FCC TEST REPORT

REPORT NO.: RF990317D04
MODEL NO.: A1103000201
RECEIVED: March 12, 2010
TESTED: March 12 ~ 17, 2010
ISSUED: March 19, 2010

APPLICANT: Safe Driving Systems, LLC

ADDRESS: 10808 South River Front, Parkway, Suite 357, South Jordan, Utah 84095

ISSUED BY: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

LAB LOCATION: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien, 244 Taiwan

TABLE OF CONTENTS

1. CERTIFICATION

PRODUCT:	OBD II Bluetooth Key
MODEL NO.:	A1103000201
APPLICANT:	Safe Driving Systems, LLC
TESTED:	March 12 ~ 17, 2010
TEST ITEM:	ENGINEERING SAMPLE
STANDARDS:	FCC Part 15, Subpart C (Section 15.247), ANSI C63.4-2003

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 : Celia Chen , **DATE:** March 19, 2010
(Celia Chen / Senior Specialist)

TECHNICAL ACCEPTANCE : Jamison Chan , **DATE:** March 19, 2010
Responsible for RF
(Jamison Chan / Supervisor)

APPROVED BY : Ken Liu , **DATE:** March 19, 2010
(Ken Liu / Assistant Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
15.207	AC Power Conducted Emission	N/A	Power supply is 12.0Vdc from DC power
15.247(a)(1)(iii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel Spec. : Max. 0.4 second within 31.6 second	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, whichever is greater (see Note) 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power Spec.: max. 21dBm (see Note)	PASS	Meet the requirement of limit.
15.247(d)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit. Minimum passing margin is –7.4dB at 1628.00MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

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:

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	30MHz ~ 1GHz	3.86 dB
	Above 1GHz	2.89 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	OBD II Bluetooth Key
MODEL NO.	A1103000201
FCC ID	XY8K21001
POWER SUPPLY	12Vdc from DC power
MODULATION TYPE	GFSK,π/4-DQPSK, 8DPSK
RADIO TECHNOLOGY	FHSS
TRANSFER RATE	1/2/3Mbps
OPERATING FREQUENCY	2402 ~ 2480MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	0.7mW
ANTENNA TYPE	Printed antenna with 0dBi gain
ANTENNA CONNECTOR	N/A
I/O PORTS	N/A
DATA CABLE	N/A
ASSOCIATED DEVICES	N/A

NOTE:

1. The EUT is an OBD II Bluetooth Key, which is a transceiver.

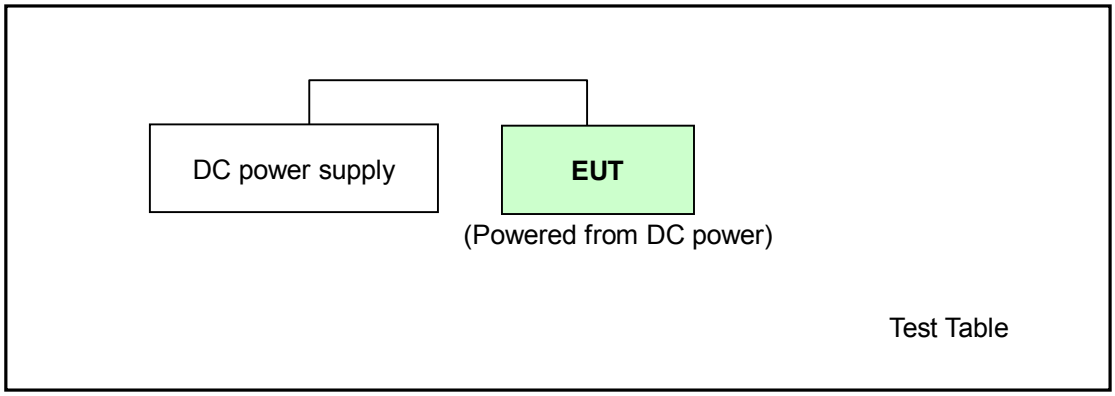
2. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

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 CONFIGURATION OF SYSTEM UNDER TEST



3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	Applicable to				Description
	PLC	RE<1G	RE≥1G	APCM	
-	Note	√	√	√	-

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

RE≥1G: Radiated Emission above 1GHz **APCM:** Antenna Port Conducted Measurement

Note: No need to concern of Conducted Emission due to the EUT is powered by DC power.

RADIATED EMISSION TEST (BELOW 1 GHz):

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

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	DATA RATE (Mbps)	AXIS
0 to 78	39	FHSS	8DPSK	DH5	3	X

RADIATED EMISSION TEST (ABOVE 1 GHz):

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

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	DATA RATE (Mbps)	AXIS
0 to 78	0, 39, 78	FHSS	GFSK	DH5	1	X
0 to 78	0, 39, 78	FHSS	8DPSK	DH5	3	X

BANDEDGE MEASUREMENT:

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

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	DATA RATE (Mbps)
0 to 78	0, 78	FHSS	GFSK	DH5	1
0 to 78	0, 78	FHSS	8DPSK	DH5	3

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 and packet types of the antenna and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	DATA RATE (Mbps)
0 to 78	0, 39, 78	FHSS	GFSK	DH5	1
0 to 78	0, 39, 78	FHSS	8DPSK	DH5	3

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	18deg. C, 71% RH, 1023hPa	12Vdc	Chad Lee
RE <1G	18deg. C, 71% RH, 1023hPa	12Vdc	Chad Lee
APCM	18deg. C, 71% RH, 1021hPa	12Vdc	Nick Chen

3.2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC Part 15, Subpart C. (15.247)
ANSI C63.4- 2003

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

3.2.4 DESCRIPTION OF SUPPORT UNITS

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

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC power supply	Topward	6603D	713072	N/A

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

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

4. TEST TYPES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

N/A

4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	May 04, 2009	May 03, 2010
HP Preamplifier	8449B	3008A01924	Aug. 31, 2009	Aug. 30, 2010
HP Preamplifier	8449B	3008A01292	Aug. 10, 2009	Aug. 09, 2010
ROHDE & SCHWARZ TEST RECEIVER	ESU26	100005	Jun. 06, 2009	Jun. 05, 2010
Schwarzbeck Antenna	VULB 9168	137	Apr. 29, 2009	Apr. 28, 2010
Schwarzbeck Antenna	VHBA 9123	480	Apr. 21, 2009	Apr. 20, 2010
EMCO Horn Antenna	3115	6714	Oct. 26, 2009	Oct. 25, 2010
EMCO Horn Antenna	3115	9312-4192	Apr. 17, 2009	Apr. 16, 2010
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V 7.6.15.9.2	NA	NA	NA
SUHNER RF cable	SF104-26.5	CABLE-CH6-17m -01	Aug. 20, 2009	Aug. 19, 2010
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

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 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 Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

4.2.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic 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. 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. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

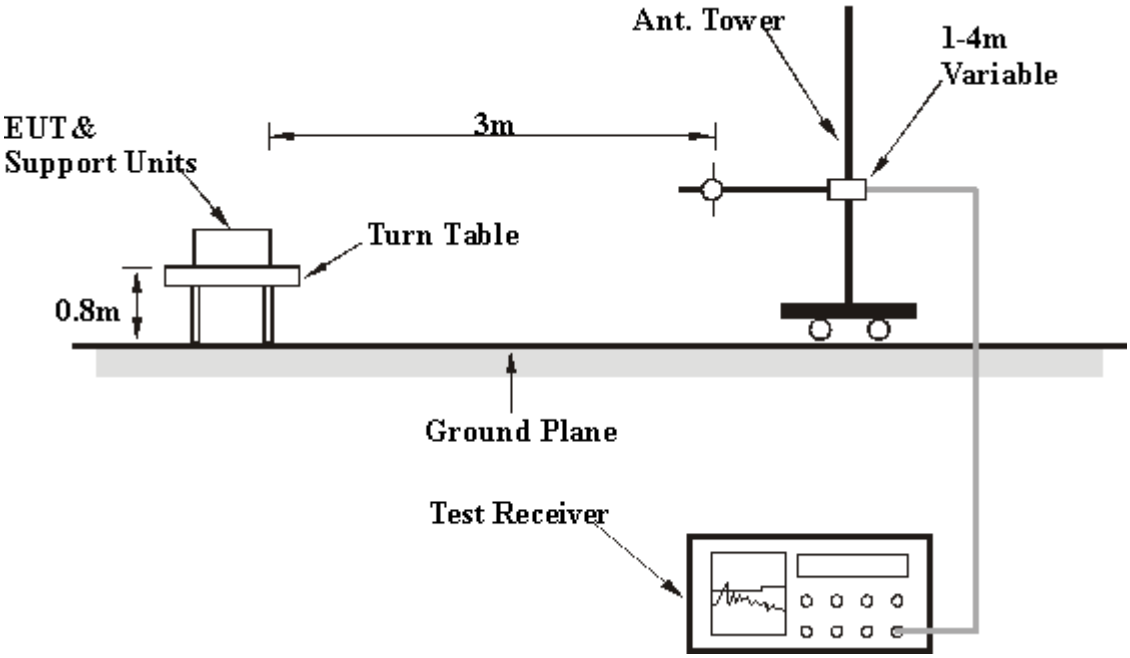
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation

4.2.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.2.6 EUT OPERATING CONDITIONS

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

4.2.7 TEST RESULTS

GFSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
INPUT POWER	12Vdc	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	**TESTED BY**	Chad Lee

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	1602.00	47.6 PK	74.0	-26.4	1.00 H	16	18.39	29.22
2	1602.00	44.9 AV	54.0	-9.2	1.00 H	16	15.63	29.22
3	2390.00	58.5 PK	74.0	-15.5	1.00 H	179	26.94	31.55
4	2390.00	45.3 AV	54.0	-8.7	1.00 H	179	13.78	31.55
5	2400.00	35.8 PK	74.0	-38.2	1.00 H	179	4.18	31.59
6	2400.00	5.7 AV	54.0	-48.3	1.00 H	179	-25.92	31.59
7	*2402.00	72.0 PK			1.00 H	179	40.43	31.60
8	*2402.00	41.9 AV			1.00 H	179	10.33	31.60
9	4804.00	55.8 PK	74.0	-18.2	1.15 H	61	18.18	37.66
10	4804.00	25.7 AV	54.0	-28.3	1.15 H	61	-11.92	37.66

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1602.00	44.8 PK	74.0	-29.3	1.05 V	349	15.53	29.22
2	1602.00	41.0 AV	54.0	-13.1	1.05 V	349	11.73	29.22
3	2390.00	58.4 PK	74.0	-15.6	1.05 V	349	26.88	31.55
4	2390.00	45.0 AV	54.0	-9.0	1.05 V	349	13.45	31.55
5	2400.00	30.9 PK	74.0	-43.1	1.05 V	349	-0.68	31.59
6	2400.00	0.8 AV	54.0	-53.2	1.05 V	349	-30.78	31.59
7	*2402.00	67.2 PK			1.00 V	1	35.57	31.60
8	*2402.00	37.1 AV			1.00 V	1	5.47	31.60
9	4804.00	56.6 PK	74.0	-17.4	1.00 V	184	18.97	37.66
10	4804.00	26.5 AV	54.0	-27.5	1.00 V	184	-11.13	37.66

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1628.00	48.8 PK	74.0	-25.2	1.10 H	172	19.53	29.26
2	**1628.00**	**46.6 AV**	**54.0**	**-7.4**	**1.10 H**	**172**	**17.32**	**29.26**
3	*2441.00	71.5 PK			1.00 H	96	39.70	31.75
4	*2441.00	41.4 AV			1.00 H	96	9.60	31.75
5	4882.00	58.1 PK	74.0	-15.9	1.00 H	26	20.20	37.94
6	4882.00	28.0 AV	54.0	-26.0	1.00 H	26	-9.90	37.94
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	1628.00	45.8 PK	74.0	-28.2	1.00 V	16	16.49	29.26
2	1628.00	41.1 AV	54.0	-12.9	1.00 V	16	11.86	29.26
3	*2441.00	66.3 PK			1.00 V	351	34.53	31.75
4	*2441.00	36.2 AV			1.00 V	351	4.43	31.75
5	4882.00	59.2 PK	74.0	-14.8	1.00 V	186	21.29	37.94
6	4882.00	29.1 AV	54.0	-24.9	1.00 V	186	-8.81	37.94

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1654.00	47.4 PK	74.0	-26.6	1.00 H	296	18.07	29.30
2	1654.00	44.7 AV	54.0	-9.3	1.00 H	296	15.38	29.30
3	*2480.00	74.1 PK			1.03 H	63	42.23	31.89
4	*2480.00	44.0 AV			1.03 H	63	12.13	31.89
5	2483.50	31.2 PK	74.0	-42.8	1.03 H	63	-0.73	31.91
6	2483.50	1.1 AV	54.0	-52.9	1.03 H	63	-30.83	31.91
7	4960.00	53.2 PK	74.0	-20.9	1.00 H	0	15.05	38.10
8	4960.00	23.1 AV	54.0	-31.0	1.00 H	0	-15.05	38.10
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	1654.00	46.5 PK	74.0	-27.5	1.00 V	5	17.21	29.30
2	1654.00	42.4 AV	54.0	-11.6	1.00 V	5	13.09	29.30
3	*2480.00	69.1 PK			1.00 V	343	37.25	31.89
4	*2480.00	39.0 AV			1.00 V	343	7.15	31.89
5	2483.50	26.2 PK	74.0	-47.8	1.00 V	343	-5.71	31.91
6	2483.50	-3.9 AV	54.0	-57.9	1.00 V	343	-35.81	31.91
7	4960.00	55.9 PK	74.0	-18.1	1.15 V	313	17.80	38.10
8	4960.00	25.8 AV	54.0	-28.2	1.15 V	313	-12.30	38.10

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 MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1602.00	49.0 PK	74.0	-25.0	1.00 H	290	19.77	29.22
2	1602.00	46.3 AV	54.0	-7.7	1.00 H	290	17.08	29.22
3	2390.00	58.4 PK	74.0	-15.6	1.00 H	164	26.85	31.55
4	2390.00	45.2 AV	54.0	-8.8	1.00 H	164	13.69	31.55
5	2400.00	34.5 PK	74.0	-39.5	1.00 H	164	2.87	31.59
6	2400.00	4.4 AV	54.0	-49.6	1.00 H	164	-27.23	31.59
7	*2402.00	70.3 PK			1.00 H	164	38.72	31.60
8	*2402.00	40.2 AV			1.00 H	164	8.62	31.60
9	4804.00	50.9 PK	74.0	-23.1	1.00 H	3	13.24	37.66
10	4804.00	20.8 AV	54.0	-33.2	1.00 H	3	-16.86	37.66

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1602.00	45.6 PK	74.0	-28.5	1.00 V	5	16.33	29.22
2	1602.00	40.6 AV	54.0	-13.4	1.00 V	5	11.38	29.22
3	2390.00	57.8 PK	74.0	-16.2	1.00 V	79	26.28	31.55
4	2390.00	45.1 AV	54.0	-8.9	1.00 V	79	13.52	31.55
5	2400.00	30.9 PK	74.0	-43.1	1.00 V	79	-0.68	31.59
6	2400.00	0.8 AV	54.0	-53.2	1.00 V	79	-30.78	31.59
7	*2402.00	66.8 PK			1.00 V	79	35.17	31.60
8	*2402.00	36.7 AV			1.00 V	79	5.07	31.60
9	4804.00	54.5 PK	74.0	-19.5	1.00 V	182	16.80	37.66
10	4804.00	24.4 AV	54.0	-29.6	1.00 V	182	-13.30	37.66

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1628.00	48.2 PK	74.0	-25.8	1.00 H	297	18.92	29.26
2	1628.00	45.6 AV	54.0	-8.4	1.00 H	297	16.36	29.26
3	*2441.00	72.3 PK			1.00 H	335	40.51	31.75
4	*2441.00	42.2 AV			1.00 H	335	10.41	31.75
5	4882.00	50.9 PK	74.0	-23.1	1.00 H	10	12.97	37.94
6	4882.00	20.8 AV	54.0	-33.2	1.00 H	10	-17.13	37.94
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	1628.00	47.5 PK	74.0	-26.5	1.00 V	41	18.27	29.26
2	1628.00	44.0 AV	54.0	-10.0	1.00 V	41	14.69	29.26
3	*2441.00	68.4 PK			1.00 V	343	36.68	31.75
4	*2441.00	38.3 AV			1.00 V	343	6.58	31.75
5	4882.00	57.2 PK	74.0	-16.8	1.00 V	89	19.30	37.94
6	4882.00	27.1 AV	54.0	-26.9	1.00 V	89	-10.80	37.94

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).

