FCC Test Report (Bluetooth)

Report No.: RF150820E01C-3

FCC ID: 2AD8UFZPFWFF01

Test Model: FWFF

Received Date: Aug. 20, 2015

Test Date: Sep. 30 to Oct. 20, 2015

Issued Date: Jan. 15, 2016

Applicant: Nokia Solutions and Networks

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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Table of Contents

Release Control Record **4**

1 Certificate of Conformity **5**

2 Summary of Test Results **6**

2.1 Measurement Uncertainty 7
2.2 Modification Record 7

3 General Information **8**

3.1 General Description of EUT (Bluetooth) 8
3.2 Description of Test Modes 10
3.2.1 Test Mode Applicability and Tested Channel Detail 11
3.3 Description of Support Units 13
3.3.1 Configuration of System under Test 14
3.4 General Description of Applied Standards 16

4 Test Types and Results **17**

4.1 Radiated Emission and Bandedge Measurement 17
4.1.1 Limits of Radiated Emission and Bandedge Measurement 17
4.1.2 Test Instruments 18
4.1.3 Test Procedures 19
4.1.4 Deviation from Test Standard 19
4.1.5 Test Setup 20
4.1.6 EUT Operating Conditions 21
4.1.7 Test Results (Mode 1) 22
4.1.8 Test Results (Mode 2) 29
4.2 Conducted Emission Measurement 30
4.2.1 Limits of Conducted Emission Measurement 30
4.2.2 Test Instruments 30
4.2.3 Test Procedures 31
4.2.4 Deviation From Test Standard 31
4.2.5 Test Setup 31
4.2.6 EUT Operating Condition 31
4.2.7 Test Results (Mode 1) 32
4.2.8 Test Results (Mode 2) 34
4.3 Number of Hopping Frequency Used 36
4.3.1 Limits of Hopping Frequency Used Measurement 36
4.3.2 Test Setup 36
4.3.3 Test Instruments 36
4.3.4 Test Procedure 36
4.3.5 Deviation fromTest Standard 36
4.3.6 Test Results 37
4.4 Dwell Time on Each Channel 38
4.4.1 Limits of Dwell Time on Each Channel Measurement 38
4.4.2 Test Setup 38
4.4.3 Test Instruments 38
4.4.4 Test Procedures 38
4.4.5 Deviation from Test Standard 38
4.4.6 Test Results 39
4.5 Channel Bandwidth 43
4.5.1 Limits of Channel Bandwidth Measurement 43
4.5.2 Test Setup 43
4.5.3 Test Instruments 43
4.5.4 Test Procedure 43
4.5.5 Deviation from Test Standard 43
4.5.6 EUT Operating Condition 43
4.5.7 Test Results 44

4.6 Hopping Channel Separation 45
4.6.1 Limits of Hopping Channel Separation Measurement 45
4.6.2 Test Setup 45
4.6.3 Test Instruments 45
4.6.4 Test Procedure 45
4.6.5 Deviation from Test Standard 45
4.6.6 Test Results 46
4.7 Maximum Output Power 47
4.7.1 Limits of Maximum Output Power Measurement 47
4.7.2 Test Setup 47
4.7.3 Test Instruments 47
4.7.4 Test Procedure 47
4.7.5 Deviation fromTest Standard 47
4.7.6 EUT Operating Condition 47
4.7.7 Test Results 48
4.8 Conducted Out of Band Emission Measurement 49
4.8.1 Limits of Conducted Out of Band Emission Measurement 49
4.8.2 Test Instruments 49
4.8.3 Test Procedure 49
4.8.4 Deviation from Test Standard 49
4.8.5 EUT Operating Condition 49
4.8.6 Test Results 49

5 Pictures of Test Arrangements 52

Appendix – Information on the Testing Laboratories 53

Release Control Record

Issue No.	Description	Date Issued
RF150820E01C-3	Original release.	Jan. 15, 2016

1 Certificate of Conformity

Product: Flexi Zone Indoor Pico BTS

Brand: Nokia

Test Model: FWFF

Sample Status: MASS-PRODUCTION

Applicant: Nokia Solutions and Networks

Test Date: Sep. 30 to Oct. 20, 2015

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:** Jan. 15, 2016
Lori Chung / Specialist

Approved by : _____ , **Date:** Jan. 15, 2016
May Chen / 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 -5.67dB at 5.44531MHz.
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 & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -4.3dB at 921.62MHz.
15.247(d)	Antenna Port Emission	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:

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	5.43 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.72 dB
	6GHz ~ 18GHz	4.00 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (Bluetooth)

Product	Flexi Zone Indoor Pico BTS
Brand	Nokia
Test Model	FWFF
Test Sample S/N	EA151910377
Hardware Version	473237A.101
Software Version	Band 2 WCDMA SW version: FB_FZM_PS_LFS_OS_2014_05_102-0-gb723a75
Status of EUT	MASS-PRODUCTION
Power Supply Rating	12Vdc from power adapter or 55Vdc from POE
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	9.795mW
Antenna Type	Refer to note as below
Antenna Connector	Refer to note as below
Accessory Device	Adapter x1
Data Cable Supplied	NA

Note:

1. There are BT, WWAN and GPS technology used for the EUT.
2. The EUT's spec. as below table:

Model name	WWAN			BT	GPS
	Freq.(MHz)		Band		
FWFF	DL	1932.4~1987.6	2	✓	✓

3. The emission of the simultaneous operation (BT & WWAN) has been evaluated and no non-compliance was found.
4. The EUT must be supplied with a POE(option) or power adapter as following table:

Power adapter		
Brand	Model No.	Spec.
DVE	DSA-60PFB-12 1 120500	Input: 100-240V, 2.0A, 50/60Hz AC input cable(1.8m, unshielded) Output: 12V, 5A DC output cable(1.2m, unshielded, with one core)

5. The EUT was pre-tested under following test modes :

Test Mode	Description
Mode A	**With POE**
Mode B	With adapter

For the above modes, the worst radaited emission (above 1GHz) test was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

6. The antenna provided to the EUT, please refer to the following table:

BT Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
Internal BT Ant	INPAQ	Fz PICO	Chip	NA	-1.22	NA	2400~2500

7. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
1	√	√	√	√	With POE
2	-	√	√	-	With adapter

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

NOTE: 1. "-"means no effect.
2. This device can be installed in different orientations (wall mounted or tabletop), so had been investigated two different orientations. The worst case was found when positioned on X-plane (for below 1GHz) and Y-plane (for above 1GHz)

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
1	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Radiated Emission Test (Below 1GHz):

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
1	0 to 78	39	FHSS	8DPSK	3DH5
2	0 to 78	39	FHSS	8DPSK	3DH5

Power Line Conducted Emission Test:

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
1	0 to 78	39	FHSS	8DPSK	3DH5
2	0 to 78	39	FHSS	8DPSK	3DH5

Antenna Port Conducted Measurement:

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

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

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
1	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	23deg. C, 70%RH	120Vac, 60Hz	Andy Ho
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Gary Cheng
PLC	25deg. C, 60%RH 26deg. C, 66%RH	120Vac, 60Hz	Timmy Hu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

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.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
B	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC	Provided by Lab
C	NOTEBOOK COMPUTER	DELL	PP27L	7YLB32S	FCC DoC	Provided by Lab
D	POE ADAPTER	NA	TR60A-POE-L	NA	NA	Provided by Lab
E	Bluetooth Simulator	Anritsu	MT8852B	1218002	NA	Provided by Lab

NOTE:

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

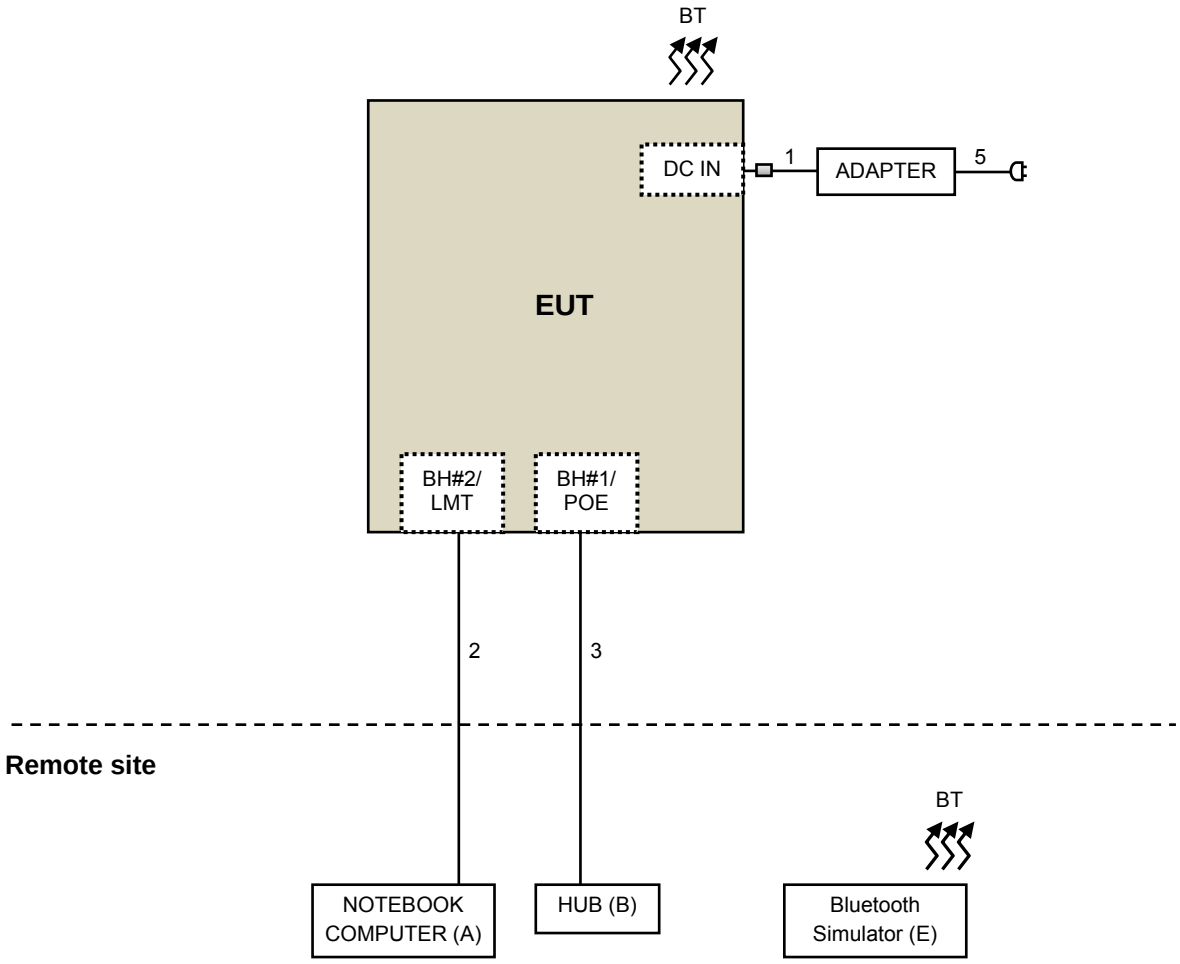
No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	DC	1	1.2	No	1	Supplied by Client
2	RJ-45	1	10	No	0	Provided by Lab
3	RJ-45	1	10	No	0	Provided by Lab
4	RJ-45	1	3	No	0	Provided by Lab
5	AC	1	1.8	No	0	Supplied by Client

