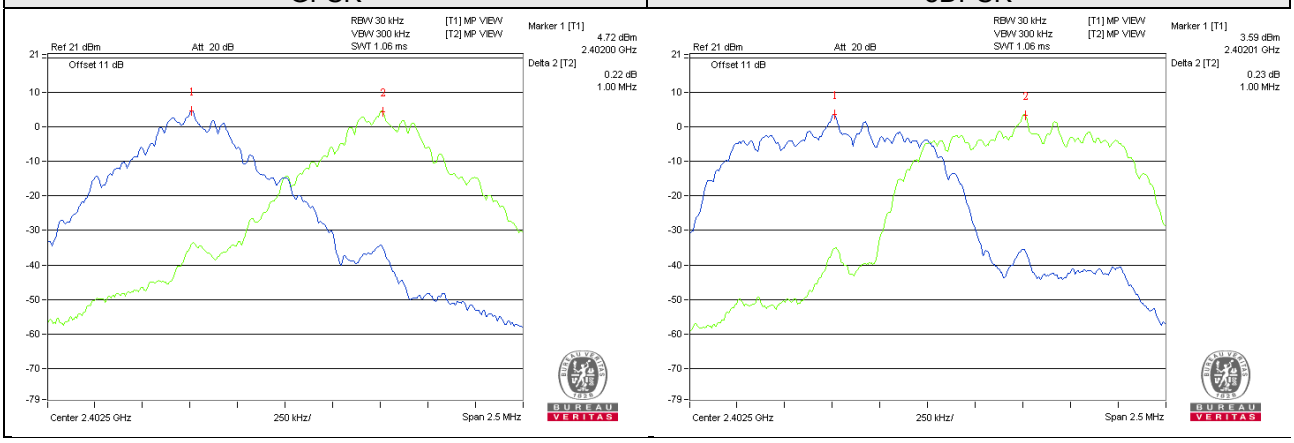


Test Mode B

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.00	1.00	1.02	1.32	0.68	0.88	Pass
39	2441	1.00	1.00	1.03	1.33	0.69	0.89	Pass
78	2480	1.00	1.00	1.02	1.32	0.68	0.88	Pass

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

Spectrum Plot of Worst Value	
GFSK	8DPSK

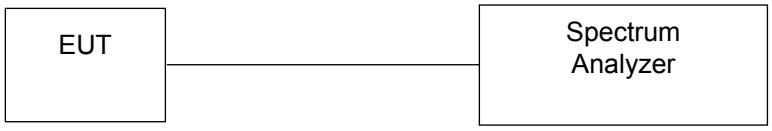


4.7 Maximum Output Power

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. 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. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.

d. Measure the captured power within the band and recording the plot.

e. Repeat above procedures until all frequencies required were complete.

4.7.5 Deviation fromTest 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.

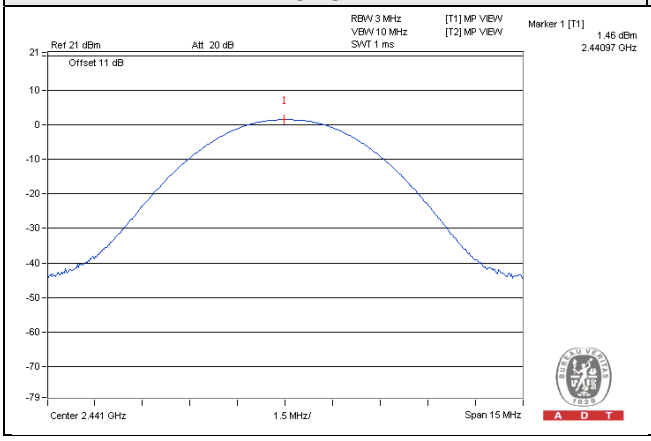
4.7.7 Test Results

Test Mode A

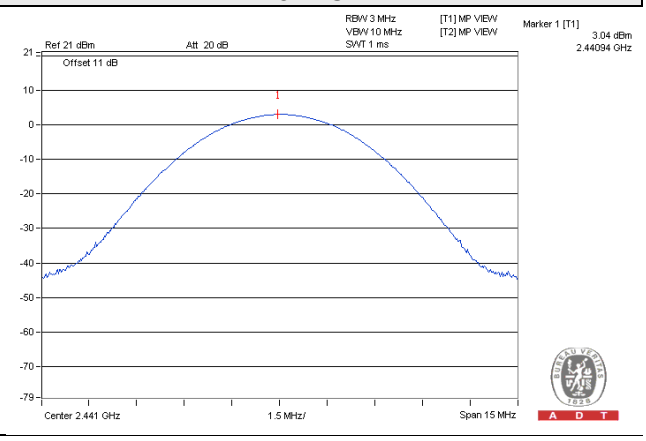
Channel	Frequency (MHz)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	1.318	1.866	1.20	2.71	125	Pass
39	2441	1.400	2.014	1.46	3.04	125	Pass
78	2480	1.245	1.905	0.95	2.80	125	Pass

