

FCC Test Report (BT-EDR)

Report No.: RF150423E12

FCC ID: UZ7RFD8500

Test Model: RFD8500

Received Date: Apr. 23, 2015

Test Date: June 16 to 18, 2015

Issued Date: July 20, 2015

Applicant: Zebra Technologies Corporation

Address: 1 Zebra Plaza, Holtsville, NY 11742

Manufacturer: Zebra Technologies Corporation

Address: 1 Zebra Plaza, Holtsville, NY 11742

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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A D T

Release Control Record

Issue No.	Description	Date Issued
RF150423E12	Original release.	July 20, 2015

1 Certificate of Conformity

Product: RFD8500 UHF RFID READER

Brand: ZEBRA

Test Model: RFD8500

Sample Status: ENGINEERING SAMPLE

Applicant: Zebra Technologies Corporation

Test Date: June 16 to 18, 2015

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2009

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 : C. L. , **Date:** July 20, 2015
Claire Kuan / Specialist

Approved by : May Chen , **Date:** July 20, 2015
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 -11.75dB at 0.32133MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 15.209 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -5.3dB at 12400.00MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.43 dB
	200MHz ~1000MHz	3.65 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	3.88 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	RFD8500 UHF RFID READER
Brand	ZEBRA
Test Model	RFD8500
Operating Software	GENX_DEVICE 1.2.28 NGE 1.4.32.0
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 4.2V/3.7V from battery DC 5V or DC 12V from Cradle
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	3.428mW
Antenna Type	Please see next page
Antenna Connector	Please see next page
Accessory Device	Battery x 1
Data Cable Supplied	NA

Note:

1. There are BT and RFID technology used for the EUT.
2. Conducted emission and Radiated emission of the simultaneous operation (Bluetooth & RFID) has been evaluated and no non-compliance was found.
3. The EUT could be supplied with a Cradle and battery as below table:

Cradle 1 (TC55 Rugged Charging Cable, not for sale together)	
Brand:	MOTOROLA / Symbol
Model No.:	CBL-TC55-CHG1-01
Input power :	+5V ----- 1.2A
Cradle 2 (USB power supply cable, not for sale together)	
Brand:	MOTOROLA / no Brand
Model No.:	25-MCXUSB-01R
Cradle 3 (5-slot, not for sale together)	
Brand:	MOTOROLA / Symbol
Model No.:	CRDUNIV
Input power :	+12V ----- 4.16A
Associated Devices:	Adapter x 2 (Adapter 1: Part No.: PWRS-124306-01R) (Adapter 2: Part No.: PWRS-14000-148C)

Adapter 1 (for Cradle 1 & 2, and not for sale together)

Brand: MOTOROLA / Symbol

Model No.: IU08-2050120-WP

Part No.: PWRS-124306-01R

Input power : 100-240V, 50-60Hz, 0.2A

Output power : +5V ----- 1.2A

Adapter 2 (for Cradle 3 only, and not for sale together)

Brand: HIPRO

Model No.: HP-A0502R3D

Part No.: PWRS-14000-148C

Input power : 100-240V, 50-60Hz, 2.4A

Output power : +12V ----- 4.16A

Remark: Core *1pcs

Battery

Brand: MOTOROLA / Symbol

Part No.: 82-172087-01

Rating: 4.2V/ 3.7V, 4410mAh, 16.32Wh

4. The EUT antennas information:

Bluetooth							
No.	Brand	Antenna Type	Gain (dBi) < excluded cable loss>	Connector Type	Frequency range (MHz)	Cable Loss (dB)	
1	Auden	PIFA and PCB chip	2.6	NA	2400~2483.5	1	
RFID Antenna Spec.							
No.	Brand	Antenna Type	Gain (dBi) < included cable loss>	Connector Type	Frequency range (MHz)	Cable Loss (dB)	Cable Length (mm)
1	Auden	Patch	4.63	U.fl	902~928	0.4	130

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

Pre-test Mode	Description
Mode A	Cradle 1 + Battery
Mode B	Cradle 2 + Battery
Mode C	Cradle 3 + Battery

The worst radiated emission was found in **Mode C**. Therefore only the test data of the modes were recorded in this report.

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

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE:

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

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.

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

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.

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

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	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.

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

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	23deg. C, 66%RH	3.7Vdc	Tim Ho
RE<1G	27deg. C, 76%RH	3.7Vdc	Tim Ho
PLC	24deg. C, 54%RH	120Vac, 60Hz (System)	JyunChun.Lin
APCM	25deg. C, 60%RH	3.7Vdc	Robert 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.

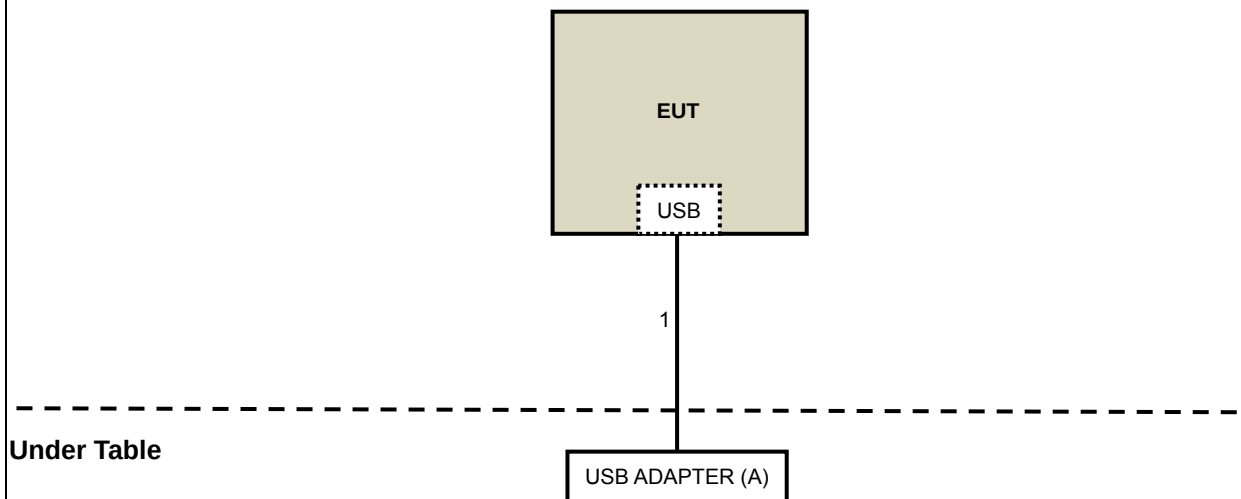
No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	USB ADAPTER	Nicelink	US-T12B(W)	NA	NA	Supplied by client

NOTE:

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

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	USB	1	1	Yes	0	Supplied by client

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

FCC Public Notice DA 00-705

ANSI C63.10-2009

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

For Above 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210105	July 21, 2014	July 20, 2015
Horn_Antenna AISI	AIH.8018	000032009111 0	Feb. 09, 2015	Feb. 08, 2016
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	131205 131216 131217 SNMY23684/ 4	Jan. 16, 2015	Jan. 15, 2016
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Dec. 12, 2014	Dec. 11, 2015
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Feb. 05, 2015	Feb. 04, 2016
RF Cable	NA	329751/4 RF104-204	Dec. 11, 2014	Dec. 10, 2015

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. G.
3. The FCC Site Registration No. is 966073.
4. The VCCI Site Registration No. is G-137.
5. The CANADA Site Registration No. is IC 7450H-2.
6. Tested Date: June 17, 2015

For Below 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 11, 2014	Aug. 10, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 09, 2015	Feb. 08, 2016
RF Cable	8D-FB	CHHCAB-001-1 CHHCAB-001-2	Oct. 05, 2014	Oct. 04, 2015
	RF-141	CHHCAB-004	Oct. 05, 2014	Oct. 04, 2015
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 test was performed in 966 Chamber No. H.
3. The FCC Site Registration No. is 797305.
4. The CANADA Site Registration No. is IC 7450H-3.
5. Tested Date: June 16, 2015