NOTE:

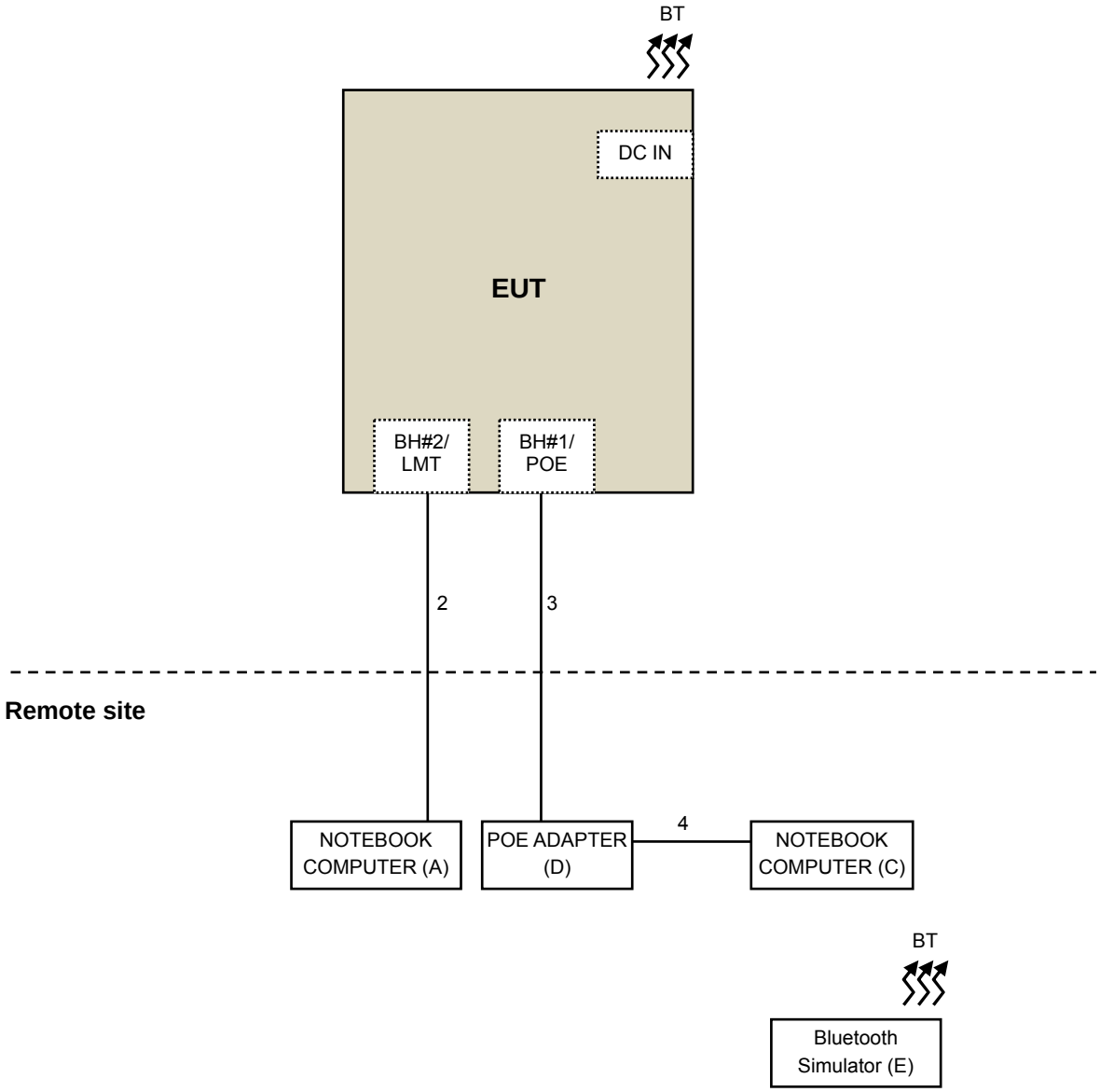
1. The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test

For Adapter mode:



For POE mode:


BT
DC IN
EUT
BH#2/
LMT
BH#1/
POE
2
3
Remote site
NOTEBOOK
COMPUTER (A)
POE ADAPTER
(D)
4
NOTEBOOK
COMPUTER (C)
BT
Bluetooth
Simulator (E)

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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 12, 2014	Dec. 11, 2015
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 13, 2014	Jan. 12, 2016
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2015	Jan. 17, 2016
Horn_Antenna AISI	AIH.8018	0000220091110	Feb. 06, 2015	Feb. 05, 2016
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 28, 2014	Oct. 27, 2015
RF Cable	NA	131206 131213 131215 SNMY23685/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	June 26, 2015	June 25, 2016
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Dec. 12, 2014	Dec. 11, 2015
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Feb. 05, 2015	Feb. 04, 2016
RF Cable	NA	329751/4 RF104-204	Dec. 11, 2014	Dec. 10, 2015
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
Power Meter Anritsu	ML2495A	1014008	Apr. 28, 2015	Apr. 27, 2016
Power Sensor Anritsu	MA2411B	0917122	Apr. 28, 2015	Apr. 27, 2016
Spectrum Analyzer R&S	FSP40	100060	May 08, 2015	May 07, 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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Loop antenna was used for all emissions below 30 MHz.
4. The test was performed in 966 Chamber No. H.
5. The FCC Site Registration No. is 797305.
6 The CANADA Site Registration No. is IC 7450H-3.
7 Tested Date: Oct. 20, 2015

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:

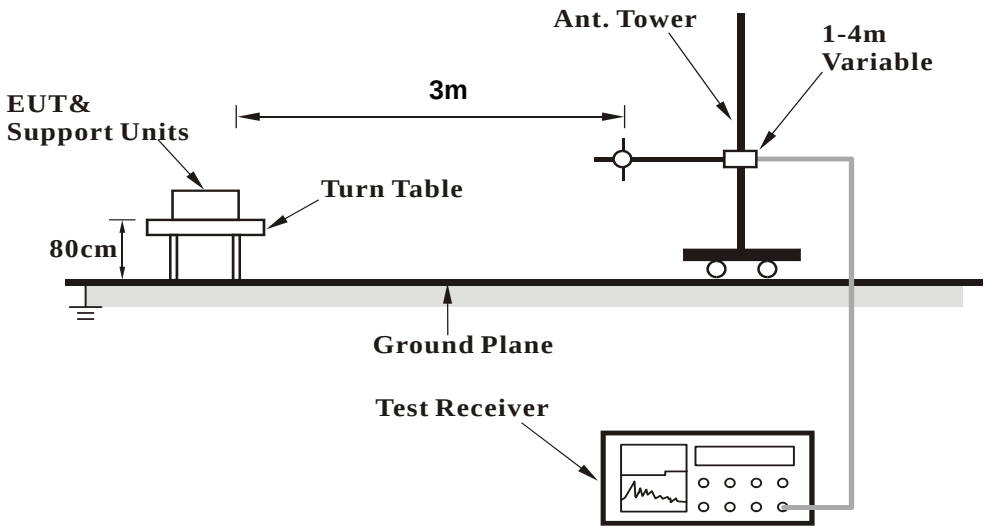
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

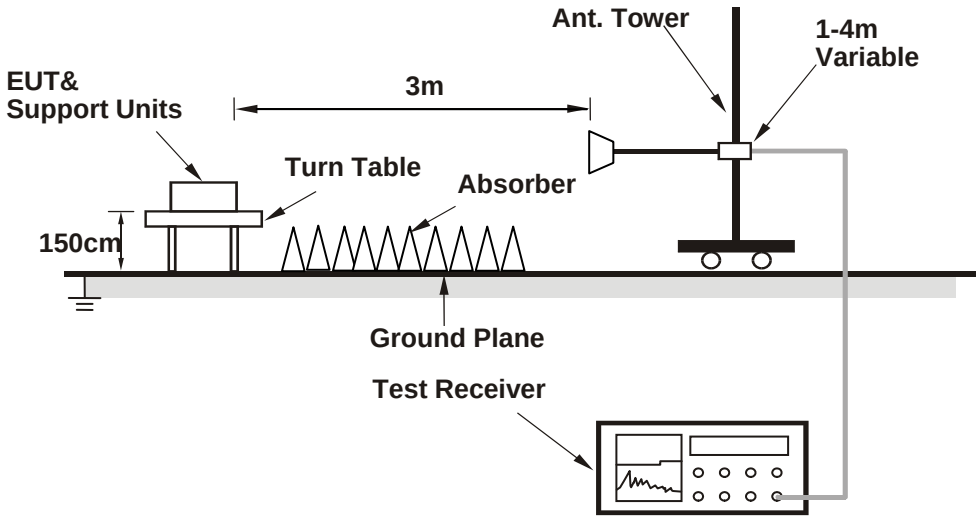
No deviation.