Spectrum Plot of Worst Value

GFSK



8DPSK

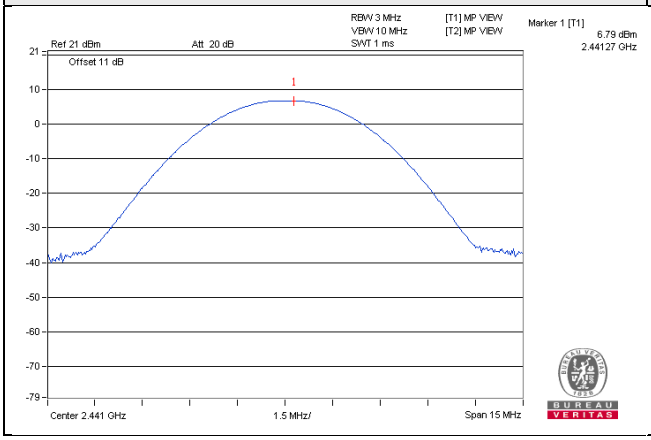


Test Mode B

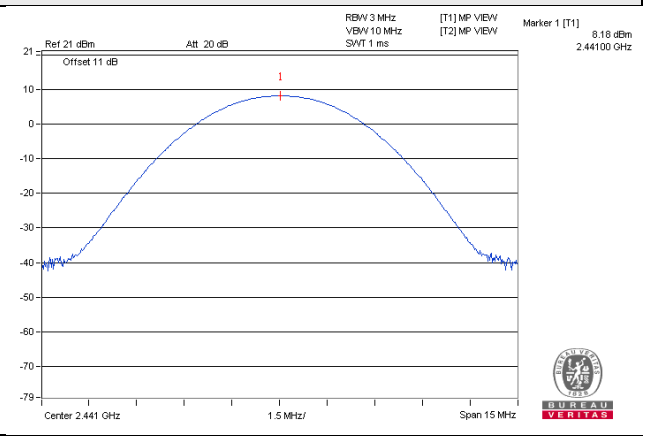
Channel	Frequency (MHz)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	4.519	6.124	6.55	7.87	125	Pass
39	2441	4.775	**6.577**	6.79	8.18	125	Pass
78	2480	4.519	6.081	6.55	7.84	125	Pass

Spectrum Plot of Worst Value

GFSK



8DPSK



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 RBW).

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

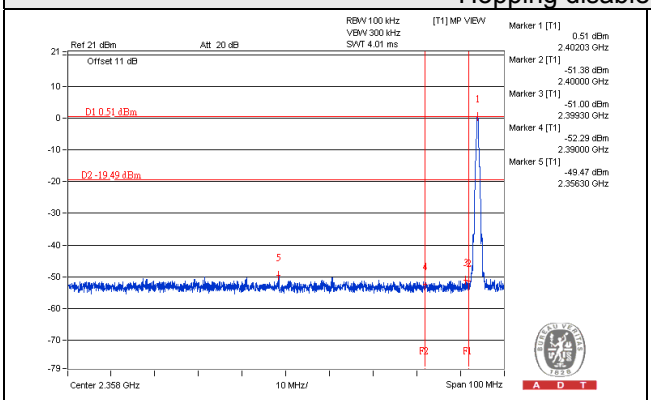
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

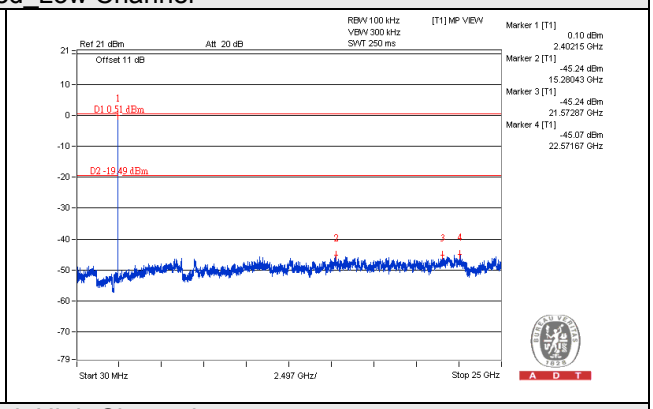
4.8.6 Test Results

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.