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1023 hPa	TESTED BY	Chad Lee

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	1654.00	47.2 PK	74.0	-26.8	1.00 H	322	17.85	29.30
2	1654.00	44.3 AV	54.0	-9.7	1.00 H	322	14.97	29.30
3	*2480.00	70.9 PK			1.00 H	63	38.99	31.89
4	*2480.00	40.8 AV			1.00 H	63	8.89	31.89
5	2483.50	29.1 PK	74.0	-44.9	1.00 H	63	-2.85	31.91
6	2483.50	-1.0 AV	54.0	-55.0	1.00 H	63	-32.95	31.91
7	4960.00	49.8 PK	74.0	-24.2	1.00 H	328	11.67	38.10
8	4960.00	19.7 AV	54.0	-34.3	1.00 H	328	-18.43	38.10
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	1654.00	46.8 PK	74.0	-27.2	1.00 V	10	17.53	29.30
2	1654.00	43.7 AV	54.0	-10.3	1.00 V	10	14.37	29.30
3	*2480.00	68.8 PK			1.00 V	333	36.88	31.89
4	*2480.00	38.7 AV			1.00 V	333	6.78	31.89
5	2483.50	27.0 PK	74.0	-47.1	1.00 V	333	-4.96	31.91
6	2483.50	-3.1 AV	54.0	-57.1	1.00 V	333	-35.01	31.91
7	4960.00	52.0 PK	74.0	-22.0	1.00 V	321	13.89	38.10
8	4960.00	21.9 AV	54.0	-32.1	1.00 V	321	-16.21	38.10

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：8DPSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	12Vdc	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	18deg. C, 71%RH 1019 hPa	TESTED BY	Chad Lee

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	93.73	25.1 QP	43.5	-18.4	1.55 H	217	16.70	8.39
2	112.39	30.1 QP	43.5	-13.4	1.43 H	85	19.67	10.43
3	159.02	24.7 QP	43.5	-18.8	1.06 H	253	10.65	14.04
4	168.35	28.7 QP	43.5	-14.9	1.22 H	73	14.79	13.86
5	891.19	28.9 QP	46.0	-17.1	1.00 H	10	0.94	27.93
6	914.50	29.1 QP	46.0	-16.9	1.00 H	238	0.90	28.20
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	104.62	30.1 QP	43.5	-13.4	1.12 V	7	20.61	9.46
2	152.80	28.8 QP	43.5	-14.7	1.59 V	151	14.46	14.31
3	180.79	27.4 QP	43.5	-16.1	1.53 V	22	14.91	12.45
4	204.10	24.9 QP	43.5	-18.6	1.42 V	271	13.53	11.37
5	830.56	27.0 QP	46.0	-19.0	1.44 V	265	-0.05	27.09
6	920.72	27.9 QP	46.0	-18.1	1.50 V	208	-0.39	28.27

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.

4.3 NUMBER OF HOPPING FREQUENCY USED

4.3.1 LIMIT OF HOPPING FREQUENCY USED

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

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST PROCEDURES

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

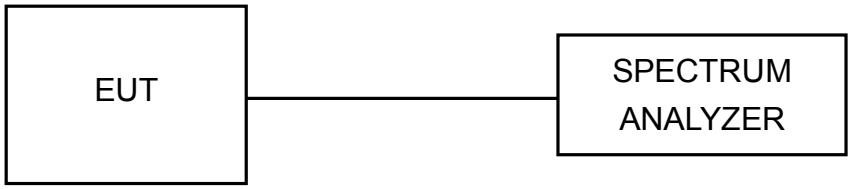
d. Set the SA on View mode and then plot the result on SA screen.

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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

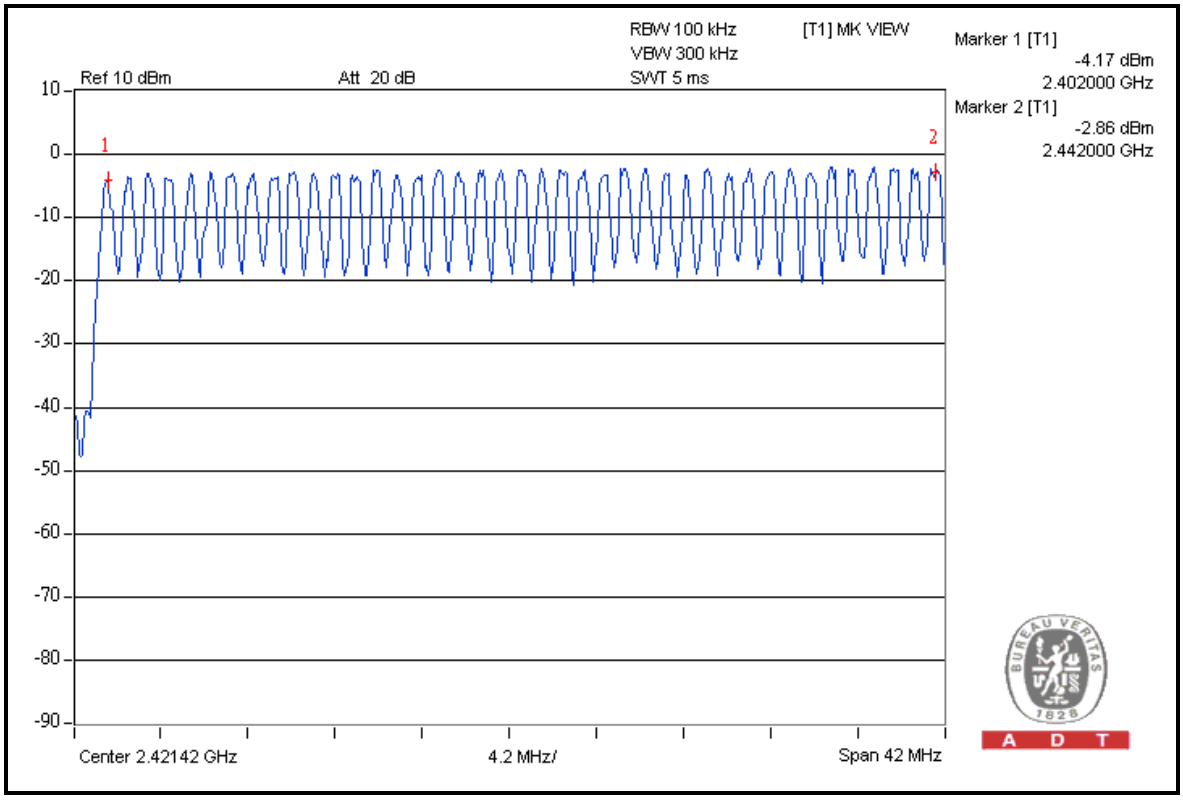
4.3.5 TEST SETUP

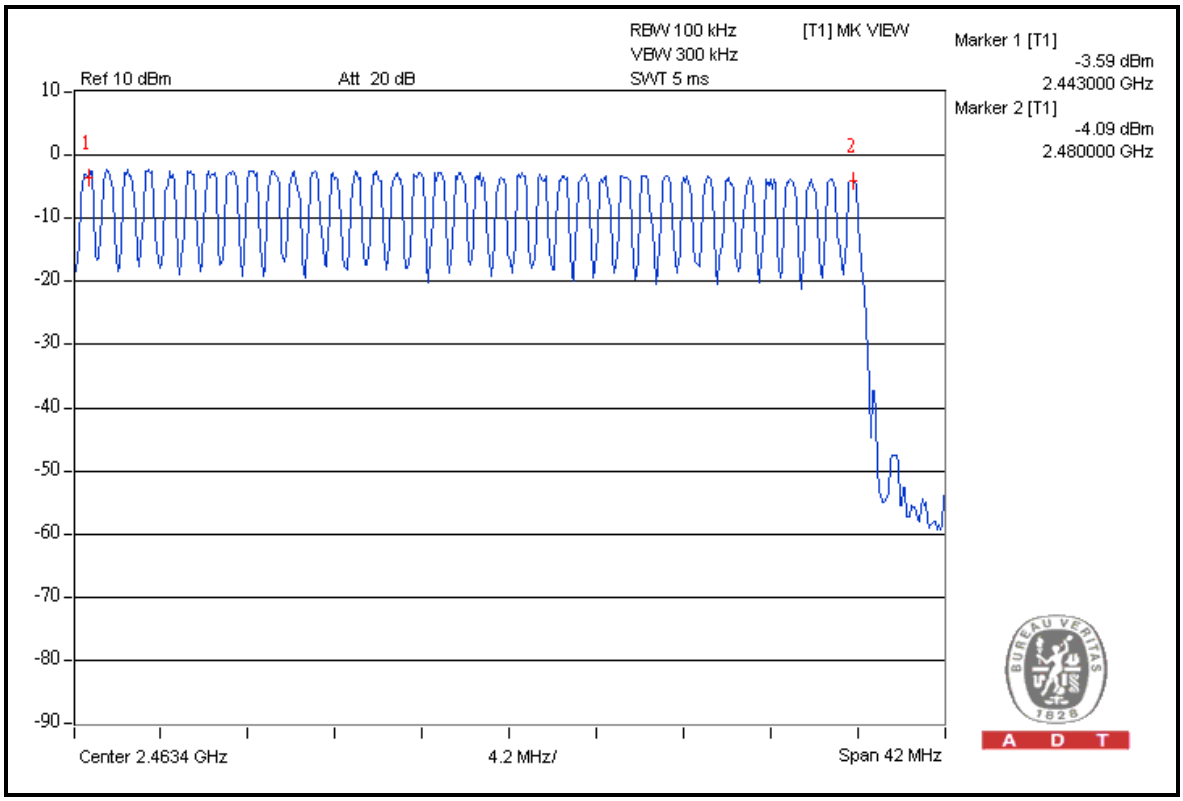


4.3.6 TEST RESULTS

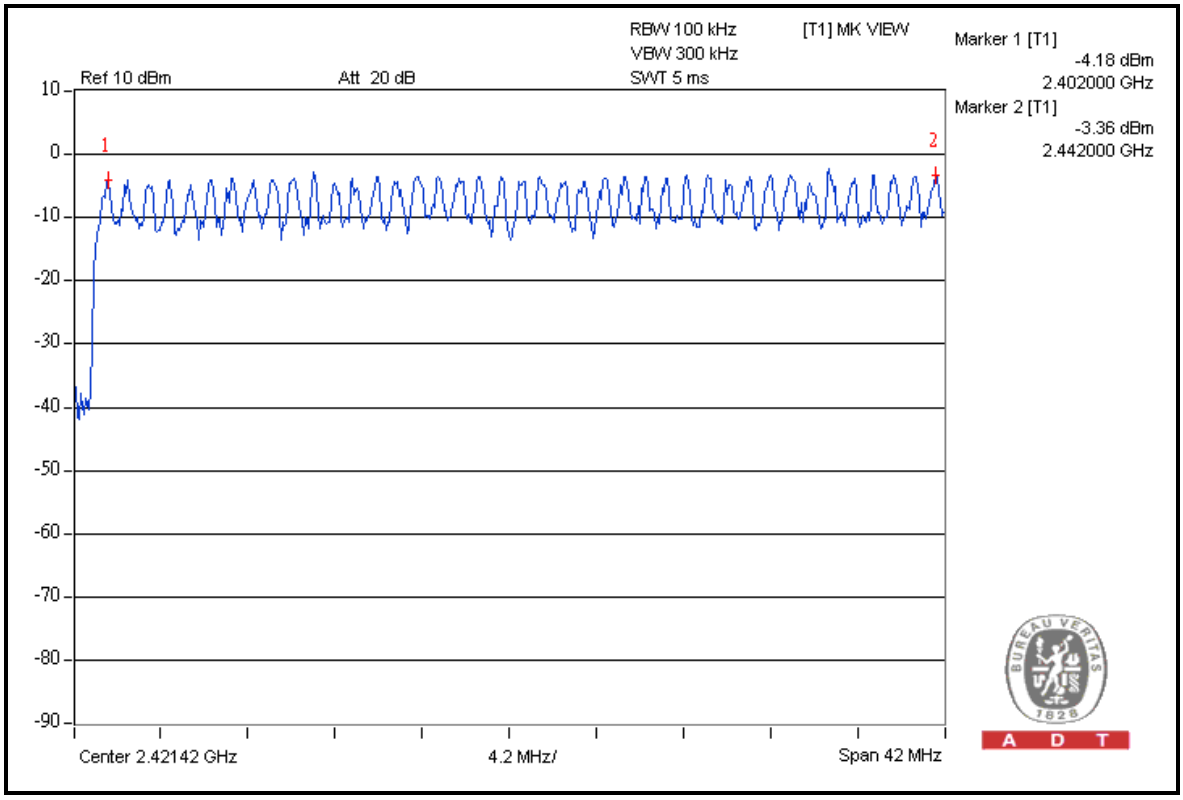
There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

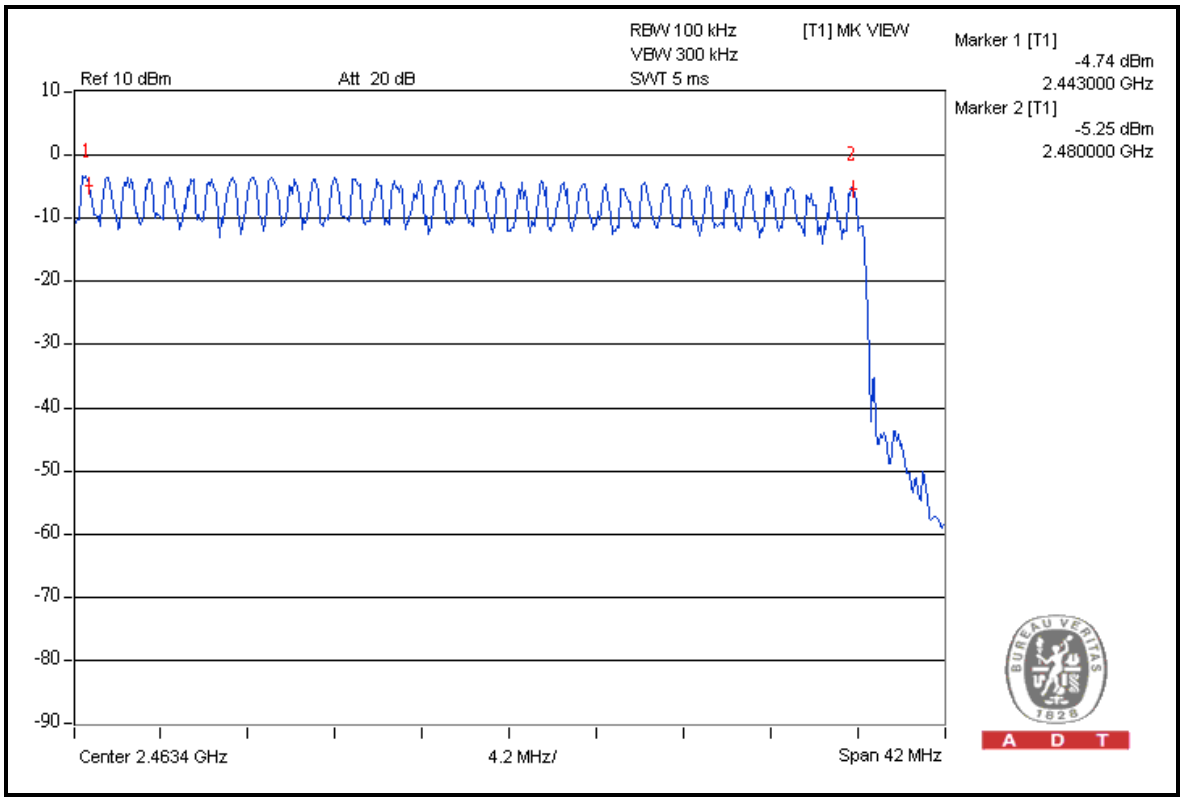
GFSK


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK VIEW
Marker 1 [T1]
-4.17 dBm
2.402000 GHz
Marker 2 [T1]
-2.86 dBm
2.442000 GHz
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.42142 GHz
4.2 MHz/
Span 42 MHz


