FCC TEST REPORT

REPORT NO.:	RF131014E08
MODEL NO.:	ALOHA
FCC ID:	WTU28658913-A1
RECEIVED:	Oct. 14, 2013
TESTED:	Jan. 22 to 28, 2014
ISSUED:	Apr. 01, 2014

APPLICANT:	Open Road Solutions, Inc.
ADDRESS:	No.88-13,Shueili Rd,Hsinchu City 30059,Taiwan

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
LAB ADDRESS:	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.
TEST LOCATION (1):	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, Taiwan, R.O.C.
TEST LOCATION (2):	No.49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, Taiwan, R.O.C.

This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF131014E08	Original release	Apr. 01, 2014

1 CERTIFICATION

PRODUCT :	Bluetooth Headset
BRAND NAME :	BIKECOMM
MODEL NO. :	ALOHA
TEST SAMPLE :	R&D SAMPLE
APPLICANT :	Open Road Solutions, Inc.
TESTED DATE :	Jan. 22 to 28, 2014
STANDARDS :	**FCC Part 15, Subpart C (Section 15.247)**
	ANSI C63.10-2009

The above equipment (Model: ALOHA) 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:** *Apr. 01, 2014*
(Elsie Hsu, Specialist)

APPROVED BY : _____ , **DATE:** *Apr. 01, 2014*
(May Chen, 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	PASS	Meet the requirement of limit. Minimum passing margin is -15.77dB at 0.41172MHz.
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.
15.247(d)	Transmitter Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -0.3dB at 2483.5MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

NOTE: 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 ME ASUREMENT 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	Value
Conducted emissions	2.98 dB
Radiated emissions (30MHz-1GHz)	5.37 dB
Radiated emissions (1GHz -6GHz)	3.65 dB
Radiated emissions (6GHz -18GHz)	3.88 dB
Radiated emissions (18GHz -40GHz)	4.11 dB

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Bluetooth Headset
MODEL NO.	ALOHA
POWER SUPPLY	DC 3.7V from battery DC 5V from USB interface
MODULATION TYPE	GFSK, π/4-DQPSK, 8DPSK
MODULATION TECHNOLOGY	FHSS
DATE RATE	Up to 3Mbps
FREQUENCY RANGE	2402MHz ~ 2480MHz
NUMBER OF CHANNEL	79
MAX. OUTPUT POWER	70.632 mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	USB cable x 1(Shielded, 0.5m) USB vs Audio cable x 1(unshielded, 0.8m) Audio vs Audio cable x 1(unshielded, 0.8m)
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	Speaker + Microphone x 1

NOTE:

1. The antennas provided to the EUT, please refer to the following table:

Brand Name	Model Name	Antenna Gain(dBi)	Antenna Type	Connector Type	Frequency range (GHz to GHz)
BIKECOMM	ALOHA	1.4	PCB	NA	2.4~2.5

2. The EUT must be supplied with battery as following table:

Brand	L/N	Spec.
BULL ELECTRONIC	102040PL	DC 3.7V, 700mAh

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

Pre-test Mode	Description	Power
Mode A	**USB vs Audio cable**	**Adapter**
Mode B	USB cable	Adapter
Mode C	Audio vs Audio	Battery

From the above modes, the worst radiated emission was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

4. The above EUT information was declared by the 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 Bluetooth.

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		

3.3 TEST MODE APPLICABLITY AND TESTED CHANNEL DETAIL:

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	RE < 1G	RE ³ 1G	APCM	OB	
-	√	√	√	√	√	-

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

RE ³ 1G: Radiated Emission above 1GHz **APCM:** Antenna Port Conducted Measurement

OB: Conducted Out-Band Emission Measurement

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.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	39	FHSS	8DPSK	DH1

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ 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.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	39	FHSS	8DPSK	DH1

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ 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.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	DH5

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ 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.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	DH5

CONDUCTED OUT-BAND EMISSION MEASUREMENT:

☒ 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.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 78	FHSS	GFSK	DH5
0 to 78	0, 78	FHSS	8DPSK	DH5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	19deg. C, 62%RH	120Vac, 60 Hz	Sean Huang
RE<1G	26deg. C, 70%RH	120Vac, 60 Hz	Tim Ho
RE≥1G	21deg. C, 61%RH	120Vac, 60 Hz	Robert Cheng
APCM	25deg. C, 60%RH	120Vac, 60 Hz	Nelson Teng
OB	25deg. C, 60%RH	120Vac, 60 Hz	Nelson Teng

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)
ANSI C63.10-2009

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

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

3.5 DESCRIPTION OF SUPPORT UNITS

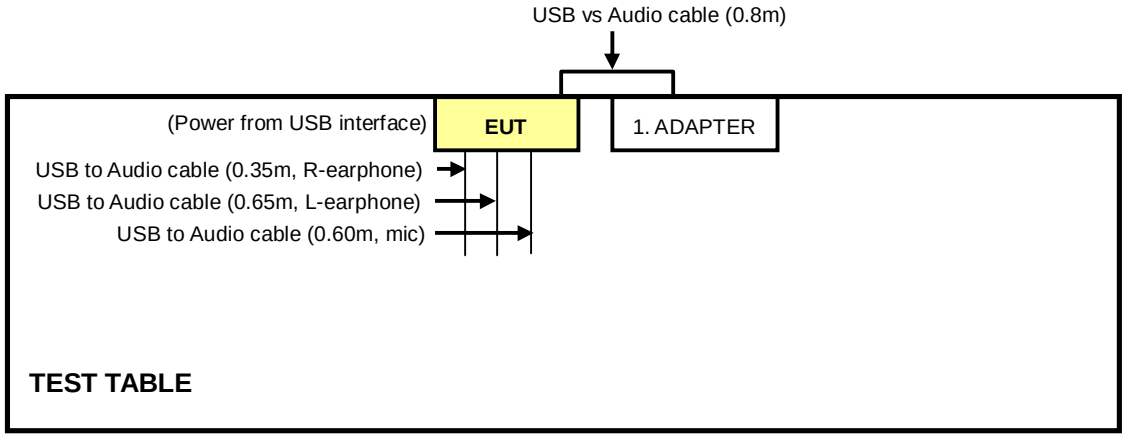
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Adapter	Kamera	DB110	DB110_01	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	USB vs Audio cable (0.8m)

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

3.6 CONFIGURATION OF SYSTEM UNDER TEST



4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	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 0.50 MHz.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Mar. 08, 2013	Mar. 07, 2014
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 05, 2013	Sep. 04, 2014
Line-Impedance Stabilization Network (for Peripheral)	ENV216	100072	June 06, 2013	June 05, 2014
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 11, 2013	Mar. 10, 2014
50 ohms Terminator	50	EMC-03	Sep. 24, 2013	Sep. 23, 2014
Software ADT	BV ADT_Cond_V7.3.7.3	NA	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3 The VCCI Con C Registration No. is C-3611.
4 Tested Date: Jan. 27, 2014

4.1.3 TEST PROCEDURE

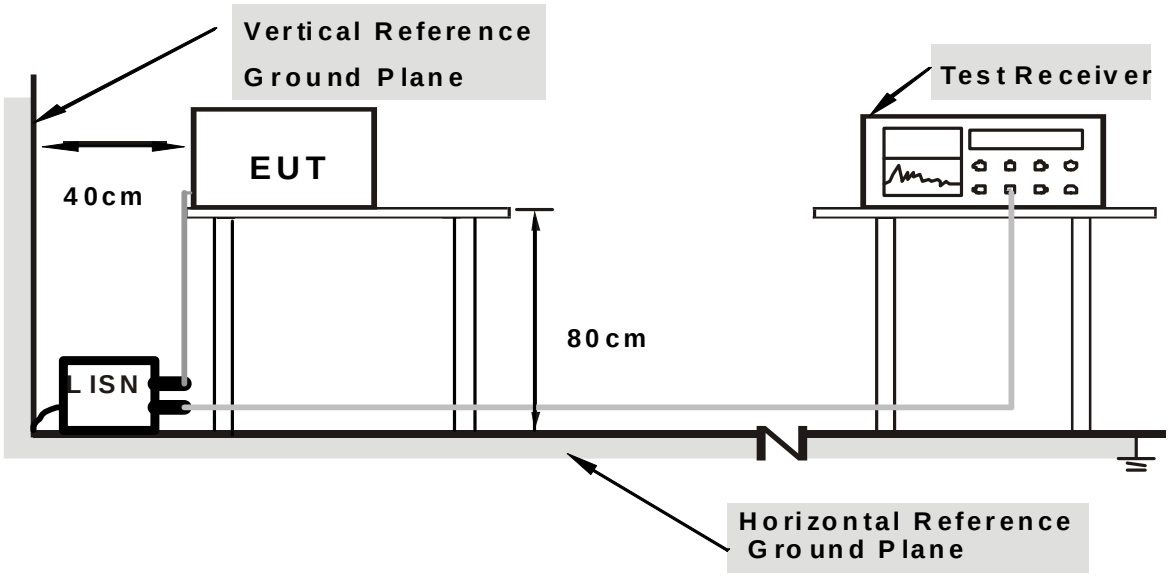
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN.
b. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
c. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
d. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit – 20dB) were not recorded.