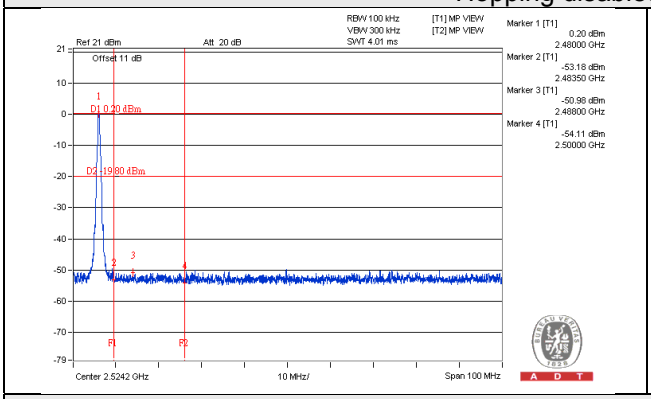
Test Mode A
GFSK

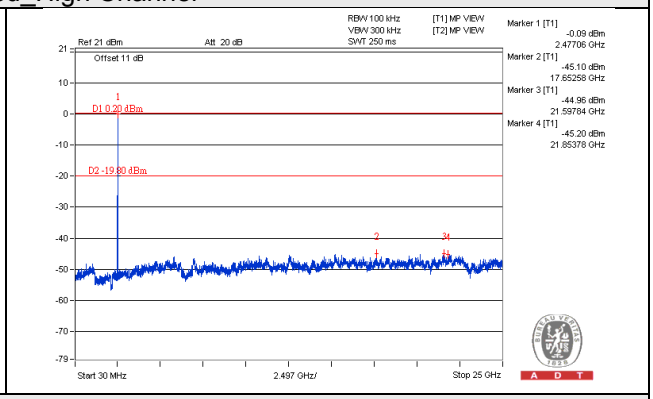
Hopping disabled_Low Channel



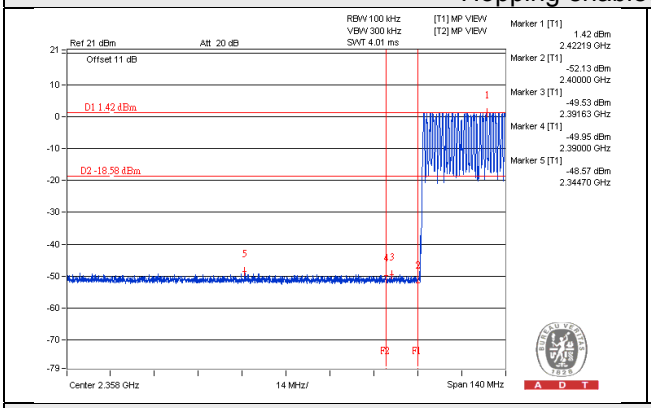


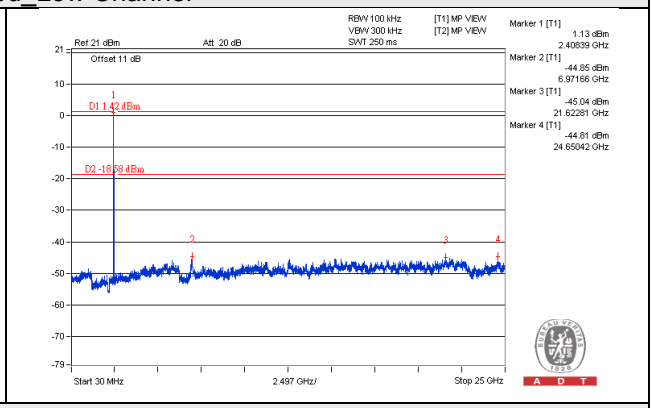
Hopping disabled_High Channel



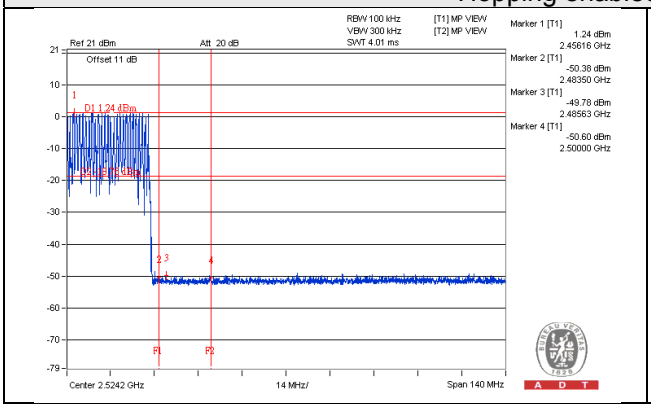


