FCC Test Report

Report No.:	RF160407E10-2
FCC ID:	WBV-AP550
Test Model:	AP550
Received Date:	Apr. 07, 2016
Test Date:	May 28 ~ Jun. 17, 2016
Issued Date:	Jun. 29, 2016
Applicant:	Aerohive Networks Inc.
Address:	1011 McCarthy Blvd, Milpitas, CA 95035, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RF160407E10-2	Original release	Jun. 29, 2016

1 Certificate of Conformity

Product:	Access Point
Brand:	Aerohive
Test Model:	AP550
Sample Status:	Engineering Sample
Applicant:	Aerohive Networks Inc.
Test Date:	May 28 ~ Jun. 17, 2016
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

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

Prepared by : _____ , **Date:** Jun. 29, 2016

Ivy Lin / Specialist

Approved by : _____ , **Date:** Jun. 29, 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 -14.99dB at 24.00109MHz.
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	Pass	Meet the requirement of limit. Minimum passing margin is -3.9dB at 66.41MHz.
15.205 / 15.209 / 15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -22.4dB at 2483.50MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is IPEX not a standard connector.

Note: If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.31 dB
	200MHz ~1000MHz	3.40 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	3.73 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

Product	Access Point
Brand	Aerohive
Test Model	AP550
Sample Status	Engineering Sample
Power Supply Rating	12Vdc from adapter 55Vdc from PoE
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1/2/3Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	79
Output Power	3.443mW
Antenna Type	Refer to Note
Antenna Connector	IPEX
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are three radios for the EUT.

Radio	Function
Radio 1	WLAN 2.4G & 5G
Radio 2	WLAN 5G
Radio 3	BT EDR & BT LE

2. The EUT uses following adapter & PoE. (Support unit only)

Adapter	
Brand	DVE
Model	DSA-36PFH-12FUS
Input Power	100-240Vac, 50/60Hz, 1A
Output Power	12.0Vdc / 3.0A
Power Line	1.5m DC cable without core attached on adapter

PoE	
Brand	PowerDsine
Model	PD-9001GR/AT/AC
Input Power	100-240Vac, 50/60Hz, 0.67A
Output Power	55Vdc / 0.6A

3. The following antennas were provided to the EUT.

Radio	Ant. No.	Chain No.	Antenna Gain(dBi) (Including cable loss)	Frequency range	Antenna Type	Connecter Type	*Cable Loss(dB)	*Cable Length
1	Ant. 1	Chain 0	4.00 5.84 5.92 5.29 5.78	2.4~2.4835GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.39	95
	Ant. 2	Chain 1	3.41 5.88 5.36 5.84 5.72	2.4~2.4835GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.41	100
	Ant. 3	Chain 2	3.77 5.64 5.49 5.31 5.75	2.4~2.4835GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.65	160
	Ant. 4	Chain 3	3.94 5.39 5.91 5.67 5.92	2.4~2.4835GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.83	203
2	Ant. 5	Chain 0	5.11 5.50 5.08 5.40	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.4	98
	Ant. 6	Chain 1	5.55 5.02 5.30 5.94	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.32	78
	Ant. 7	Chain 2	5.62 5.78 5.67 5.64	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.6	148
	Ant. 8	Chain 3	5.23 5.69 5.75 5.73	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	PIFA	i-pex	0.87	213
	Ant. 10	Chain 0	4.70 5.31 5.68 4.74	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	Dipole	i-pex	0.23	57
	Ant. 11	Chain 1	5.15 5.25 4.50 5.20	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	Dipole	i-pex	0.44	107
	Ant. 12	Chain 2	4.53 4.55 4.42 5.21	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	Dipole	i-pex	0.68	167
	Ant. 13	Chain 3	4.87 4.69 4.95 4.41	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz	Dipole	i-pex	0.93	227
3	Ant. 9	Chain 0	5.83	2.4~2.4835GHz	Dipole	i-pex	0.36	148

4. The power setting are listed as below:

	GFSK	8DPSK
CH 0	Default	Default
CH 39	Default	Default
CH 78	Default	Default

5. Spurious emission of the simultaneous operation (Radio 1, 2, & 3) has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

79 channels are provided to this EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	√	√	EUT with PoE mode
B	-	√	√	-	EUT with Adapter mode

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

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

NOTE:

1. The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on Y-plane
2. "-" means no effect.

Radiated Emission Test (Above 1GHz):

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

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

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

Radiated Emission Test (Below 1GHz):

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

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A, B	0 to 78	78	FHSS	GFSK	DH5

Power Line Conducted Emission Test:

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

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A, B	0 to 78	78	FHSS	GFSK	DH5

Antenna Port Conducted Measurement:

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

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

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

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

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	23deg. C, 68%RH	120Vac, 60Hz	Robert Cheng
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Tim Ho
PLC	24deg. C, 61%RH	120Vac, 60Hz	Jyun Chun Lin
APCM	25deg. C, 60%RH	120Vac, 60Hz	Gary Cheng

3.3 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5430	HYV4VY1	FCC DoC Approved	-
B.	iPod	Apple	MC749TA/A	CC4DMFJUDFDM	FCC DoC Approved	-
C.	HUB	ZyXEL	ES-116P	S060H02000215	FCC DoC Approved	-
D.	POE	PowerDsine	PD-9001GR/AT/AC	NA	NA	For test mode A
E.	Adapter	DVE	DSA-36PFH-12FUS	NA	NA	For test mode B

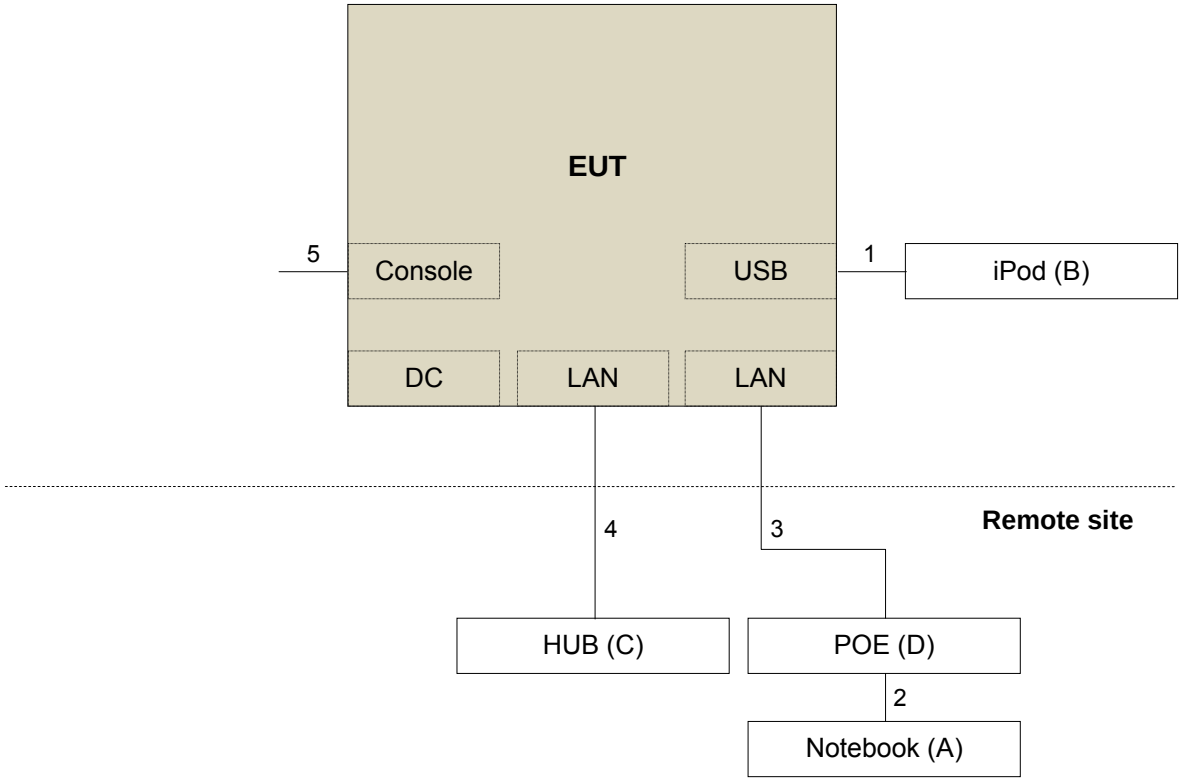
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items A and C acted as communication partners to transfer data.