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

For adapter mode:

1. Connect the EUT with the support unit A (Notebook Computer) which is placed in remote site.
2. The communication partner run test program “Cart type command [Cart command_(FZI).txt]” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

For POE mode:

1. Connect the EUT with the support units A &C (Notebook Computer) which is placed in remote site.
2. The communication partner run test program “Cart type command [Cart command_(FZI).txt]” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.1.7 Test Results (Mode 1)

Above 1GHz Data:

BT_GFSK

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK)
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	47.1 PK	74.0	-26.9	1.87 H	301	47.26	-0.16
2	2390.00	17.0 AV	54.0	-37.0	1.87 H	301	17.16	-0.16
3	*2402.00	89.2 PK			1.87 H	301	89.33	-0.13
4	*2402.00	59.1 AV			1.87 H	301	59.23	-0.13
5	4804.00	46.3 PK	74.0	-27.7	1.10 H	74	37.61	8.69
6	4804.00	16.2 AV	54.0	-37.8	1.10 H	74	7.51	8.69
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	46.9 PK	74.0	-27.1	1.82 V	122	47.06	-0.16
2	2390.00	16.8 AV	54.0	-37.2	1.82 V	122	16.96	-0.16
3	*2402.00	86.4 PK			1.82 V	122	86.53	-0.13
4	*2402.00	56.3 AV			1.82 V	122	56.43	-0.13
5	4804.00	46.9 PK	74.0	-27.1	1.15 V	302	38.21	8.69
6	4804.00	16.8 AV	54.0	-37.2	1.15 V	302	8.11	8.69

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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 39	DETECTOR FUNCTION	Peak (PK)
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	91.4 PK			1.58 H	297	91.42	-0.02
2	*2441.00	61.3 AV			1.58 H	297	61.32	-0.02
3	4882.00	46.8 PK	74.0	-27.2	1.06 H	71	37.87	8.93
4	4882.00	16.7 AV	54.0	-37.3	1.06 H	71	7.77	8.93
5	7323.00	54.7 PK	74.0	-19.3	1.11 H	319	38.21	16.49
6	7323.00	24.6 AV	54.0	-29.4	1.11 H	319	8.11	16.49
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	88.6 PK			1.79 V	168	88.62	-0.02
2	*2441.00	58.5 AV			1.79 V	168	58.52	-0.02
3	4882.00	47.2 PK	74.0	-26.8	1.11 V	294	38.27	8.93
4	4882.00	17.1 AV	54.0	-36.9	1.11 V	294	8.17	8.93
5	7323.00	53.8 PK	74.0	-20.2	1.02 V	60	37.31	16.49
6	7323.00	23.7 AV	54.0	-30.3	1.02 V	60	7.21	16.49

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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)
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	91.2 PK			1.73 H	284	91.09	0.11
2	*2480.00	61.1 AV			1.73 H	284	60.99	0.11
3	2483.50	48.7 PK	74.0	-25.3	1.73 H	284	48.59	0.11
4	2483.50	18.6 AV	54.0	-35.4	1.73 H	284	18.49	0.11
5	4960.00	46.4 PK	74.0	-27.6	1.09 H	64	37.13	9.27
6	4960.00	16.3 AV	54.0	-37.7	1.09 H	64	7.03	9.27
7	7440.00	55.2 PK	74.0	-18.8	1.06 H	316	38.58	16.62
8	7440.00	25.1 AV	54.0	-28.9	1.06 H	316	8.48	16.62
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	88.3 PK			1.62 V	360	88.19	0.11
2	*2480.00	58.2 AV			1.62 V	360	58.09	0.11
3	2483.50	48.0 PK	74.0	-26.0	1.62 V	360	47.89	0.11
4	2483.50	17.9 AV	54.0	-36.1	1.62 V	360	17.79	0.11
5	4960.00	46.6 PK	74.0	-27.4	1.09 V	293	37.33	9.27
6	4960.00	16.5 AV	54.0	-37.5	1.09 V	293	7.23	9.27
7	7440.00	54.0 PK	74.0	-20.0	1.05 V	66	37.38	16.62
8	7440.00	23.9 AV	54.0	-30.1	1.05 V	66	7.28	16.62

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier 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).

BT_8DPSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
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	48.1 PK	74.0	-25.9	1.82 H	302	48.26	-0.16
2	2390.00	18.0 AV	54.0	-36.0	1.82 H	302	18.16	-0.16
3	*2402.00	89.3 PK			1.82 H	302	89.43	-0.13
4	*2402.00	59.2 AV			1.82 H	302	59.33	-0.13
5	4804.00	45.6 PK	74.0	-28.4	1.07 H	47	36.91	8.69
6	4804.00	15.5 AV	54.0	-38.5	1.07 H	47	6.81	8.69
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	47.3 PK	74.0	-26.7	1.60 V	16	47.46	-0.16
2	2390.00	17.2 AV	54.0	-36.8	1.60 V	16	17.36	-0.16
3	*2402.00	86.4 PK			1.60 V	16	86.53	-0.13
4	*2402.00	56.3 AV			1.60 V	16	56.43	-0.13
5	4804.00	46.4 PK	74.0	-27.6	1.12 V	308	37.71	8.69
6	4804.00	16.3 AV	54.0	-37.7	1.12 V	308	7.61	8.69

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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 39	DETECTOR FUNCTION	Peak (PK)
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	91.9 PK			1.88 H	283	91.92	-0.02
2	*2441.00	61.8 AV			1.88 H	283	61.82	-0.02
3	4882.00	46.0 PK	74.0	-28.0	1.04 H	61	37.07	8.93
4	4882.00	15.9 AV	54.0	-38.1	1.04 H	61	6.97	8.93
5	7323.00	55.8 PK	74.0	-18.2	1.07 H	325	39.31	16.49
6	7323.00	25.7 AV	54.0	-28.3	1.07 H	325	9.21	16.49
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	89.2 PK			1.60 V	6	89.22	-0.02
2	*2441.00	59.1 AV			1.60 V	6	59.12	-0.02
3	4882.00	46.5 PK	74.0	-27.5	1.10 V	294	37.57	8.93
4	4882.00	16.4 AV	54.0	-37.6	1.10 V	294	7.47	8.93
5	7323.00	53.4 PK	74.0	-20.6	1.11 V	63	36.91	16.49
6	7323.00	23.3 AV	54.0	-30.7	1.11 V	63	6.81	16.49

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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)
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	91.6 PK			1.81 H	278	91.49	0.11
2	*2480.00	61.5 AV			1.81 H	278	61.39	0.11
3	2483.50	48.2 PK	74.0	-25.8	1.81 H	278	48.09	0.11
4	2483.50	18.1 AV	54.0	-35.9	1.81 H	278	17.99	0.11
5	4960.00	45.9 PK	74.0	-28.1	1.07 H	48	36.63	9.27
6	4960.00	15.8 AV	54.0	-38.2	1.07 H	48	6.53	9.27
7	7440.00	55.8 PK	74.0	-18.2	1.08 H	314	39.18	16.62
8	7440.00	25.7 AV	54.0	-28.3	1.08 H	314	9.08	16.62
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	88.6 PK			1.63 V	14	88.49	0.11
2	*2480.00	58.5 AV			1.63 V	14	58.39	0.11
3	2483.50	47.4 PK	74.0	-26.6	1.63 V	14	47.29	0.11
4	2483.50	17.3 AV	54.0	-36.7	1.63 V	14	17.19	0.11
5	4960.00	46.3 PK	74.0	-27.7	1.08 V	305	37.03	9.27
6	4960.00	16.2 AV	54.0	-37.8	1.08 V	305	6.93	9.27
7	7440.00	53.8 PK	74.0	-20.2	1.09 V	73	37.18	16.62
8	7440.00	23.7 AV	54.0	-30.3	1.09 V	73	7.08	16.62

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier 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:

BT_8DPSK

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 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	145.90	33.8 QP	43.5	-9.7	1.49 H	100	47.51	-13.71
2	299.30	37.6 QP	46.0	-8.4	1.10 H	108	50.16	-12.60
3	342.34	35.3 QP	46.0	-10.7	1.02 H	110	46.87	-11.55
4	540.01	36.7 QP	46.0	-9.4	1.10 H	222	43.59	-6.94
5	687.89	35.8 QP	46.0	-10.2	1.10 H	114	39.68	-3.88
6	921.62	41.5 QP	46.0	-4.5	2.20 H	320	41.71	-0.20
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	132.70	31.5 QP	43.5	-12.0	1.10 V	320	45.96	-14.46
2	375.99	35.3 QP	46.0	-10.7	1.80 V	243	45.82	-10.48
3	479.30	33.7 QP	46.0	-12.3	1.40 V	280	41.81	-8.11
4	550.01	32.1 QP	46.0	-13.9	1.20 V	13	38.87	-6.77
5	757.16	35.8 QP	46.0	-10.2	1.40 V	106	38.37	-2.55
6	**921.62**	**41.7 QP**	**46.0**	**-4.3**	**1.60 V**	**300**	**41.90**	**-0.20**

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.1.8 Test Results (Mode 2)

Below 1GHz Worst-Case Data:

BT_8DPSK

CHANNEL	TX Channel 39	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	Below 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	156.50	33.8 QP	43.5	-9.7	1.10 H	265	46.65	-12.87
2	233.16	33.1 QP	46.0	-12.9	1.20 H	262	48.40	-15.30
3	350.00	32.4 QP	46.0	-13.6	1.10 H	150	43.74	-11.36
4	650.16	35.7 QP	46.0	-10.3	1.40 H	122	40.03	-4.30
5	700.15	33.4 QP	46.0	-12.6	1.30 H	320	37.13	-3.73
6	921.62	40.7 QP	46.0	-5.3	1.20 H	231	40.90	-0.20
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	97.93	30.8 QP	43.5	-12.7	1.10 V	350	49.33	-18.53
2	309.80	30.4 QP	46.0	-15.6	1.40 V	110	42.58	-12.18
3	500.01	32.2 QP	46.0	-13.8	1.20 V	112	39.93	-7.77
4	550.01	31.9 QP	46.0	-14.1	1.40 V	302	38.67	-6.77
5	650.02	31.7 QP	46.0	-14.3	1.20 V	208	36.01	-4.30
6	921.62	39.5 QP	46.0	-6.5	1.20 V	130	39.70	-0.20

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 06, 2015	May 05, 2016
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 01, 2015	Aug. 31, 2016
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 11, 2015	June 10, 2016
RF Cable	5D-FB	COCCAB-001	Mar. 09, 2015	Mar. 08, 2016
50 ohms Terminator	E1-011311	09	Nov. 27, 2014	Nov. 26, 2015
50 ohms Terminator	E1-011315	13	Dec. 12, 2014	Dec. 11, 2015
Software BVADT	BVADT_Cond_ V7.3.7.3	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3 The VCCI Con C Registration No. is C-3611.
4 Tested Date: Sep. 30 to Oct. 02, 2015

4.2.3 Test Procedures

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

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

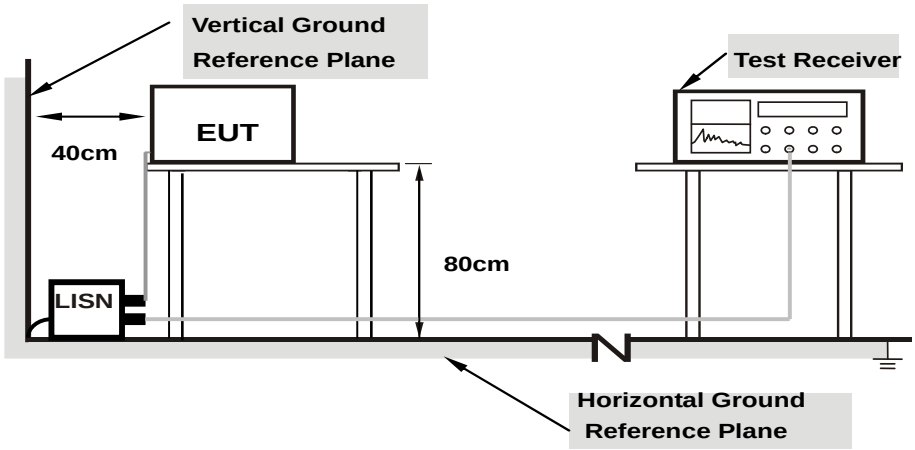
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation From Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Condition

Same as 4.1.6.

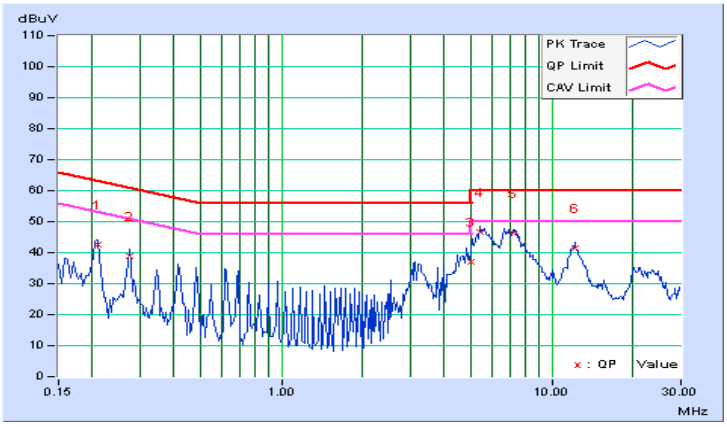
4.2.7 Test Results (Mode 1)

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20859	0.12	42.46	36.68	42.58	36.80	63.26	53.26	-20.68	-16.46
2	0.27500	0.13	38.71	32.34	38.84	32.47	60.97	50.97	-22.13	-18.50
3	5.00000	0.32	36.75	21.14	37.07	21.46	56.00	46.00	-18.93	-24.54
4	**5.44531**	**0.34**	**46.25**	**43.99**	**46.59**	**44.33**	**60.00**	**50.00**	**-13.41**	**-5.67**
5	7.16769	0.41	45.88	42.99	46.29	43.40	60.00	50.00	-13.71	-6.60
6	12.12963	0.58	40.80	38.05	41.38	38.63	60.00	50.00	-18.62	-11.37

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

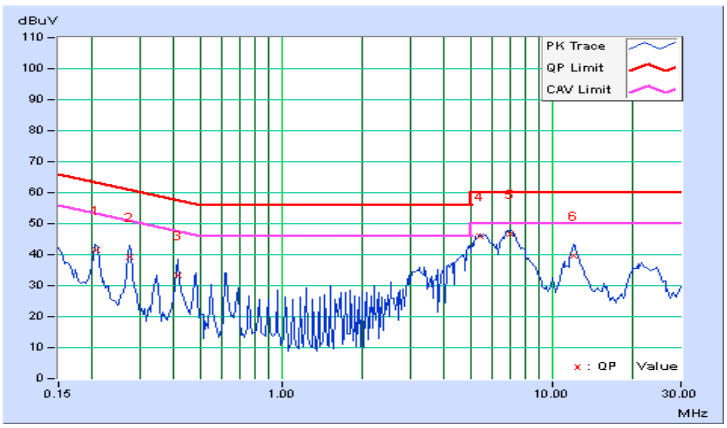


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20606	0.10	41.34	35.32	41.44	35.42	63.36	53.36	-21.92	-17.94
2	0.27500	0.11	39.19	33.91	39.30	34.02	60.97	50.97	-21.67	-16.95
3	0.41422	0.12	33.20	28.33	33.32	28.45	57.56	47.56	-24.24	-19.11
4	5.44981	0.35	45.43	43.24	45.78	43.59	60.00	50.00	-14.22	-6.41
5	7.03516	0.41	46.27	43.34	46.68	43.75	60.00	50.00	-13.32	-6.25
6	12.00250	0.59	39.22	37.08	39.81	37.67	60.00	50.00	-20.19	-12.33

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



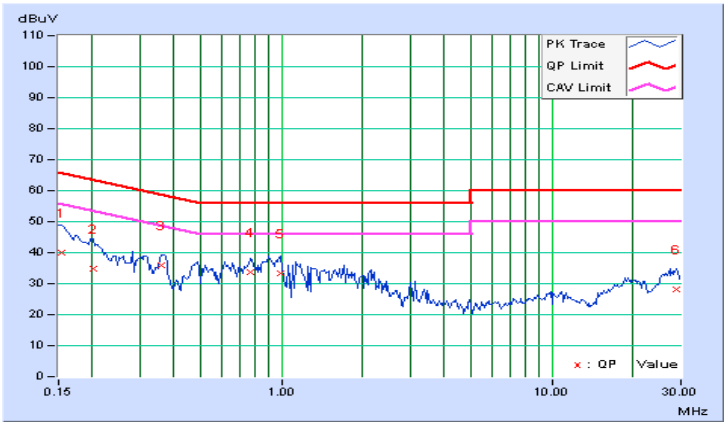
4.2.8 Test Results (Mode 2)

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	0.11	40.03	24.97	40.14	25.08	65.79	55.79	-25.65	-30.71
2	0.20078	0.12	34.80	24.78	34.92	24.90	63.58	53.58	-28.66	-28.68
3	0.36094	0.14	35.89	30.41	36.03	30.55	58.71	48.71	-22.68	-18.16
4	0.77109	0.16	33.39	25.42	33.55	25.58	56.00	46.00	-22.45	-20.42
5	0.99766	0.17	33.14	23.51	33.31	23.68	56.00	46.00	-22.69	-22.32
6	28.68750	1.10	27.20	22.81	28.30	23.91	60.00	50.00	-31.70	-26.09