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

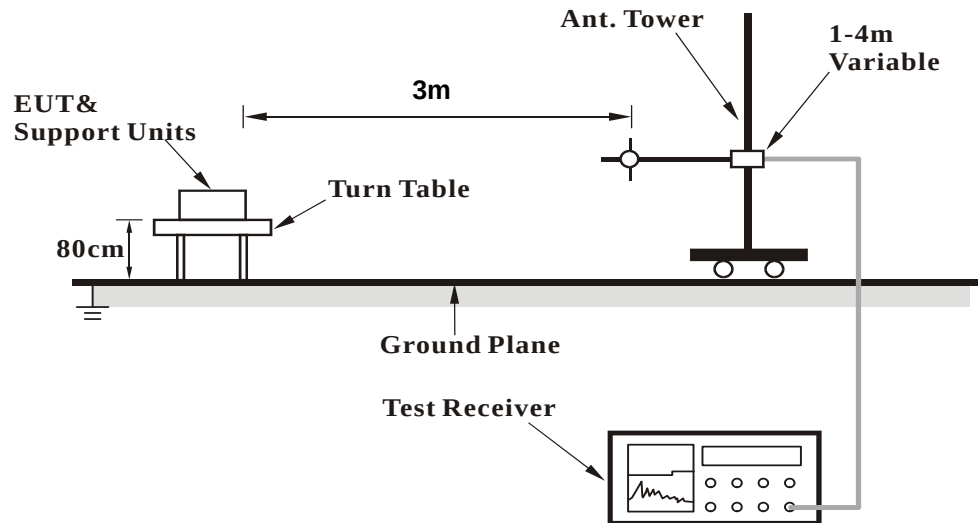
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

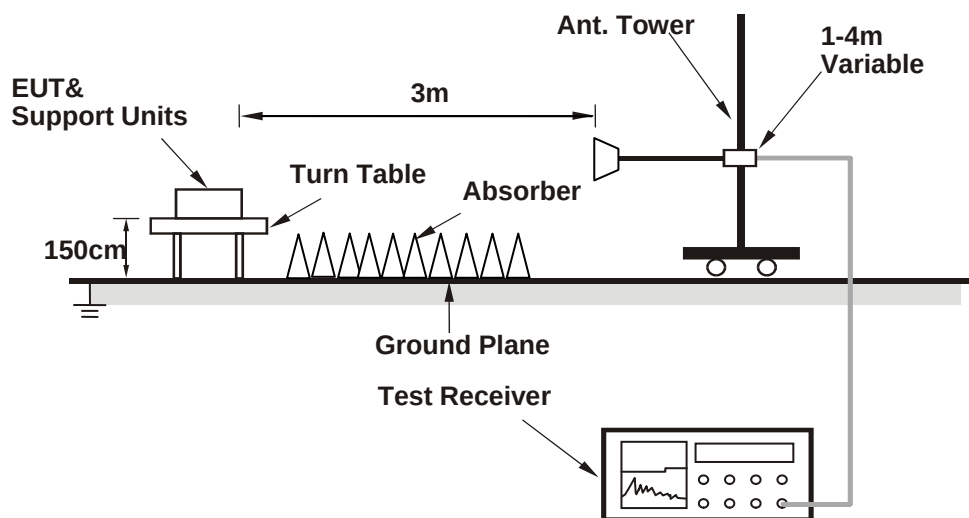
No deviation.

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

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

4.1.7 Test Results

ABOVE 1GHz DATA

BT_GFSK

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	49.3 PK	74.0	-24.7	1.66 H	156	52.49	-3.19
2	2390.00	36.5 AV	54.0	-17.5	1.66 H	156	39.69	-3.19
3	*2402.00	100.0 PK			1.66 H	156	103.16	-3.16
4	*2402.00	99.4 AV			1.66 H	156	102.56	-3.16
5	4804.00	49.6 PK	74.0	-24.4	1.62 H	37	43.66	5.94
6	4804.00	37.4 AV	54.0	-16.6	1.62 H	37	31.46	5.94
7	12010.00	59.3 PK	74.0	-14.7	1.73 H	96	45.39	13.91
8	12010.00	48.2 AV	54.0	-5.8	1.73 H	96	34.29	13.91
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	49.0 PK	74.0	-25.0	1.02 V	4	52.19	-3.19
2	2390.00	34.2 AV	54.0	-19.8	1.02 V	4	37.39	-3.19
3	*2402.00	92.9 PK			1.02 V	4	96.06	-3.16
4	*2402.00	92.5 AV			1.02 V	4	95.66	-3.16
5	4804.00	50.4 PK	74.0	-23.6	1.09 V	305	44.46	5.94
6	4804.00	38.9 AV	54.0	-15.1	1.09 V	305	32.96	5.94
7	12010.00	60.3 PK	74.0	-13.7	1.67 V	91	46.39	13.91
8	12010.00	48.3 AV	54.0	-5.7	1.67 V	91	34.39	13.91

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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
7. Average value = peak reading + $20\log(\text{duty cycle})$.

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	100.4 PK			1.62 H	15	103.42	-3.02
2	*2441.00	99.9 AV			1.62 H	15	102.92	-3.02
3	4882.00	50.1 PK	74.0	-23.9	1.63 H	22	44.05	6.05
4	4882.00	37.9 AV	54.0	-16.1	1.63 H	22	31.85	6.05
5	7323.00	58.3 PK	74.0	-15.7	1.00 H	49	47.28	11.02
6	7323.00	45.4 AV	54.0	-8.6	1.00 H	49	34.38	11.02
7	12205.00	59.5 PK	74.0	-14.5	1.73 H	101	44.81	14.69
8	12205.00	48.1 AV	54.0	-5.9	1.73 H	101	33.41	14.69
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	93.0 PK			1.07 V	1	96.02	-3.02
2	*2441.00	92.3 AV			1.07 V	1	95.32	-3.02
3	4882.00	50.0 PK	74.0	-24.0	1.11 V	318	43.95	6.05
4	4882.00	38.7 AV	54.0	-15.3	1.11 V	318	32.65	6.05
5	7323.00	58.1 PK	74.0	-15.9	1.16 V	67	47.08	11.02
6	7323.00	45.9 AV	54.0	-8.1	1.16 V	67	34.88	11.02
7	12205.00	60.5 PK	74.0	-13.5	1.68 V	98	45.81	14.69
8	12205.00	48.3 AV	54.0	-5.7	1.68 V	98	33.61	14.69

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- 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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
- Average value = peak reading + $20\log(\text{duty cycle})$.

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	100.5 PK			1.61 H	6	103.38	-2.88
2	*2480.00	100.0 AV			1.61 H	6	102.88	-2.88
3	2483.50	51.9 PK	74.0	-22.1	1.61 H	6	54.77	-2.87
4	2483.50	36.3 AV	54.0	-17.7	1.61 H	6	39.17	-2.87
5	4960.00	50.8 PK	74.0	-23.2	1.68 H	27	44.76	6.04
6	4960.00	38.3 AV	54.0	-15.7	1.68 H	27	32.26	6.04
7	7440.00	58.5 PK	74.0	-15.5	1.20 H	50	46.77	11.73
8	7440.00	45.5 AV	54.0	-8.5	1.20 H	50	33.77	11.73
9	12400.00	58.7 PK	74.0	-15.3	1.79 H	91	43.58	15.12
10	12400.00	47.8 AV	54.0	-6.2	1.79 H	91	32.68	15.12
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	92.9 PK			1.10 V	5	95.78	-2.88
2	*2480.00	92.2 AV			1.10 V	5	95.08	-2.88
3	2483.50	49.8 PK	74.0	-24.2	1.10 V	5	52.67	-2.87
4	2483.50	34.0 AV	54.0	-20.0	1.10 V	5	36.87	-2.87
5	4960.00	50.4 PK	74.0	-23.6	1.00 V	318	44.36	6.04
6	4960.00	38.8 AV	54.0	-15.2	1.00 V	318	32.76	6.04
7	7440.00	58.3 PK	74.0	-15.7	1.19 V	60	46.57	11.73
8	7440.00	46.3 AV	54.0	-7.7	1.19 V	60	34.57	11.73
9	12400.00	60.1 PK	74.0	-13.9	1.72 V	93	44.98	15.12
10	12400.00	48.0 AV	54.0	-6.0	1.72 V	93	32.88	15.12

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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
7. Average value = peak reading + $20\log(\text{duty cycle})$.