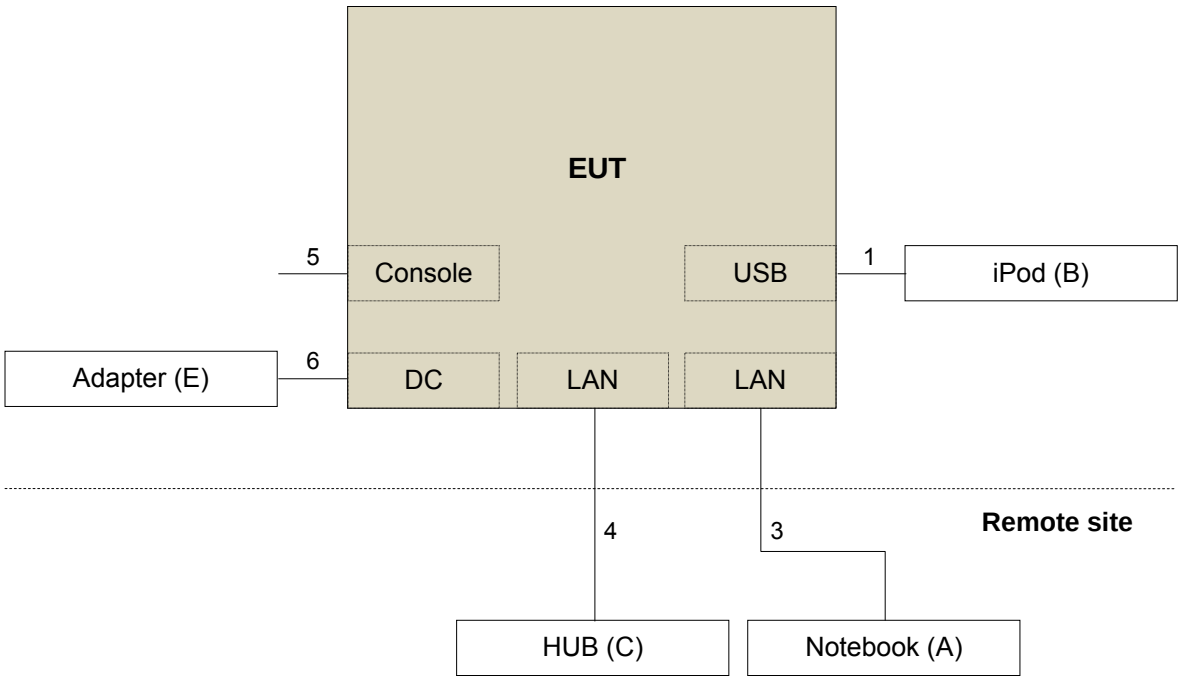
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	0.1	Y	0	-
2.	RJ45 cable	1	3	N	0	Cat5e For test mode A
3.	RJ45 cable	1	10	N	0	Cat5e
4.	RJ45 cable	1	10	N	0	Cat5e
5.	Console cable	1	1.5	N	0	-
6.	DC power cable	1	1.5	N	0	Attached on adapter For test mode B

3.3.1 Configuration of System under Test

Test Mode A



Test Mode B



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 C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Agilent	N9038A	MY50010156	Aug. 12, 2015	Aug. 11, 2016
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 26, 2015	July 25, 2016
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated_V8.7.07	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 966 Chamber No. 3.
3. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Tested Date: May 28 ~ Jun. 02, 2016

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer R&S	FSP40	100060	May 11, 2016	May 10, 2017
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 22, 2015	Dec. 21, 2016
Power meter Anritsu	ML2495A	1014008	May 5, 2016	May 4, 2017
Power sensor Anritsu	MA2411B	0917122	May 5, 2016	May 4, 2017
AC Power Source Extech Electronics	6205	1440452	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 15, 2016	Jan. 14, 2017
DC Power Supply Topward	6603D	795558	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016
Mech Switch Absorptive Mini-Circuits	MSP4TA-18+	0140	Mar. 19, 2016	Mar. 18, 2017
FXD ATTEN Mini-Circuits	BW-S3W2+	MN71981	Mar. 19, 2016	Mar. 18, 2017
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA

Note:
1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Jun. 16, 2016

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:

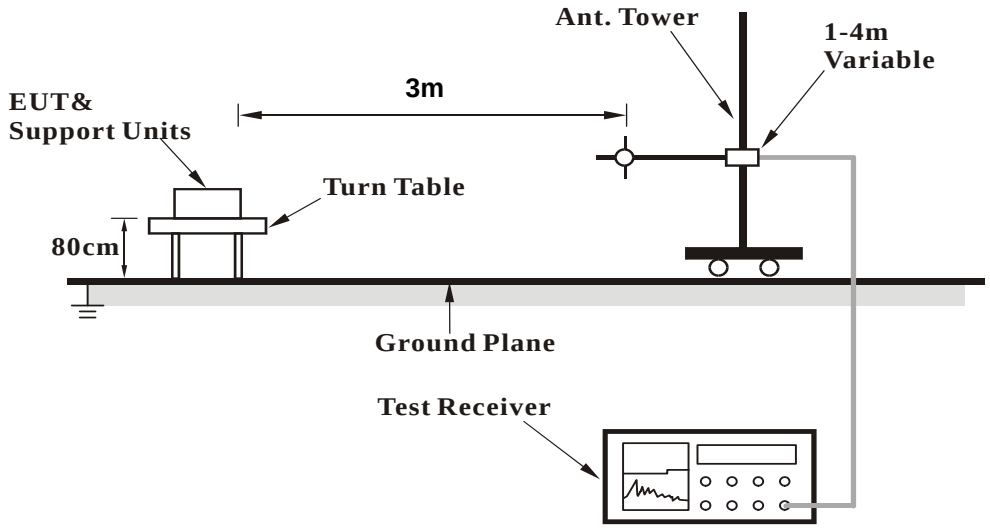
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

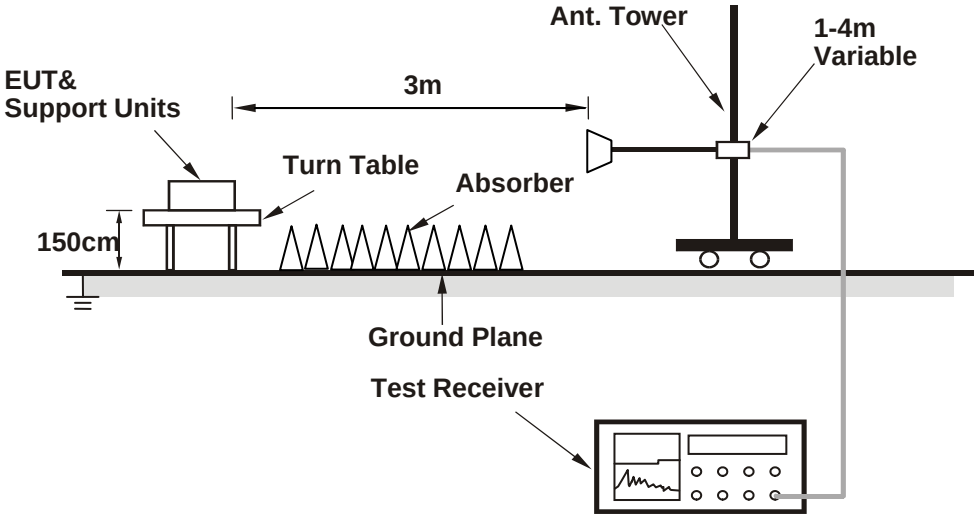
No deviation.

4.1.5 Test Set Up

<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

a. Placed the EUT on the testing table.
b. Prepared notebook to act as communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (MTool_REL_2_0_3_2) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz Worst-case Data:

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	50.0 PK	74.0	-24.0	1.00 H	186	54.20	-4.20
2	2390.00	19.9 AV	54.0	-34.1	1.00 H	186	24.10	-4.20
3	*2402.00	101.9 PK			1.00 H	186	106.00	-4.10
4	*2402.00	71.8 AV			1.00 H	186	75.90	-4.10
5	4804.00	41.0 PK	74.0	-33.0	2.91 H	142	38.70	2.30
6	4804.00	10.9 AV	54.0	-43.1	2.91 H	142	8.60	2.30
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	47.6 PK	74.0	-26.4	2.72 V	148	51.80	-4.20
2	2390.00	17.5 AV	54.0	-36.5	2.72 V	148	21.70	-4.20
3	*2402.00	94.0 PK			2.72 V	148	98.10	-4.10
4	*2402.00	63.9 AV			2.72 V	148	68.00	-4.10
5	4804.00	41.3 PK	74.0	-32.7	1.50 V	240	39.00	2.30
6	4804.00	11.2 AV	54.0	-42.8	1.50 V	240	8.90	2.30

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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	102.4 PK			1.00 H	182	106.40	-4.00
2	*2441.00	72.3 AV			1.00 H	182	76.30	-4.00
3	4882.00	40.8 PK	74.0	-33.2	2.86 H	144	38.30	2.50
4	4882.00	10.7 AV	54.0	-43.3	2.86 H	144	8.20	2.50
5	7323.00	45.6 PK	74.0	-28.4	1.43 H	233	36.60	9.00
6	7323.00	15.5 AV	54.0	-38.5	1.43 H	233	6.50	9.00
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	*2441.00	94.1 PK			2.76 V	134	98.10	-4.00
2	*2441.00	64.0 AV			2.76 V	134	68.00	-4.00
3	4882.00	41.2 PK	74.0	-32.8	1.47 V	226	38.70	2.50
4	4882.00	11.1 AV	54.0	-42.9	1.47 V	226	8.60	2.50
5	7323.00	45.9 PK	74.0	-28.1	2.91 V	136	36.90	9.00
6	7323.00	15.8 AV	54.0	-38.2	2.91 V	136	6.80	9.00