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

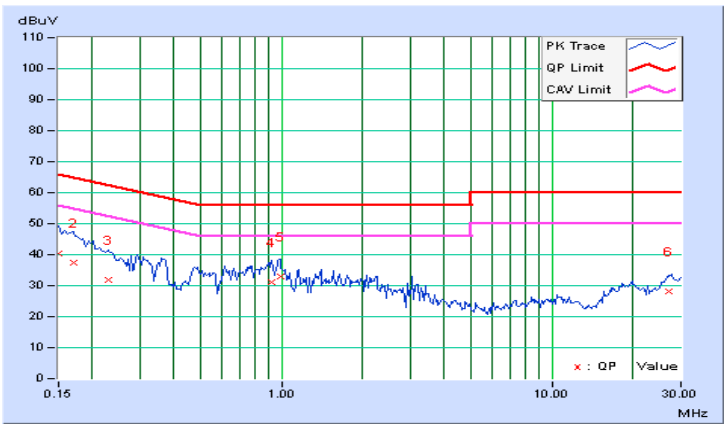


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	0.09	40.35	22.08	40.44	22.17	66.00	56.00	-25.56	-33.83
2	0.16953	0.09	37.29	14.05	37.38	14.14	64.98	54.98	-27.60	-40.84
3	0.22812	0.10	31.80	18.68	31.90	18.78	62.52	52.52	-30.62	-33.74
4	0.92344	0.15	30.95	22.65	31.10	22.80	56.00	46.00	-24.90	-23.20
5	0.98984	0.16	32.72	21.41	32.88	21.57	56.00	46.00	-23.12	-24.43
6	26.97656	1.05	27.06	22.49	28.11	23.54	60.00	50.00	-31.89	-26.46

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

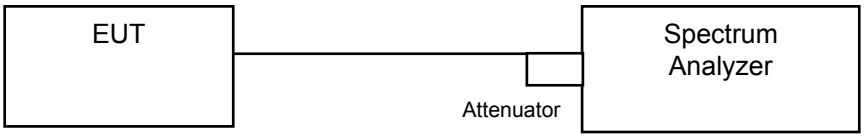


4.3 Number of Hopping Frequency Used

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.

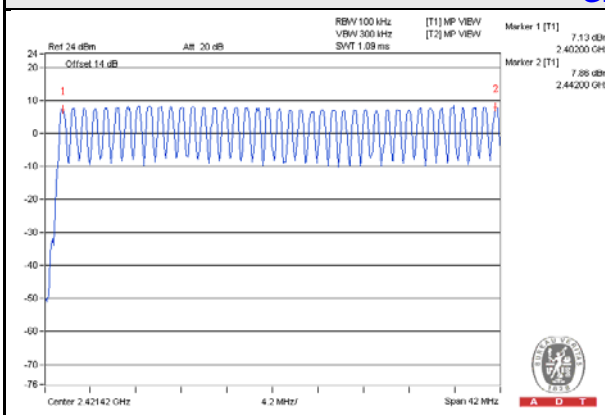
4.3.5 Deviation fromTest Standard

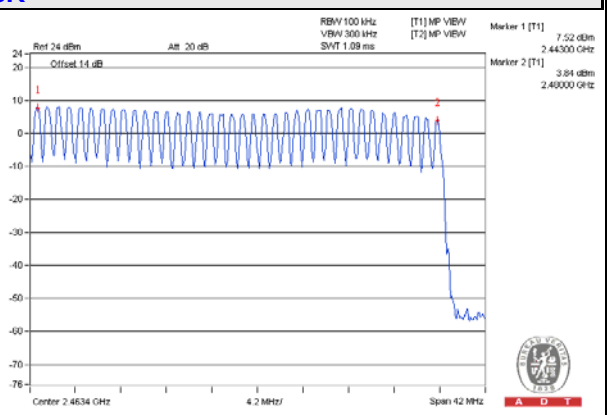
No deviation.

4.3.6 Test Results

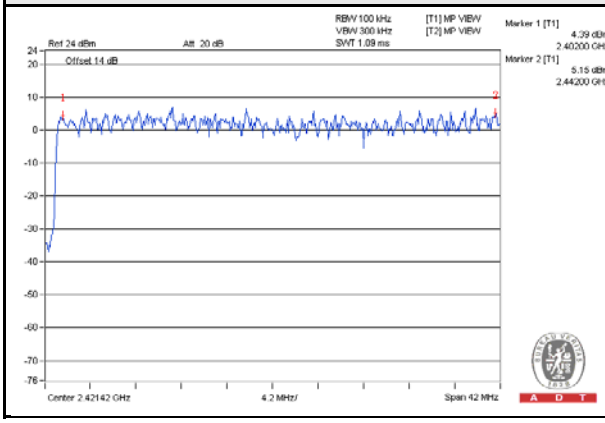
There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

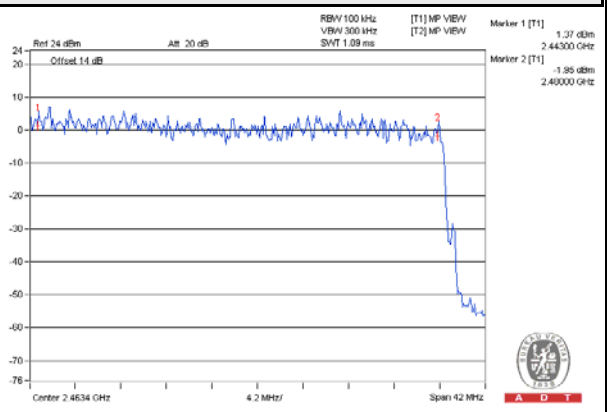
GFSK





8DPSK



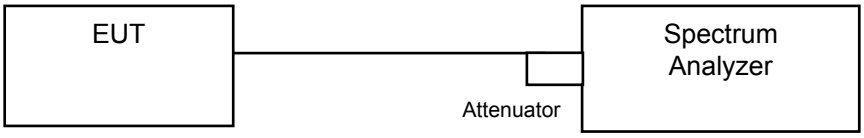


4.4 Dwell Time on Each Channel

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.

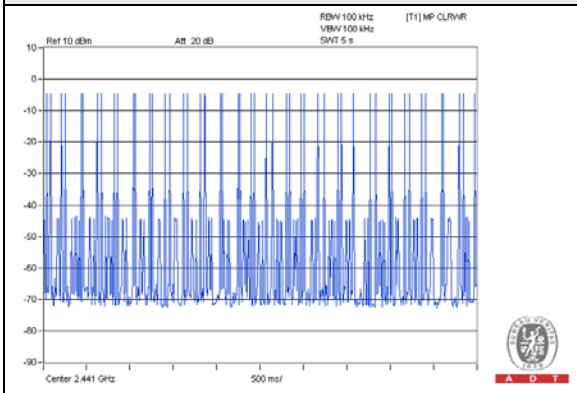
4.4.6 Test Results

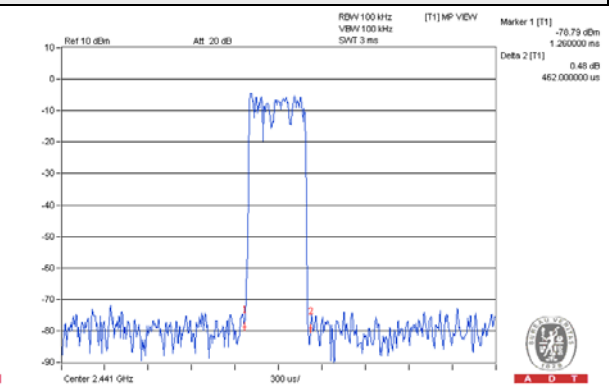
GFSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316 times	0.462	145.99	400
DH3	17 (times / 5 sec) * 6.32 = 107.44 times	1.71	183.72	400
DH5	12 (times / 5 sec) * 6.32 = 75.84 times	3.024	229.34	400

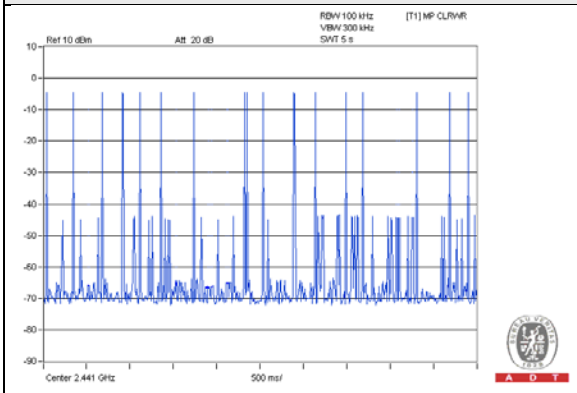
NOTE: Test plots of the transmitting time slot are shown on next page.