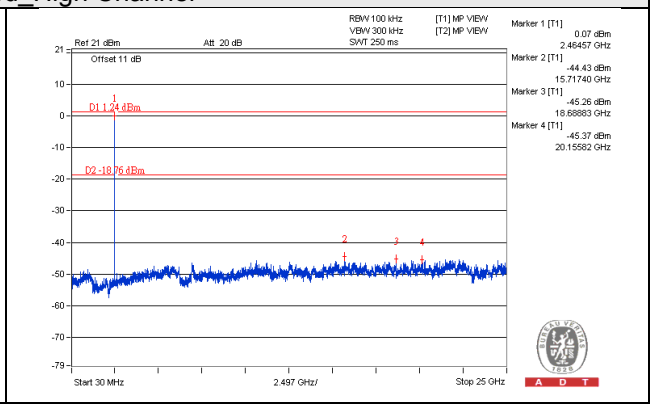
Hopping enabled_Low Channel





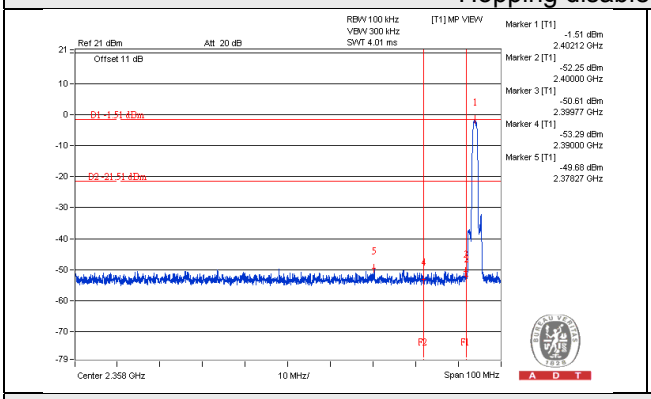
Hopping enabled_High Channel

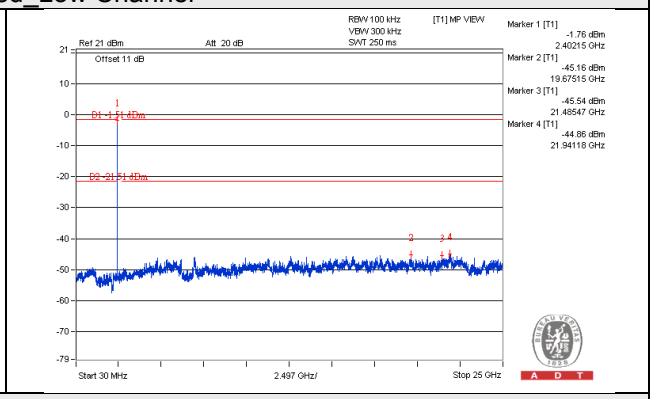




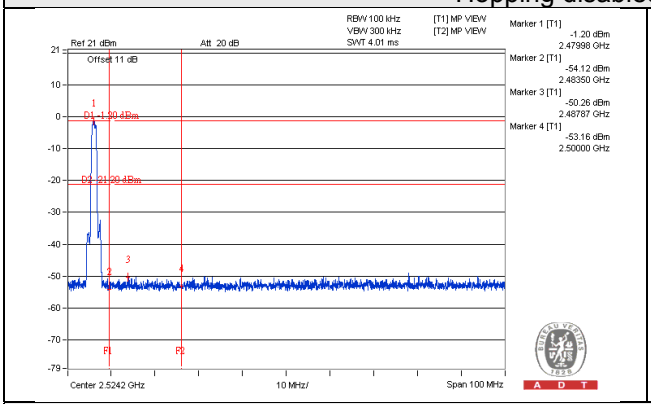
8DPSK

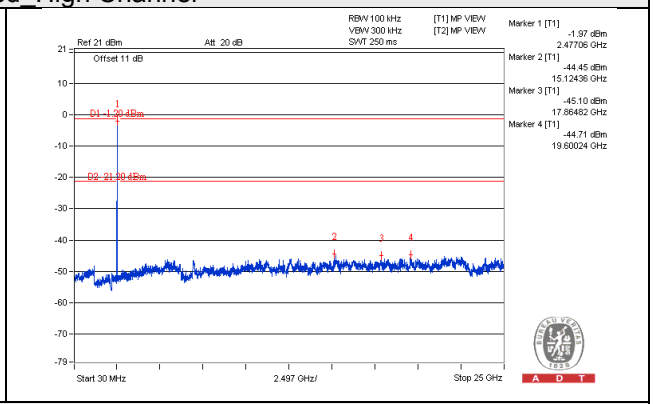
Hopping disabled_Low Channel