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	*2480.00	102.0 PK			3.22 H	186	106.00	-4.00
2	*2480.00	71.9 AV			3.22 H	186	75.90	-4.00
3	2483.50	51.6 PK	74.0	-22.4	3.22 H	186	55.60	-4.00
4	2483.50	21.5 AV	54.0	-32.5	3.22 H	186	25.50	-4.00
5	4960.00	41.0 PK	74.0	-33.0	2.89 H	135	38.50	2.50
6	4960.00	10.9 AV	54.0	-43.1	2.89 H	135	8.40	2.50
7	7440.00	46.0 PK	74.0	-28.0	1.49 H	220	36.50	9.50
8	7440.00	15.9 AV	54.0	-38.1	1.49 H	220	6.40	9.50
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	94.7 PK			2.73 V	156	98.70	-4.00
2	*2480.00	64.6 AV			2.73 V	156	68.60	-4.00
3	2483.50	48.1 PK	74.0	-25.9	2.73 V	156	52.10	-4.00
4	2483.50	18.0 AV	54.0	-36.0	2.73 V	156	22.00	-4.00
5	4960.00	41.4 PK	74.0	-32.6	1.53 V	238	38.90	2.50
6	4960.00	11.3 AV	54.0	-42.7	1.53 V	238	8.80	2.50
7	7440.00	46.1 PK	74.0	-27.9	2.93 V	134	36.60	9.50
8	7440.00	16.0 AV	54.0	-38.0	2.93 V	134	6.50	9.50

Remarks:

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

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	47.5 PK	74.0	-26.5	1.14 H	176	51.70	-4.20
2	2390.00	17.4 AV	54.0	-36.6	1.14 H	176	21.60	-4.20
3	*2402.00	101.9 PK			1.14 H	176	106.00	-4.10
4	*2402.00	71.8 AV			1.14 H	176	75.90	-4.10
5	4804.00	40.8 PK	74.0	-33.2	2.85 H	157	38.50	2.30
6	4804.00	10.7 AV	54.0	-43.3	2.85 H	157	8.40	2.30
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	48.1 PK	74.0	-25.9	2.70 V	147	52.30	-4.20
2	2390.00	18.0 AV	54.0	-36.0	2.70 V	147	22.20	-4.20
3	*2402.00	93.8 PK			2.70 V	147	97.90	-4.10
4	*2402.00	63.7 AV			2.70 V	147	67.80	-4.10
5	4804.00	41.2 PK	74.0	-32.8	1.45 V	240	38.90	2.30
6	4804.00	11.1 AV	54.0	-42.9	1.45 V	240	8.80	2.30

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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	101.8 PK			1.31 H	188	105.80	-4.00
2	*2441.00	71.7 AV			1.31 H	188	75.70	-4.00
3	4882.00	41.2 PK	74.0	-32.8	2.88 H	146	38.70	2.50
4	4882.00	11.1 AV	54.0	-42.9	2.88 H	146	8.60	2.50
5	7323.00	46.0 PK	74.0	-28.0	1.42 H	220	37.00	9.00
6	7323.00	15.9 AV	54.0	-38.1	1.42 H	220	6.90	9.00
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	*2441.00	94.6 PK			2.71 V	147	98.60	-4.00
2	*2441.00	64.5 AV			2.71 V	147	68.50	-4.00
3	4882.00	40.9 PK	74.0	-33.1	1.46 V	216	38.40	2.50
4	4882.00	10.8 AV	54.0	-43.2	1.46 V	216	8.30	2.50
5	7323.00	45.5 PK	74.0	-28.5	2.88 V	134	36.50	9.00
6	7323.00	15.4 AV	54.0	-38.6	2.88 V	134	6.40	9.00

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	*2480.00	101.5 PK			3.18 H	177	105.50	-4.00
2	*2480.00	71.4 AV			3.18 H	177	75.40	-4.00
3	2483.50	50.2 PK	74.0	-23.8	3.18 H	177	54.20	-4.00
4	2483.50	20.1 AV	54.0	-33.9	3.18 H	177	24.10	-4.00
5	4960.00	40.7 PK	74.0	-33.3	2.86 H	135	38.20	2.50
6	4960.00	10.6 AV	54.0	-43.4	2.86 H	135	8.10	2.50
7	7440.00	46.1 PK	74.0	-27.9	1.41 H	221	36.60	9.50
8	7440.00	16.0 AV	54.0	-38.0	1.41 H	221	6.50	9.50
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	93.9 PK			2.77 V	158	97.90	-4.00
2	*2480.00	63.8 AV			2.77 V	158	67.80	-4.00
3	2483.50	47.3 PK	74.0	-26.7	2.77 V	158	51.30	-4.00
4	2483.50	17.2 AV	54.0	-36.8	2.77 V	158	21.20	-4.00
5	4960.00	41.2 PK	74.0	-32.8	1.49 V	231	38.70	2.50
6	4960.00	11.1 AV	54.0	-42.9	1.49 V	231	8.60	2.50
7	7440.00	45.3 PK	74.0	-28.7	2.89 V	152	35.80	9.50
8	7440.00	15.2 AV	54.0	-38.8	2.89 V	152	5.70	9.50

Remarks:

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

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Below 1GHz worst-case data:

GFSK

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		
TEST MODE	A		

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	98.06	31.2 QP	43.5	-12.3	2.00 H	251	44.40	-13.20
2	209.78	34.2 QP	43.5	-9.3	1.50 H	251	45.60	-11.40
3	269.42	30.7 QP	46.0	-15.3	1.00 H	113	39.10	-8.40
4	343.84	30.6 QP	46.0	-15.4	1.00 H	319	37.10	-6.50
5	400.11	33.0 QP	46.0	-13.0	1.00 H	217	38.00	-5.00
6	800.02	33.7 QP	46.0	-12.3	1.00 H	116	30.60	3.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	37.91	35.7 QP	40.0	-4.3	1.00 V	347	45.00	-9.30
2	72.14	35.2 QP	40.0	-4.8	1.00 V	151	46.20	-11.00
3	157.07	35.2 QP	43.5	-8.3	1.00 V	117	43.50	-8.30
4	302.81	34.6 QP	46.0	-11.4	1.00 V	327	41.90	-7.30
5	400.12	32.2 QP	46.0	-13.8	1.00 V	171	37.20	-5.00
6	644.26	30.1 QP	46.0	-15.9	2.00 V	212	29.40	0.70

Remarks:

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

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		
TEST MODE	B		

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	147.25	33.4 QP	43.5	-10.1	2.00 H	202	41.84	-8.48
2	180.58	37.1 QP	43.5	-6.4	1.50 H	265	46.69	-9.58
3	274.82	35.1 QP	46.0	-10.9	1.00 H	218	43.31	-8.17
4	399.96	36.4 QP	46.0	-9.6	1.00 H	214	41.43	-5.01
5	799.91	36.5 QP	46.0	-9.5	1.00 H	266	33.47	3.07
6	899.95	34.6 QP	46.0	-11.4	1.50 H	318	30.30	4.27
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	**66.41**	**36.1 QP**	**40.0**	**-3.9**	**1.00 V**	**332**	**45.93**	**-9.82**
2	149.32	36.2 QP	43.5	-7.3	1.50 V	240	44.57	-8.39
3	180.97	35.8 QP	43.5	-7.7	1.00 V	249	45.44	-9.64
4	275.11	34.5 QP	46.0	-11.5	1.00 V	306	42.64	-8.17
5	399.84	36.0 QP	46.0	-10.0	1.00 V	328	40.99	-5.01
6	900.15	34.8 QP	46.0	-11.3	1.00 V	327	30.48	4.27

Remarks:

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

4.2 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.	Cal. Date	Cal. Due
Test Receiver R&S	ESCS 30	847124/029	Oct. 23, 2015	Oct. 22, 2016
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 28, 2015	Oct. 27, 2016
RF Cable	5D-FB	COACAB-002	Mar. 04, 2016	Mar. 03, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	Jun. 20, 2015	Jun. 19, 2016
Software BVADT	BVADT_Cond_ V7.3.7.3	NA	NA	NA

Note:
1. The test was performed in Shielded Room No. 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Jun. 17, 2016

4.2.3 Test Procedures

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

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

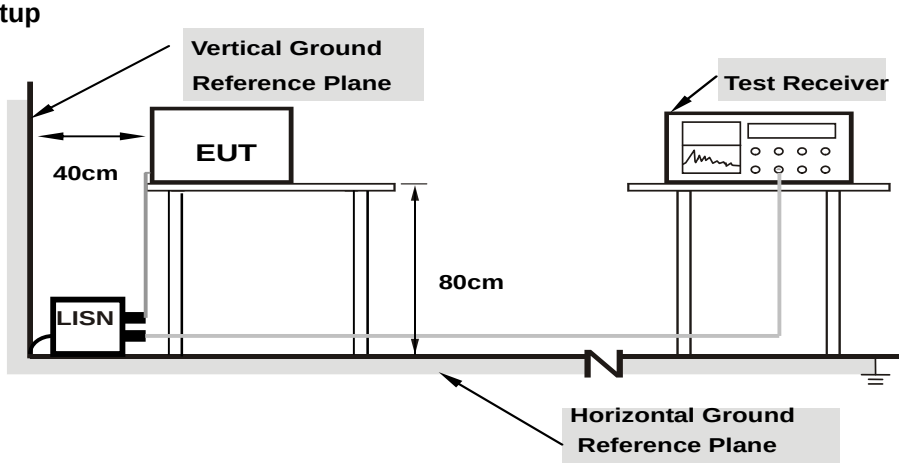
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