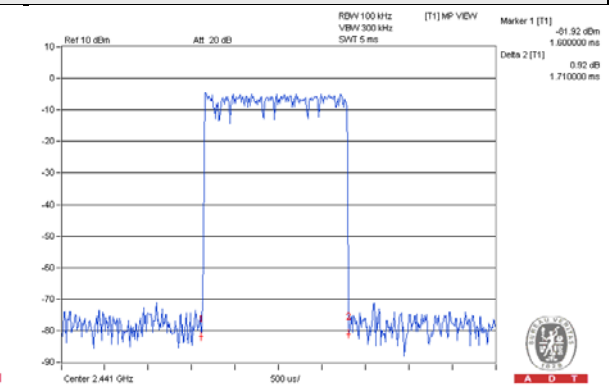
DH1


RBW 100 kHz
VBW 100 kHz
SWT 5 s
[T1] MP CLRWR
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
500 ms/

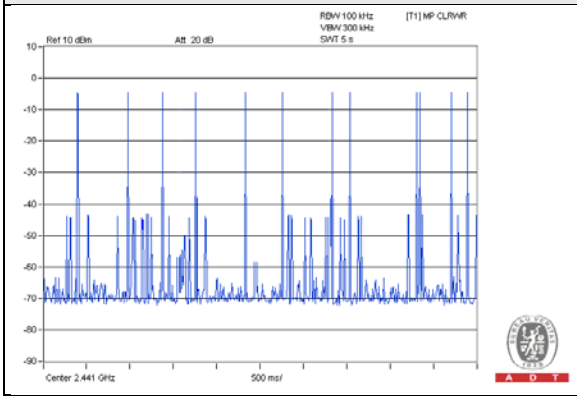

RBW 100 kHz
VBW 100 kHz
SWT 3 ms
[T1] MP VIEW
Marker 1 [T1]
-78.79 dBm
1.260000 ms
Delta 2 [T1]
0.48 dB
462.000000 us
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
300 us/

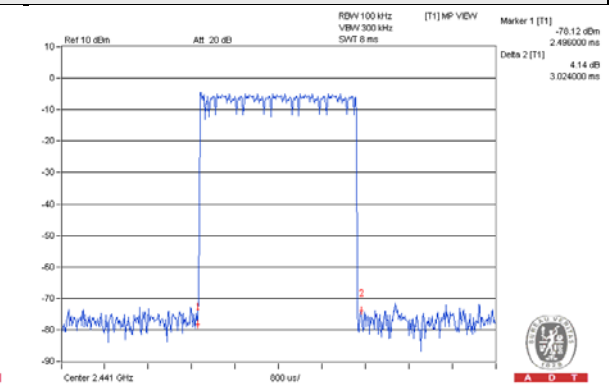
DH3


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MP VIEW
Marker 1 [T1]
-81.92 dBm
1.600000 ms
Delta 2 [T1]
0.92 dB
1.710000 ms
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
500 us/

DH5


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
500 ms/

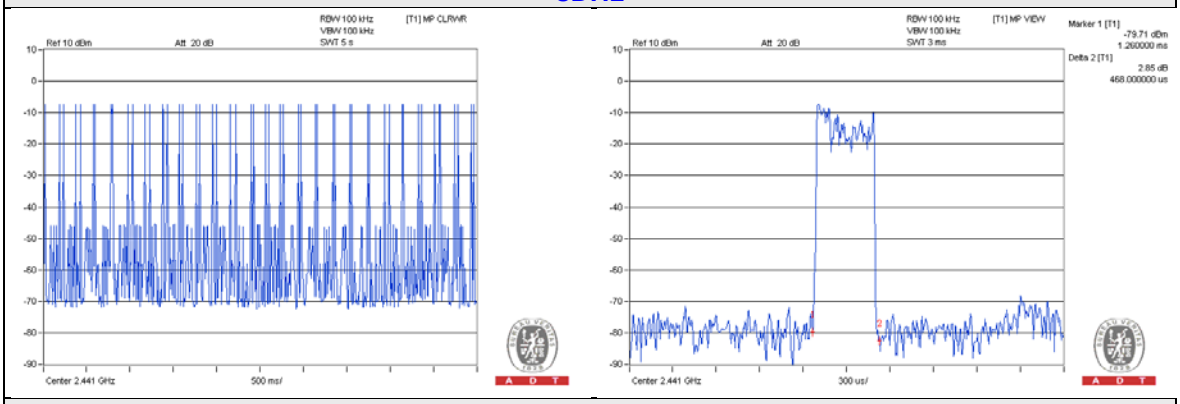

RBW 100 kHz
VBW 300 kHz
SWT 8 ms
[T1] MP VIEW
Marker 1 [T1]
-78.12 dBm
2.496000 ms
Delta 2 [T1]
4.14 dB
3.024000 ms
Ref 10 dBm
Att 20 dB
Center 2.441 GHz
800 us/

8DPSK

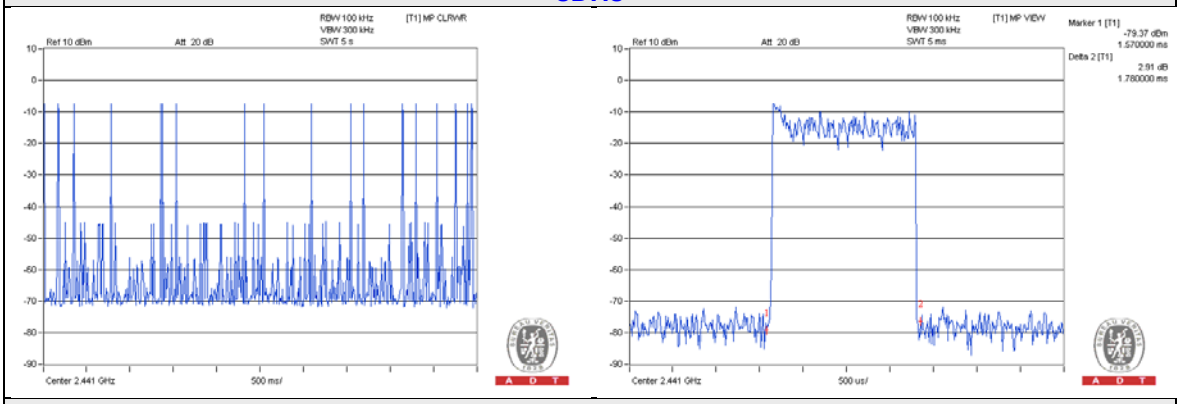
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
3DH1	50 (times / 5 sec) * 6.32 = 316 times	0.468	147.89	400
3DH3	17 (times / 5 sec) * 6.32 = 107.44 times	1.78	191.24	400
3DH5	11 (times / 5 sec) * 6.32 = 69.52 times	2.976	206.89	400

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

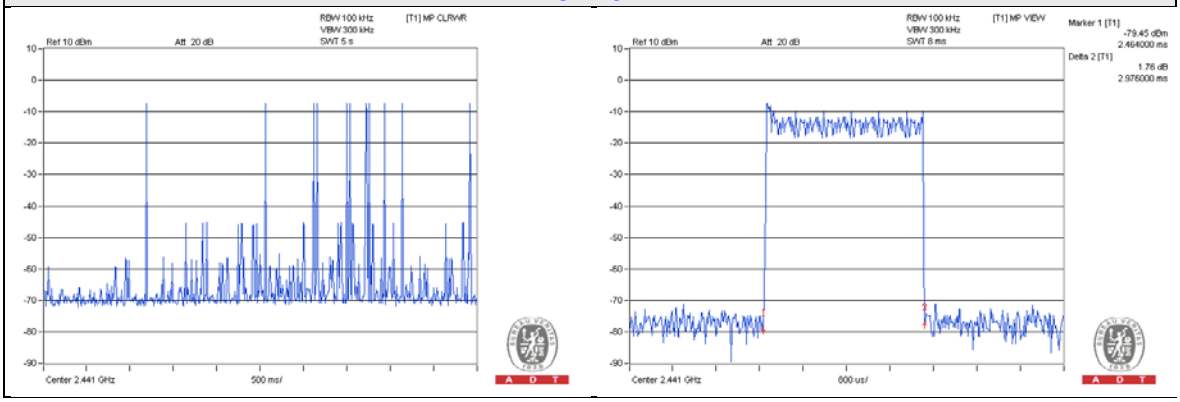
3DH1



3DH3



3DH5

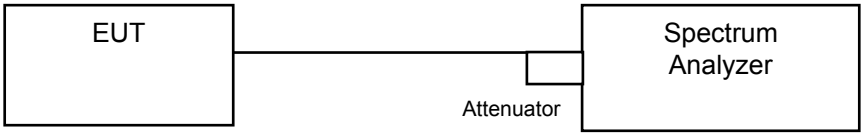


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

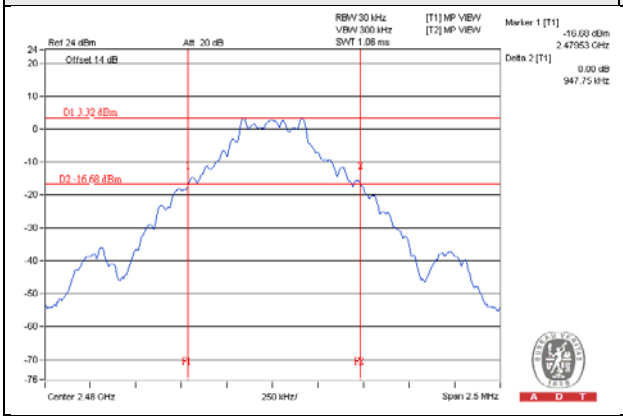
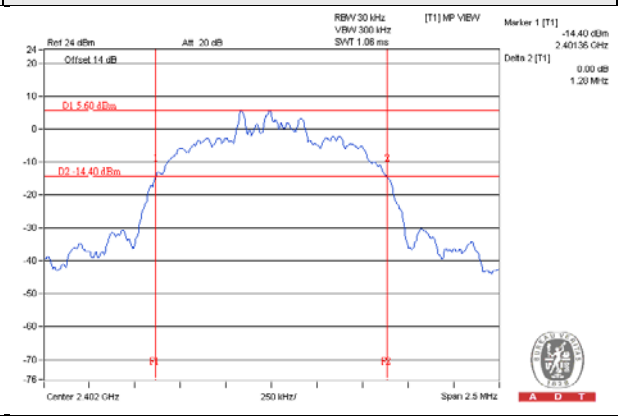
No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	0.94	1.28
39	2441	0.94	1.27
78	2480	0.94	1.25