BT_8DPSK

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	49.5 PK	74.0	-24.5	1.17 H	159	52.69	-3.19
2	2390.00	36.9 AV	54.0	-17.1	1.17 H	159	40.09	-3.19
3	*2402.00	100.0 PK			1.17 H	159	103.16	-3.16
4	*2402.00	99.2 AV			1.17 H	159	102.36	-3.16
5	4804.00	49.3 PK	74.0	-24.7	1.92 H	360	43.36	5.94
6	4804.00	37.1 AV	54.0	-16.9	1.92 H	360	31.16	5.94
7	12010.00	58.8 PK	74.0	-15.2	1.73 H	108	44.89	13.91
8	12010.00	47.8 AV	54.0	-6.2	1.73 H	108	33.89	13.91
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	48.8 PK	74.0	-25.2	1.18 V	155	51.99	-3.19
2	2390.00	34.0 AV	54.0	-20.0	1.18 V	155	37.19	-3.19
3	*2402.00	92.3 PK			1.18 V	155	95.46	-3.16
4	*2402.00	92.1 AV			1.18 V	155	95.26	-3.16
5	4804.00	50.4 PK	74.0	-23.6	1.08 V	210	44.46	5.94
6	4804.00	39.1 AV	54.0	-14.9	1.08 V	210	33.16	5.94
7	12010.00	60.5 PK	74.0	-13.5	1.73 V	98	46.59	13.91
8	12010.00	48.6 AV	54.0	-5.4	1.73 V	98	34.69	13.91

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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
7. Average value = peak reading + $20\log(\text{duty cycle})$.

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	100.3 PK			1.68 H	187	103.32	-3.02
2	*2441.00	99.7 AV			1.68 H	187	102.72	-3.02
3	4882.00	50.1 PK	74.0	-23.9	1.37 H	195	44.05	6.05
4	4882.00	37.9 AV	54.0	-16.1	1.37 H	195	31.85	6.05
5	7323.00	58.3 PK	74.0	-15.7	1.37 H	197	47.28	11.02
6	7323.00	45.2 AV	54.0	-8.8	1.37 H	197	34.18	11.02
7	12205.00	59.2 PK	74.0	-14.8	1.78 H	104	44.51	14.69
8	12205.00	47.8 AV	54.0	-6.2	1.78 H	104	33.11	14.69
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	93.1 PK			1.73 V	109	96.12	-3.02
2	*2441.00	92.4 AV			1.73 V	109	95.42	-3.02
3	4882.00	49.6 PK	74.0	-24.4	1.08 V	22	43.55	6.05
4	4882.00	38.5 AV	54.0	-15.5	1.08 V	22	32.45	6.05
5	7323.00	57.9 PK	74.0	-16.1	1.06 V	203	46.88	11.02
6	7323.00	45.4 AV	54.0	-8.6	1.06 V	203	34.38	11.02
7	12205.00	60.7 PK	74.0	-13.3	1.72 V	104	46.01	14.69
8	12205.00	48.6 AV	54.0	-5.4	1.72 V	104	33.91	14.69

REMARKS:

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

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	100.8 PK			1.75 H	0	103.68	-2.88
2	*2480.00	100.5 AV			1.75 H	0	103.38	-2.88
3	2483.50	51.9 PK	74.0	-22.1	1.75 H	0	54.77	-2.87
4	2483.50	36.0 AV	54.0	-18.0	1.75 H	0	38.87	-2.87
5	4960.00	50.9 PK	74.0	-23.1	1.35 H	193	44.86	6.04
6	4960.00	38.4 AV	54.0	-15.6	1.35 H	193	32.36	6.04
7	7440.00	58.5 PK	74.0	-15.5	1.36 H	197	46.77	11.73
8	7440.00	45.5 AV	54.0	-8.5	1.36 H	197	33.77	11.73
9	12400.00	59.8 PK	74.0	-14.2	1.76 H	80	44.68	15.12
10	12400.00	48.7 AV	54.0	-5.3	1.76 H	80	33.58	15.12
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	92.4 PK			1.75 V	8	95.28	-2.88
2	*2480.00	91.8 AV			1.75 V	8	94.68	-2.88
3	2483.50	49.8 PK	74.0	-24.2	1.75 V	8	52.67	-2.87
4	2483.50	33.9 AV	54.0	-20.1	1.75 V	8	36.77	-2.87
5	4960.00	50.4 PK	74.0	-23.6	1.04 V	35	44.36	6.04
6	4960.00	39.1 AV	54.0	-14.9	1.04 V	35	33.06	6.04
7	7440.00	58.4 PK	74.0	-15.6	1.03 V	192	46.67	11.73
8	7440.00	46.4 AV	54.0	-7.6	1.03 V	192	34.67	11.73
9	12400.00	60.1 PK	74.0	-13.9	1.68 V	103	44.98	15.12
10	12400.00	48.0 AV	54.0	-6.0	1.68 V	103	32.88	15.12

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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
7. Average value = peak reading + $20\log(\text{duty cycle})$.

BELOW 1GHz WORST-CASE DATA

BT_GFSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.76	22.3 QP	43.5	-21.2	1.10 H	119	35.68	-13.38
2	259.14	26.1 QP	46.0	-19.9	1.10 H	283	39.77	-13.65
3	432.13	24.1 QP	46.0	-21.9	1.10 H	314	32.52	-8.40
4	504.11	24.2 QP	46.0	-21.9	1.20 H	119	31.21	-7.06
5	611.36	25.1 QP	46.0	-20.9	1.10 H	36	29.53	-4.42
6	777.59	29.1 QP	46.0	-16.9	1.90 H	183	30.65	-1.56
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	32.14	28.1 QP	40.0	-11.9	1.00 V	142	42.98	-14.85
2	108.74	24.1 QP	43.5	-19.4	1.20 V	112	40.29	-16.15
3	141.11	34.2 QP	43.5	-9.3	1.10 V	153	47.44	-13.28
4	182.71	26.2 QP	43.5	-17.3	1.10 V	106	40.97	-14.81
5	247.66	30.1 QP	46.0	-15.9	1.00 V	194	43.97	-13.90
6	956.71	31.2 QP	46.0	-14.8	1.20 V	165	30.00	1.16

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.74	22.3 QP	43.5	-21.2	1.00 H	109	35.66	-13.38
2	259.11	26.1 QP	46.0	-19.9	1.00 H	273	39.75	-13.65
3	432.11	24.1 QP	46.0	-21.9	1.00 H	304	32.50	-8.40
4	504.10	24.2 QP	46.0	-21.8	1.10 H	109	31.26	-7.06
5	611.31	25.1 QP	46.0	-20.9	1.00 H	106	29.52	-4.42
6	777.62	29.1 QP	46.0	-16.9	1.20 H	123	30.68	-1.56
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	32.10	28.1 QP	40.0	-11.9	1.10 V	128	42.96	-14.86
2	108.71	24.1 QP	43.5	-19.4	1.10 V	102	40.26	-16.15
3	141.10	34.1 QP	43.5	-9.4	1.10 V	143	47.41	-13.29
4	182.70	26.1 QP	43.5	-17.4	1.00 V	116	40.93	-14.81
5	247.60	30.1 QP	46.0	-15.9	1.10 V	174	44.02	-13.90
6	956.70	31.1 QP	46.0	-14.9	1.10 V	125	29.96	1.16

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

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.70	22.3 QP	43.5	-21.2	1.10 H	119	35.71	-13.39
2	259.10	26.3 QP	46.0	-19.8	1.10 H	263	39.90	-13.65
3	432.02	24.2 QP	46.0	-21.8	1.10 H	300	32.62	-8.40
4	504.12	24.3 QP	46.0	-21.7	1.00 H	112	31.33	-7.06
5	611.28	25.3 QP	46.0	-20.7	1.10 H	100	29.70	-4.42
6	777.60	29.1 QP	46.0	-16.9	1.10 H	113	30.68	-1.56
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	32.02	28.1 QP	40.0	-11.9	1.10 V	118	43.01	-14.88
2	108.70	24.1 QP	43.5	-19.4	1.10 V	112	40.27	-16.15
3	141.02	34.1 QP	43.5	-9.4	1.10 V	123	47.40	-13.29
4	182.58	26.1 QP	43.5	-17.4	1.10 V	106	40.91	-14.80
5	247.62	30.0 QP	46.0	-16.0	1.10 V	134	43.92	-13.90
6	956.68	31.1 QP	46.0	-14.9	1.00 V	115	29.95	1.16