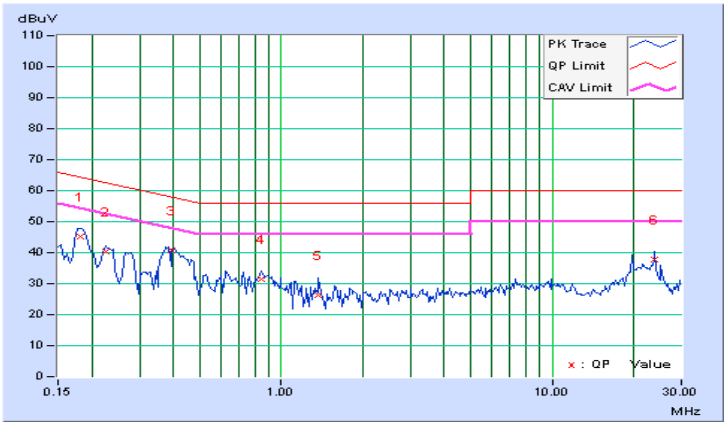
4.2.7 Test Results

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

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	0.18125	10.22	35.00	26.60	45.22	36.82	64.43	54.43	-19.21	-17.61
2	0.22422	10.22	30.01	23.23	40.23	33.45	62.66	52.66	-22.43	-19.21
3	0.39194	10.22	30.45	22.77	40.67	32.99	58.02	48.02	-17.35	-15.03
4	0.84531	10.25	21.31	13.26	31.56	23.51	56.00	46.00	-24.44	-22.49
5	1.37500	10.28	15.89	6.57	26.17	16.85	56.00	46.00	-29.83	-29.15
6	**24.00109**	**11.43**	**26.42**	**23.58**	**37.85**	**35.01**	**60.00**	**50.00**	**-22.15**	**-14.99**

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.

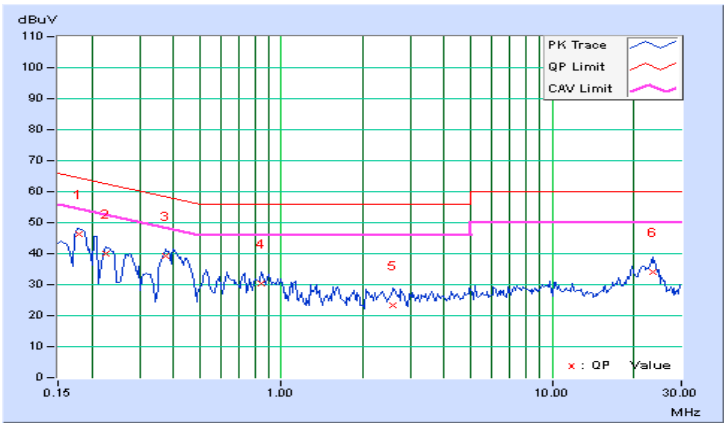


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17934	10.20	35.93	26.48	46.13	36.68	64.52	54.52	-18.38	-17.83
2	0.22666	10.21	29.83	21.78	40.04	31.99	62.57	52.57	-22.53	-20.58
3	0.37656	10.20	28.96	19.04	39.16	29.24	58.35	48.35	-19.19	-19.11
4	0.84531	10.23	20.19	10.21	30.42	20.44	56.00	46.00	-25.58	-25.56
5	2.58984	10.28	12.92	4.52	23.20	14.80	56.00	46.00	-32.80	-31.20
6	23.60156	11.13	23.12	17.40	34.25	28.53	60.00	50.00	-25.75	-21.47

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.

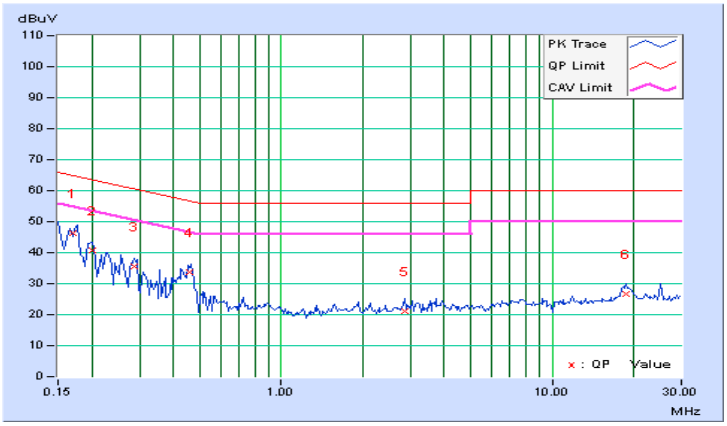


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17034	10.21	36.21	24.20	46.42	34.41	64.94	54.94	-18.52	-20.53
2	0.20078	10.22	30.68	20.58	40.90	30.80	63.58	53.58	-22.68	-22.78
3	0.28672	10.22	25.35	14.82	35.57	25.04	60.62	50.62	-25.05	-25.58
4	0.45637	10.22	23.58	17.98	33.80	28.20	56.76	46.76	-22.95	-18.55
5	2.87109	10.30	10.68	5.75	20.98	16.05	56.00	46.00	-35.02	-29.95
6	18.80469	11.28	15.54	8.66	26.82	19.94	60.00	50.00	-33.18	-30.06

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.

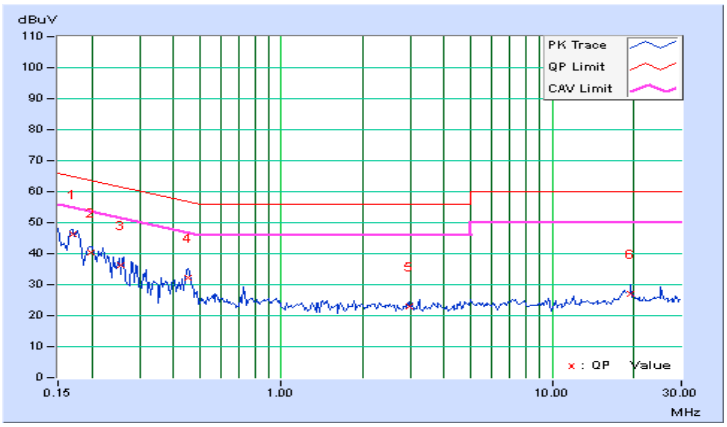


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

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	0.16953	10.20	36.11	23.92	46.31	34.12	64.98	54.98	-18.68	-20.87
2	0.19956	10.21	30.33	19.54	40.54	29.75	63.63	53.63	-23.09	-23.88
3	0.25716	10.21	26.08	14.43	36.29	24.64	61.52	51.52	-25.24	-26.89
4	0.45469	10.20	21.93	14.86	32.13	25.06	56.79	46.79	-24.66	-21.73
5	2.98047	10.27	12.77	5.26	23.04	15.53	56.00	46.00	-32.96	-30.47
6	19.47266	11.10	15.93	8.44	27.03	19.54	60.00	50.00	-32.97	-30.46

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.

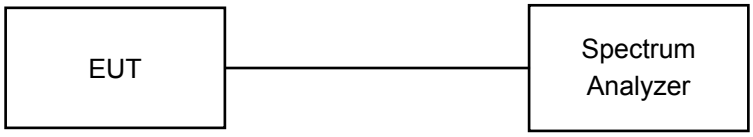


4.3 Number of Hopping Frequency Used

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.

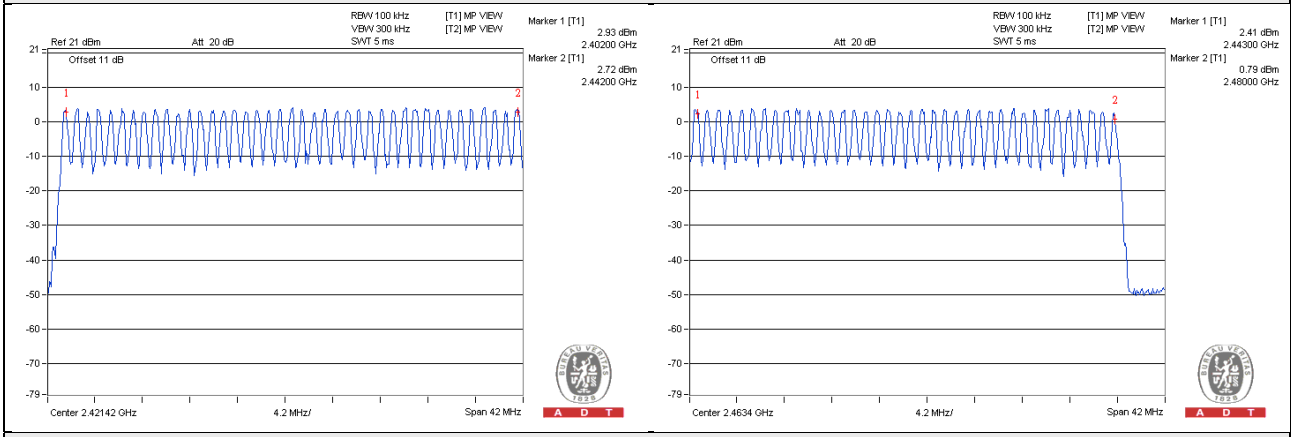
4.3.5 Deviation from Test Standard

No deviation.