NOTE: The resolution bandwidth of test receiver is 9kHz for Quasi-peak detection (QP) & Average detection (AV).

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



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

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

4.1.6 EUT OPERATING CONDITIONS

1. Controlling software (Blue Test 3 CSR BlueSuite 2.5.0) has been activated to set the EUT on specific status.

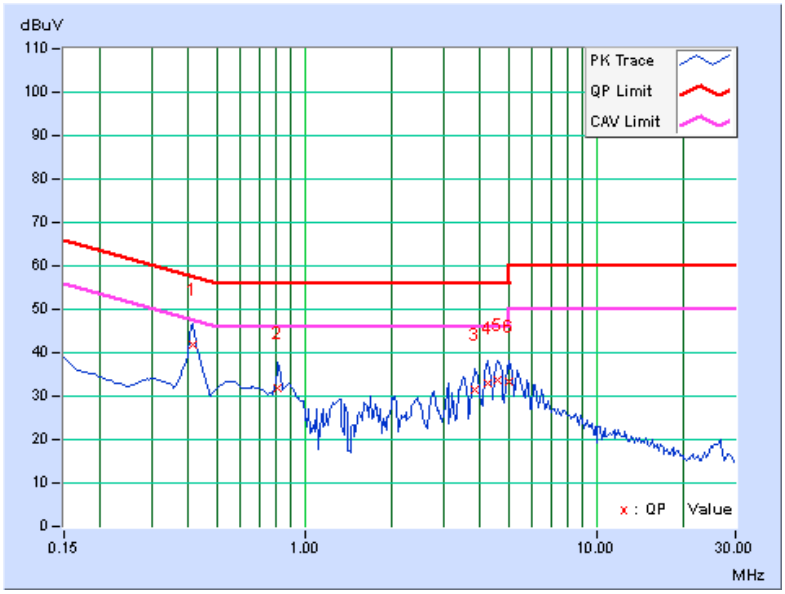
4.1.7 TEST RESULTS

PHASE	Line (L)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.41172**	**0.14**	**41.70**	**30.92**	**41.84**	**31.06**	**57.61**	**47.61**	**-15.77**	**-16.55**
2	0.81016	0.16	31.71	19.67	31.87	19.83	56.00	46.00	-24.13	-26.17
3	3.85547	0.27	31.05	15.51	31.32	15.78	56.00	46.00	-24.68	-30.22
4	4.25000	0.29	32.81	16.24	33.10	16.53	56.00	46.00	-22.90	-29.47
5	4.59375	0.30	33.54	17.12	33.84	17.42	56.00	46.00	-22.16	-28.58
6	5.01953	0.31	33.12	16.99	33.43	17.30	60.00	50.00	-26.57	-32.70

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

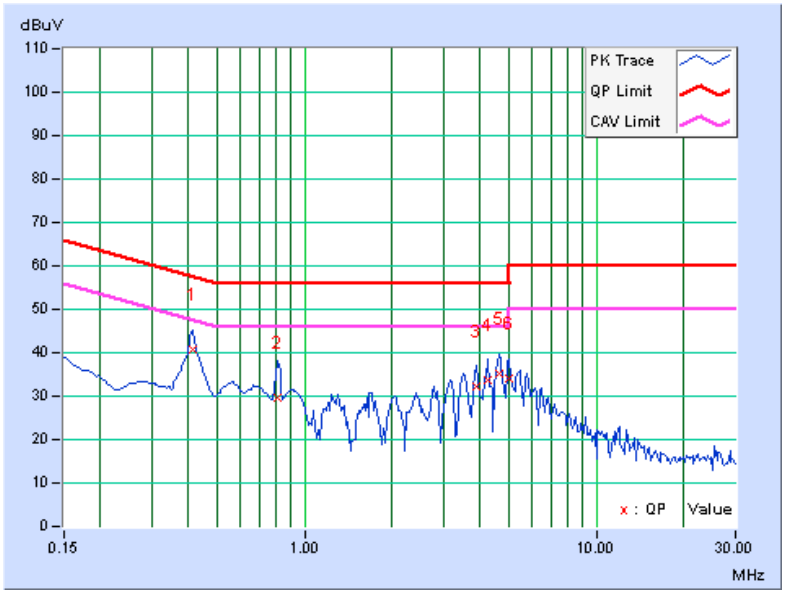


PHASE	Neutral (N)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.41172	0.14	40.45	31.35	40.59	31.49	57.61	47.61	-17.02	-16.12
2	0.81016	0.16	29.37	18.07	29.53	18.23	56.00	46.00	-26.47	-27.77
3	3.90234	0.28	31.80	18.10	32.08	18.38	56.00	46.00	-23.92	-27.62
4	4.23438	0.29	33.25	18.53	33.54	18.82	56.00	46.00	-22.46	-27.18
5	4.62891	0.30	34.92	19.25	35.22	19.55	56.00	46.00	-20.78	-26.45
6	5.00391	0.31	33.94	18.69	34.25	19.00	60.00	50.00	-25.75	-31.00

REMARKS:

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



4.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.2.1 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.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	Jan. 29,2013	Jan. 28,2014
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Mar. 19, 2013	Mar. 18, 2014
RF Cable	NA	CHGCAB_001	Oct. 05, 2013	Oct. 04, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISI	AIH.8018	0000320091110	Nov. 18, 2013	Nov. 17, 2014
Pre-Amplifier Agilent	8449B	3008A02578	June 25, 2013	June 24, 2014
RF Cable	NA	RF104-201 RF104-203 RF104-204	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3 The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
5 The VCCI Site Registration No. is G-137.
6 The CANADA Site Registration No. is IC 7450H-2.
7 Tested Date: Jan. 22 to 24, 2014

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 meters 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. 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.

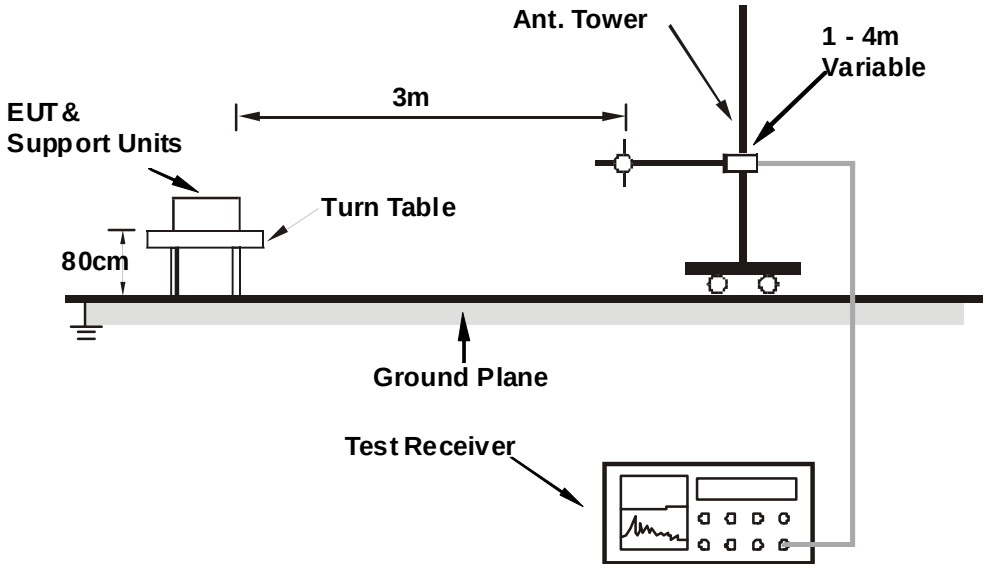
NOTE:

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 1MHz and video bandwidth is 1MHz for Peak detection at frequency above 1GHz.
3. 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