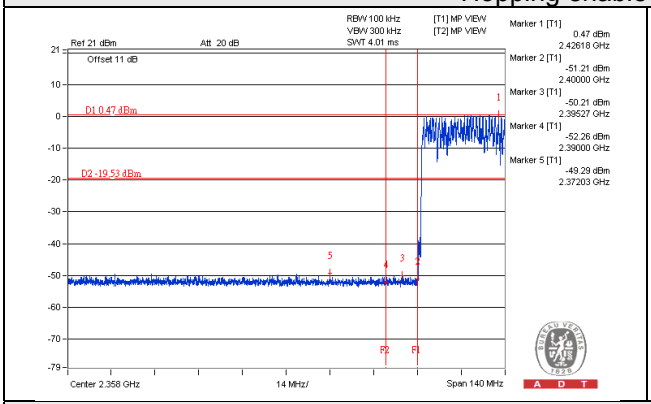


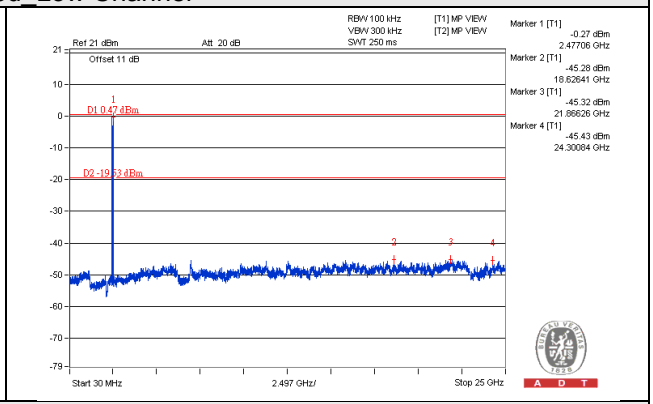
Hopping disabled_High Channel



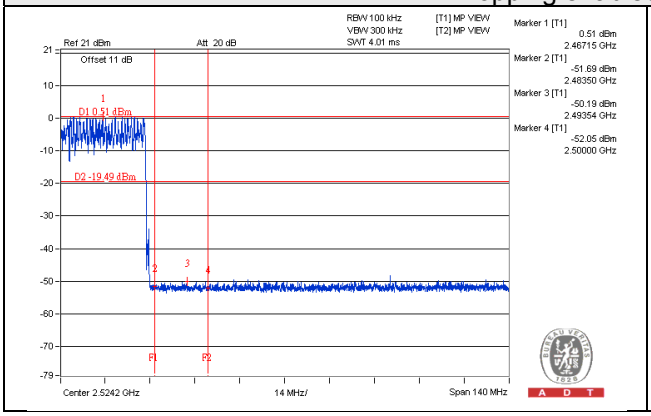


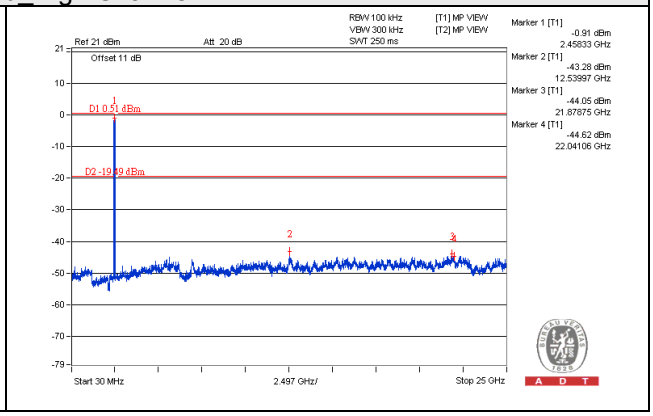
Hopping enabled_Low Channel





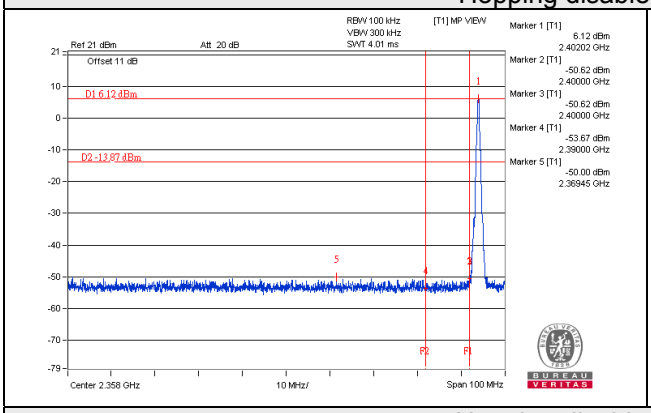
Hopping enabled_High Channel