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK VIEW
Marker 1 [T1]
-3.59 dBm
2.443000 GHz
Marker 2 [T1]
-4.09 dBm
2.480000 GHz
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

8DPSK


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK VIEW
Marker 1 [T1]
-4.18 dBm
2.402000 GHz
Marker 2 [T1]
-3.36 dBm
2.442000 GHz
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.42142 GHz
4.2 MHz/
Span 42 MHz


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK VIEW
Marker 1 [T1]
-4.74 dBm
2.443000 GHz
Marker 2 [T1]
-5.25 dBm
2.480000 GHz
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

4.4 DWELL TIME ON EACH CHANNEL

4.4.1 LIMIT OF DWELL TIME USED

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

4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

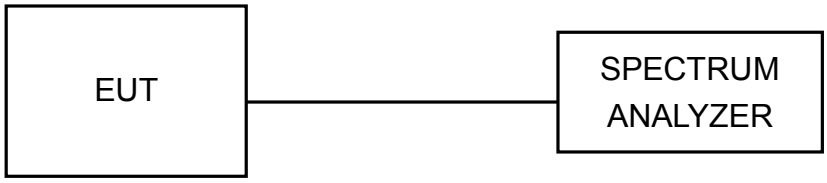
4.4.3 TEST PROCEDURES

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.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP



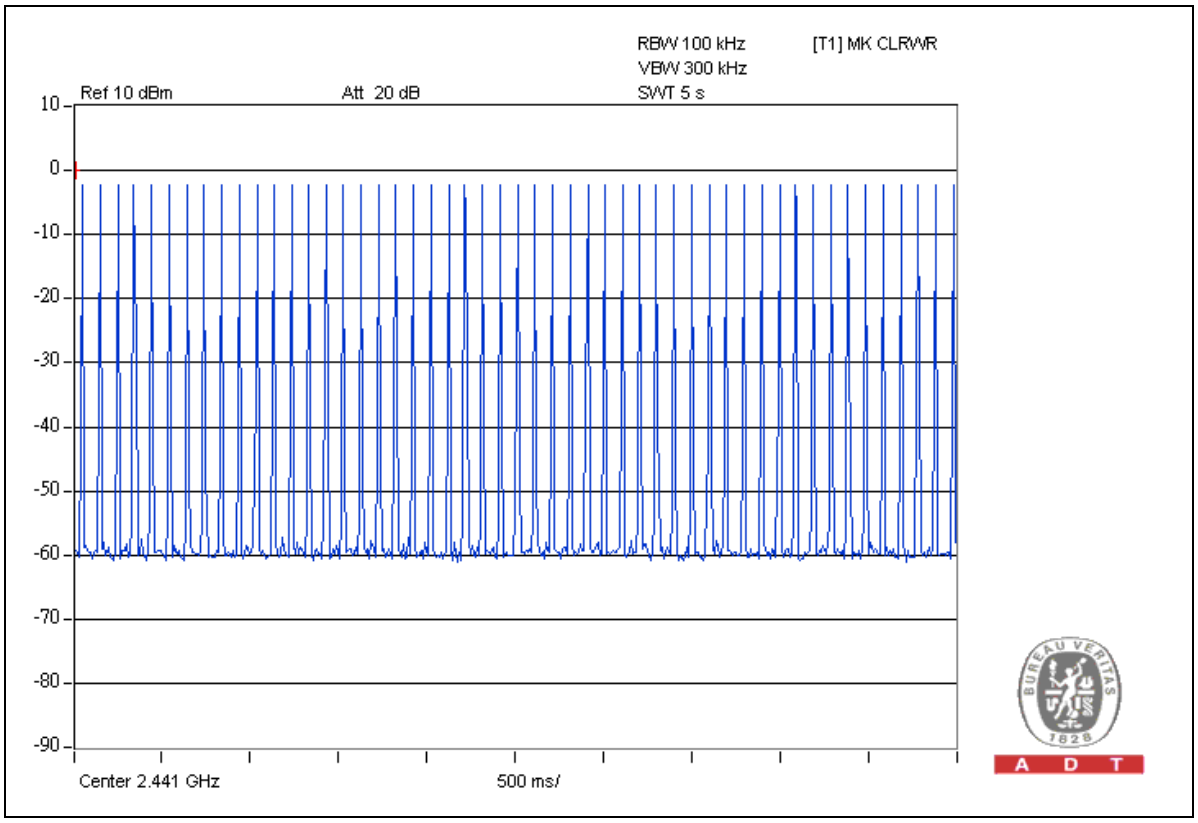
4.4.6 TEST RESULTS

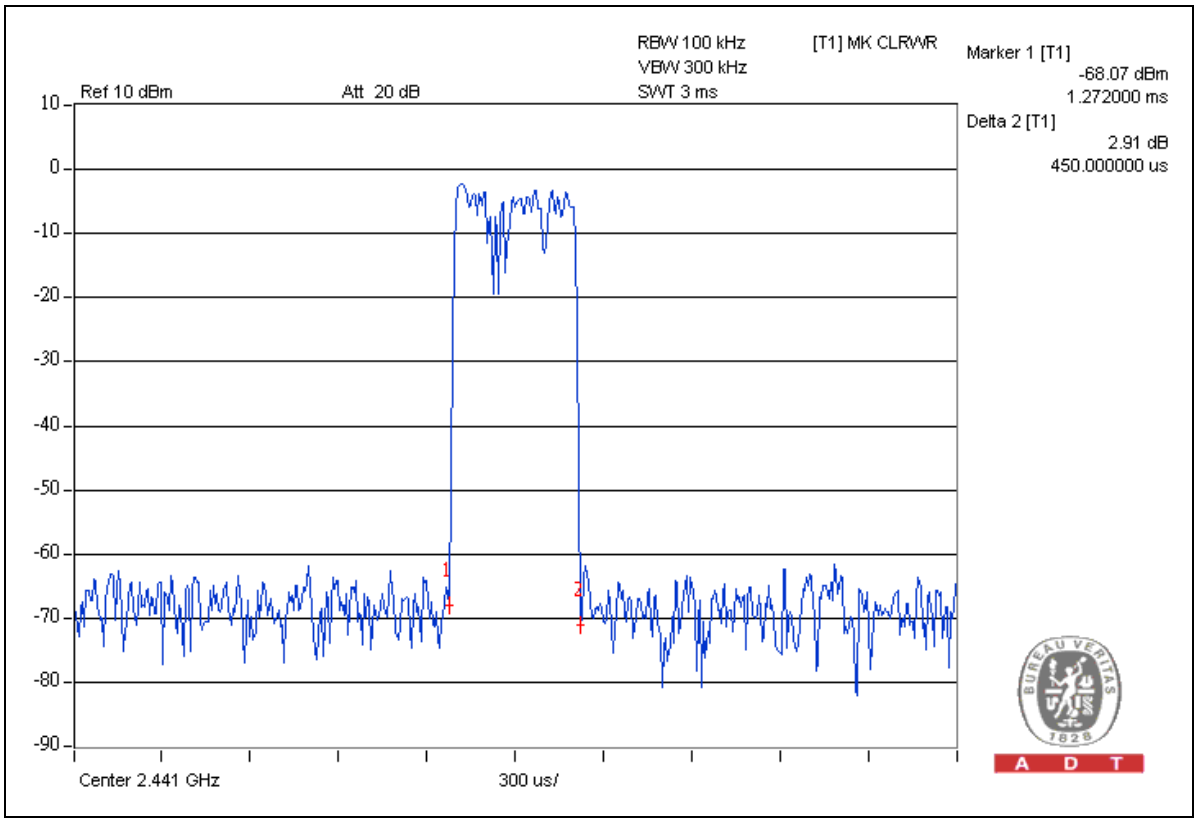
GFSK MODULATION

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	51 (times / 5 sec) *6.32=322.32 times	0.45	145.0440	400
DH3	25 (times / 5 sec) *6.32=158.00 times	1.74	274.9200	400
DH5	16 (times / 5 sec) *6.32=101.12 times	2.98	301.3376	400

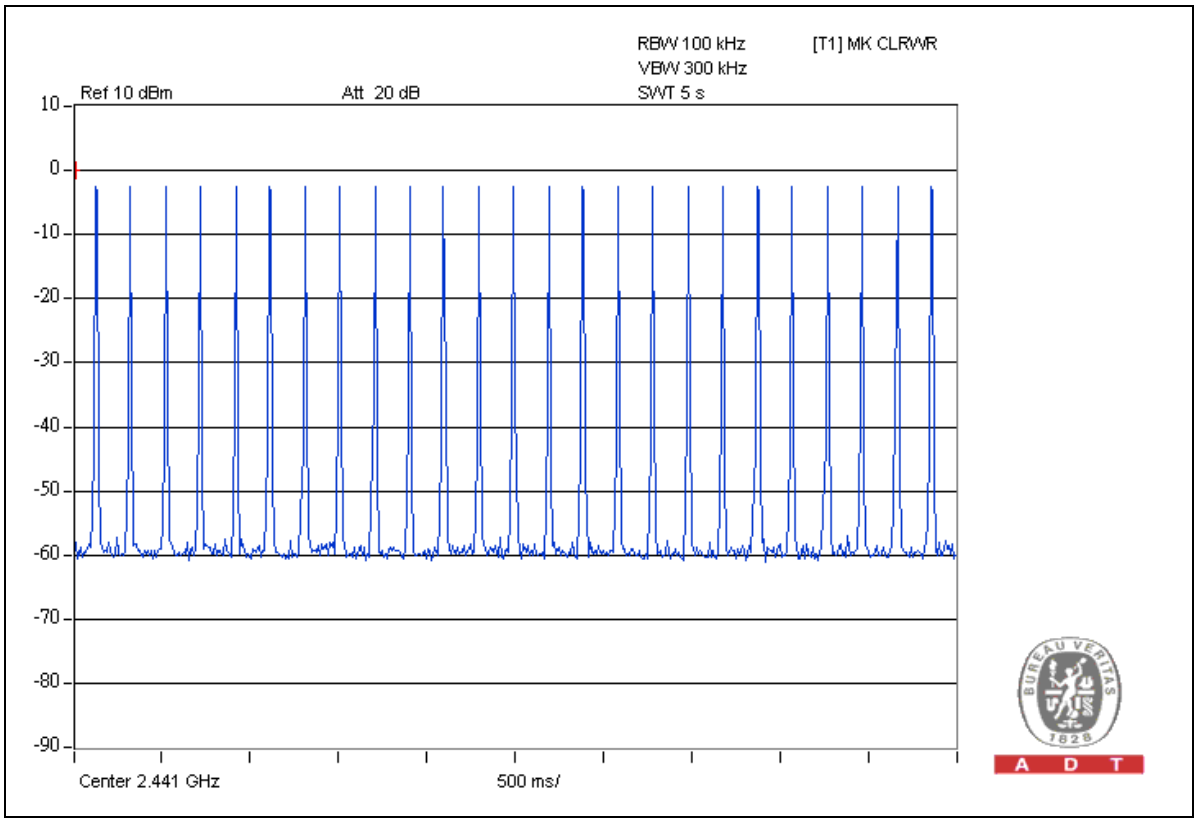
NOTE: Test plots of the transmitting time slot are shown on next 3 pages for test channel 39.