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

BT_8DPSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.28	22.3 QP	43.5	-21.2	1.00 H	109	35.71	-13.42
2	259.02	26.2 QP	46.0	-19.8	1.00 H	243	39.87	-13.65
3	432.00	24.2 QP	46.0	-21.8	1.00 H	280	32.60	-8.40
4	504.10	24.2 QP	46.0	-21.8	1.10 H	102	31.29	-7.06
5	611.22	25.2 QP	46.0	-20.8	1.00 H	110	29.66	-4.42
6	777.63	29.1 QP	46.0	-16.9	1.00 H	103	30.70	-1.56
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	32.12	28.1 QP	40.0	-11.9	1.00 V	108	42.97	-14.86
2	108.68	24.1 QP	43.5	-19.4	1.00 V	102	40.26	-16.15
3	141.12	34.1 QP	43.5	-9.4	1.10 V	113	47.39	-13.28
4	182.51	26.1 QP	43.5	-17.4	1.00 V	116	40.92	-14.80
5	247.61	30.1 QP	46.0	-15.9	1.00 V	114	44.02	-13.90
6	956.62	31.0 QP	46.0	-15.0	1.10 V	105	29.86	1.16

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.32	22.4 QP	43.5	-21.1	1.10 H	110	35.80	-13.42
2	259.12	26.2 QP	46.0	-19.8	1.10 H	223	39.85	-13.65
3	432.12	24.2 QP	46.0	-21.8	1.10 H	220	32.62	-8.40
4	504.02	24.2 QP	46.0	-21.8	1.00 H	112	31.26	-7.06
5	611.20	25.2 QP	46.0	-20.8	1.20 H	100	29.62	-4.42
6	777.60	29.2 QP	46.0	-16.8	1.10 H	113	30.72	-1.56
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	32.02	28.1 QP	40.0	-11.9	1.10 V	118	42.99	-14.88
2	108.72	24.0 QP	43.5	-19.5	1.10 V	112	40.17	-16.15
3	141.02	34.2 QP	43.5	-9.3	1.00 V	103	47.47	-13.29
4	182.68	26.3 QP	43.5	-17.2	1.10 V	106	41.14	-14.81
5	247.78	30.0 QP	46.0	-16.0	1.10 V	104	43.92	-13.90
6	956.60	31.1 QP	46.0	-14.9	1.00 V	115	29.92	1.16

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

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	139.02	22.3 QP	43.5	-21.2	1.00 H	100	35.76	-13.46
2	259.10	26.5 QP	46.0	-19.5	1.00 H	202	40.11	-13.65
3	432.11	24.2 QP	46.0	-21.8	1.10 H	210	32.61	-8.40
4	504.00	24.3 QP	46.0	-21.7	1.10 H	102	31.34	-7.06
5	611.02	25.3 QP	46.0	-20.7	1.20 H	110	29.69	-4.42
6	777.62	29.2 QP	46.0	-16.8	1.00 H	103	30.74	-1.56
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	32.12	28.2 QP	40.0	-11.8	1.00 V	108	43.02	-14.86
2	108.70	24.1 QP	43.5	-19.4	1.00 V	102	40.26	-16.15
3	141.12	34.1 QP	43.5	-9.4	1.10 V	113	47.39	-13.28
4	182.72	26.3 QP	43.5	-17.2	1.02 V	116	41.11	-14.81
5	247.71	30.1 QP	46.0	-15.9	1.00 V	114	44.01	-13.90
6	956.62	31.1 QP	46.0	-14.9	1.10 V	105	29.95	1.16

REMARKS:

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

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 06, 2015	May 05, 2016
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 15, 2014	Sep. 14, 2015
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100071	Nov. 10, 2014	Nov. 09, 2015
RF Cable	5D-FB	COCCAB-001	Mar. 09, 2015	Mar. 08, 2016
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2014	Sep. 21, 2015
50 ohms Terminator	N/A	EMC-02	Sep. 30, 2014	Sep. 29, 2015
Software BVADT	BVADT_Cond_ V7.3.7.3	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: June 18, 2015

4.2.3 Test Procedures

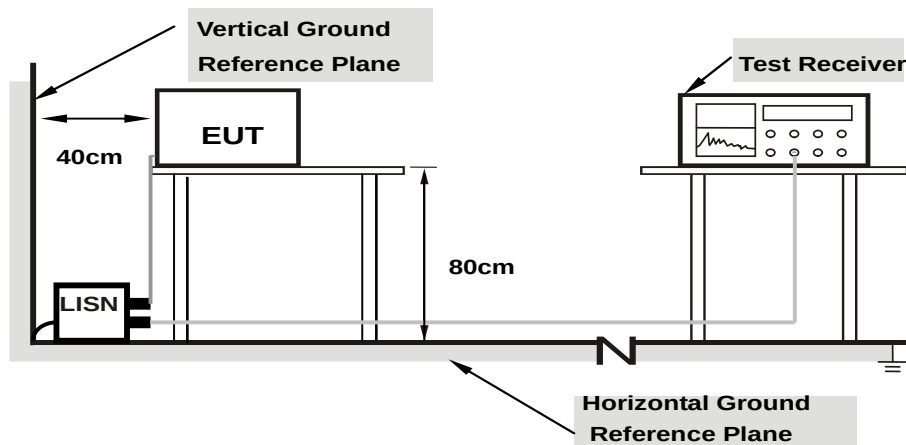
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT Operating Condition

Same as 4.1.6.

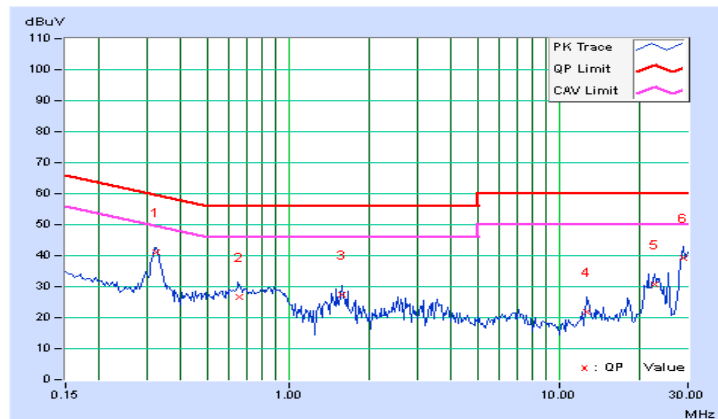
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.32580	0.16	41.00	35.76	41.16	35.92	59.56	49.56	-18.40	-13.64
2	0.65401	0.18	26.54	19.92	26.72	20.10	56.00	46.00	-29.28	-25.90
3	1.58200	0.23	27.13	20.15	27.36	20.38	56.00	46.00	-28.64	-25.62
4	12.68359	0.84	21.05	11.92	21.89	12.76	60.00	50.00	-38.11	-37.24
5	22.48456	1.20	29.61	18.45	30.81	19.65	60.00	50.00	-29.19	-30.35
6	28.91754	1.44	37.75	27.67	39.19	29.11	60.00	50.00	-20.81	-20.89

Remarks:

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

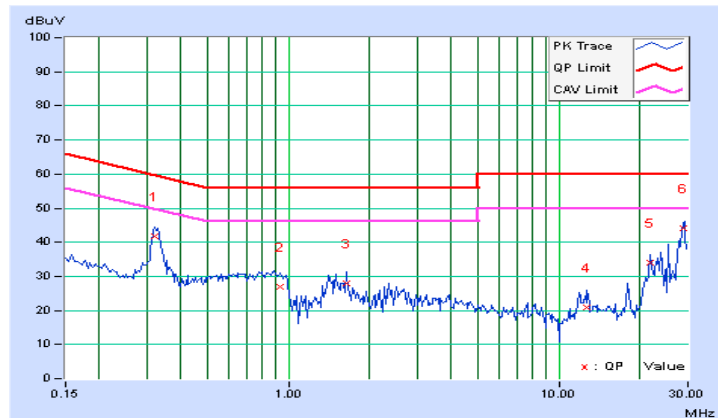


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.32133	0.17	41.71	37.75	41.88	37.92	59.67	49.67	-17.79	-11.75
2	0.93556	0.23	26.58	19.84	26.81	20.07	56.00	46.00	-29.19	-25.93
3	1.63656	0.28	27.56	20.36	27.84	20.64	56.00	46.00	-28.16	-25.36
4	12.71143	0.91	19.92	11.38	20.83	12.29	60.00	50.00	-39.17	-37.71
5	21.79347	1.28	32.65	14.45	33.93	15.73	60.00	50.00	-26.07	-34.27
6	28.79647	1.49	42.54	22.11	44.03	23.60	60.00	50.00	-15.97	-26.40

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

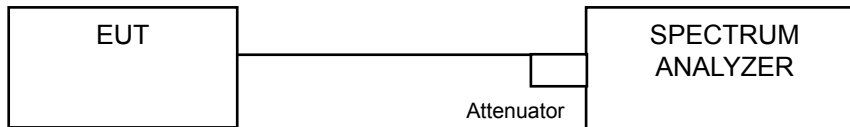


4.3 Number of Hopping Frequency Used

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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