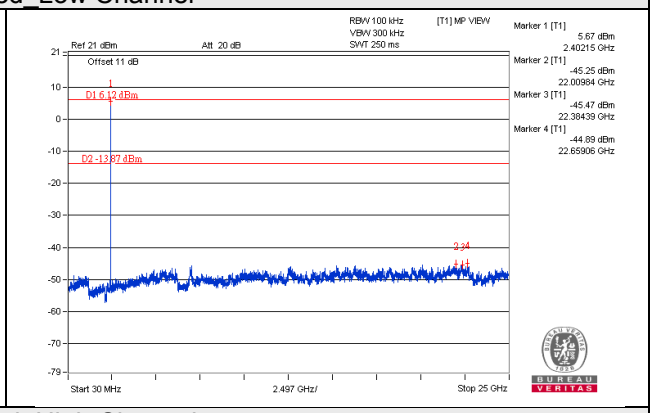




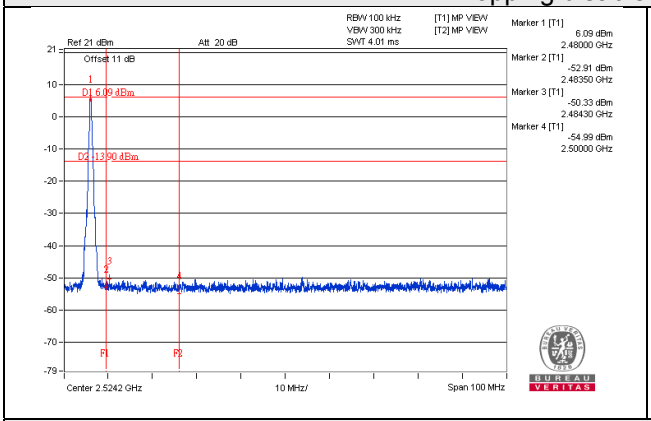
Test Mode B
GFSK

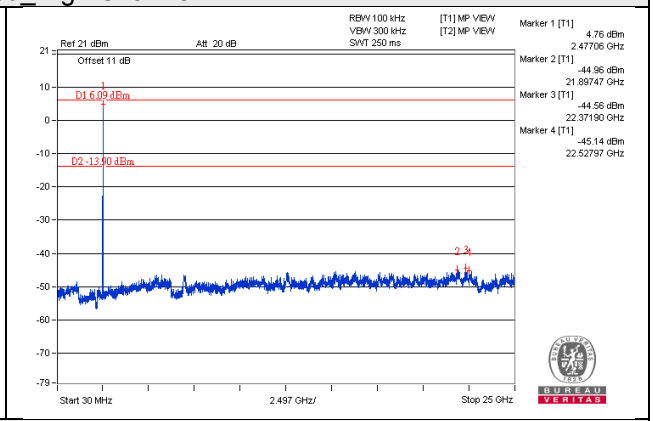
Hopping disabled_Low Channel





Hopping disabled_High Channel





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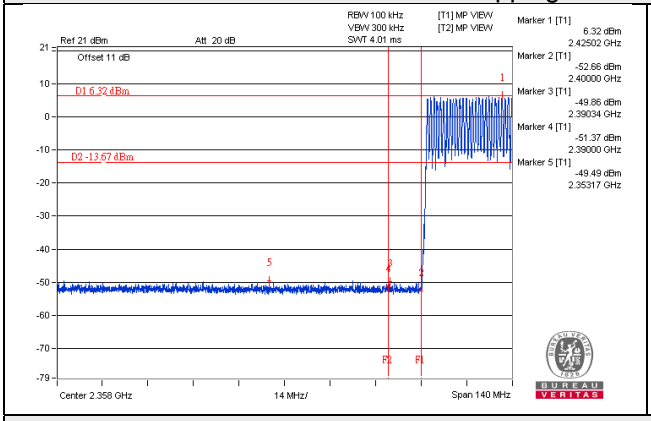