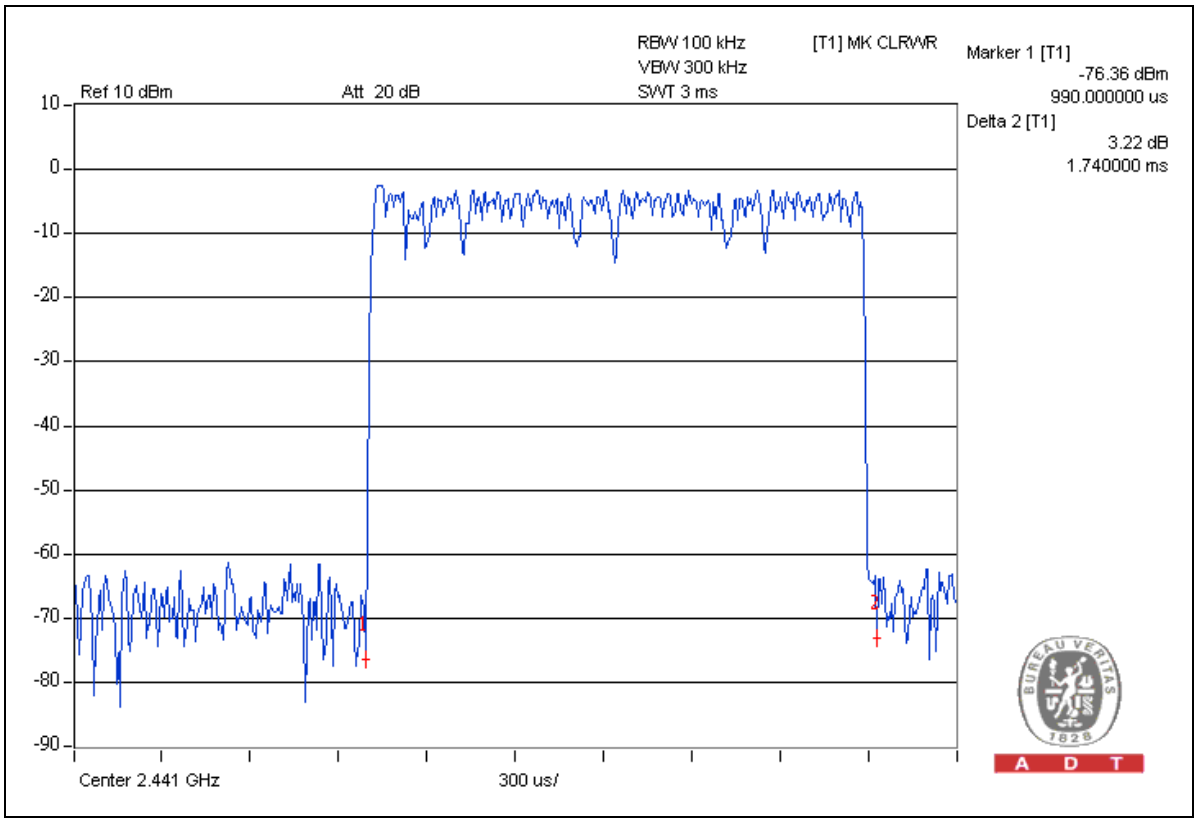
DH1


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/

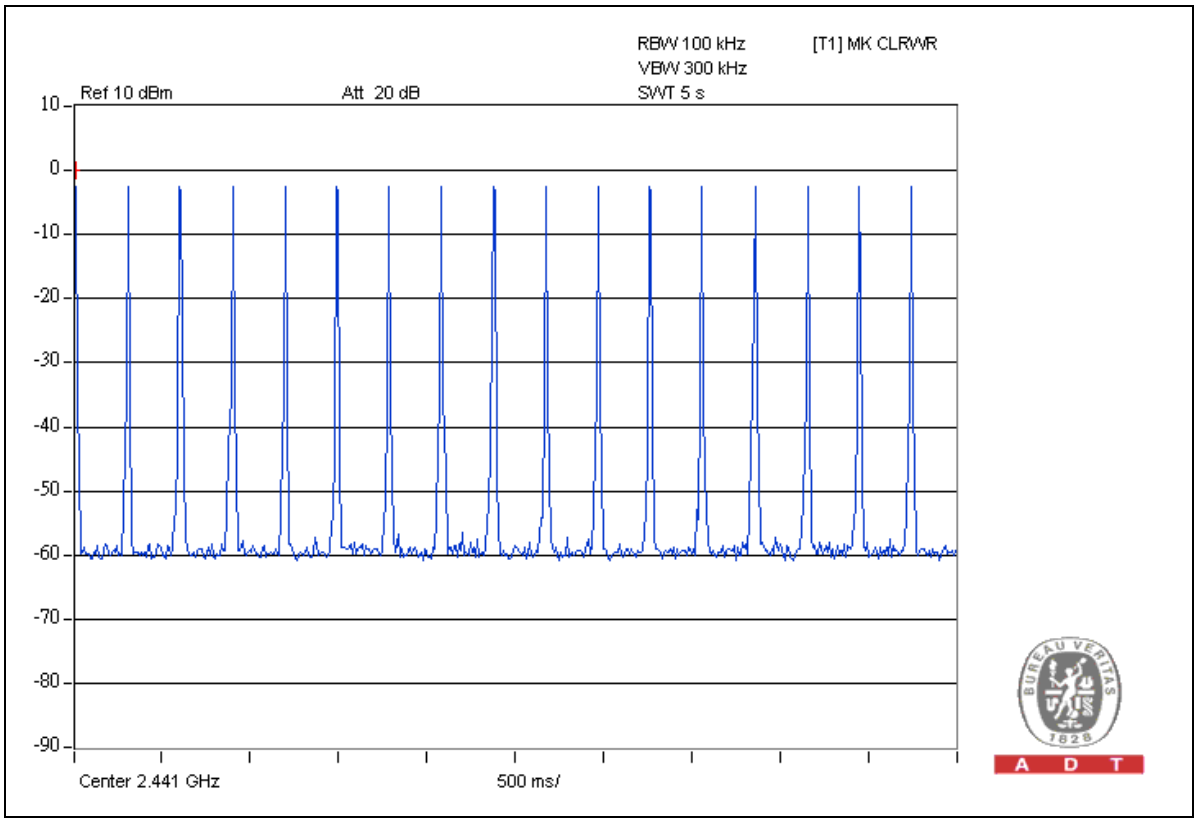

RBW 100 kHz
VBW 300 kHz
SWT 3 ms
[T1] MK CLRWR
Marker 1 [T1]
-68.07 dBm
1.272000 ms
Delta 2 [T1]
2.91 dB
450.000000 us
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
300 us/

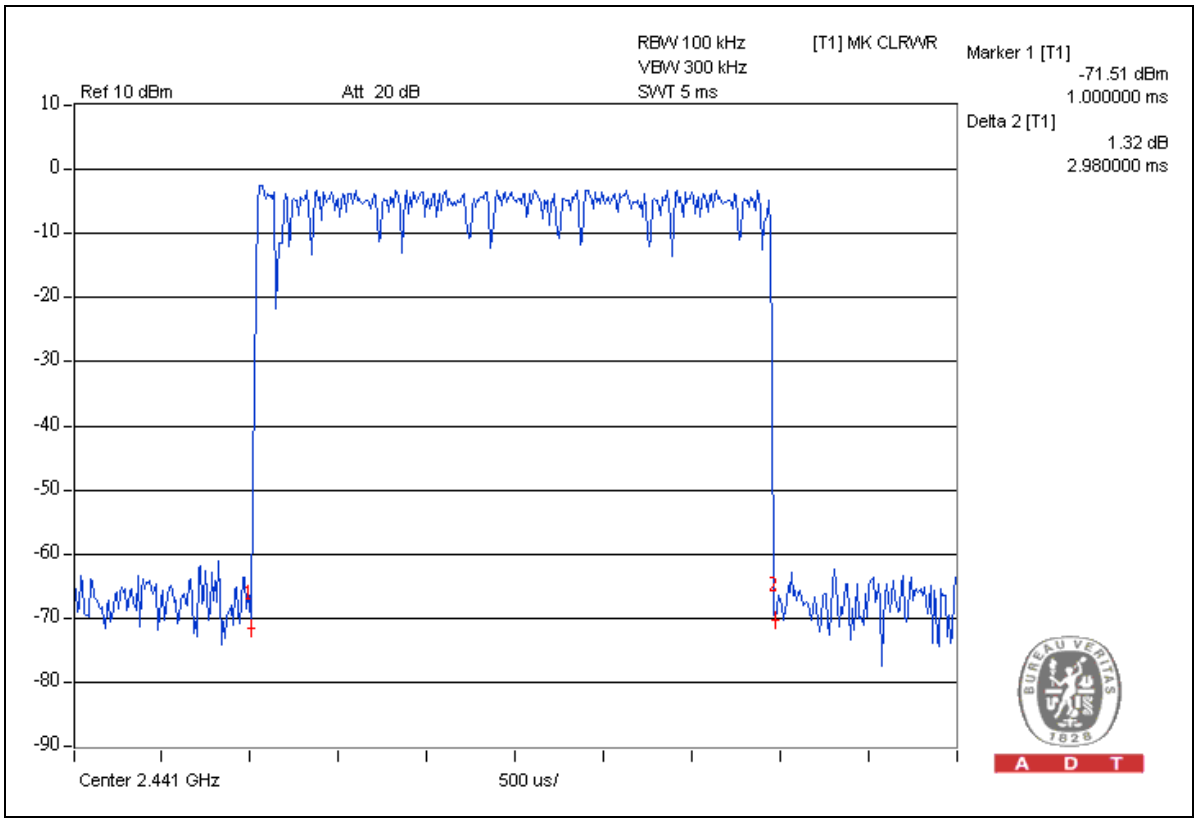
DH3


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 3 ms
[T1] MK CLRWR
Marker 1 [T1]
-76.36 dBm
990.000000 us
Delta 2 [T1]
3.22 dB
1.740000 ms
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
300 us/

DH5


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/

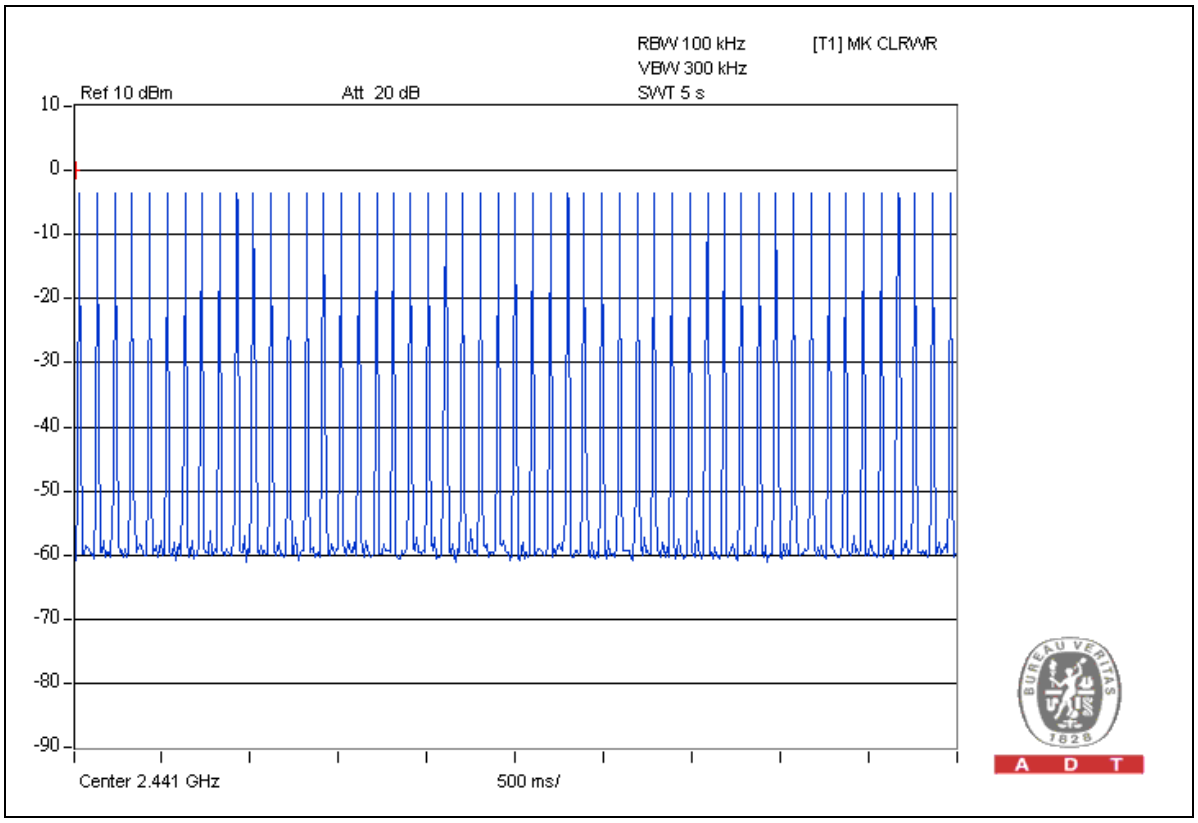

RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK CLRWR
Marker 1 [T1]
-71.51 dBm
1.000000 ms
Delta 2 [T1]
1.32 dB
2.980000 ms
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 us/

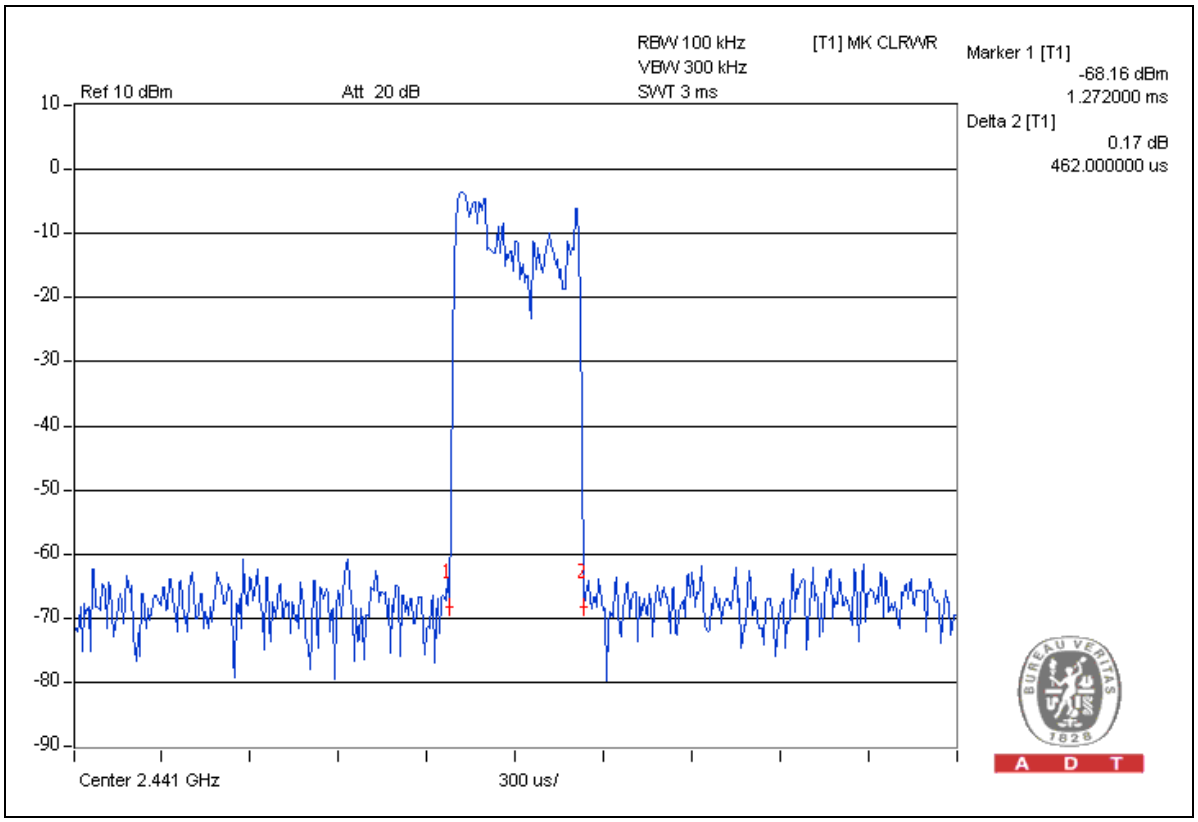
8DPSK MODULATION

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	51 (times / 5 sec) *6.32=322.32 times	0.462	148.91184	400
DH3	25 (times / 5 sec) *6.32=158.00 times	1.758	277.76400	400
DH5	17 (times / 5 sec) *6.32=107.44 times	2.980	320.17120	400

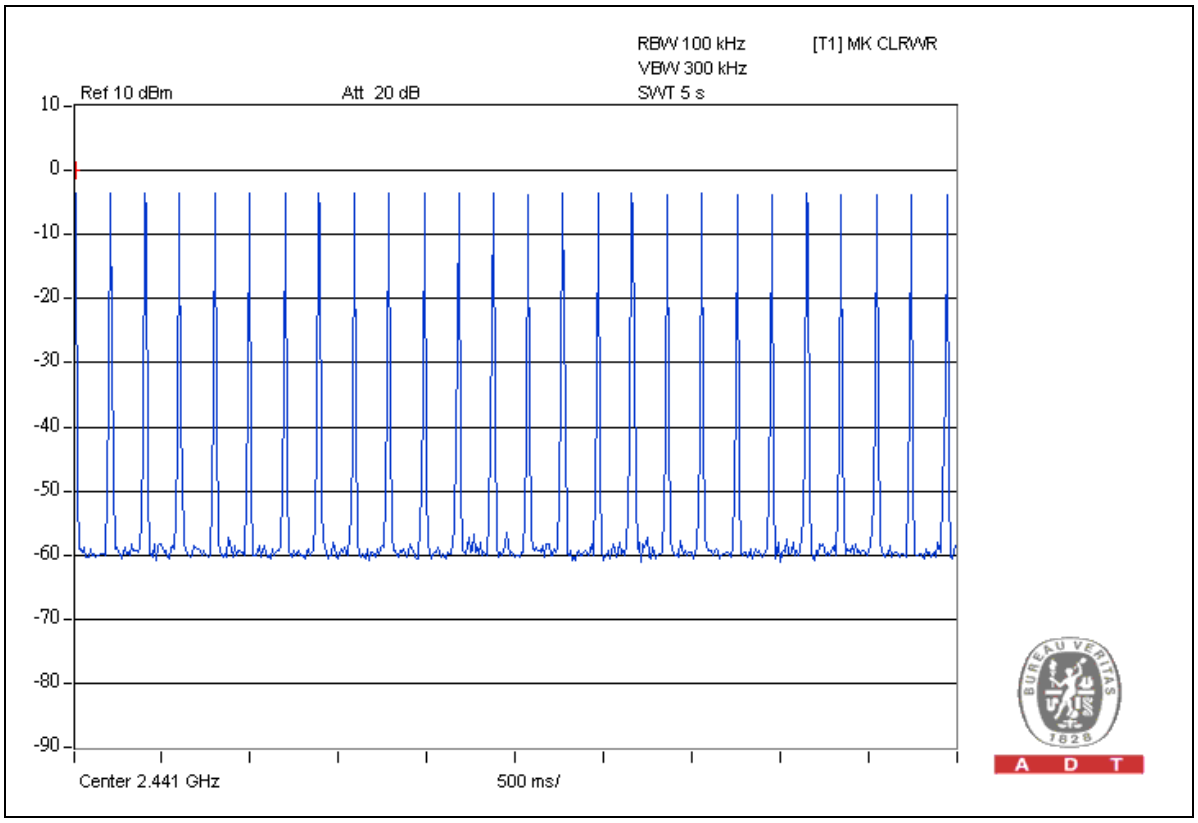
NOTE: Test plots of the transmitting time slot are shown on next 3 pages for test channel 39.