- NOTE:**
1. The test was performed in Oven room B.
 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: June 17, 2015

4.3.4 Test Procedure

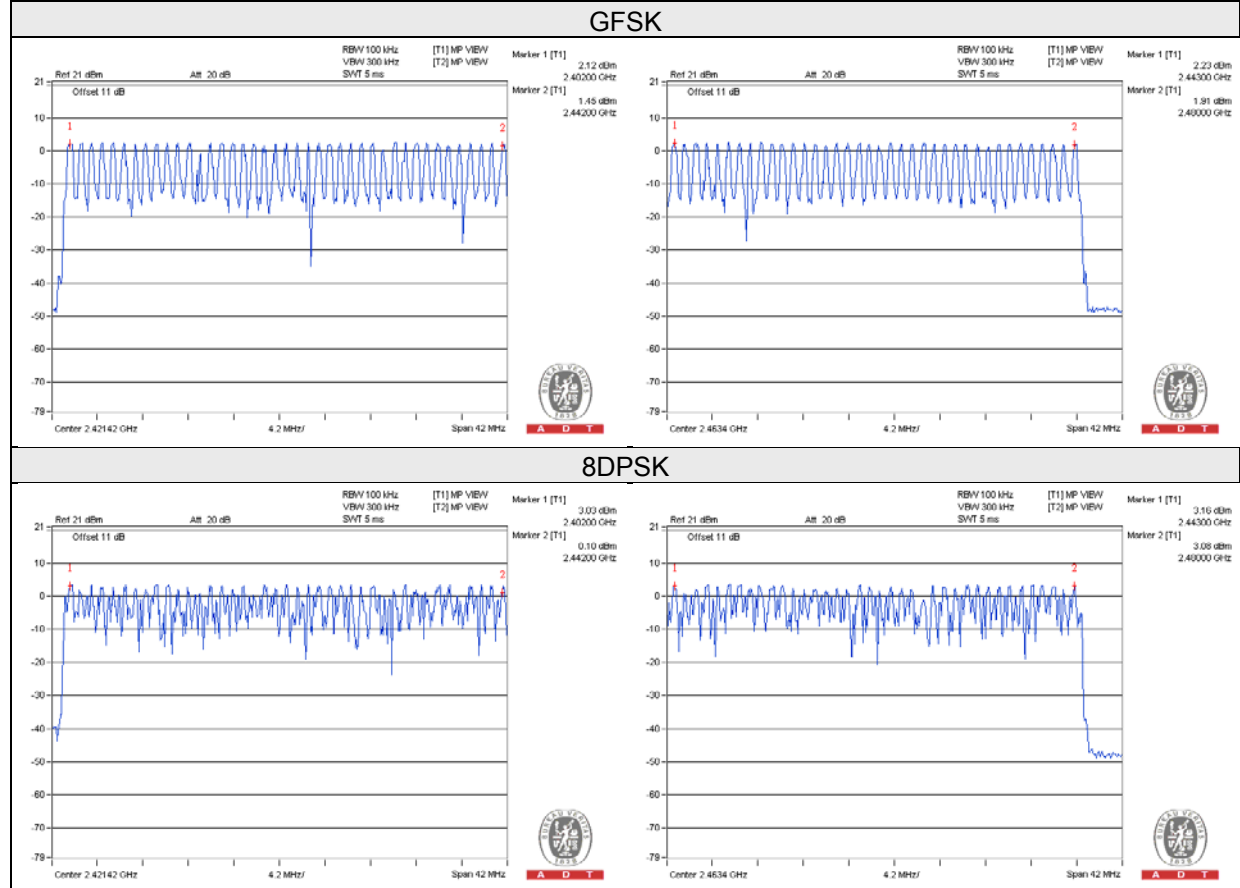
- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range 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 refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

- NOTE:**
1. The test was performed in Oven room B.
 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: June 17, 2015

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.

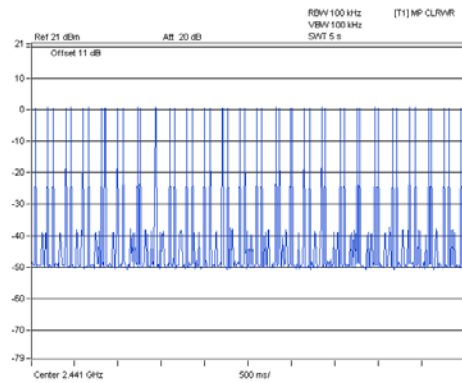
4.4.6 Test Results

GFSK

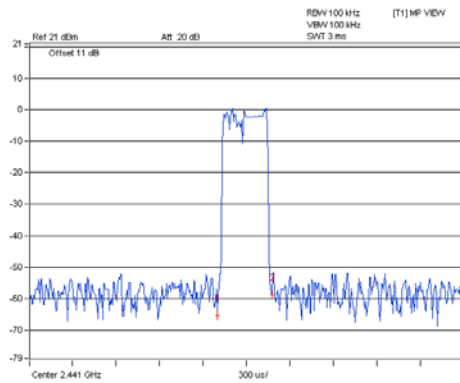
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	49 (times / 5 sec) * 6.32 = 309.68 times	0.378	117.06	400
DH3	27 (times / 5 sec) * 6.32 = 170.64 times	0.41	69.962	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	0.4	45.504	400

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

DH1



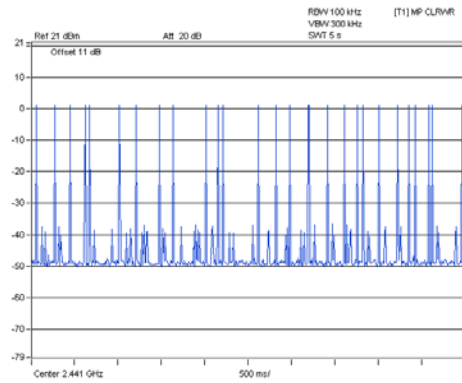
A D T



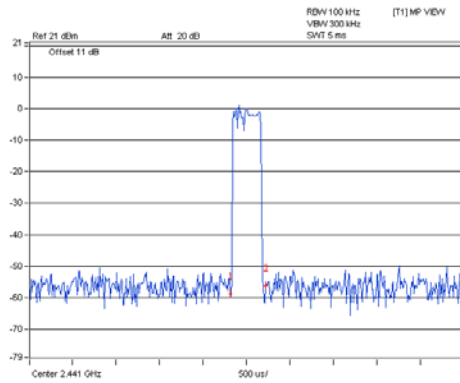
A D T

Marker 1 [T1] -55.44 dBm
1.296000 ms
Delta 2 [T1] 6.63 dB
378.000000 us

DH3



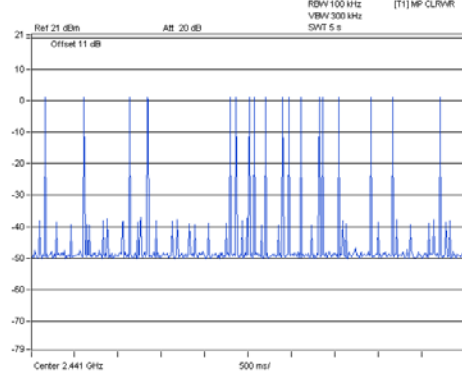
A D T



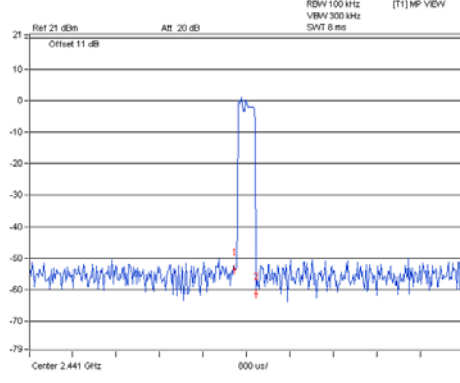
A D T

Marker 1 [T1] -50.00 dBm
2.310000 ms
Delta 2 [T1] 2.64 dB
410.000000 us

DH5



A D T



A D T

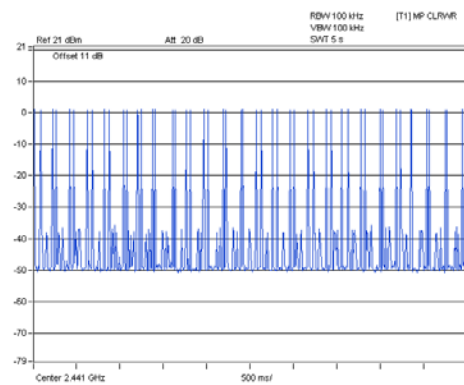
Marker 1 [T1] -53.71 dBm
3.770000 ms
Delta 2 [T1] 7.60 dB
400.000000 us