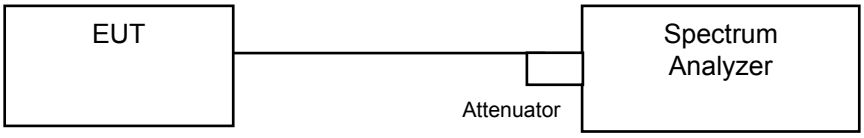
Spectrum Plot of Worst Value	
GFSK / CH78	**8DPSK / CH0**
	

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

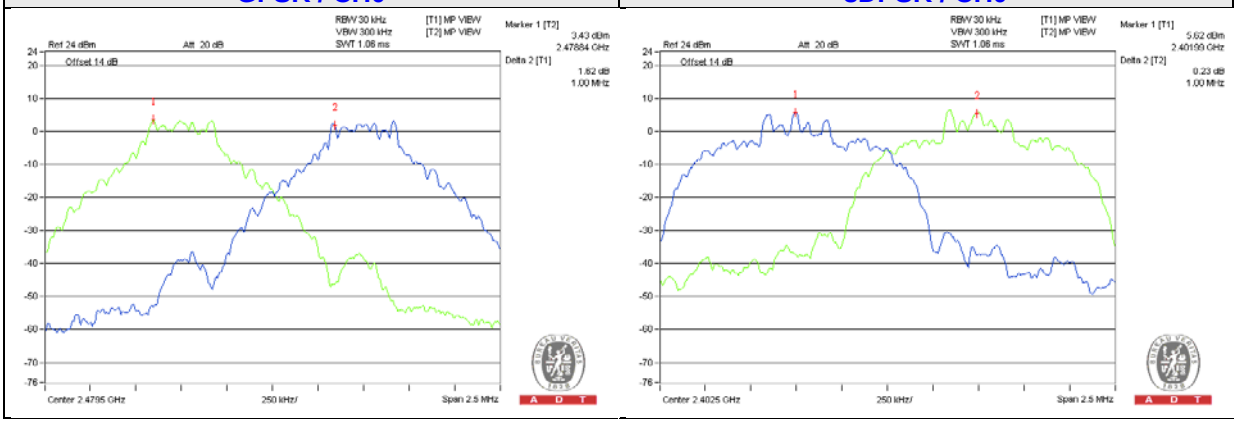
No deviation.

4.6.6 Test Results

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.01	1.00	0.94	1.28	0.63	0.86	Pass
39	2441	1.00	1.00	0.94	1.27	0.63	0.85	Pass
78	2480	1.00	1.01	0.94	1.25	0.63	0.84	Pass

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

Spectrum Plot of Worst Value	
GFSK / CH0	8DPSK / CH0

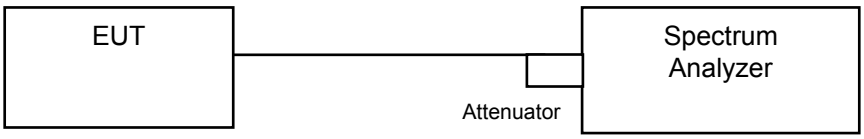


4.7 Maximum Output Power

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

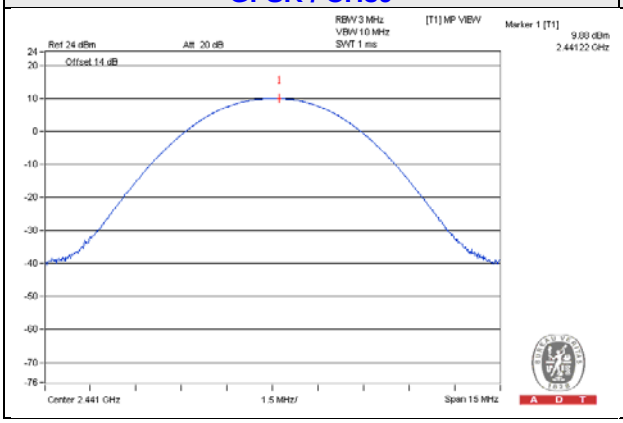
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.7.7 Test Results

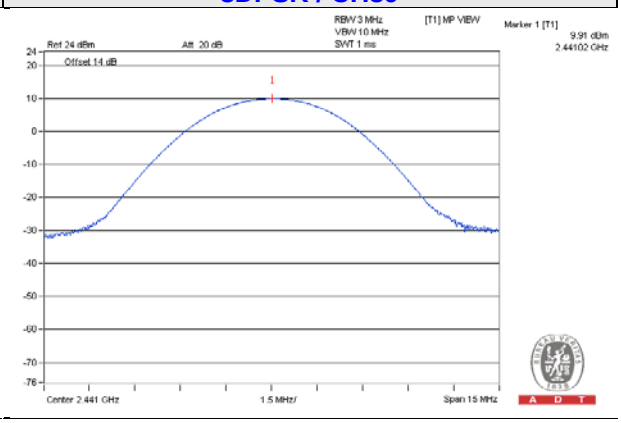
Channel	Frequency (MHZ)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	8.414	8.453	9.25	9.27	125	Pass
39	2441	9.727	9.795	9.88	9.91	125	Pass
78	2480	4.667	4.592	6.69	6.62	125	Pass

Spectrum Plot of Worst Value

GFSK / CH39



8DPSK / CH39



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

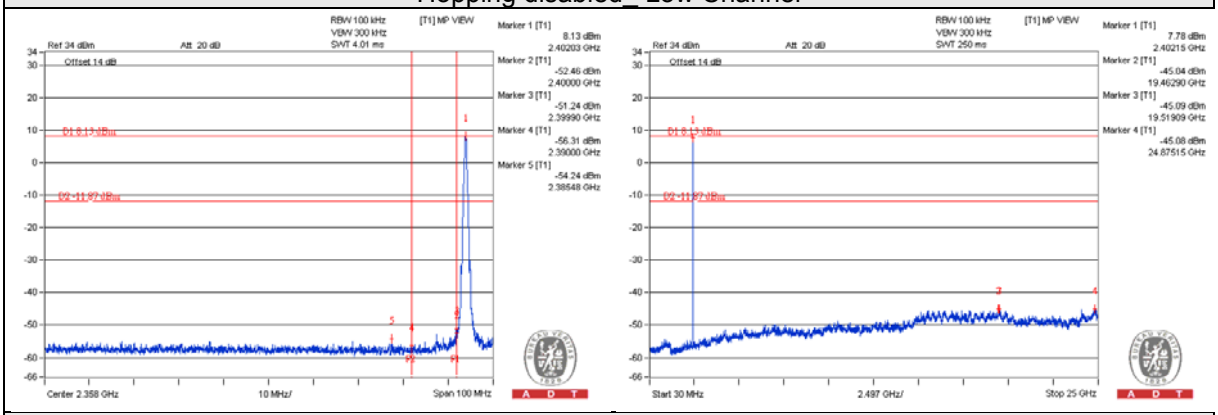
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 Test Results

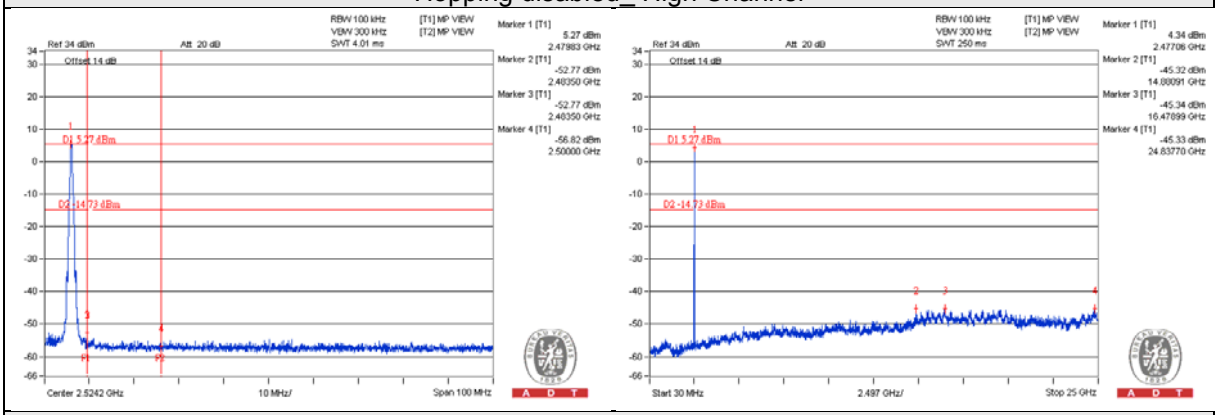
The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