Same as 4.1.6

4.2.7 TEST RESULTS

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	53.14	28.5 QP	40.0	-11.5	1.00 H	360	41.64	-13.17
2	125.50	34.7 QP	43.5	-8.8	2.00 H	196	49.45	-14.71
3	272.84	34.7 QP	46.0	-11.3	1.00 H	360	48.10	-13.39
4	296.65	34.3 QP	46.0	-11.7	2.00 H	45	46.95	-12.65
5	848.49	37.1 QP	46.0	-8.9	1.00 H	323	37.95	-0.87
6	896.31	39.8 QP	46.0	-6.2	1.00 H	360	39.76	0.00
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	53.14	36.4 QP	40.0	-3.6	1.50 V	360	49.59	-13.17
2	90.53	29.2 QP	43.5	-14.3	2.00 V	115	48.27	-19.05
3	117.88	32.0 QP	43.5	-11.5	2.00 V	204	47.30	-15.32
4	297.38	36.3 QP	46.0	-9.7	1.50 V	119	48.89	-12.62
5	897.23	35.5 QP	46.0	-10.5	1.50 V	283	35.41	0.07
6	940.59	33.6 QP	46.0	-12.4	1.00 V	148	32.89	0.68

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

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	2376.00	52.6 PK	74.0	-21.4	1.16 H	198	54.60	-2.00
2	2376.00	22.5 AV	54.0	-31.5	1.16 H	198	24.50	-2.00
3	*2402.00	118.3 PK			1.16 H	198	120.20	-1.90
4	*2402.00	88.2 AV			1.16 H	198	90.10	-1.90
5	4804.00	56.8 PK	74.0	-17.2	1.13 H	190	50.00	6.80
6	4804.00	26.7 AV	54.0	-27.3	1.13 H	190	19.90	6.80
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	2376.00	48.5 PK	74.0	-25.5	1.03 V	126	50.50	-2.00
2	2376.00	18.4 AV	54.0	-35.6	1.03 V	126	20.40	-2.00
3	*2402.00	106.2 PK			1.03 V	126	108.10	-1.90
4	*2402.00	76.1 AV			1.03 V	126	78.00	-1.90
5	4804.00	59.8 PK	74.0	-14.2	1.17 V	148	53.00	6.80
6	4804.00	29.7 AV	54.0	-24.3	1.17 V	148	22.90	6.80

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	2311.00	51.9 PK	74.0	-22.1	1.00 H	81	54.10	-2.20
2	2311.00	21.8 AV	54.0	-32.2	1.00 H	81	24.00	-2.20
3	2337.00	51.6 PK	74.0	-22.4	1.00 H	81	53.80	-2.20
4	2337.00	21.5 AV	54.0	-32.5	1.00 H	81	23.70	-2.20
5	*2441.00	118.4 PK			1.15 H	199	120.10	-1.70
6	*2441.00	88.3 AV			1.15 H	199	90.00	-1.70
7	4882.00	55.4 PK	74.0	-18.6	1.20 H	193	48.40	7.00
8	4882.00	25.3 AV	54.0	-28.7	1.20 H	193	18.30	7.00
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	2311.00	52.2 PK	74.0	-21.8	1.05 V	113	54.40	-2.20
2	2311.00	22.1 AV	54.0	-31.9	1.05 V	113	24.30	-2.20
3	2337.00	52.3 PK	74.0	-21.7	1.05 V	113	54.50	-2.20
4	2337.00	22.2 AV	54.0	-31.8	1.05 V	113	24.40	-2.20
5	*2441.00	105.9 PK			1.05 V	113	107.60	-1.70
6	*2441.00	75.8 AV			1.05 V	113	77.50	-1.70
7	4882.00	59.3 PK	74.0	-14.7	1.00 V	166	52.30	7.00
8	4882.00	29.2 AV	54.0	-24.8	1.00 V	166	22.20	7.00

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	2324.00	60.1 PK	74.0	-13.9	1.49 H	218	62.30	-2.20
2	2324.00	30.0 AV	54.0	-24.0	1.49 H	218	32.20	-2.20
3	*2480.00	118.5 PK			1.16 H	198	120.10	-1.60
4	*2480.00	88.4 AV			1.16 H	198	90.00	-1.60
5	**2483.50**	**73.7 PK**	**74.0**	**-0.3**	**1.14 H**	**196**	**75.20**	**-1.50**
6	2483.50	43.6 AV	54.0	-10.4	1.14 H	196	45.10	-1.50
7	4960.00	53.8 PK	74.0	-20.2	1.12 H	196	46.60	7.20
8	4960.00	23.7 AV	54.0	-30.3	1.12 H	196	16.50	7.20
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	2324.00	52.0 PK	74.0	-22.0	1.09 V	323	54.20	-2.20
2	2324.00	21.9 AV	54.0	-32.1	1.09 V	323	24.10	-2.20
3	*2480.00	105.8 PK			1.01 V	119	107.40	-1.60
4	*2480.00	75.7 AV			1.01 V	119	77.30	-1.60
5	2483.50	58.7 PK	74.0	-15.3	1.09 V	323	60.20	-1.50
6	2483.50	28.6 AV	54.0	-25.4	1.09 V	323	30.10	-1.50
7	4960.00	56.5 PK	74.0	-17.5	1.02 V	175	49.30	7.20
8	4960.00	26.4 AV	54.0	-27.6	1.02 V	175	19.20	7.20

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
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	2376.20	55.3 PK	74.0	-18.7	1.14 H	172	57.30	-2.00
2	2376.20	25.2 AV	54.0	-28.8	1.14 H	172	27.20	-2.00
3	*2402.00	117.5 PK			1.14 H	172	119.40	-1.90
4	*2402.00	87.4 AV			1.14 H	172	89.30	-1.90
5	4804.00	56.6 PK	74.0	-17.4	1.44 H	258	49.80	6.80
6	4804.00	26.5 AV	54.0	-27.5	1.44 H	258	19.70	6.80
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	2376.20	48.5 PK	74.0	-25.5	1.07 V	139	50.50	-2.00
2	2376.20	18.6 AV	54.0	-35.4	1.07 V	139	20.60	-2.00
3	*2402.00	106.3 PK			1.07 V	118	108.20	-1.90
4	*2402.00	76.4 AV			1.07 V	118	78.30	-1.90
5	4804.00	60.2 PK	74.0	-13.8	1.01 V	140	53.40	6.80
6	4804.00	30.1 AV	54.0	-23.9	1.01 V	140	23.30	6.80

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	2337.00	55.1 PK	74.0	-18.9	1.12 H	174	57.30	-2.20
2	2337.00	25.0 AV	54.0	-29.0	1.12 H	174	27.20	-2.20
3	*2441.00	117.8 PK			1.12 H	174	119.50	-1.70
4	*2441.00	87.7 AV			1.12 H	174	89.40	-1.70
5	2483.50	56.0 PK	74.0	-18.0	1.12 H	174	57.50	-1.50
6	2483.50	25.9 AV	54.0	-28.1	1.12 H	174	27.40	-1.50
7	4882.00	56.2 PK	74.0	-17.8	1.13 H	138	49.20	7.00
8	4882.00	26.1 AV	54.0	-27.9	1.13 H	138	19.10	7.00
9	7323.00	60.2 PK	74.0	-13.8	1.10 H	185	45.60	14.60
10	7323.00	30.1 AV	54.0	-23.9	1.10 H	185	15.50	14.60
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	2327.00	51.9 PK	74.0	-22.1	1.09 V	99	54.10	-2.20
2	2327.00	21.6 AV	54.0	-32.4	1.09 V	99	23.80	-2.20
3	*2441.00	105.9 PK			1.05 V	113	107.60	-1.70
4	*2441.00	75.8 AV			1.05 V	113	77.50	-1.70
5	2483.50	52.4 PK	74.0	-21.6	1.05 V	104	53.90	-1.50
6	2483.50	22.4 AV	54.0	-31.6	1.05 V	104	23.90	-1.50
7	4882.00	58.8 PK	74.0	-15.2	1.03 V	152	51.80	7.00
8	4882.00	28.7 AV	54.0	-25.3	1.03 V	152	21.70	7.00
9	7323.00	63.6 PK	74.0	-10.4	1.00 V	149	49.00	14.60
10	7323.00	33.5 AV	54.0	-20.5	1.00 V	149	18.90	14.60