8DPSK

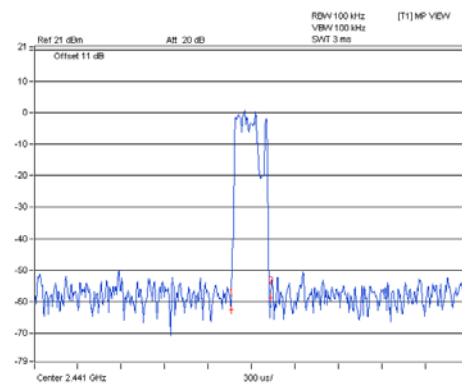
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316 times	0.276	87.216	400
DH3	25 (times / 5 sec) * 6.32 = 158 times	0.31	48.98	400
DH5	18 (times / 5 sec) * 6.32 = 113.76 times	0.352	40.044	400

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

DH1



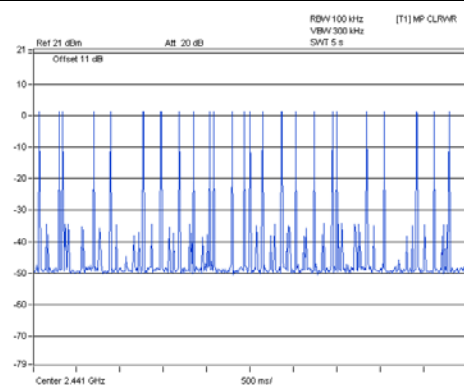
A D T



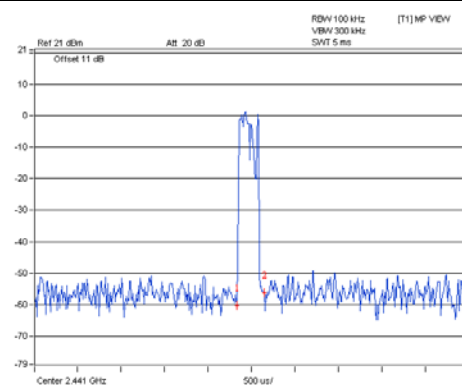
A D T

Marker 1 [T1] -52.60 dBm
1.356000 ms
Delta 2 [T1] 3.70 dB
276.000000 us

DH3



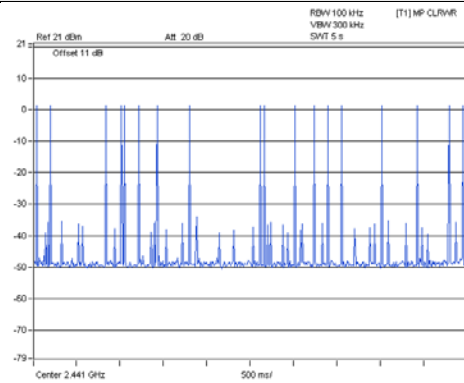
A D T



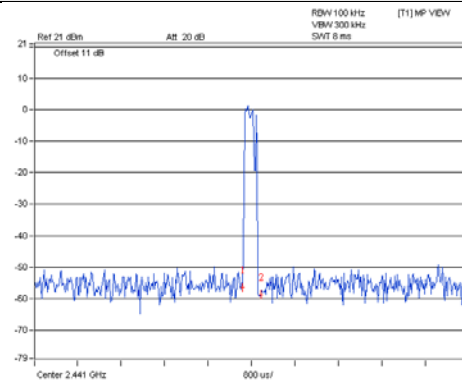
A D T

Marker 1 [T1] -50.40 dBm
2.330000 ms
Delta 2 [T1] 4.05 dB
310.000000 us

DH5



A D T



A D T

Marker 1 [T1] -56.39 dBm
3.824000 ms
Delta 2 [T1] 2.43 dB
362.000000 us

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 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

4.5.2 Test Setup



4.5.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

NOTE:

1. The test was performed in Oven room B.
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: June 17, 2015

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. Detector = peak.
- e. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

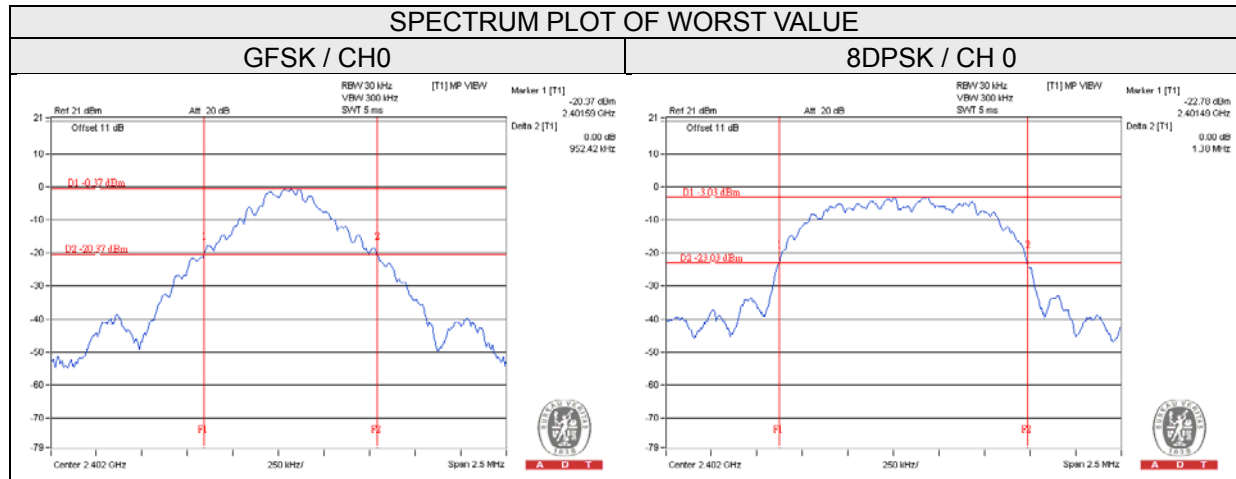
No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

CHANNEL	FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	
		GFSK	8DPSK
0	2402	0.95	1.38
39	2441	0.95	1.36
78	2480	0.95	1.37

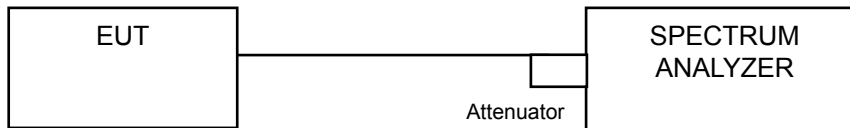


4.6 Hopping Channel Separation

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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

- NOTE:**
1. The test was performed in Oven room B.
 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: June 17, 2015

4.6.4 Test Procedure

Measurement Procedure REF

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

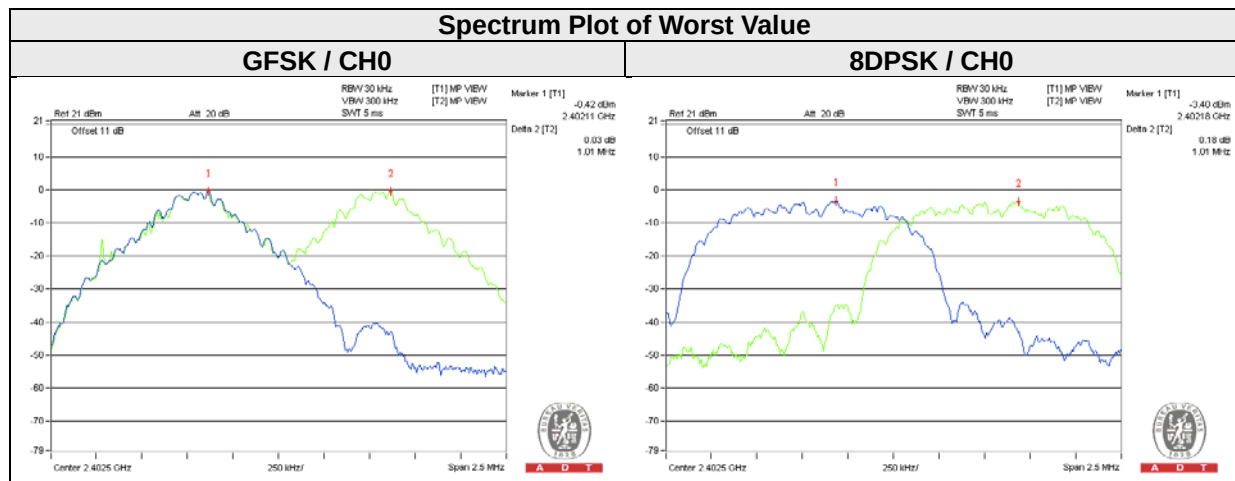
4.6.5 Deviation From Test Standard

No deviation.