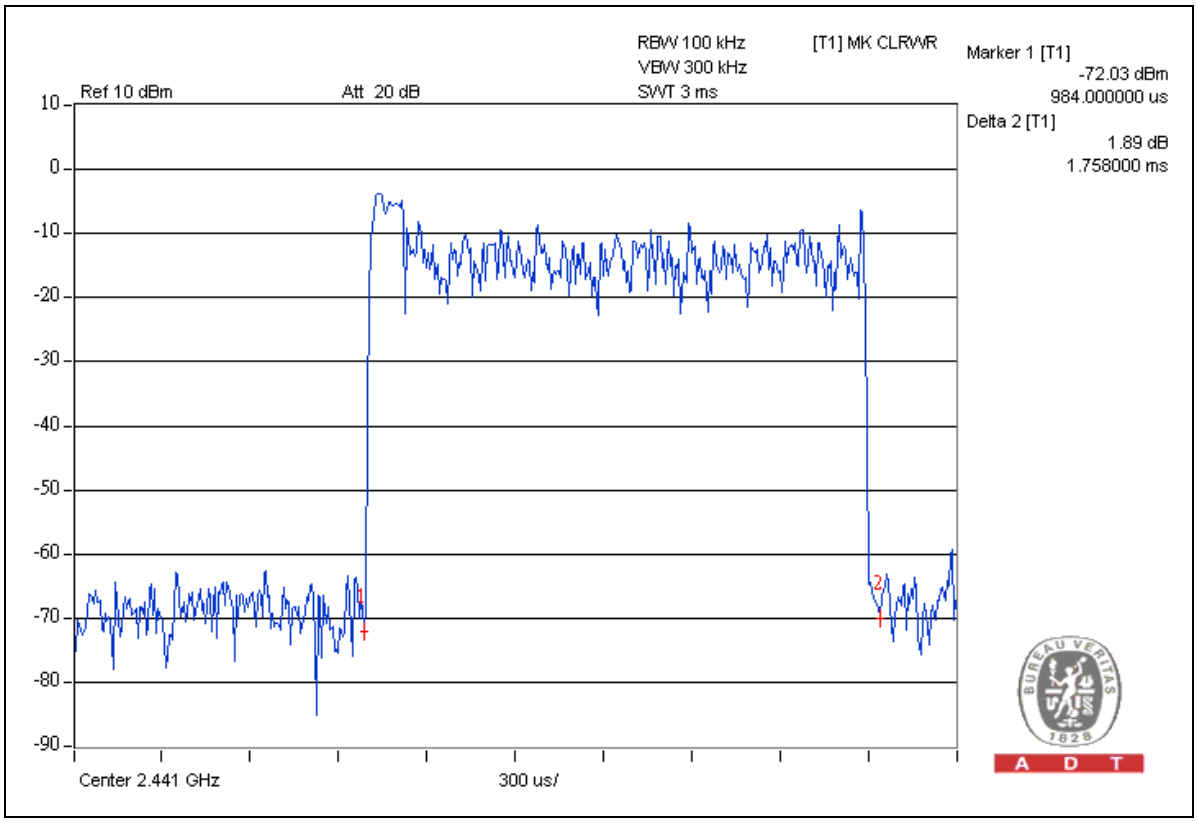
DH1


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/

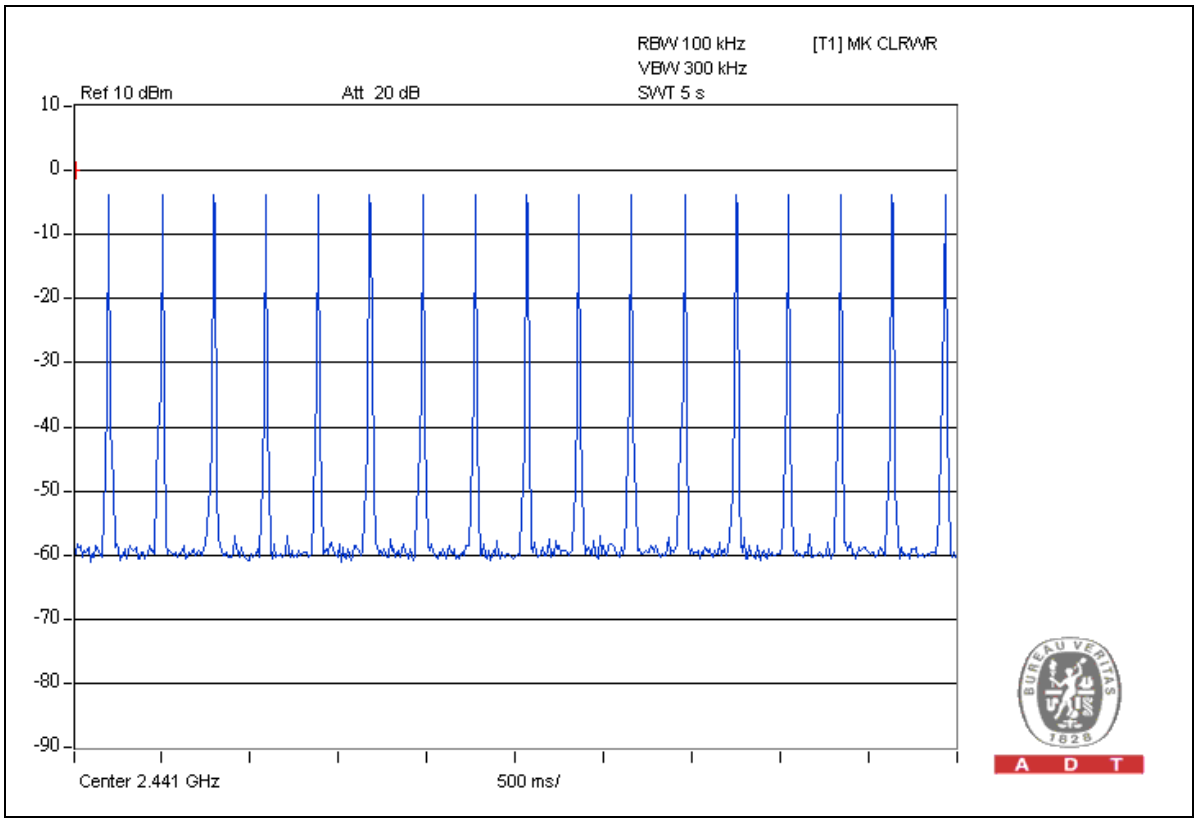

RBW 100 kHz
VBW 300 kHz
SWT 3 ms
[T1] MK CLRWR
Marker 1 [T1]
-68.16 dBm
1.272000 ms
Delta 2 [T1]
0.17 dB
462.000000 us
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
300 us/

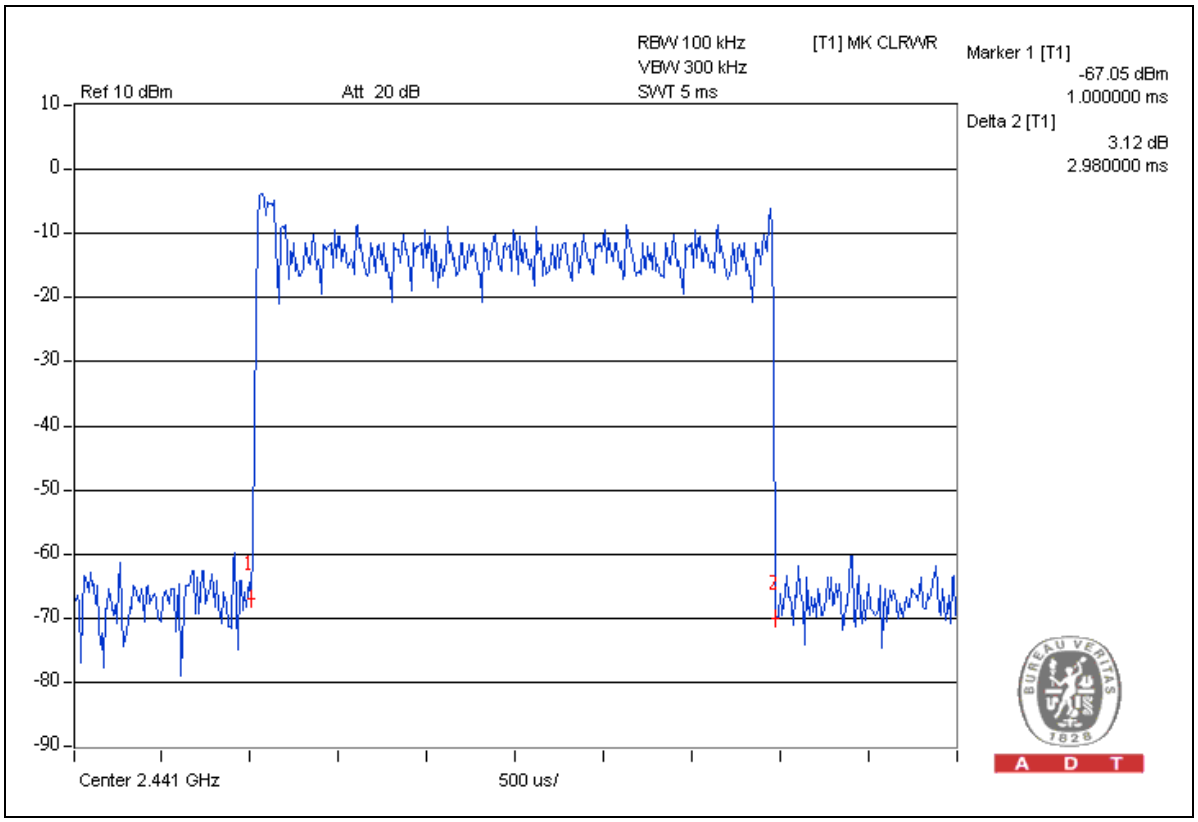
DH3


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 3 ms
[T1] MK CLRWR
Marker 1 [T1]
-72.03 dBm
984.000000 us
Delta 2 [T1]
1.89 dB
1.758000 ms
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
300 us/

DH5


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MK CLRWR
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MK CLRWR
Marker 1 [T1]
-67.05 dBm
1.000000 ms
Delta 2 [T1]
3.12 dB
2.980000 ms
Ref 10 dBm
Att 20 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
500 us/

4.5 CHANNEL BANDWIDTH

4.5.1 LIMITS OF CHANNEL BANDWIDTH

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

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.5.3 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.

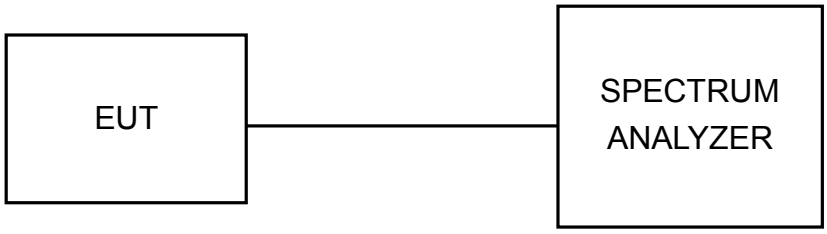
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

d. Repeat above procedures until all frequencies measured were complete.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITION

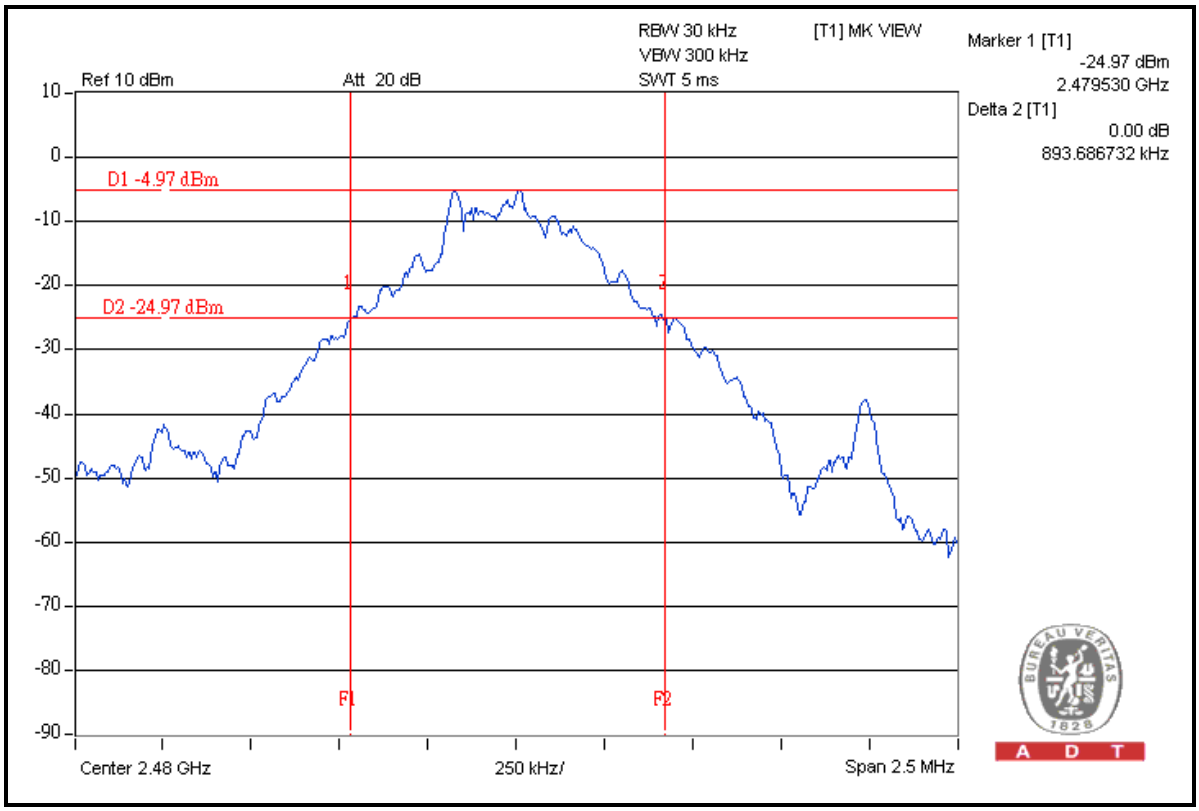
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.5.7 TEST RESULTS

GFSK MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.87
39	2441	0.85
78	2480	0.89

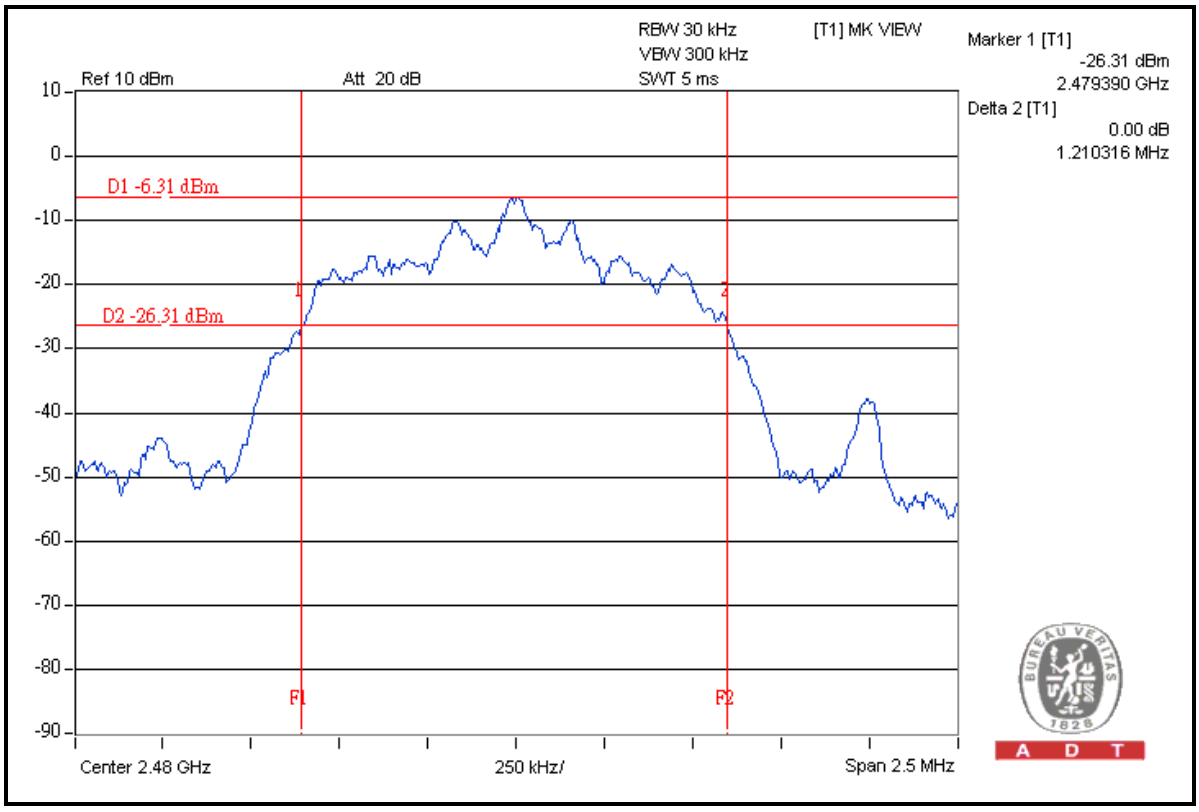
CH 78



8DPSK MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.20
39	2441	1.21
78	2480	1.21

CH 78



4.6 HOPPING CHANNEL SEPARATION

4.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

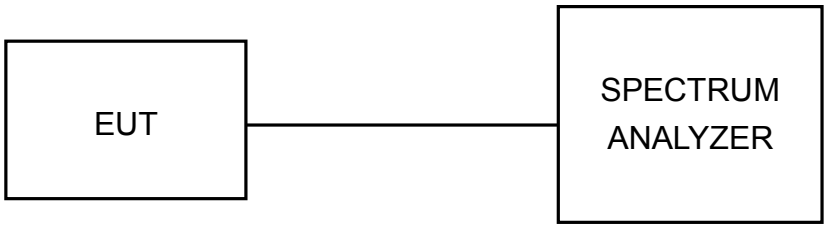
4.6.3 TEST PROCEDURES

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

4.6.4 DEVIATION FROM TEST STANDARD

No deviation.