GFSK

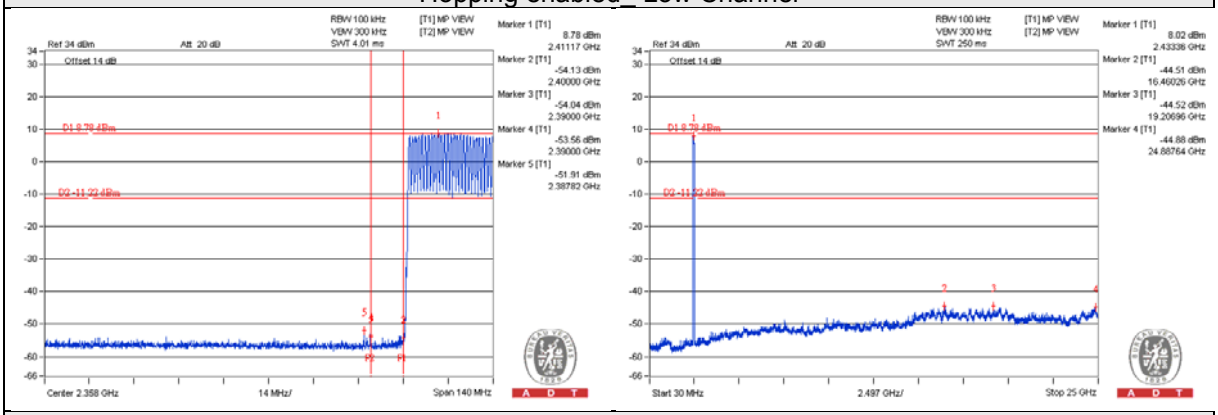
Hopping disabled_ Low Channel



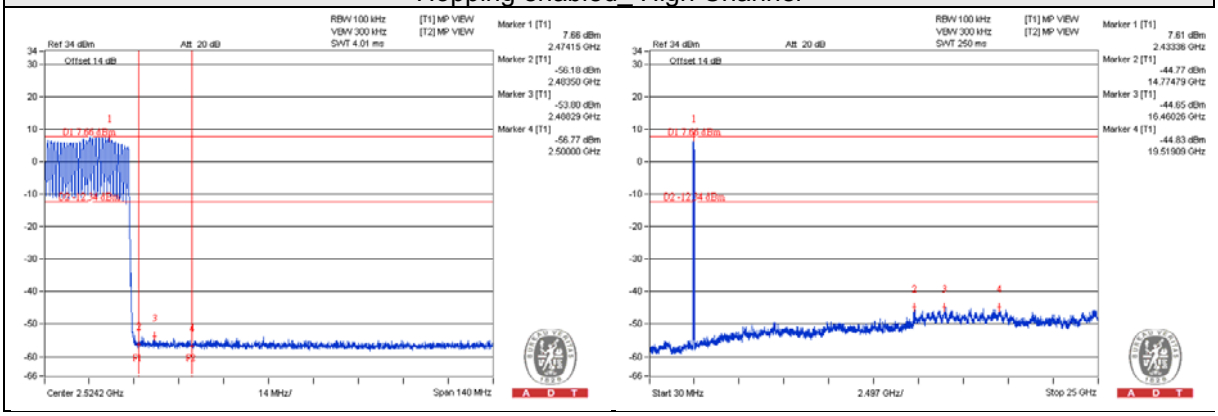
Hopping disabled_ High Channel



Hopping enabled_ Low Channel



Hopping enabled_ High Channel



8DPSK

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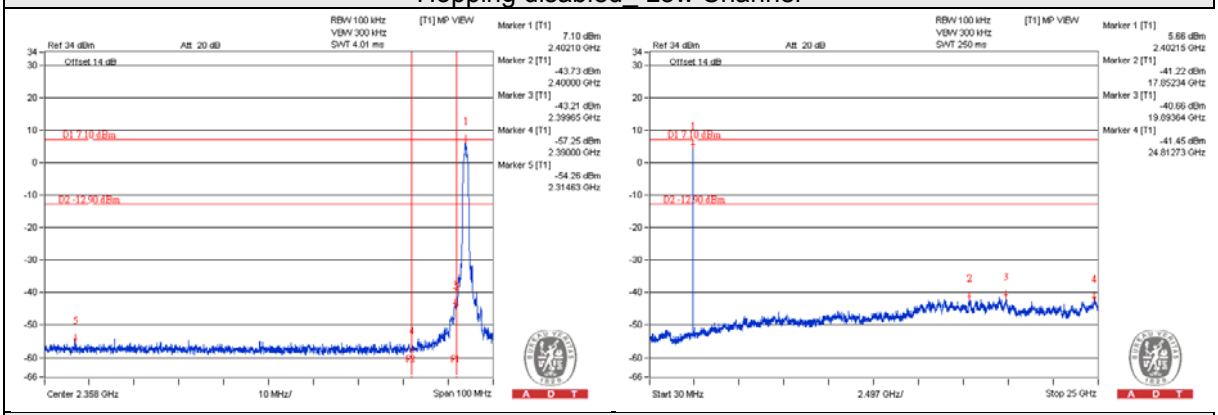

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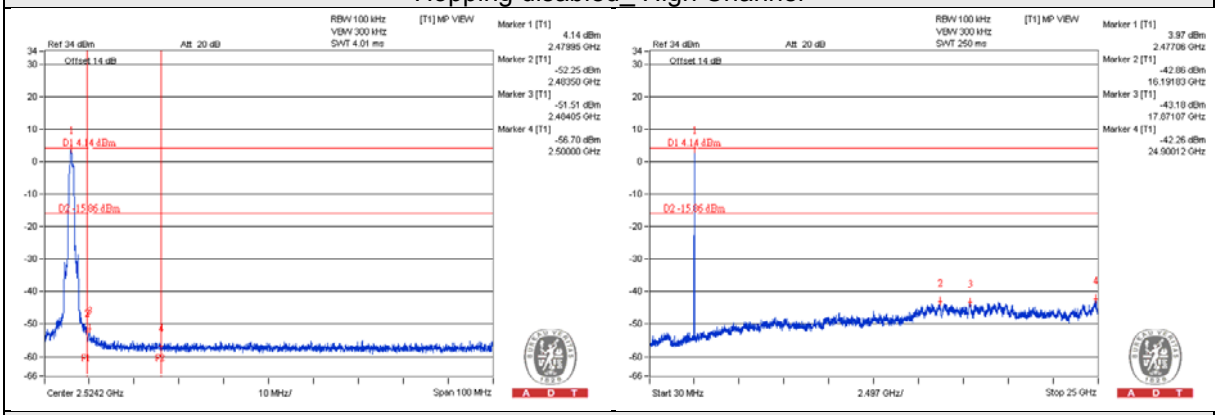

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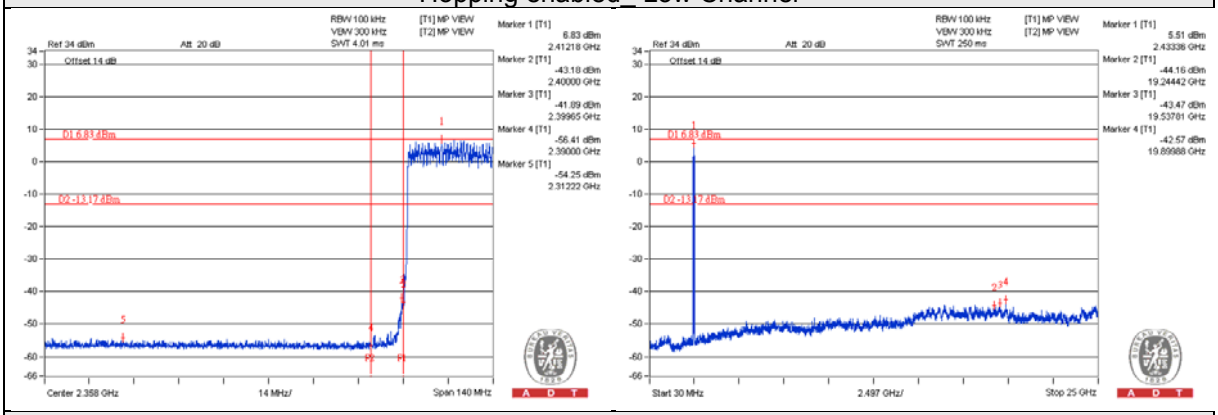

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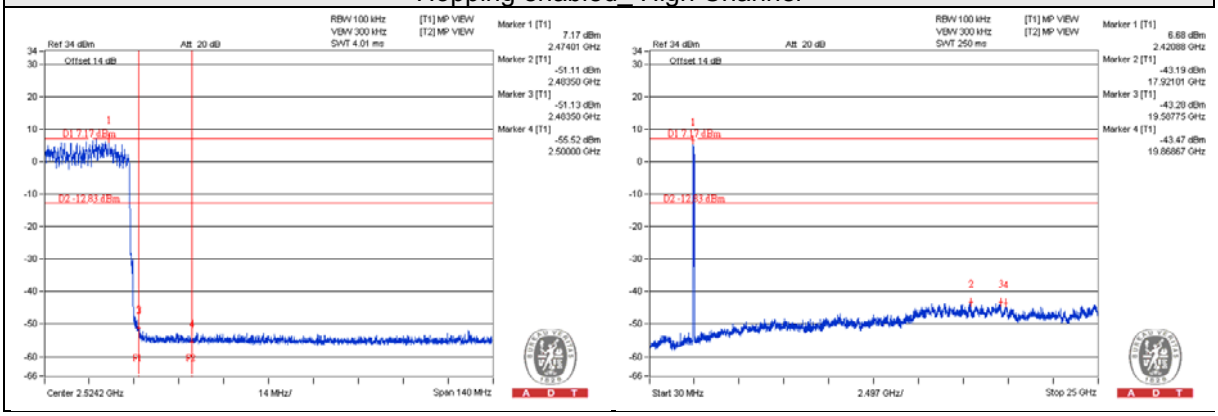

5 Pictures of Test Arrangements

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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