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	2324.00	63.5 PK	74.0	-10.5	1.18 H	176	65.70	-2.20
2	2324.00	33.4 AV	54.0	-20.6	1.18 H	176	35.60	-2.20
3	*2480.00	117.6 PK			1.17 H	110	119.20	-1.60
4	*2480.00	87.5 AV			1.17 H	110	89.10	-1.60
5	2483.50	63.9 PK	74.0	-10.1	1.17 H	110	65.40	-1.50
6	2483.50	33.8 AV	54.0	-20.2	1.17 H	110	35.30	-1.50
7	4960.00	56.3 PK	74.0	-17.7	1.17 H	254	49.10	7.20
8	4960.00	26.2 AV	54.0	-27.8	1.17 H	254	19.00	7.20
9	7440.00	59.3 PK	74.0	-14.7	1.15 H	161	44.90	14.40
10	7440.00	29.2 AV	54.0	-24.8	1.15 H	161	14.80	14.40
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	2324.00	51.9 PK	74.0	-22.1	1.04 V	313	54.10	-2.20
2	2324.00	22.1 AV	54.0	-31.9	1.04 V	313	24.30	-2.20
3	*2480.00	106.2 PK			1.00 V	111	107.80	-1.60
4	*2480.00	76.1 AV			1.00 V	111	77.70	-1.60
5	2483.50	58.3 PK	74.0	-15.7	1.09 V	316	59.80	-1.50
6	2483.50	28.2 AV	54.0	-25.8	1.09 V	316	29.70	-1.50
7	4960.00	58.6 PK	74.0	-15.4	1.00 V	154	51.40	7.20
8	4960.00	28.6 AV	54.0	-25.4	1.00 V	154	21.40	7.20
9	7440.00	63.5 PK	74.0	-10.5	1.04 V	140	49.10	14.40
10	7440.00	33.2 AV	54.0	-20.8	1.04 V	140	18.80	14.40

REMARKS:

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

4.3 NUMBER OF HOPPING FREQUENCY USED

4.3.1 LIMIT OF HOPPING FREQUENCY USED

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

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

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.

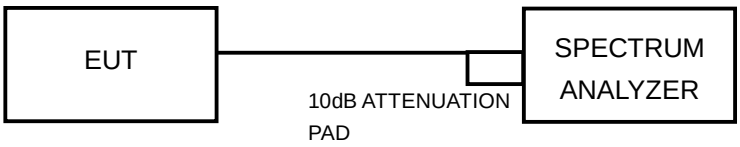
d. Set the SA on View mode and then plot the result on SA screen.

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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

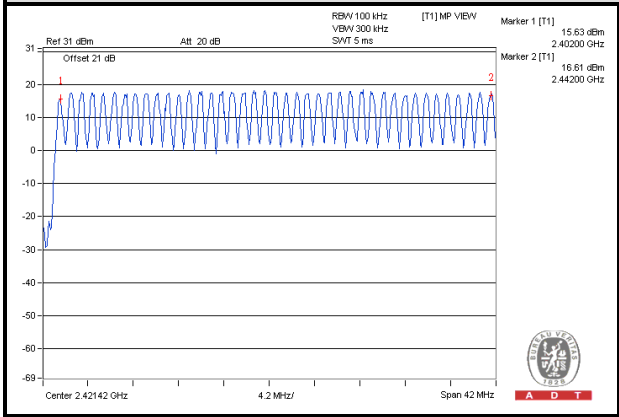
4.3.5 TEST SETUP

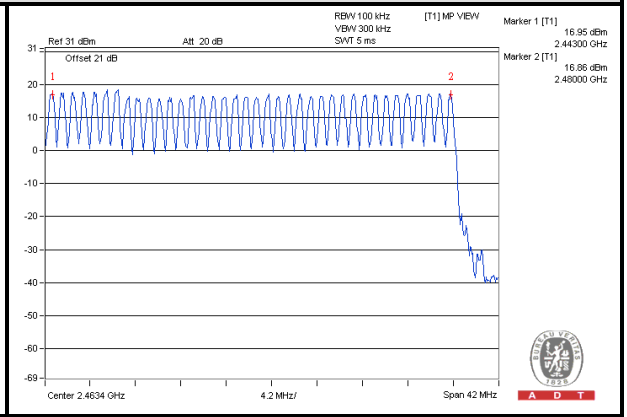


4.3.6 TEST RESULTS

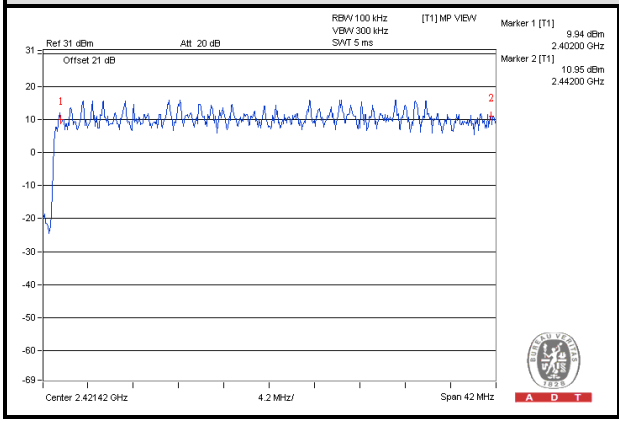
There are 79 hopping frequencies in the hopping mode. Please refer the test result. On the plots, it shows that the hopping frequencies are equally spaced.

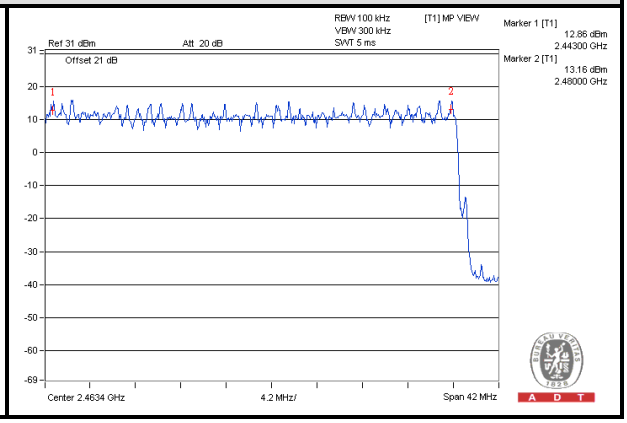
GFSK





8DPSK





4.4 DWELL TIME ON EACH CHANNEL

4.4.1 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 R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

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.

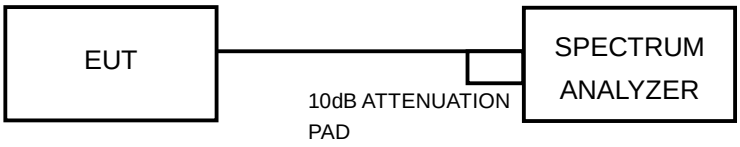
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.

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



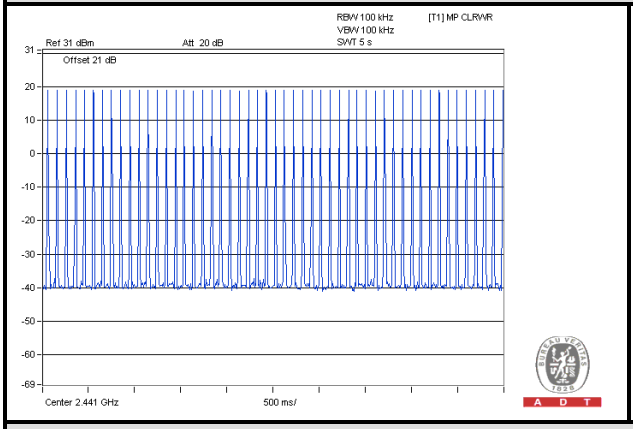
4.4.6 TEST RESULTS

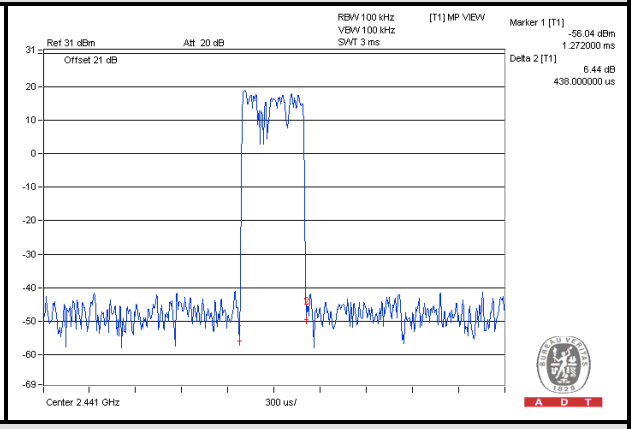
For GFSK:

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	0.438	138.41	400
DH3	25 (times / 5 sec) *6.32=158 times	1.71	270.18	400
DH5	17 (times / 5 sec) *6.32=107.44 times	3.024	324.9	400

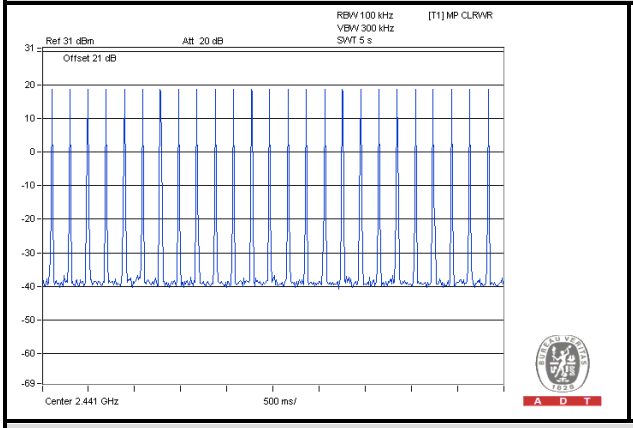
NOTE: Test plots of the transmitting time slot are shown on next page.