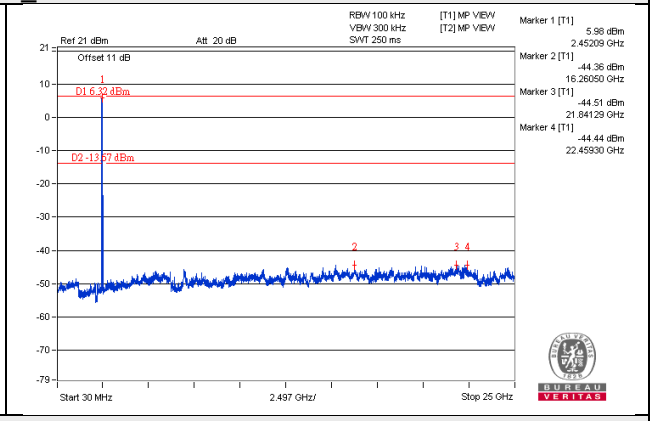

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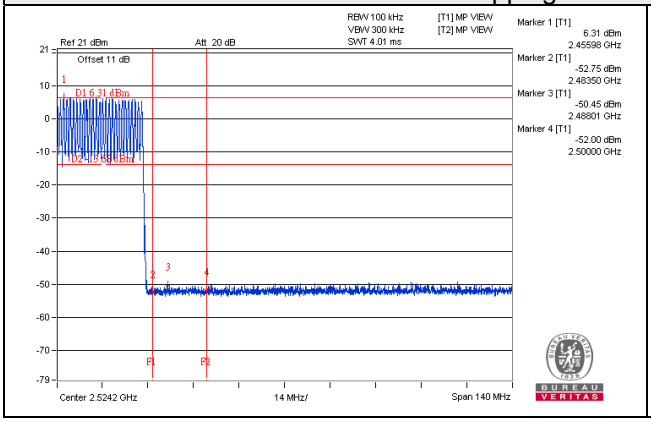

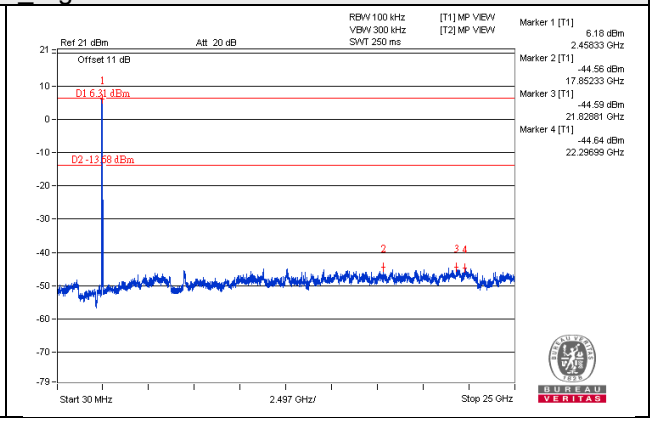

8DPSK

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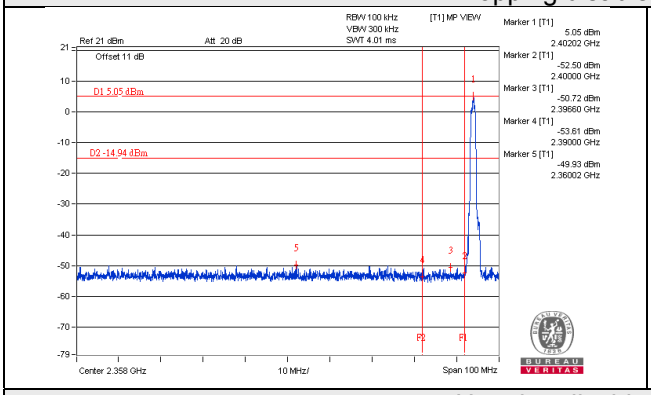

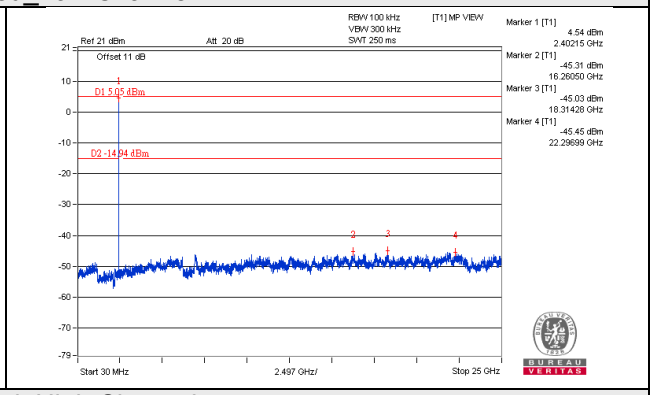

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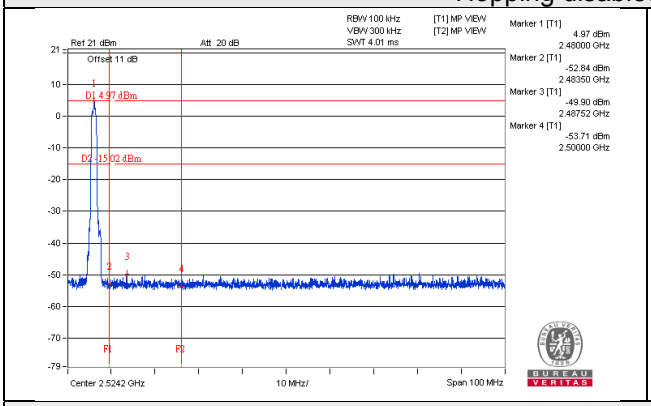