4.6.5 TEST SETUP



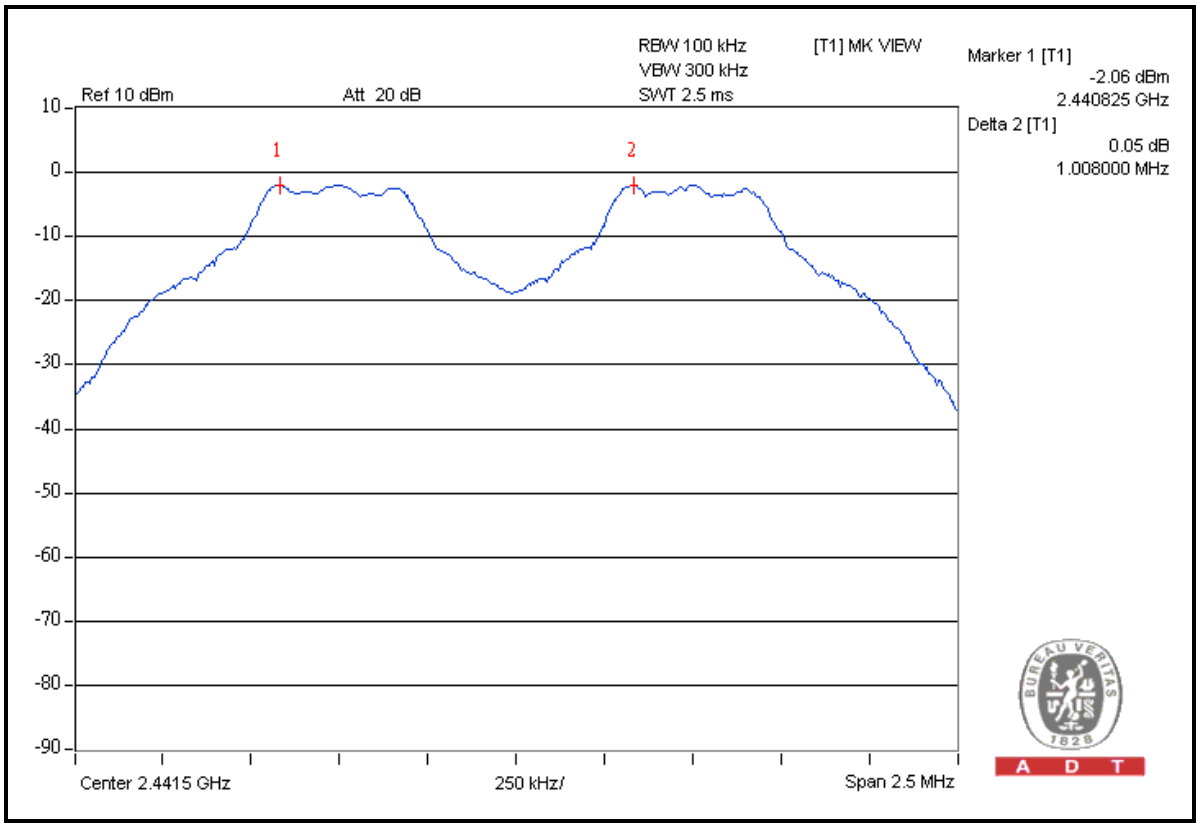
4.6.6 TEST RESULTS

GFSK MODULATION

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.00	0.87	0.58	PASS
39	2441	1.01	0.85	0.57	PASS
78	2480	1.00	0.89	0.59	PASS

NOTE: The minimum limit is two-third 20dB bandwidth. Test results please refer to following three plots.

CH 39

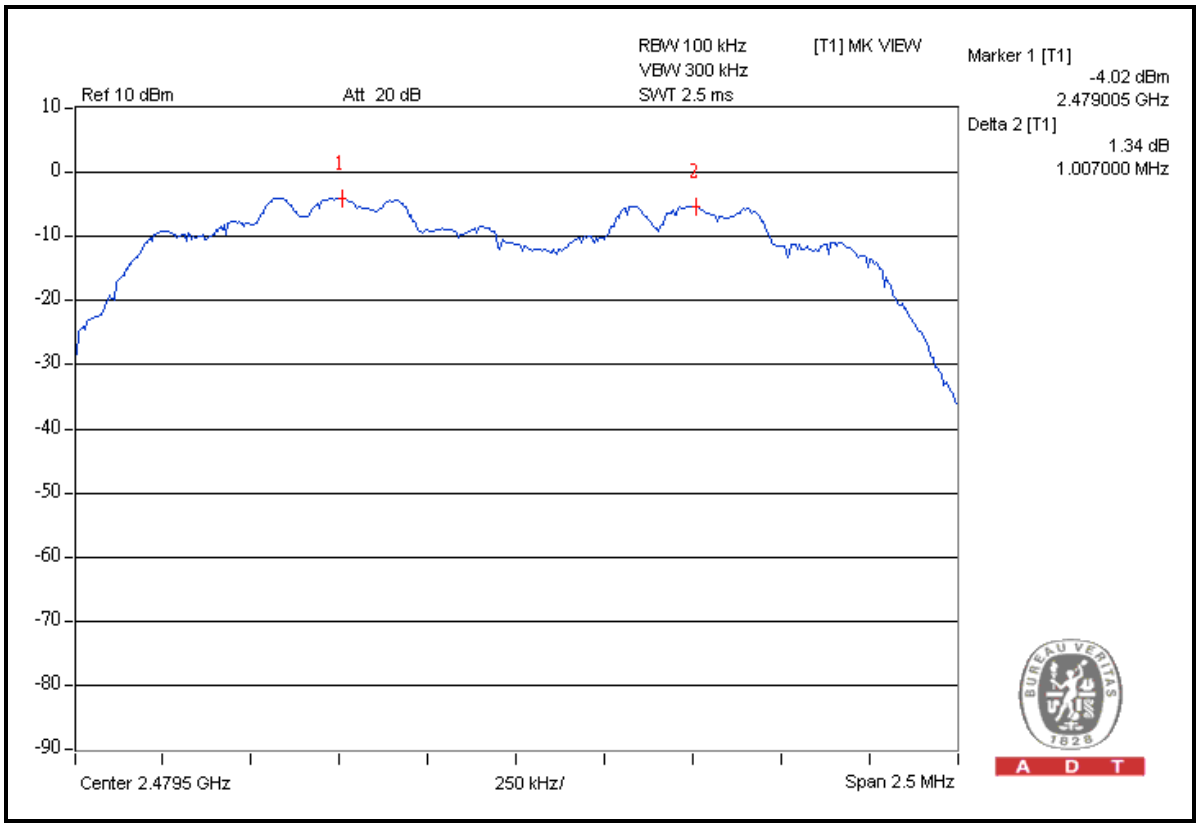


8DPSK MODULATION

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.00	1.20	0.80	PASS
39	2441	1.00	1.21	0.81	PASS
78	2480	1.01	1.21	0.81	PASS

NOTE: The minimum limit is two-third 20dB bandwidth. Test results please refer to following three plots.

CH 78



4.7 MAXIMUM PEAK OUTPUT POWER

4.7.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 125mW.

4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.7.3 TEST PROCEDURES

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.

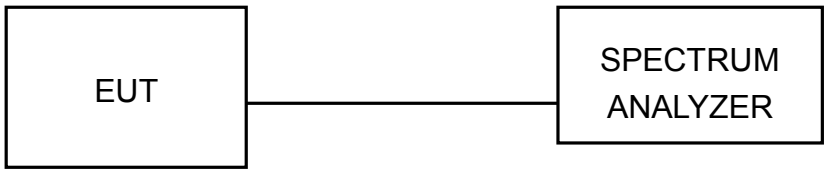
d. Measure the captured power within the band and recording the plot.

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

4.7.4 DEVIATION FROM TEST STANDARD

No deviation

4.7.5 TEST SETUP



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

4.7.6 EUT OPERATING CONDITION

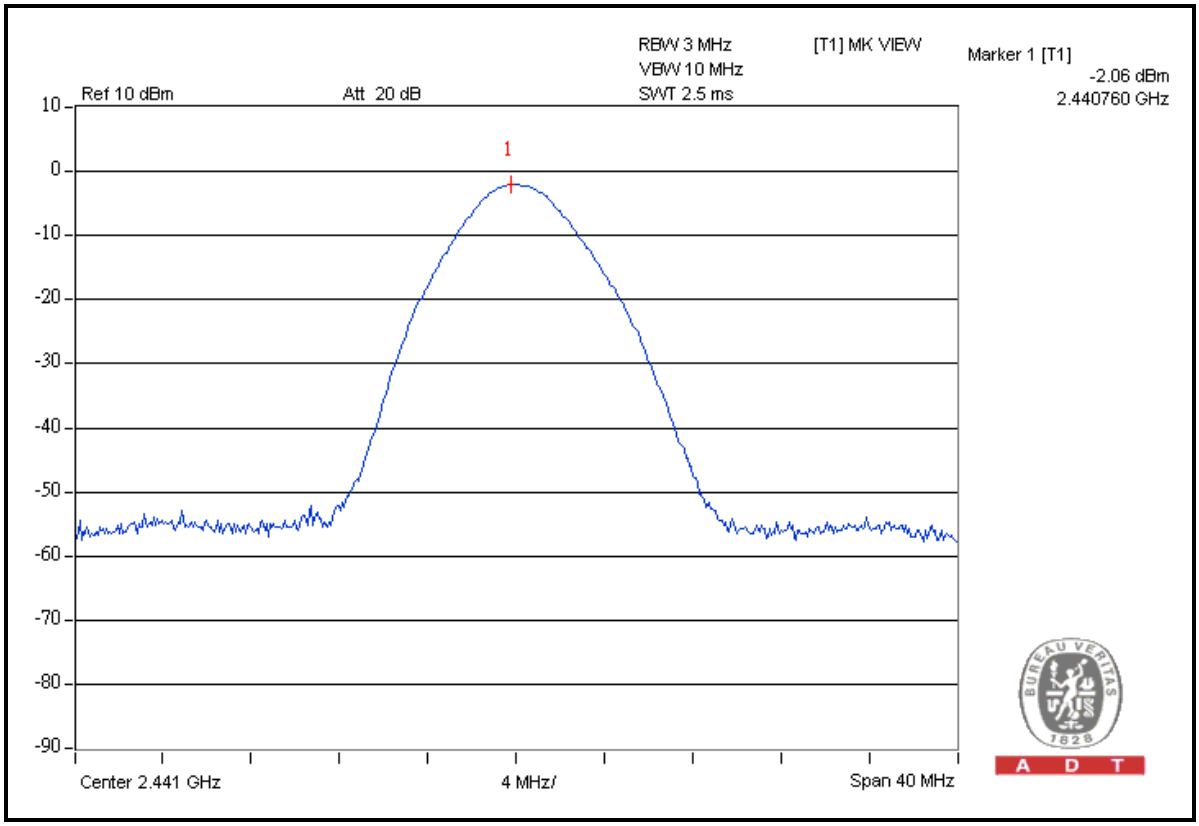
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.7.7 TEST RESULTS

GFSK MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER OUTPUT (mW)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	-3.1	0.5	125	PASS
39	2441	-2.0	0.6	125	PASS
78	2480	-3.8	0.4	125	PASS

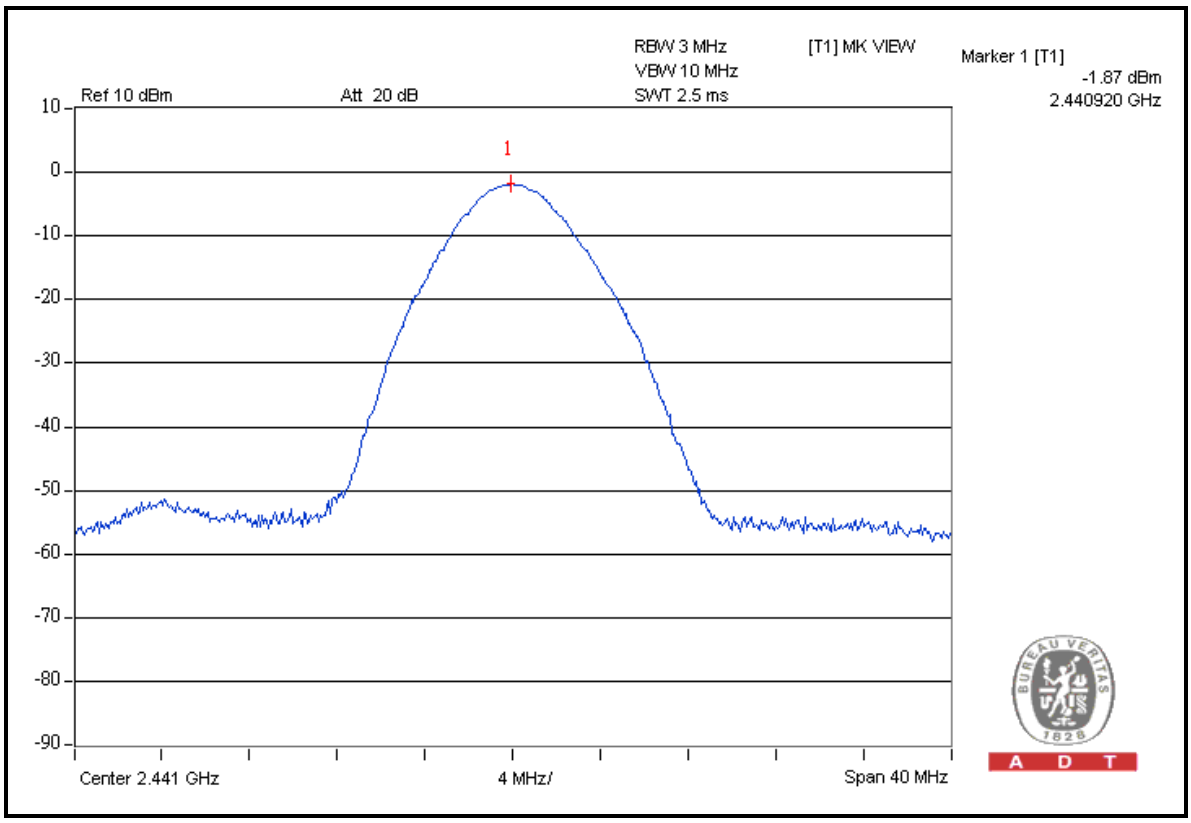
CH 39



8DPSK MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER OUTPUT (mW)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	-4.1	0.4	125	PASS
39	2441	-1.8	**0.7**	125	PASS
78	2480	-3.5	0.4	125	PASS

CH 39



4.8 BAND EDGES MEASUREMENT

4.8.1 LIMITS OF BAND EDGES MEASUREMENT

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

4.8.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 03, 2009	Apr. 02, 2010

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

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.
The spectrum plots are attached on the following pages.