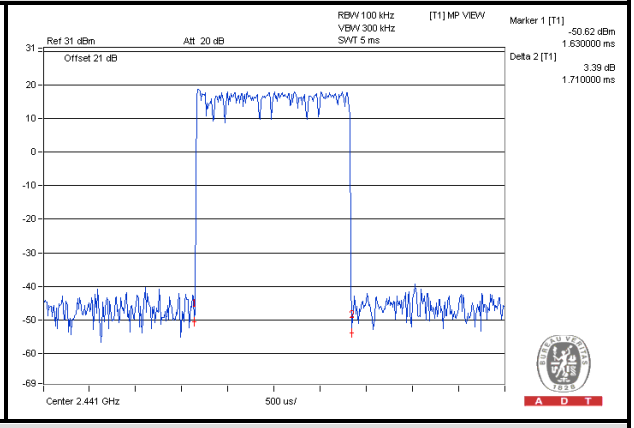
DH1


RBW 100 kHz
VBW 100 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/

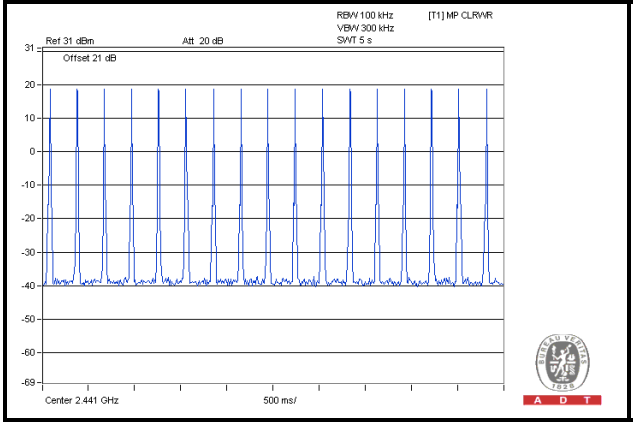

RBW 100 kHz
VBW 100 kHz
SWT 3 ms
[T1] MP VIEW
Marker 1 [T1]
-56.04 dBm
1.272000 ms
Delta 2 [T1]
6.44 dB
438.000000 us
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
300 us/

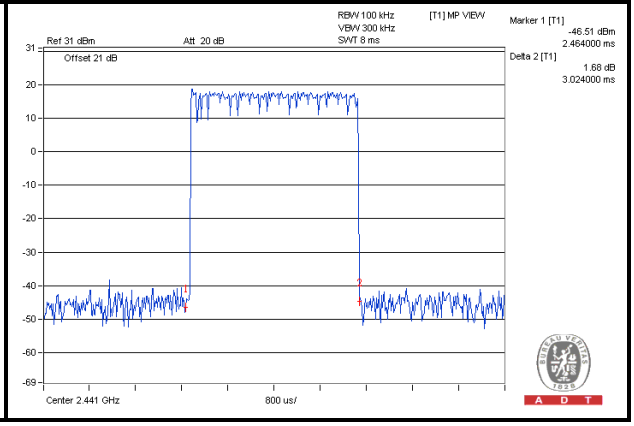
DH3


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MP VIEW
Marker 1 [T1]
-50.62 dBm
1.630000 ms
Delta 2 [T1]
3.39 dB
1.710000 ms
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 us/

DH5


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/

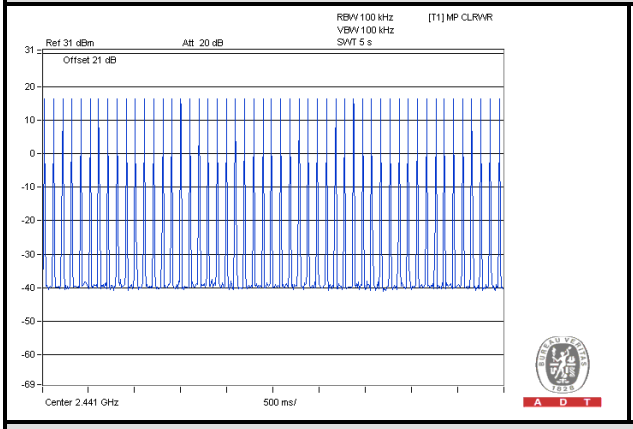

RBW 100 kHz
VBW 300 kHz
SWT 8 ms
[T1] MP VIEW
Marker 1 [T1]
-46.51 dBm
2.464000 ms
Delta 2 [T1]
1.68 dB
3.024000 ms
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
800 us/

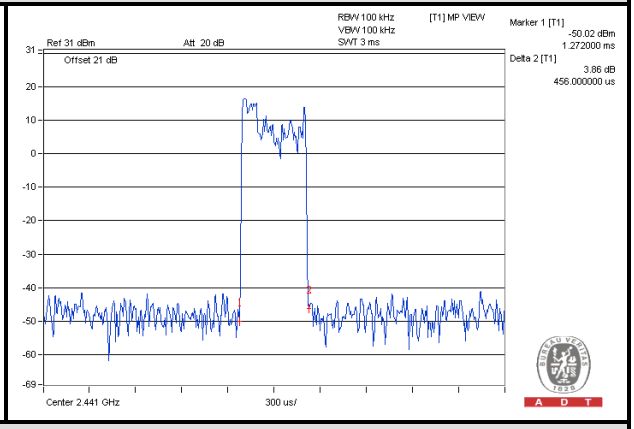
For 8DPSK:

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	0.456	146.98	400
DH3	25 (times / 5 sec) *6.32=158 times	1.75	276.5	400
DH5	17 (times / 5 sec) *6.32=107.44 times	2.976	319.74	400

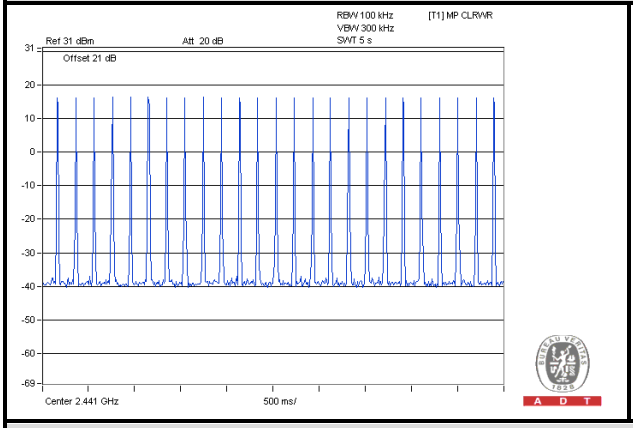
NOTE: Test plots of the transmitting time slot are shown on next page.

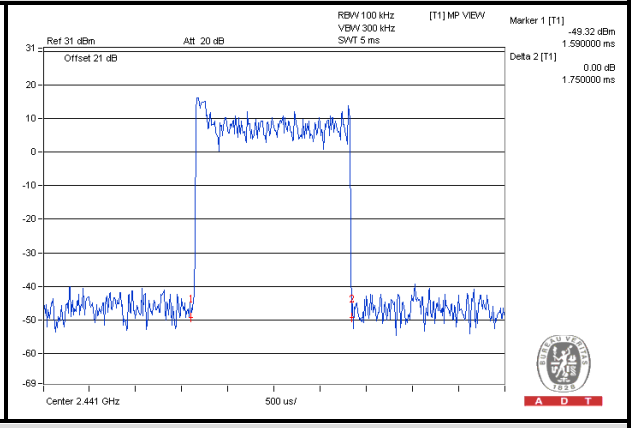
DH1


RBW 100 kHz
VBW 100 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/

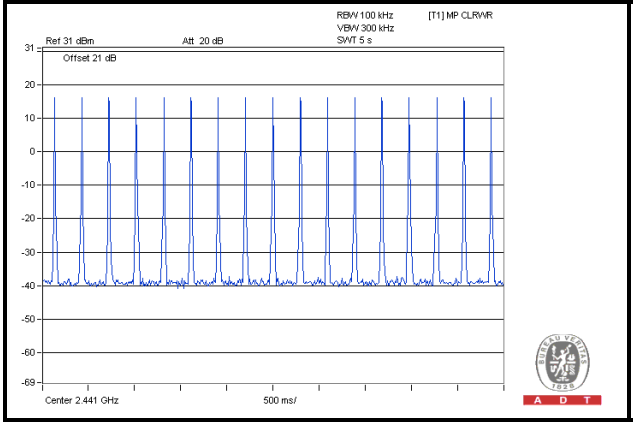

RBW 100 kHz
VBW 100 kHz
SWT 3 ms
[T1] MP VIEW
Marker 1 [T1]
-50.02 dBm
1.272000 ms
Delta 2 [T1]
3.86 dB
456.000000 us
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
300 us/