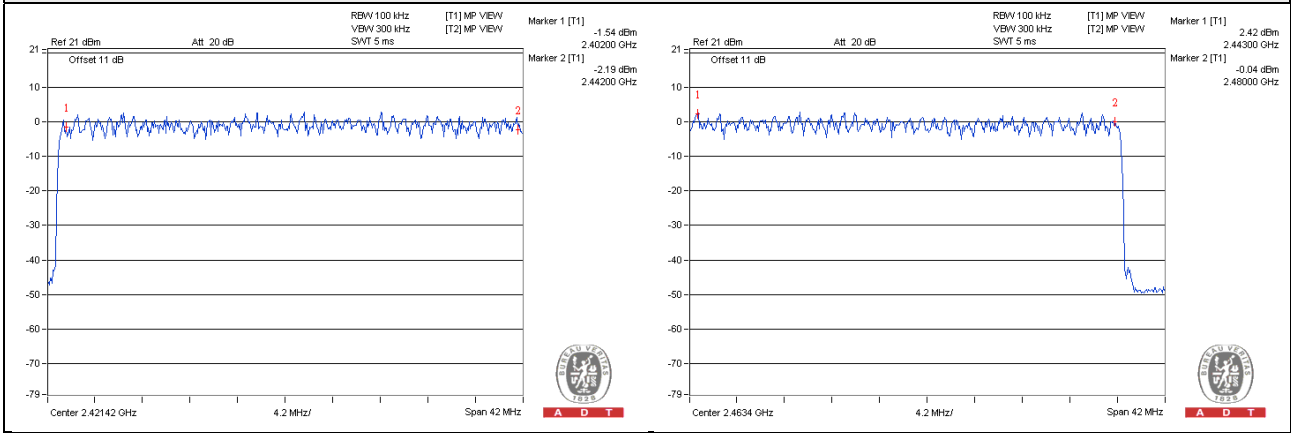
4.3.6 Test Results

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

GFSK



8DPSK

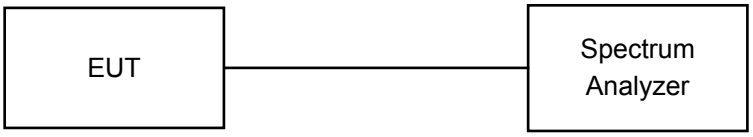


4.4 Dwell Time on Each Channel

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.

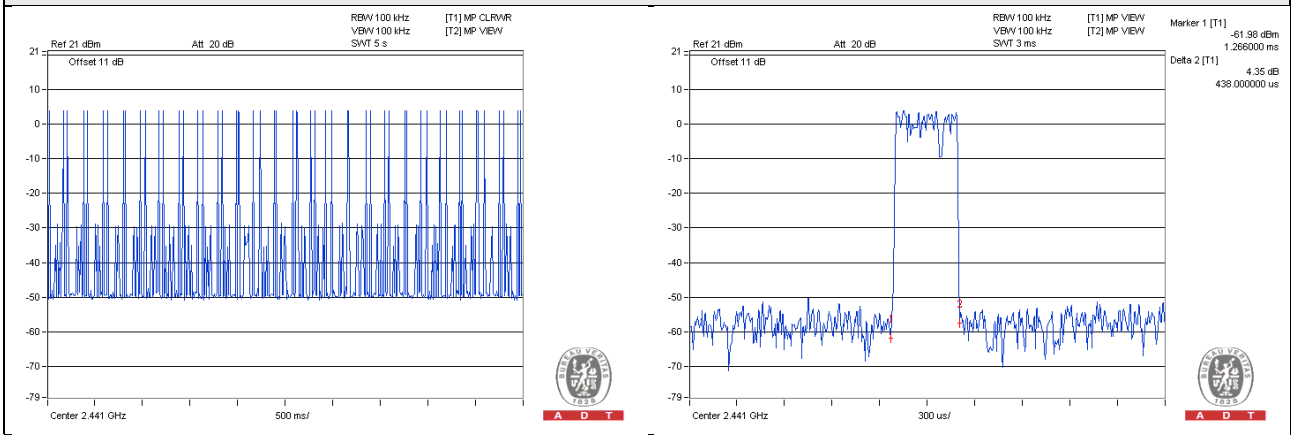
4.4.6 Test Results

GFSK

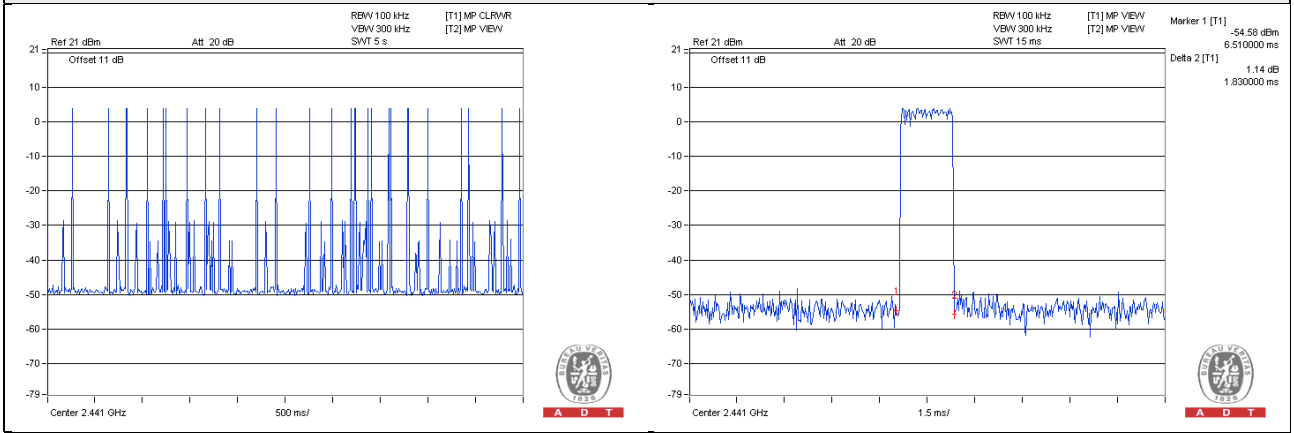
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316.00 times	0.438	138.41	400
DH3	25 (times / 5 sec) * 6.32 = 158.00 times	1.830	289.14	400
DH5	17 (times / 5 sec) * 6.32 = 107.44 times	3.056	328.34	400