4.6.6 Test Results

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.01	1.01	0.95	1.38	0.64	0.92	PASS
39	2441	1.00	1.01	0.95	1.36	0.64	0.91	PASS
78	2480	1.00	1.01	0.95	1.37	0.64	0.92	PASS

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



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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

- NOTE:**
1. The test was performed in Oven room B.
 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: June 17, 2015

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. Detector = peak.
- e. Measure the captured power within the band and recording the plot.
- f. Repeat above procedures until all frequencies required were complete.

4.7.5 Deviation from Test Standard

No deviation.

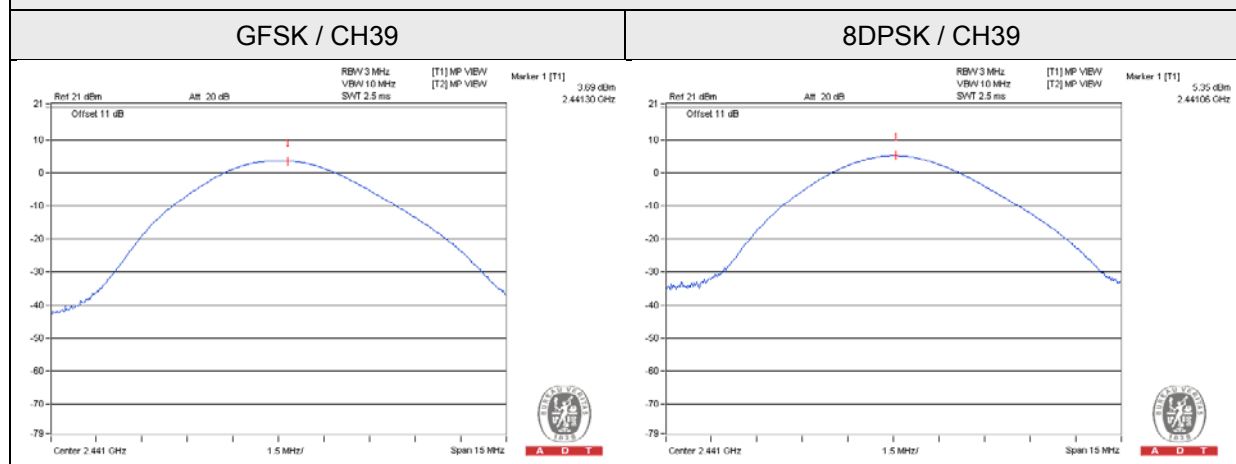
4.7.6 EUT Operating Condition

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	2.023	2.844	3.06	4.54	125	PASS
39	2441	2.339	3.428	3.69	5.35	125	PASS
78	2480	2.018	3.170	3.05	5.01	125	PASS

SPECTRUM PLOT OF WORST VALUE



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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

NOTE:

1. The test was performed in Oven room B.
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: June 17, 2015

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

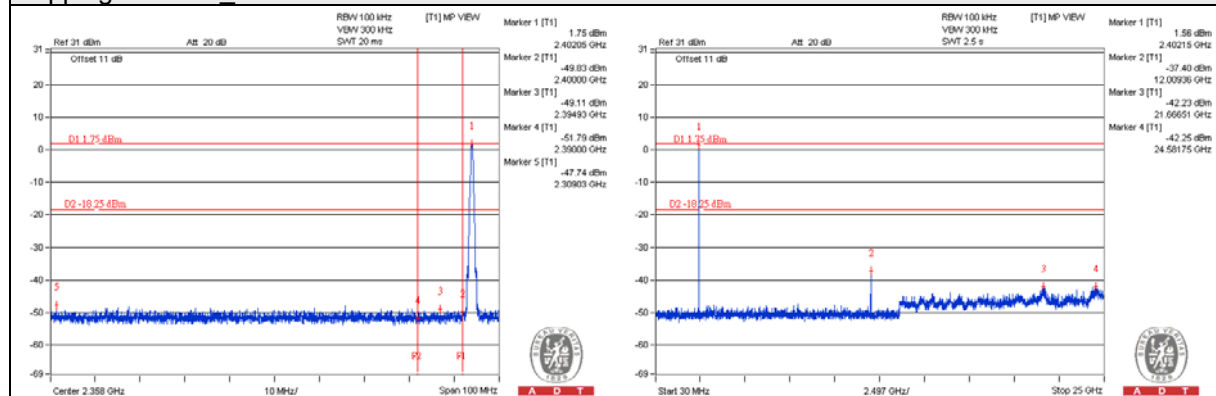
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 Test Results

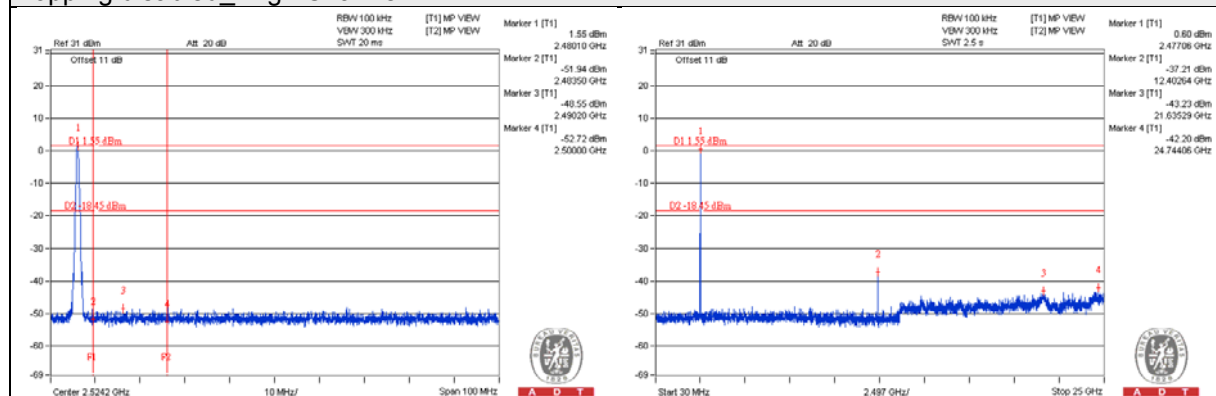
The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