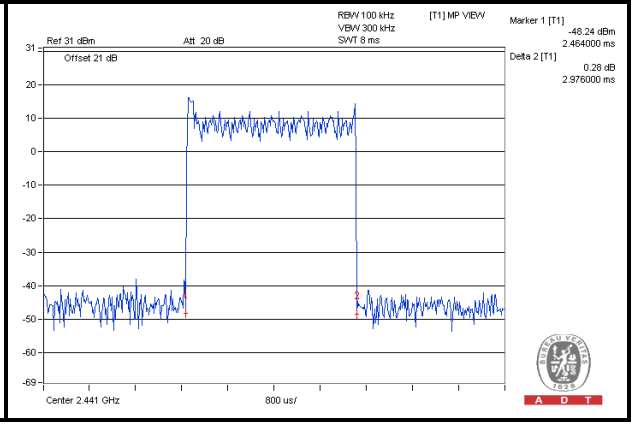
DH3


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
[T1] MP VIEW
Marker 1 [T1]
-49.32 dBm
1.590000 ms
Delta 2 [T1]
0.00 dB
1.750000 ms
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 us/

DH5


RBW 100 kHz
VBW 300 kHz
SWT 5 s
[T1] MP CLRWR
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
500 ms/


RBW 100 kHz
VBW 300 kHz
SWT 8 ms
[T1] MP VIEW
Marker 1 [T1]
-48.24 dBm
2.464000 ms
Delta 2 [T1]
0.28 dB
2.976000 ms
Ref 31 dBm
Att 20 dB
Offset 21 dB
Center 2.441 GHz
800 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 R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

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.

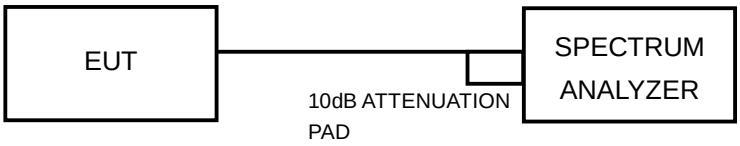
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

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

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP

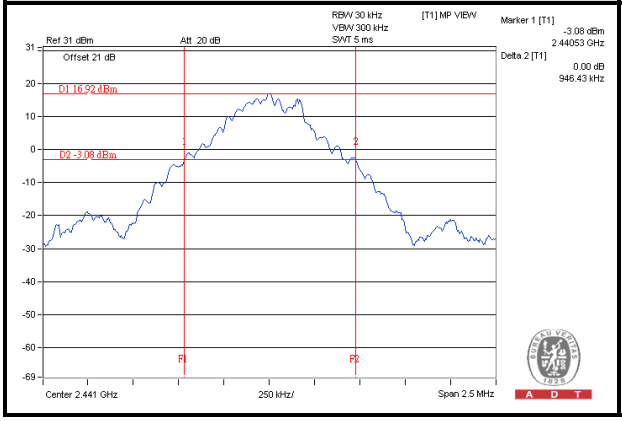
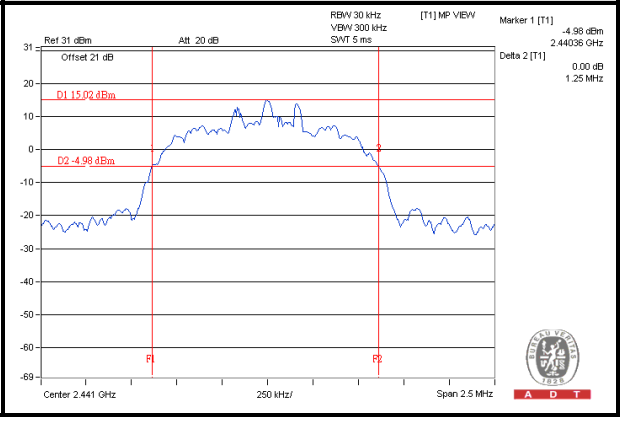


4.5.6 EUT OPERATING CONDITION

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

CHANNEL	FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	
		GFSK	8DPSK
0	2402	0.94	1.23
39	2441	0.94	1.25
78	2480	0.94	1.25

SPECTRUM PLOT OF WORST VALUE	
GFSK	8DPSK
	

4.6 HOPPING CHANNEL SEPARATION

4.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25 kHz or two-thirds 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 R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

4.6.3 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.

c. By using the MaxHold function record the separation of two adjacent channels.

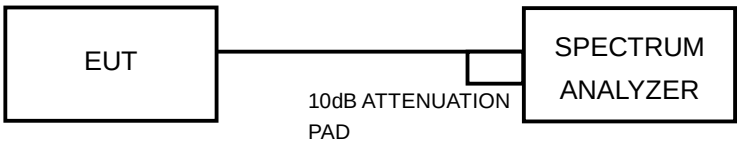
d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.

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

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



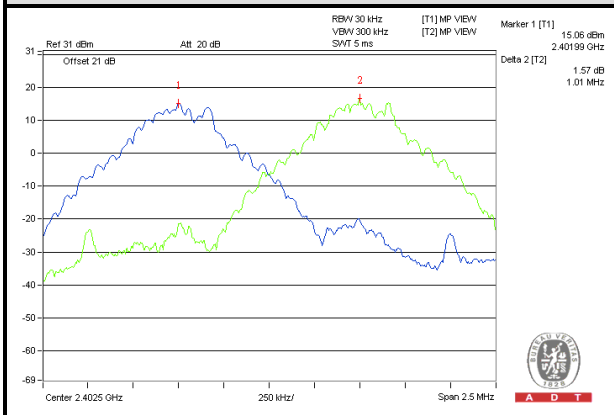
4.6.6 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)		20dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)		PASS / FAIL
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.00	1.01	0.94	1.23	0.63	0.82	PASS
39	2441	1.00	1.01	0.94	1.25	0.63	0.84	PASS
78	2480	1.00	1.01	0.94	1.25	0.63	0.84	PASS

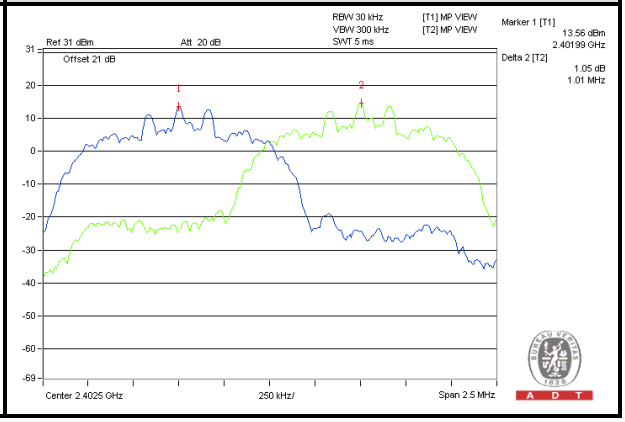
NOTE: The minimum limit is two-third 20dB bandwidth.

SPECTRUM PLOT OF WORST VALUE

GFSK



8DPSK



4.7 MAXIMUM PEAK OUTPUT POWER

4.7.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Limit is 125mW.

4.7.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

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.

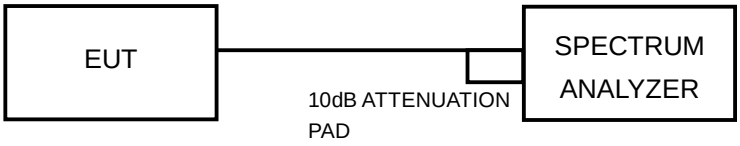
d. Measure the captured power within the band and recording the plot.