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

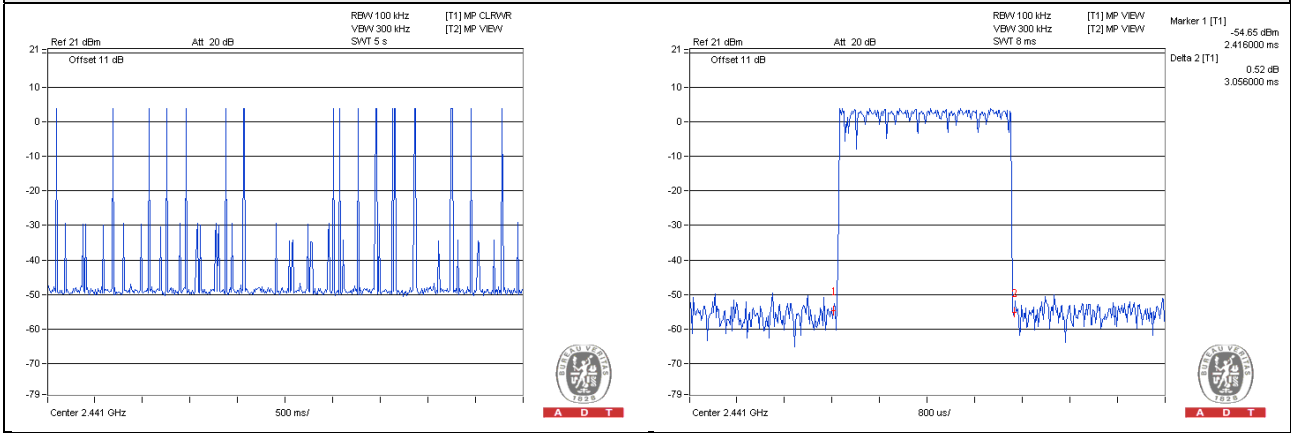
DH1



DH3



DH5

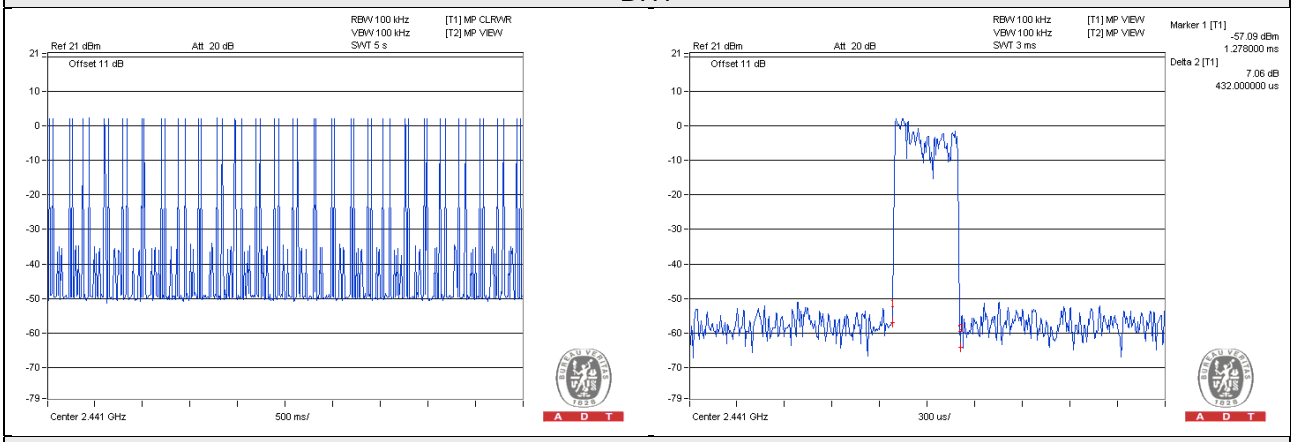


8DPSK

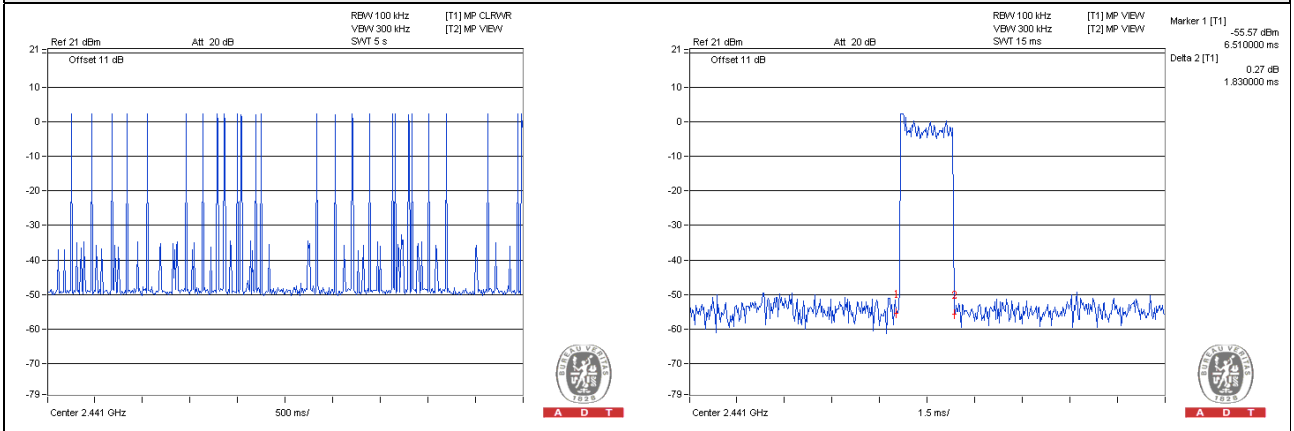
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	52 (times / 5 sec) * 6.32 = 328.64 times	0.432	141.97	400
DH3	26 (times / 5 sec) * 6.32 = 164.32 times	1.830	300.71	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	3.056	347.65	400

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

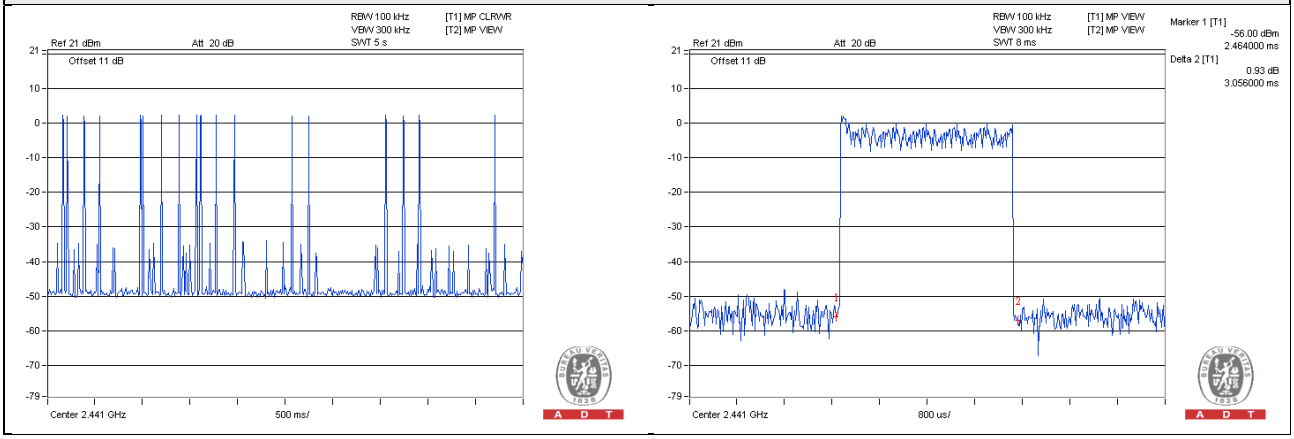
DH1



DH3



DH5

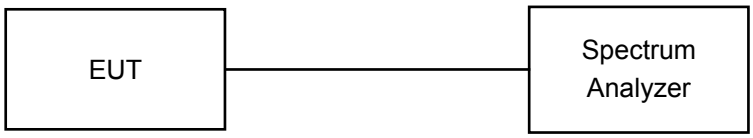


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

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

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

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

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

4.5.5 Deviation from Test Standard

No deviation.

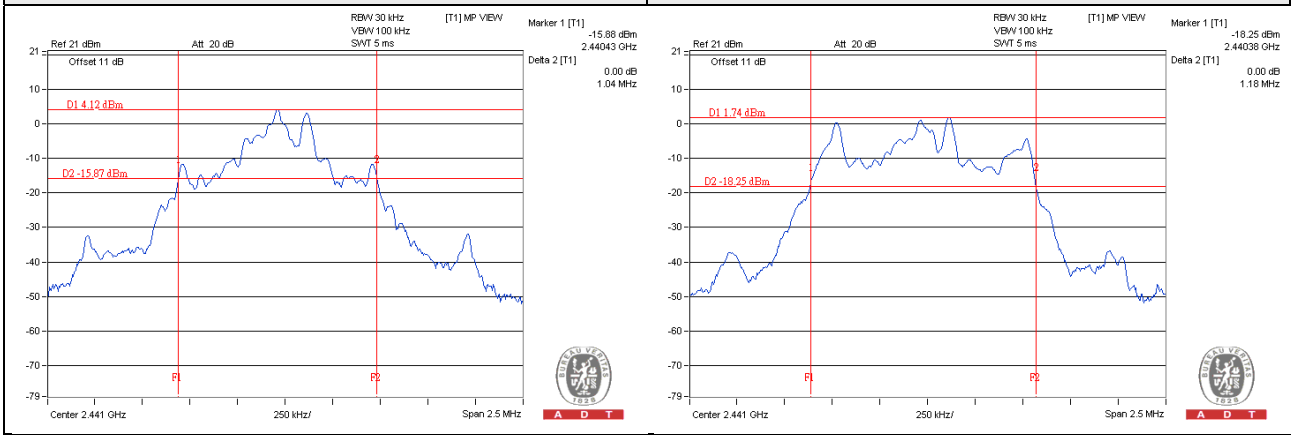
4.5.6 EUT Operating Condition

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

4.5.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	1.04	1.18
39	2441	1.04	1.18
78	2480	1.04	1.18

SPECTRUM PLOT OF WORST VALUE	
GFSK	8DPSK

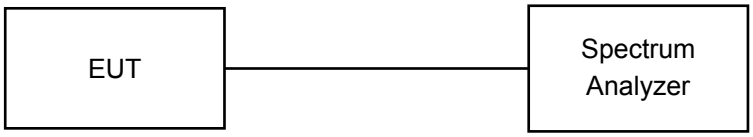


4.6 Hopping Channel Separation

4.6.1 Limits of Hopping Channel Separation Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

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

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.

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

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

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

4.6.5 Deviation from Test Standard

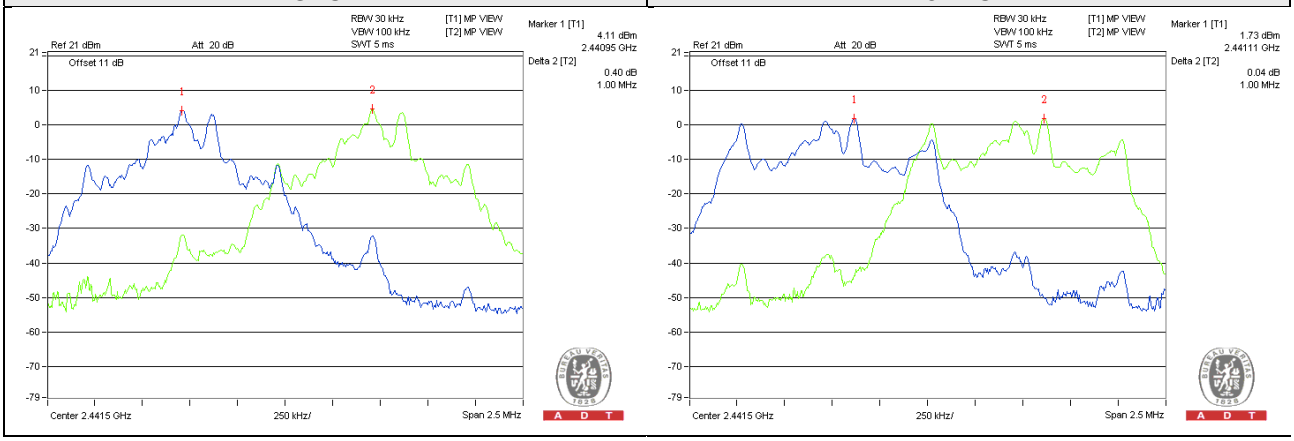
No deviation.