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 8 images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement in part 15.247(d).

GFSK MODULATION

RESTRICT BAND (2310 ~ 2390 MHz)

FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2402.00 (PK)	72.0	54.8	17.2	74.0
2402.00 (AV)	-	-	-12.9	54.0

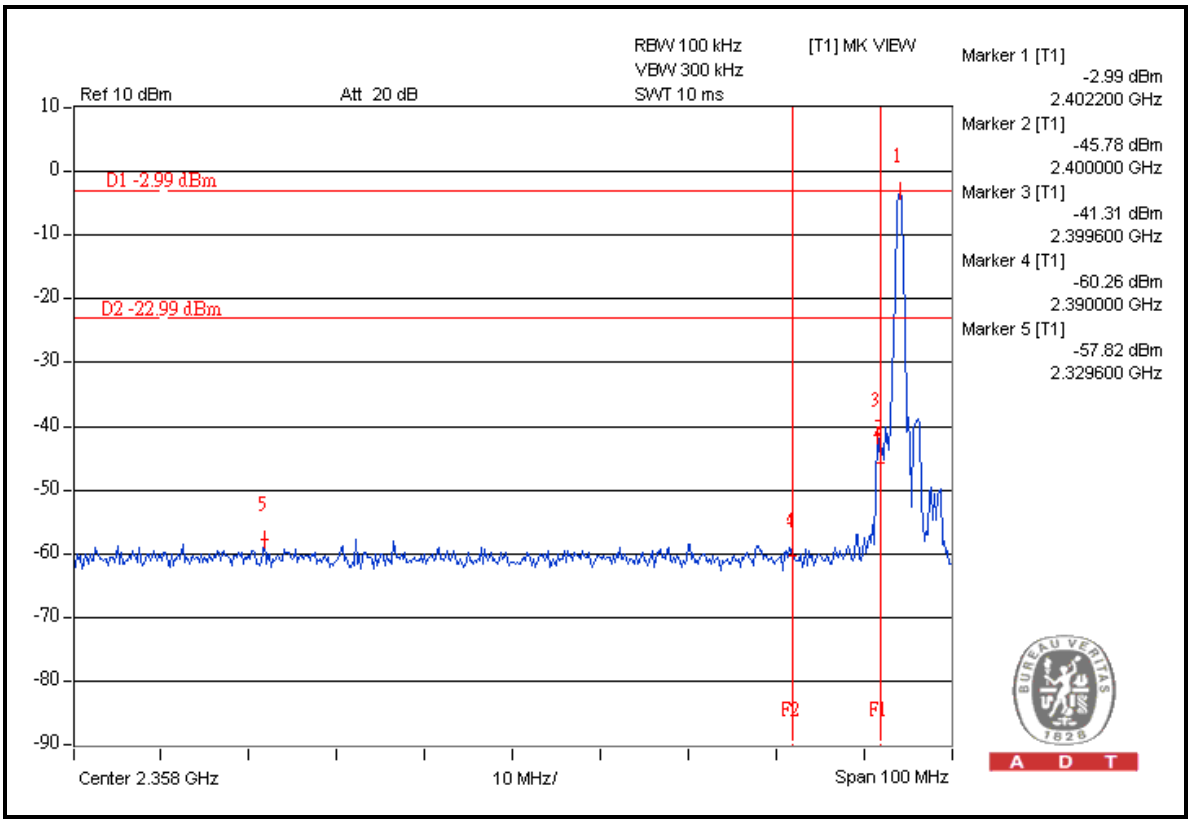
RESTRICT BAND (2483.5 ~ 2500 MHz)

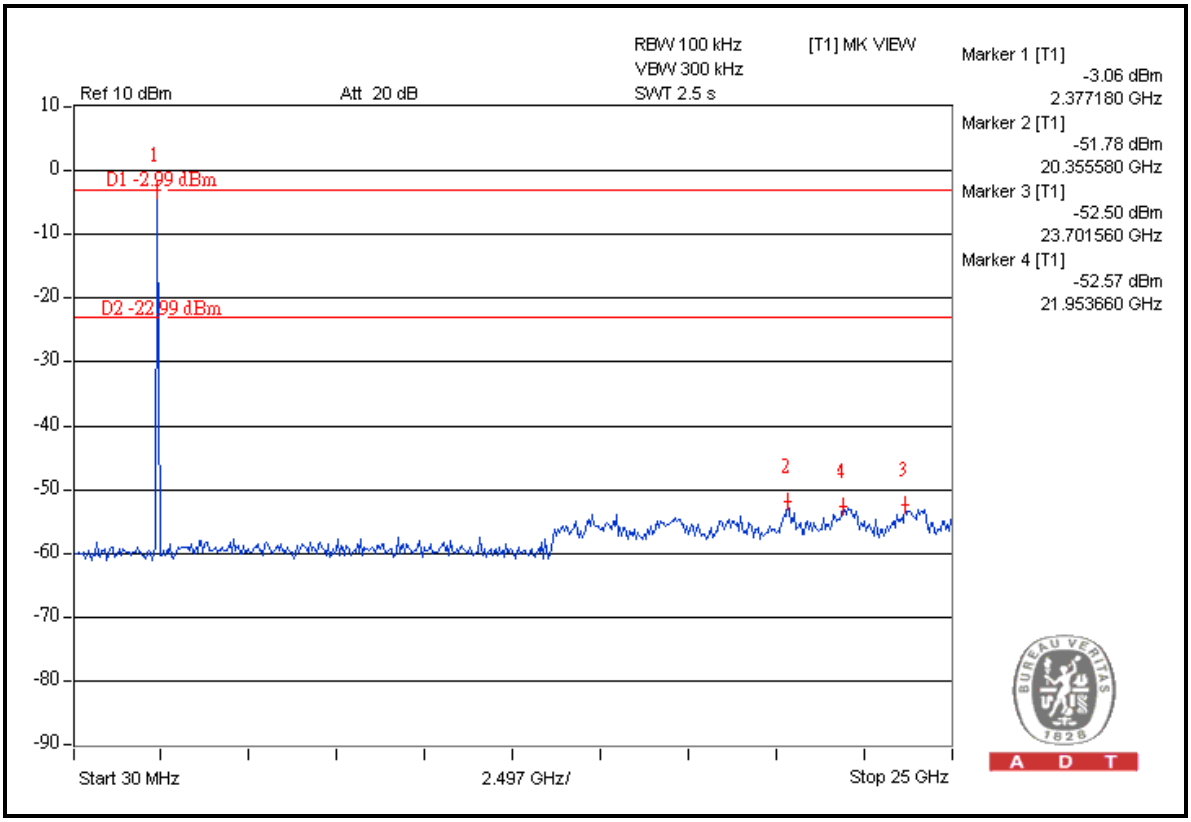
FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2480.00 (PK)	74.1	48.8	25.3	74.0
2480.00 (AV)	-	-	-4.8	54.0

NOTE:

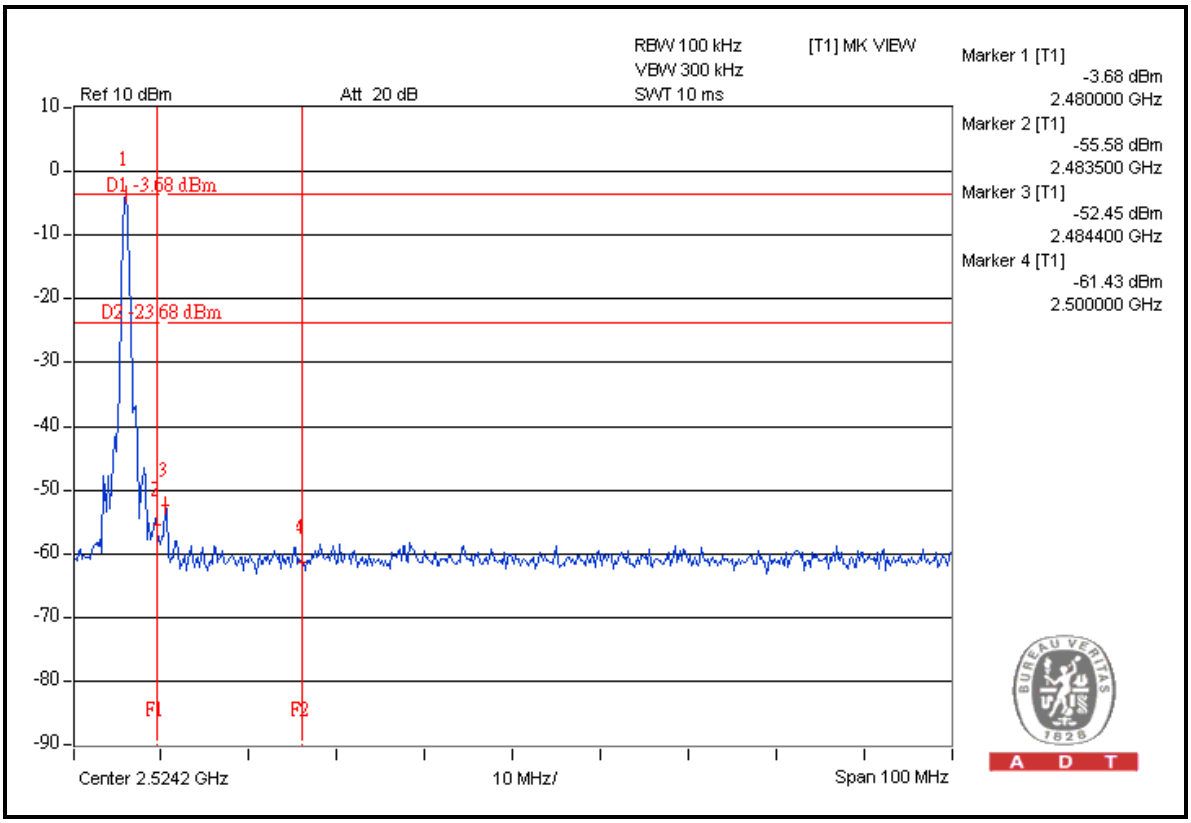
1. Delta = Amplitude between the peak of the fundamental and the peak of the band edge emission. Please check following 2 pages.
2. Maximum field strength in restrict band (PK value) = Fundamental emission (PK value) – Delta.
3. Average value =Peak value + 20 Log (duty cycle) = Peak value – 30.1dB.
4. *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 be equal to: 20log(3.125/100)= -30.1 dB.

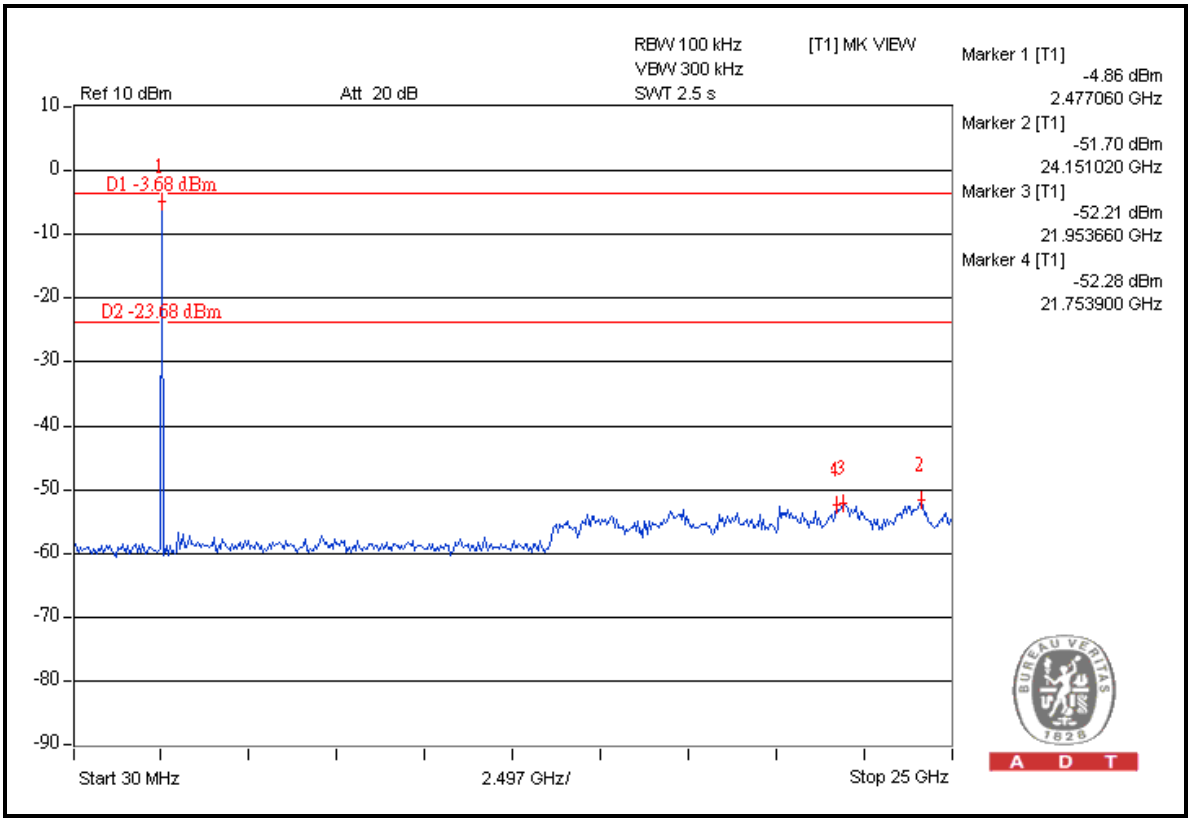
CH 0


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -2.99 dBm
D2 -22.99 dBm
Marker 1 [T1]
-2.99 dBm
2.402200 GHz
Marker 2 [T1]
-45.78 dBm
2.400000 GHz
Marker 3 [T1]
-41.31 dBm
2.399600 GHz
Marker 4 [T1]
-60.26 dBm
2.390000 GHz
Marker 5 [T1]
-57.82 dBm
2.329600 GHz
Center 2.358 GHz
10 MHz/
Span 100 MHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -2.99 dBm
D2 -22.99 dBm
Marker 1 [T1]
-3.06 dBm
2.377180 GHz
Marker 2 [T1]
-51.78 dBm
20.355580 GHz
Marker 3 [T1]
-52.50 dBm
23.701560 GHz
Marker 4 [T1]
-52.57 dBm
21.953660 GHz
Start 30 MHz
2.497 GHz/
Stop 25 GHz