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

4.7.4 DEVIATION FROM TEST STANDARD

No deviation

4.7.5 TEST SETUP



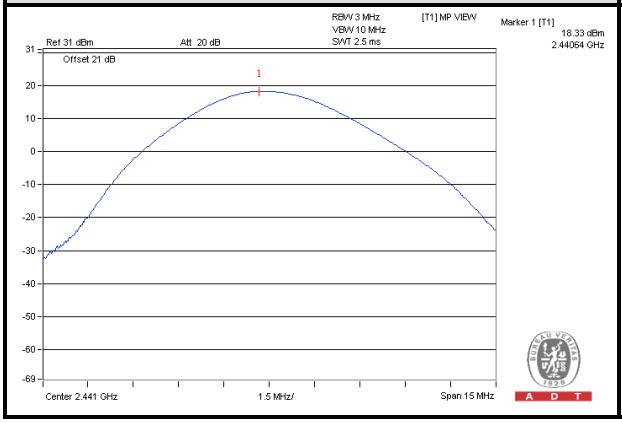
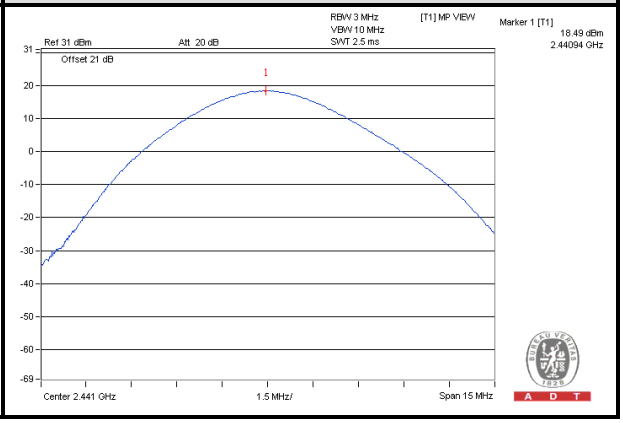
For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

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

CHANNEL	FREQUENCY (MHz)	OUTPUT POWER (mW)		OUTPUT POWER (dBm)		POWER LIMIT (mW)	PASS / FAIL
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	42.855	47.643	16.32	16.78	125	PASS
39	2441	68.077	70.632	18.33	18.49	125	PASS
78	2480	63.096	68.549	18.00	18.36	125	PASS

SPECTRUM PLOT OF WORST VALUE	
GFSK	8DPSK
	

4.8 AVERAGE OUTPUT POWER

4.8.1 FOR REFERENCE.

4.8.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power meter Anritsu	ML2495A	0824006	May 20, 2013	May 19, 2014
Power sensor Anritsu	MA2411B	0738172	May 20, 2013	May 19, 2014

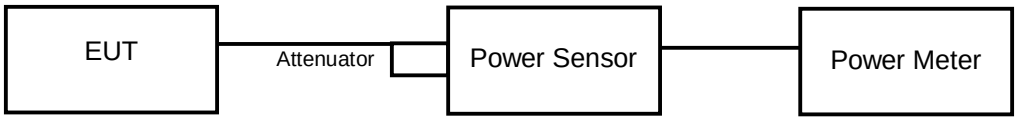
Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Jan. 28, 2014

4.8.3 TEST PROCEDURES

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak / average power sensor. Record the peak power level.

4.8.4 TEST SETUP



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

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER OUTPUT (dBm)	
		GFSK	8DPSK
0	2402	16.17	13.26
39	2441	17.83	14.97
78	2480	17.87	14.92

4.9 CONDUCTED OUT-BAND EMISSION MEASUREMENT

4.8.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

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

4.8.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 21, 2014	Jan. 20, 2015

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. Tested date : Jan. 28, 2014

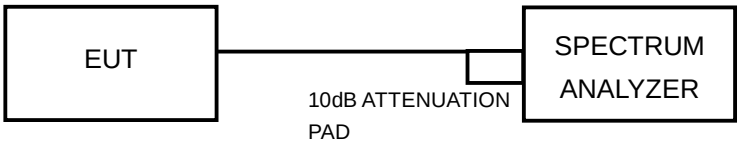
4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set RBW a of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 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 TEST SETUP



4.8.6 EUT OPERATING CONDITION

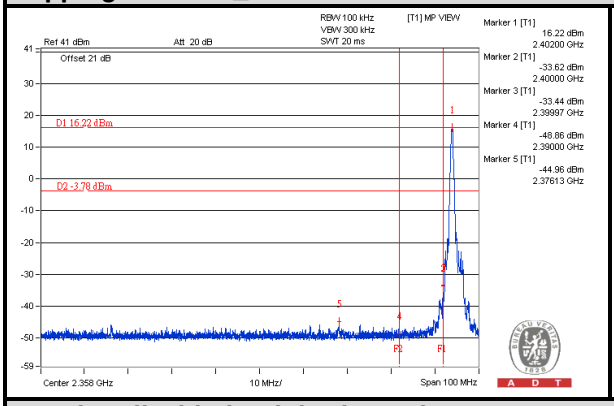
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