4.6.6 Test Results

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.00	1.00	1.04	1.18	0.70	0.79	Pass
39	2441	1.00	1.00	1.04	1.18	0.70	0.79	Pass
78	2480	1.00	1.00	1.04	1.18	0.70	0.79	Pass

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

Spectrum Plot of Worst Value	
GFSK	8DPSK

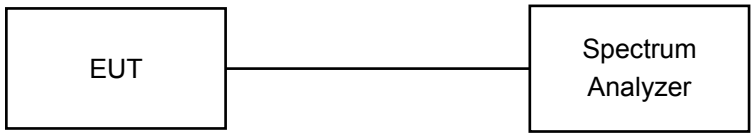


4.7 Maximum Output Power

4.7.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

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

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

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

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

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

4.7.5 Deviation from Test Standard

No deviation.

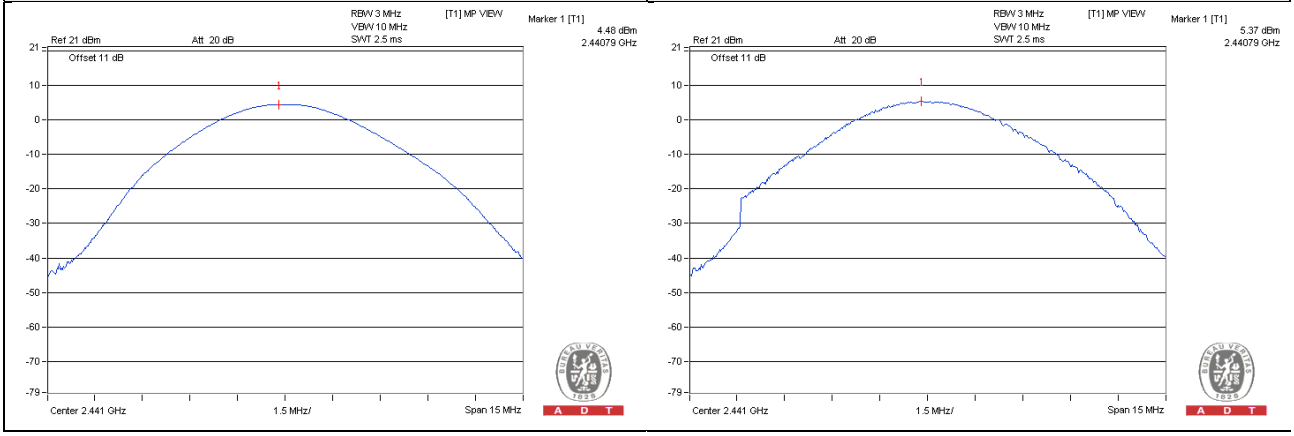
4.7.6 EUT Operating Condition

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

4.7.7 Test Results

Channel	Frequency (MHz)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	2.786	3.162	4.45	5.00	125	Pass
39	2441	2.805	**3.443**	4.48	5.37	125	Pass
78	2480	2.767	3.119	4.42	4.94	125	Pass

Spectrum Plot of Worst Value	
GFSK	8DPSK



4.8 Conducted Out of Band Emission Measurement

4.8.1 Limits Of Conducted Out Of Band Emission Measurement

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

4.8.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.8.3 Test Procedure

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

4.8.4 Deviation from Test Standard

No deviation.

4.8.5 EUT Operating Condition

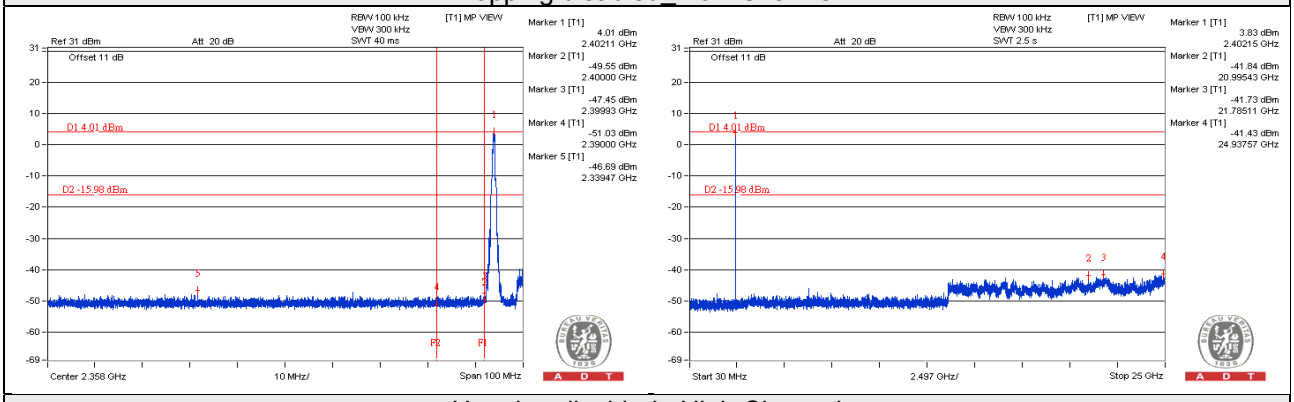
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 Test Results

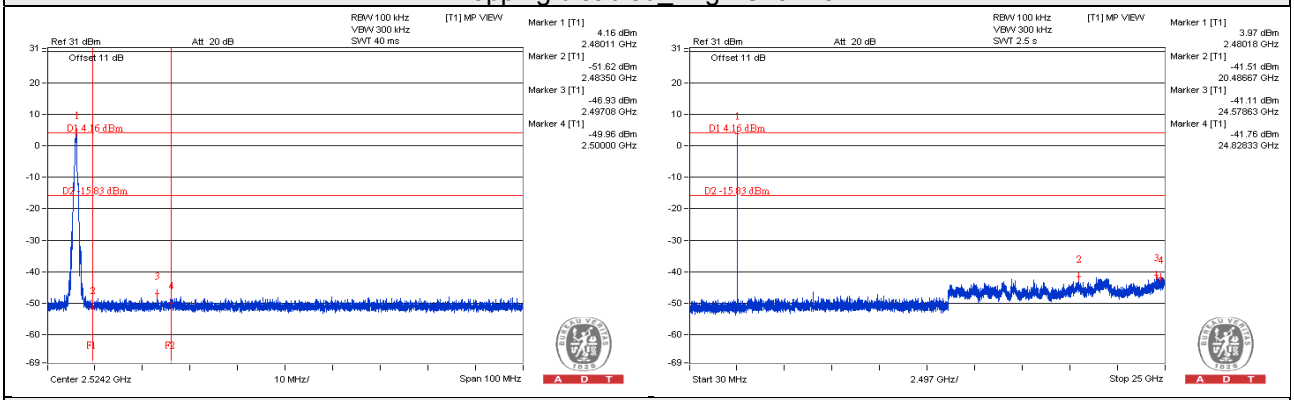
The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