GFSK

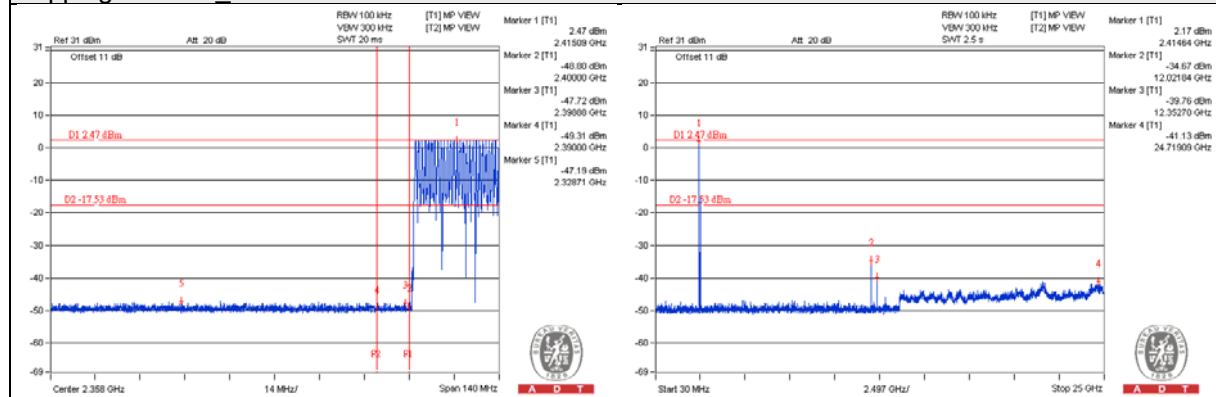
Hopping disabled Low Channel



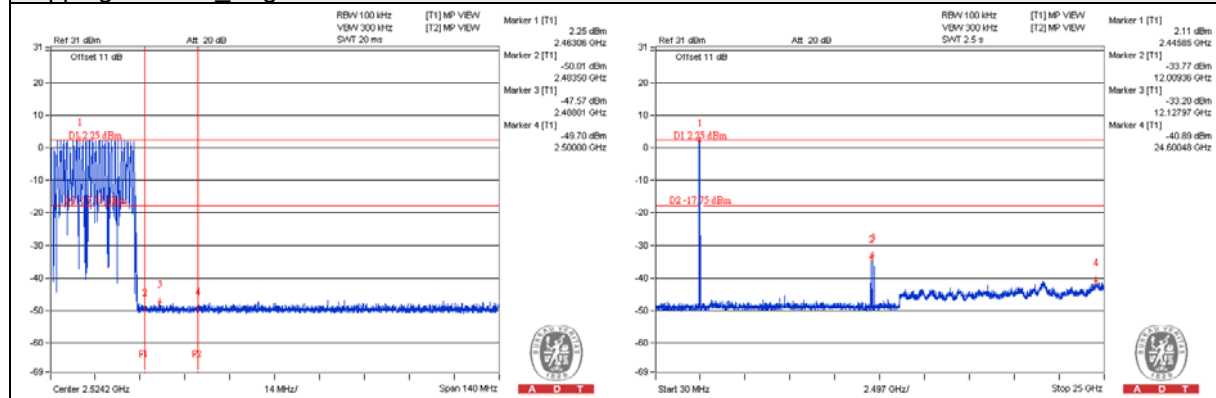
Hopping disabled High Channel



Hopping enabled Low Channel

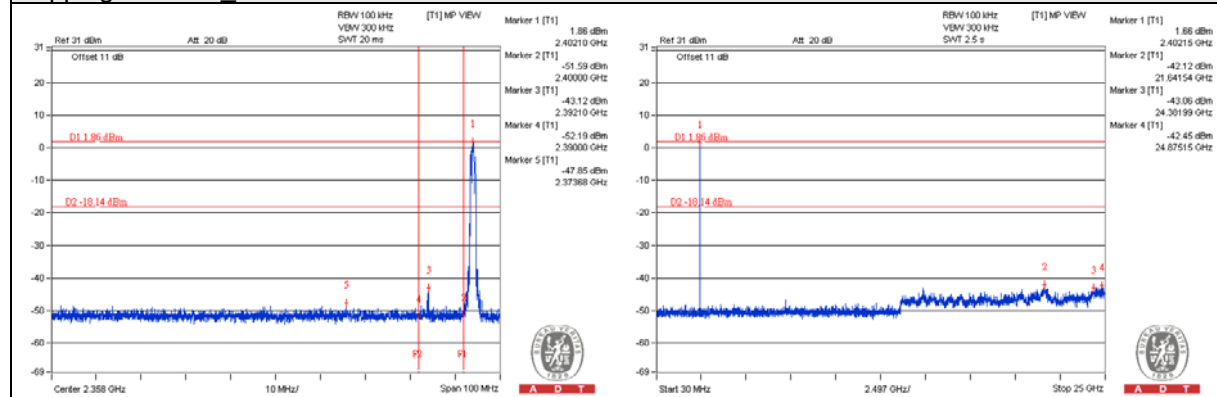


Hopping enabled High Channel

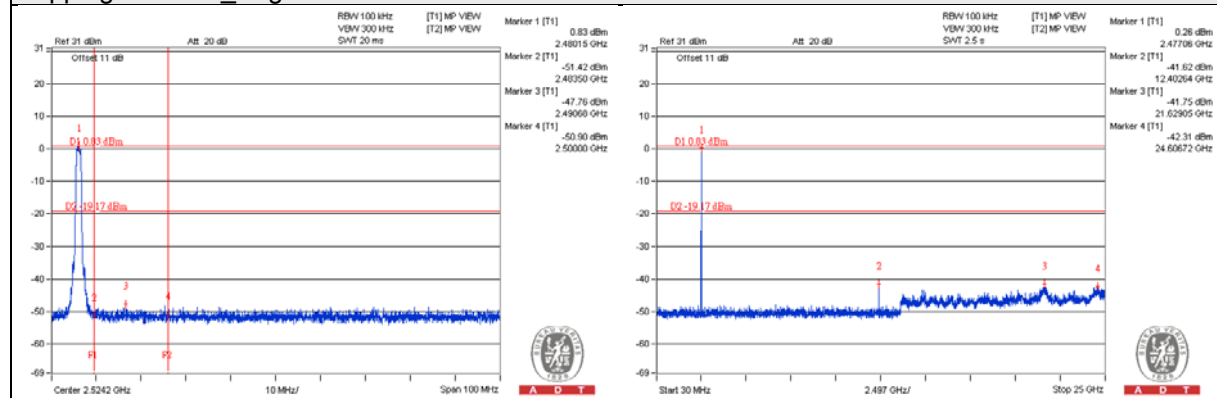


8DPSK

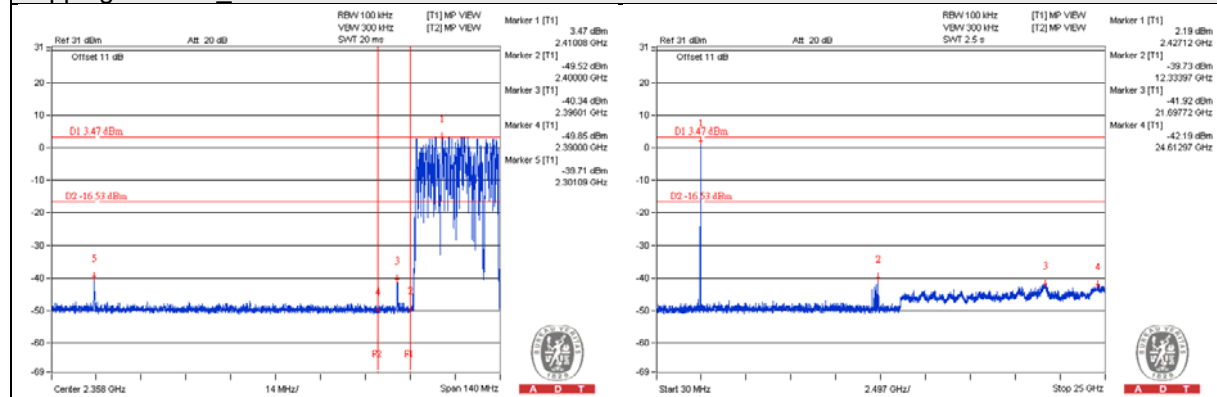
Hopping disabled Low Channel



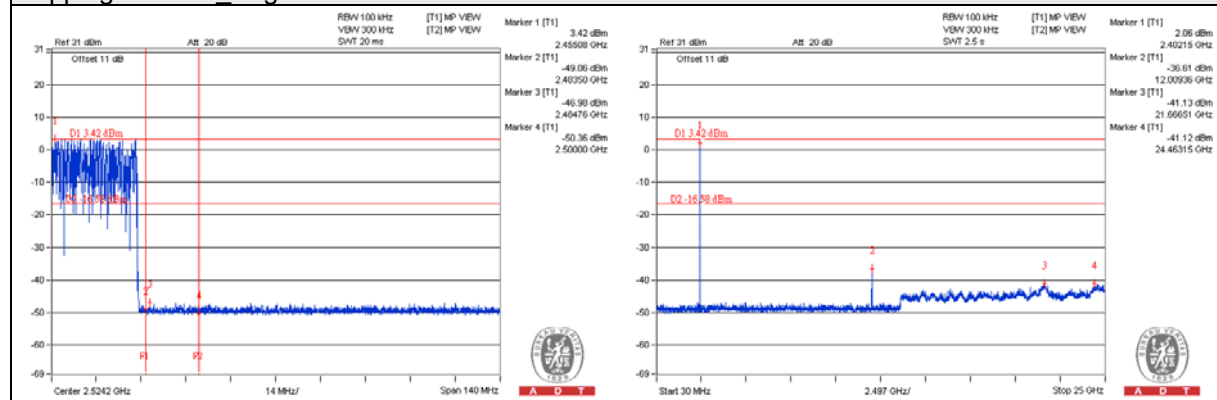
Hopping disabled High Channel



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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