CH 78


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -3.68 dBm
D2 -23.68 dBm
F1
F2
Center 2.5242 GHz
10 MHz/
Span 100 MHz
Marker 1 [T1]
-3.68 dBm
2.480000 GHz
Marker 2 [T1]
-55.58 dBm
2.483500 GHz
Marker 3 [T1]
-52.45 dBm
2.484400 GHz
Marker 4 [T1]
-61.43 dBm
2.500000 GHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -3.68 dBm
D2 -23.68 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz
Marker 1 [T1]
-4.86 dBm
2.477060 GHz
Marker 2 [T1]
-51.70 dBm
24.151020 GHz
Marker 3 [T1]
-52.21 dBm
21.953660 GHz
Marker 4 [T1]
-52.28 dBm
21.753900 GHz

8DPSK MODULATION

RESTRICT BAND (2310 ~ 2390 MHz)

FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2402.00 (PK)	70.3	54.2	16.1	74.0
2402.00 (AV)	-	-	-14.0	54.0

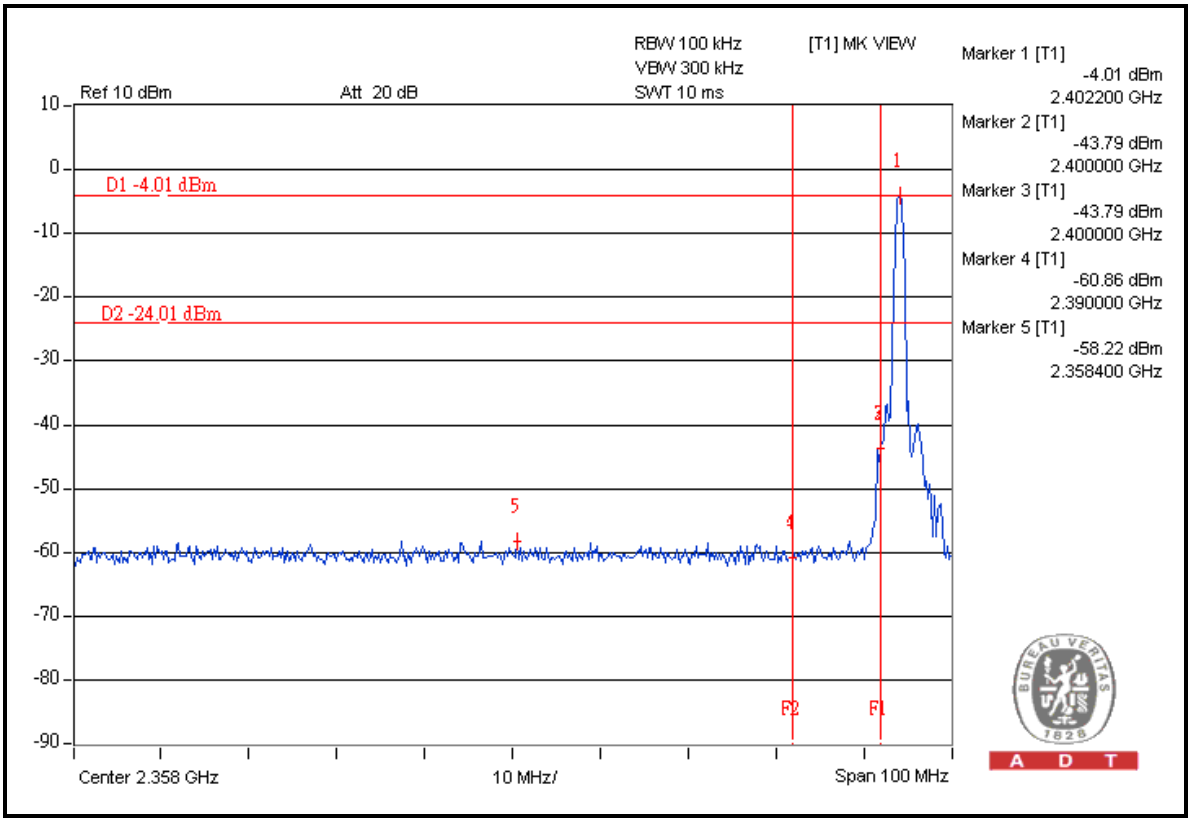
RESTRICT BAND (2483.5 ~ 2500 MHz)

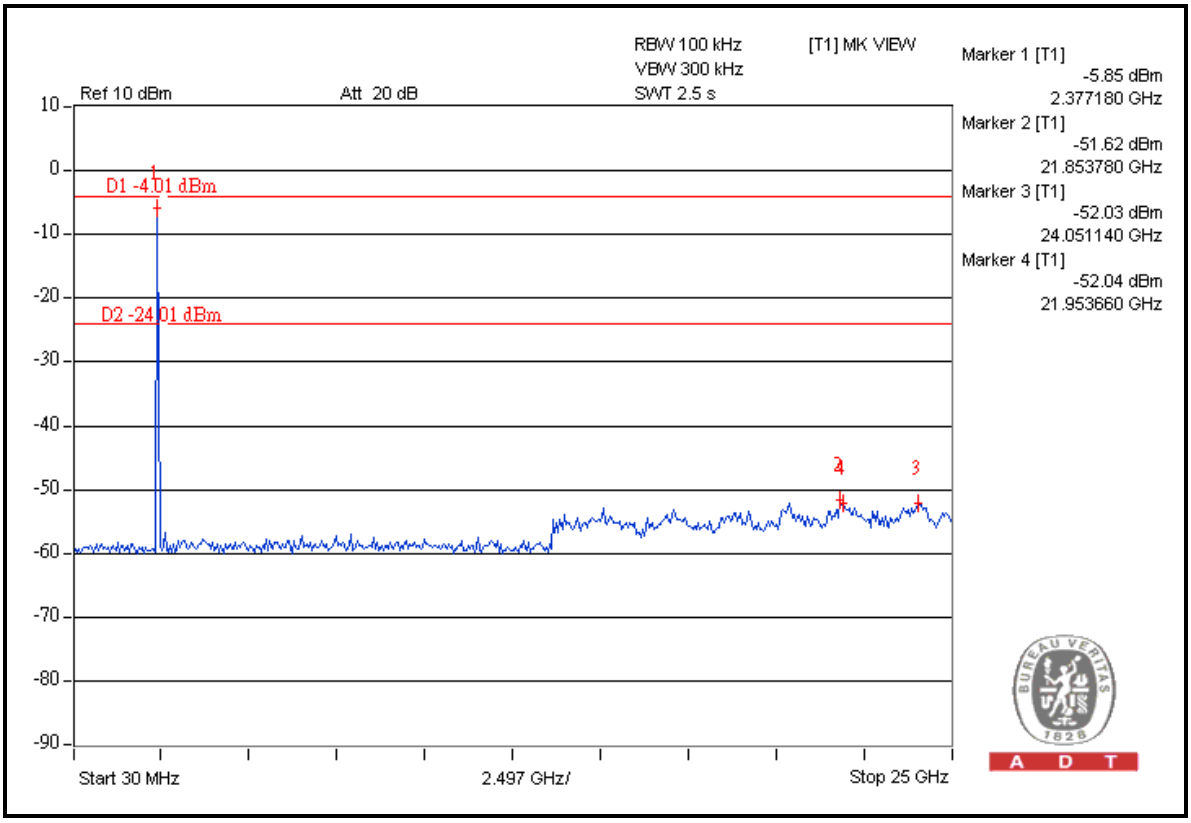
FREQUENCY (MHz)	FUNDAMENTAL EMISSION (dBuV/m)	DELTA (dB)	MAXIMUM FIELD STRENGTH IN RESTRICT BAND (dBuV/m)	LIMIT (dBuV/m)
2480.00 (PK)	70.9	48.7	22.2	74.0
2480.00 (AV)	-	-	-7.9	54.0

NOTE:

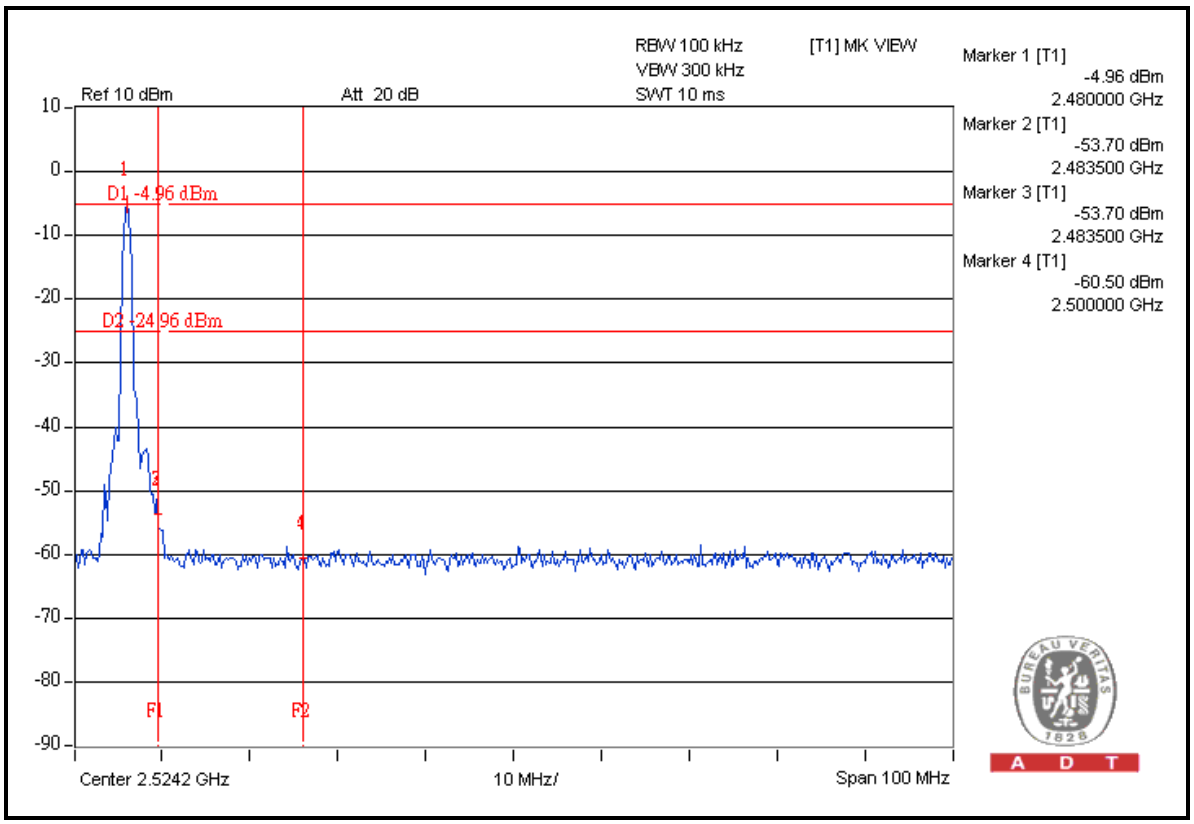
1. Delta = Amplitude between the peak of the fundamental and the peak of the band edge emission. Please check following 2 pages.
2. Maximum field strength in restrict band (PK value) = Fundamental emission (PK value) – Delta.
3. Average value =Peak value + 20 Log (duty cycle) = Peak value – 30.1dB.
4. *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 be equal to: 20log(3.125/100)= -30.1 dB.

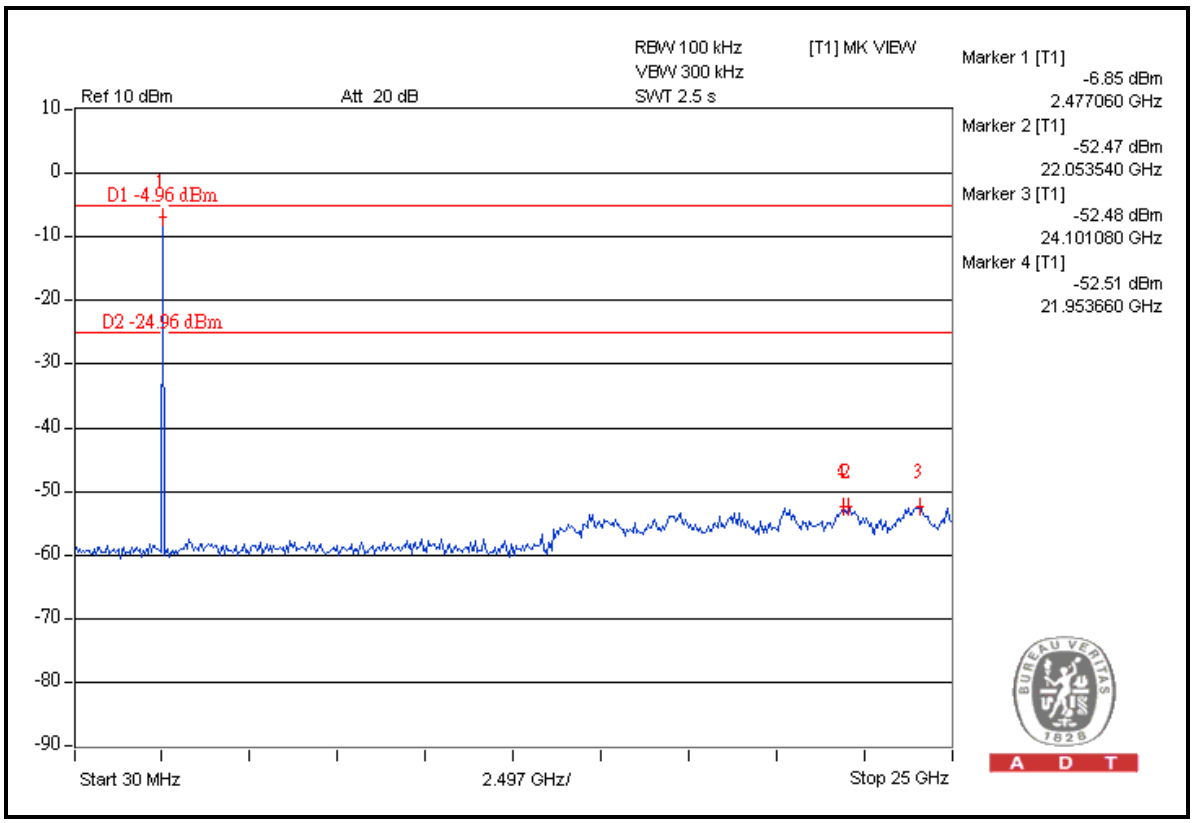
CH 0


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -4.01 dBm
D2 -24.01 dBm
Marker 1 [T1]
-4.01 dBm
2.402200 GHz
Marker 2 [T1]
-43.79 dBm
2.400000 GHz
Marker 3 [T1]
-43.79 dBm
2.400000 GHz
Marker 4 [T1]
-60.86 dBm
2.390000 GHz
Marker 5 [T1]
-58.22 dBm
2.358400 GHz
Center 2.358 GHz
10 MHz/
Span 100 MHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -4.01 dBm
D2 -24.01 dBm
Marker 1 [T1]
-5.85 dBm
2.377180 GHz
Marker 2 [T1]
-51.62 dBm
21.853780 GHz
Marker 3 [T1]
-52.03 dBm
24.051140 GHz
Marker 4 [T1]
-52.04 dBm
21.953660 GHz
Start 30 MHz
2.497 GHz/
Stop 25 GHz

CH 78


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -4.96 dBm
D2 -24.96 dBm
F1
F2
Center 2.5242 GHz
10 MHz/
Span 100 MHz
Marker 1 [T1]
-4.96 dBm
2.480000 GHz
Marker 2 [T1]
-53.70 dBm
2.483500 GHz
Marker 3 [T1]
-53.70 dBm
2.483500 GHz
Marker 4 [T1]
-60.50 dBm
2.500000 GHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 s
[T1] MK VIEW
Ref 10 dBm
Att 20 dB
D1 -4.96 dBm
D2 -24.96 dBm
Start 30 MHz
2.497 GHz/
Stop 25 GHz
Marker 1 [T1]
-6.85 dBm
2.477060 GHz
Marker 2 [T1]
-52.47 dBm
22.053540 GHz
Marker 3 [T1]
-52.48 dBm
24.101080 GHz
Marker 4 [T1]
-52.51 dBm
21.953660 GHz

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

6. 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.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Web Site: www.adt.com.tw

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

7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

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

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