GFSK

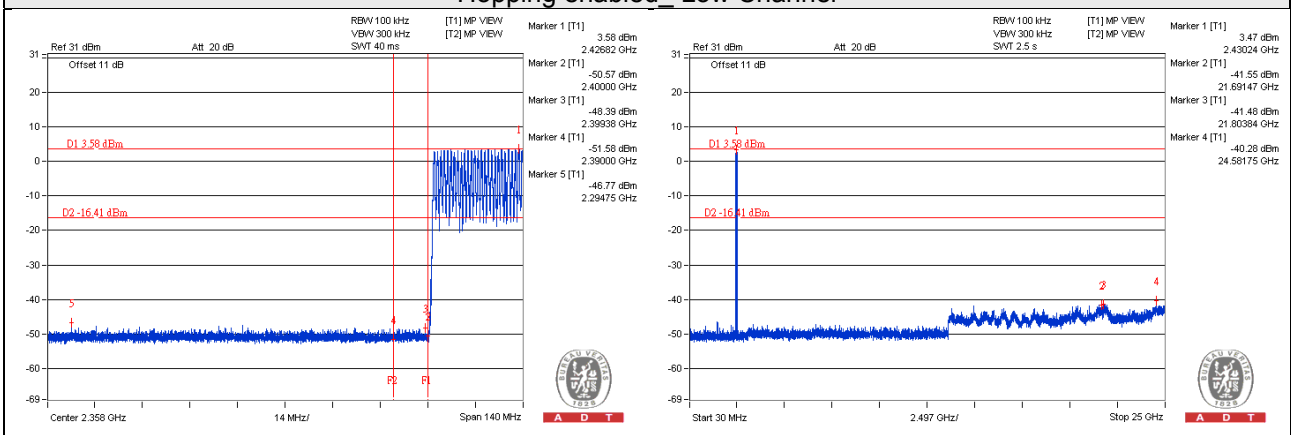
Hopping disabled_ Low Channel



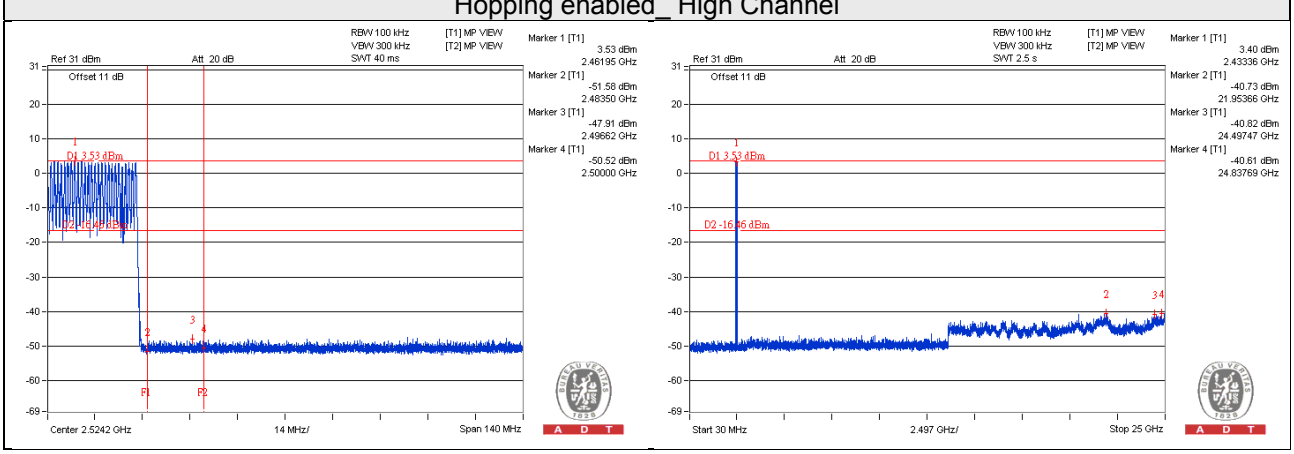
Hopping disabled_ High Channel



Hopping enabled_ Low Channel

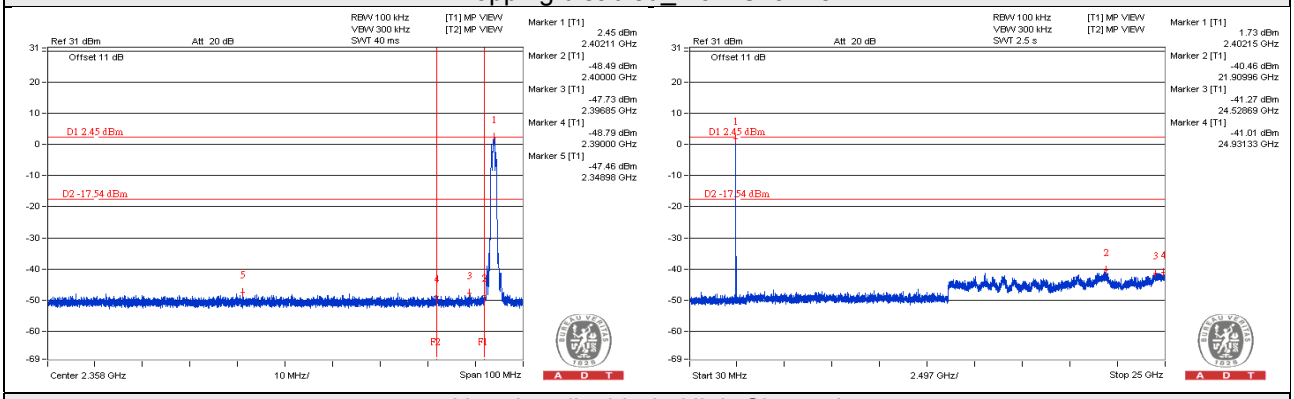


Hopping enabled_ High Channel

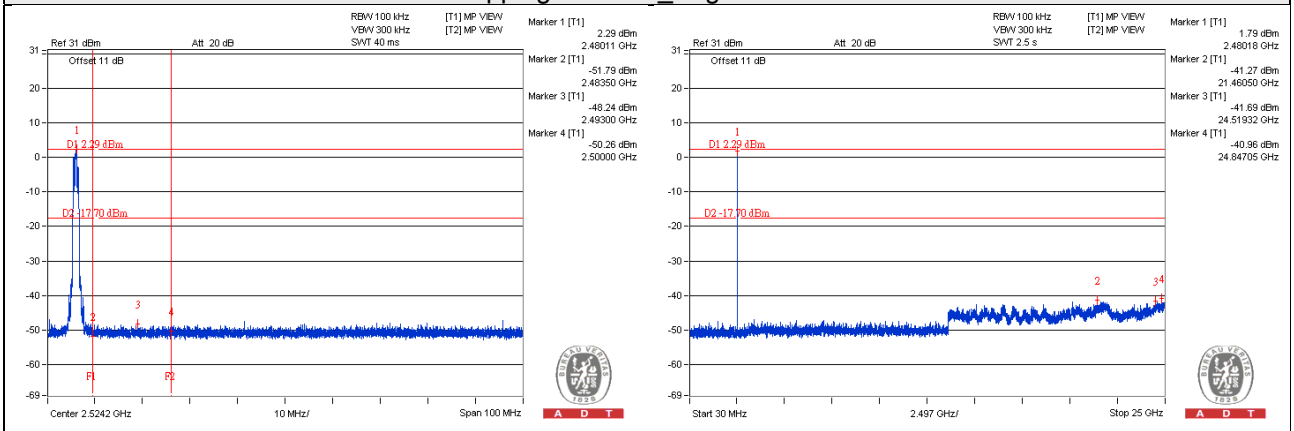


8DPSK

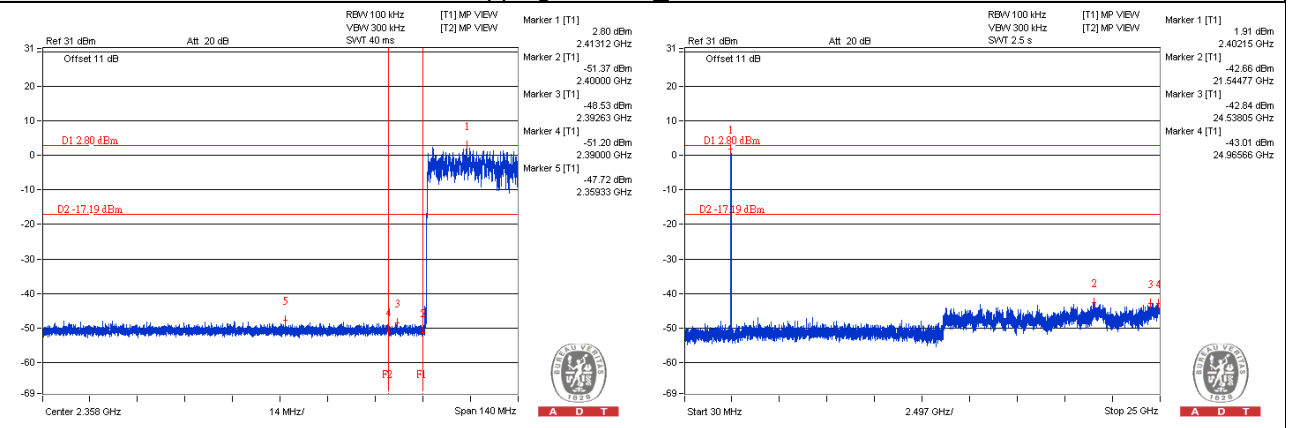
Hopping disabled_ Low Channel



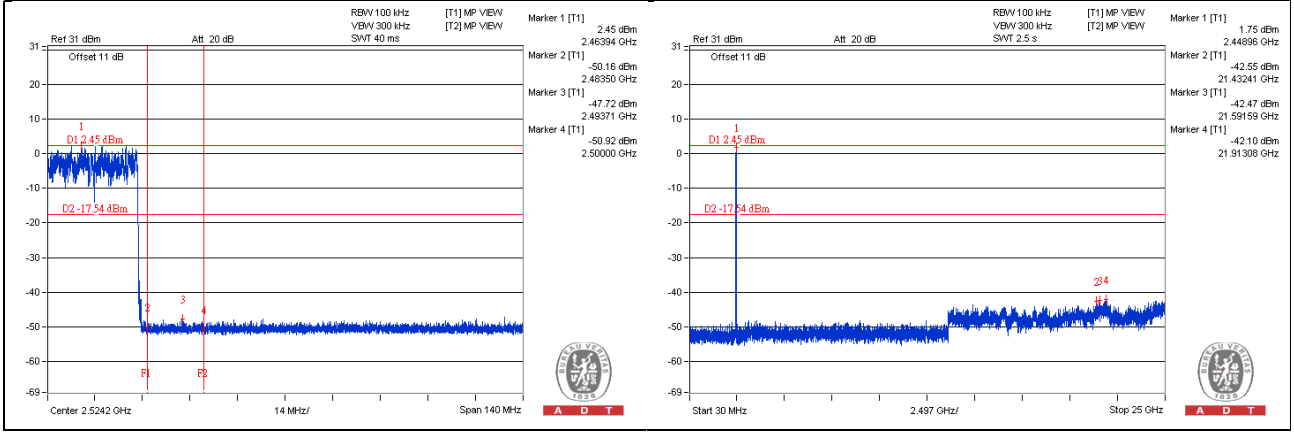
Hopping disabled_ High Channel



Hopping enabled_ Low Channel



Hopping enabled_ High Channel



5 Pictures of Test Arrangements

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

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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