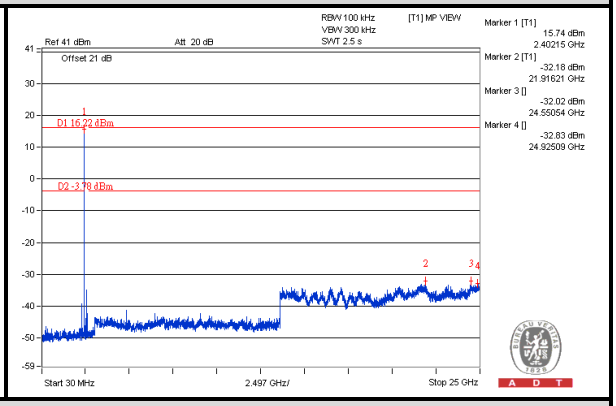
4.8.7 TEST RESULTS

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

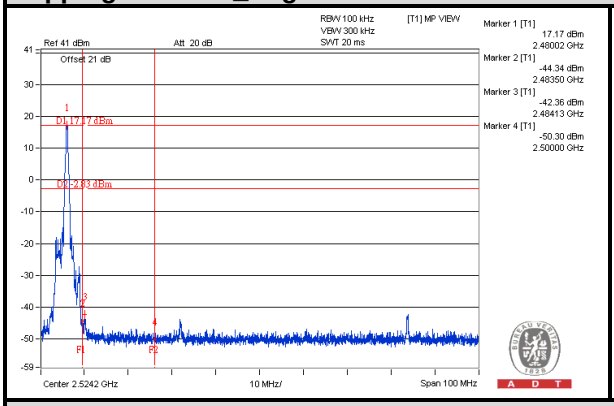
GFSK

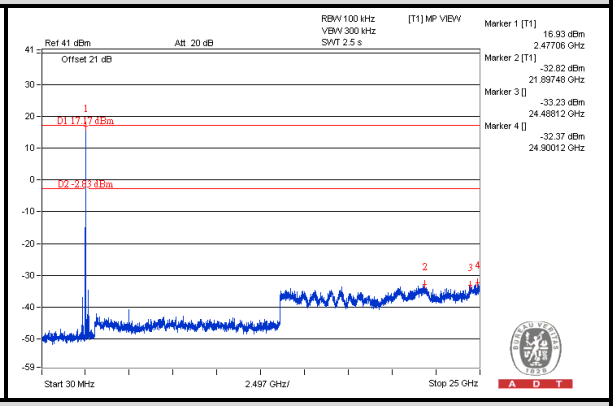
Hopping disabled_ Low Channel



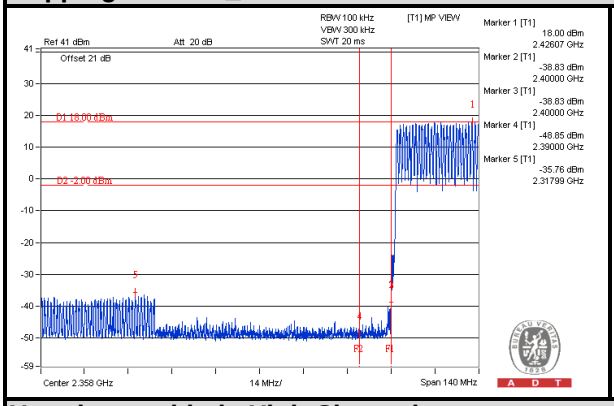


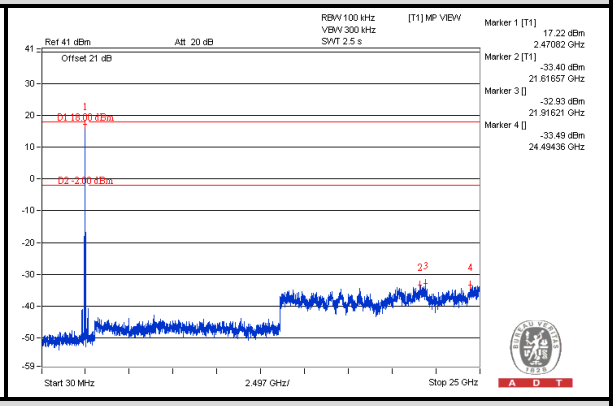
Hopping disabled_ High Channel



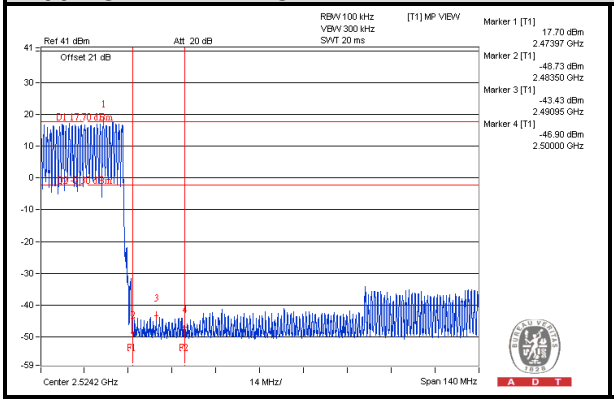


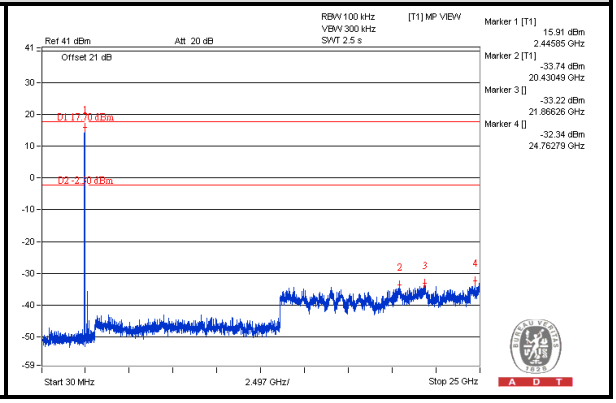
Hopping enabled_ Low Channel





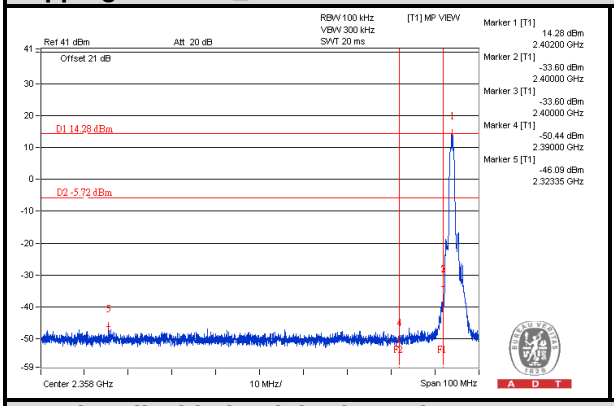
Hopping enabled_ High Channel

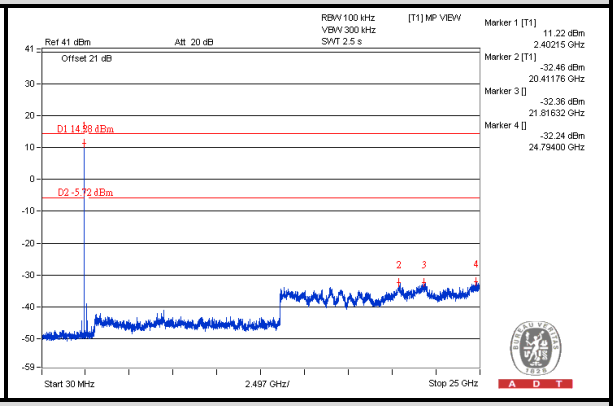




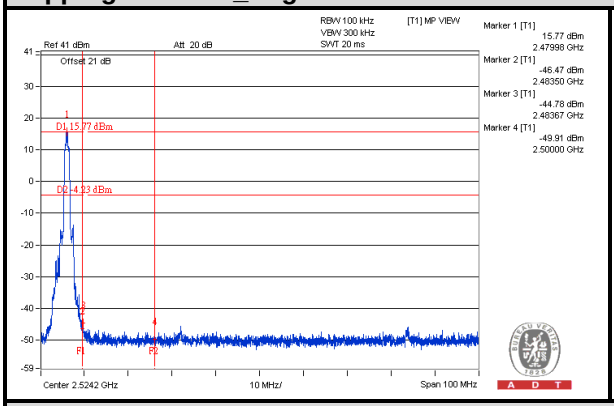
8DPSK

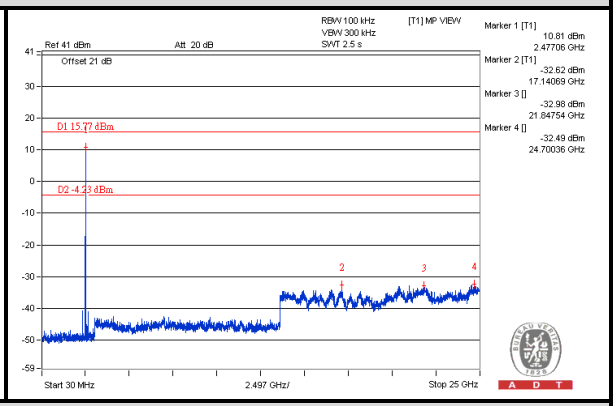
Hopping disabled_ Low Channel



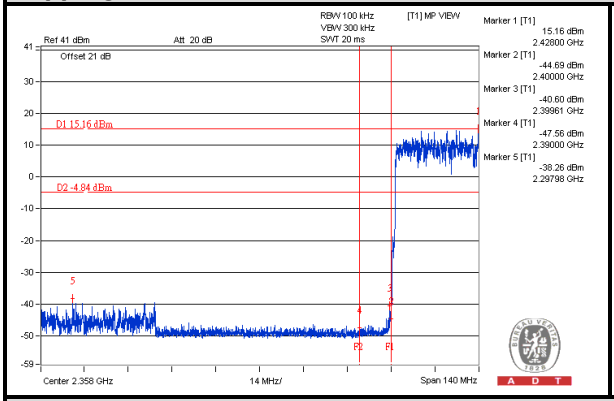


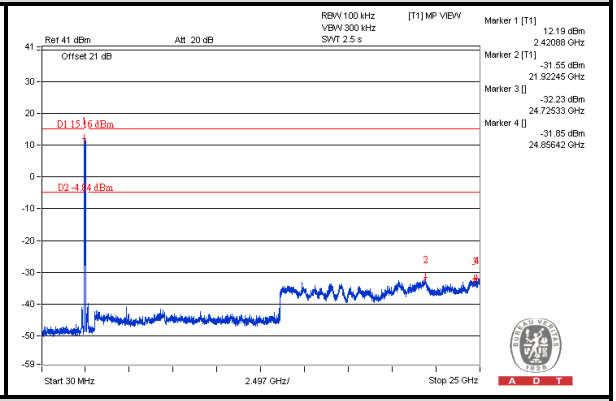
Hopping disabled_ High Channel



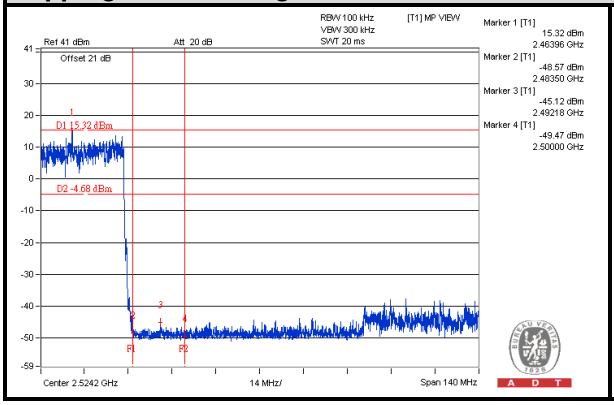


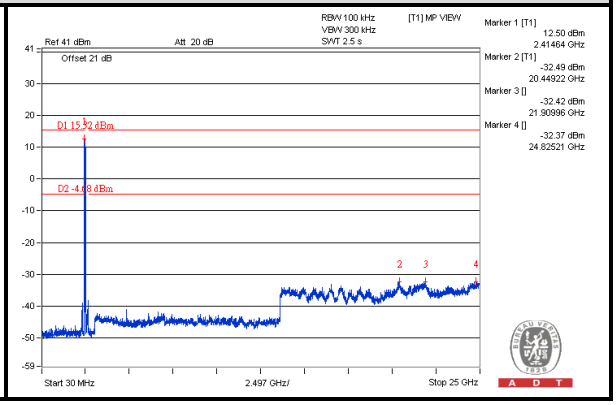
Hopping enabled_ Low Channel





Hopping enabled_ High Channel





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.

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

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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 modifications were made to the EUT by the lab during the test.

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