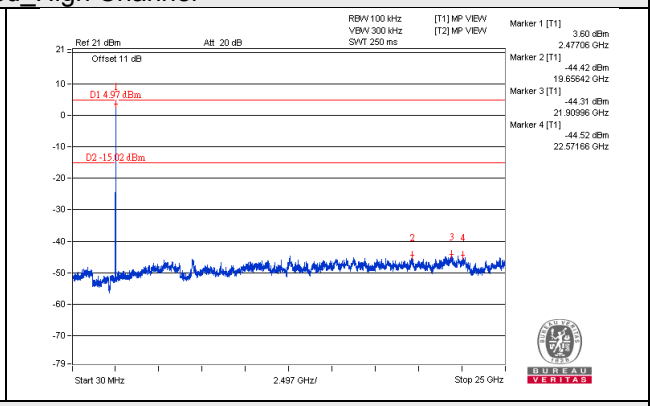

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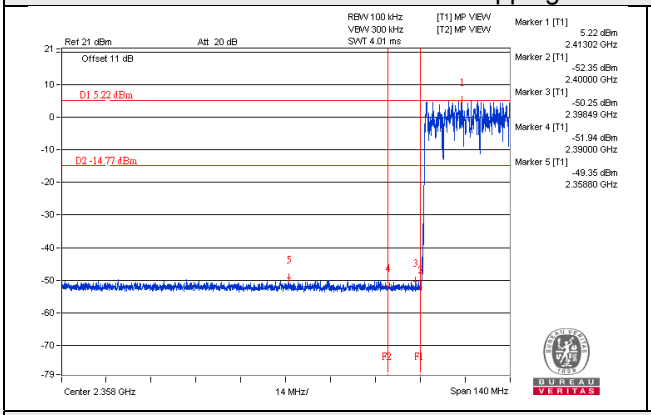

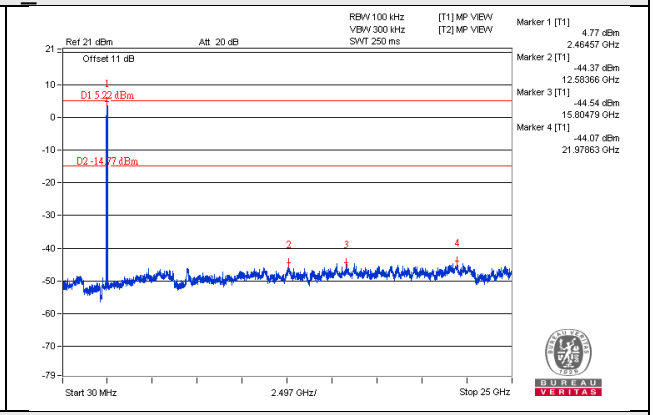

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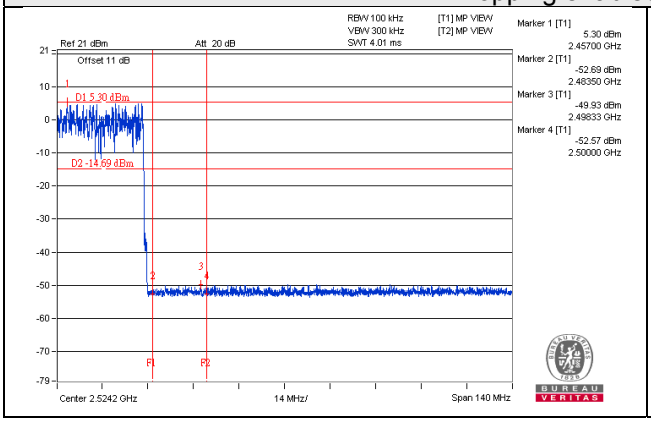

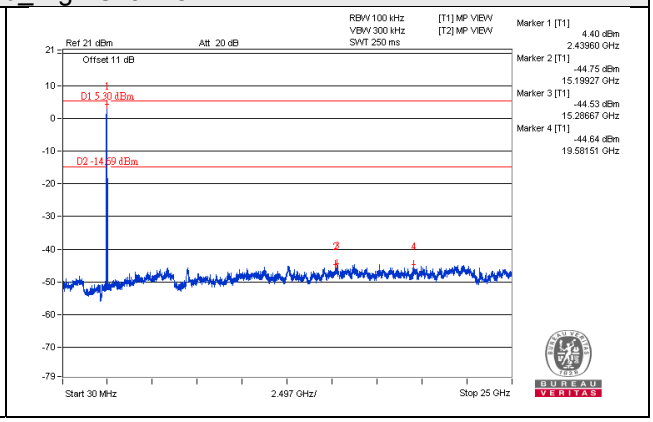

5 Pictures of Test Arrangements

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

Appendix – Information on 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 accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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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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