



# FCC TEST REPORT (BLUETOOTH/DTS)

**REPORT NO.:** RF140508E01-2

**MODEL NO.:** QCNFA354

**FCC ID:** PPD-QCNFA354

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**ISSUED:** July 08, 2014

**APPLICANT:** Qualcomm Atheros, Inc.

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**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.)  
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# TABLE OF CONTENTS

RELEASE CONTROL RECORD .....	5
1 CERTIFICATION .....	6
2 SUMMARY OF TEST RESULTS.....	7
2.1 MEASUREMENT UNCERTAINTY .....	9
3 GENERAL INFORMATION .....	10
3.1 GENERAL DESCRIPTION OF EUT(BLUETOOTH/DTS) .....	10
3.2 DESCRIPTION OF ANTENNA.....	11
3.3 DESCRIPTION OF TEST MODES.....	12
3.4 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL: .....	13
3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS .....	17
3.6 DUTY CYCLE OF TEST SIGNAL .....	18
3.7 DESCRIPTION OF SUPPORT UNITS .....	19
3.8 CONFIGURATION OF SYSTEM UNDER TEST.....	19
4 TEST PROCEDURES AND RESULTS (BLUETOOTH).....	20
4.1 MAXIMUM PEAK OUTPUT POWER .....	20
4.1.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT .....	20
4.1.2 INSTRUMENTS .....	20
4.1.3 TEST PROCEDURES .....	20
4.1.4 DEVIATION FROM TEST STANDARD .....	20
4.1.5 TEST SETUP .....	21
4.1.6 EUT OPERATING CONDITION .....	21
4.1.7 TEST RESULTS .....	22
4.2 AVERAGE OUTPUT POWER.....	24
4.2.1 FOR REFERENCE.....	24
4.2.2 INSTRUMENTS .....	24
4.2.3 TEST PROCEDURES .....	24
4.2.4 TEST SETUP .....	24
4.2.5 EUT OPERATING CONDITION .....	24
4.2.6 TEST RESULTS.....	25
4.3 CHANNEL BANDWIDTH .....	26
4.3.1 LIMITS OF CHANNEL BANDWIDTH .....	26
4.3.2 TEST INSTRUMENTS.....	26
4.3.3 TEST PROCEDURE.....	26
4.3.4 DEVIATION FROM TEST STANDARD .....	26
4.3.5 TEST SETUP .....	27
4.3.6 EUT OPERATING CONDITION .....	27
4.3.7 TEST RESULTS .....	28
4.4 HOPPING CHANNEL SEPARATION .....	30
4.4.1 LIMIT OF HOPPING CHANNEL SEPARATION.....	30
4.4.2 TEST INSTRUMENTS.....	30
4.4.3 TEST PROCEDURES .....	30
4.4.4 DEVIATION FROM TEST STANDARD .....	30
4.4.5 TEST SETUP .....	30
4.4.6 TEST RESULTS.....	31



4.5	NUMBER OF HOPPING FREQUENCY USED .....	33
4.5.1	LIMIT OF HOPPING FREQUENCY USED.....	33
4.5.2	TEST INSTRUMENTS.....	33
4.5.3	TEST PROCEDURES .....	33
4.5.4	DEVIATION FROM TEST STANDARD .....	33
4.5.5	TEST SETUP .....	34
4.5.6	TEST RESULTS .....	34
4.6	DWELL TIME ON EACH CHANNEL .....	35
4.6.1	LIMIT OF DWELL TIME USED .....	35
4.6.2	TEST INSTRUMENTS.....	35
4.6.3	TEST PROCEDURES .....	35
4.6.4	DEVIATION FROM TEST STANDARD .....	35
4.6.5	TEST SETUP .....	36
4.6.6	TEST RESULTS .....	37
4.7	CONDUCTED OUT-BAND EMISSION MEASUREMENT.....	45
4.8.1	LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT.....	45
4.8.2	TEST INSTRUMENTS.....	45
4.8.3	TEST PROCEDURE.....	45
4.8.4	DEVIATION FROM TEST STANDARD .....	45
4.7.1	TEST SETUP .....	45
4.8.5	EUT OPERATING CONDITION .....	45
4.8.6	TEST RESULTS .....	46
4.8	RADIATED EMISSION MEASUREMENT .....	49
4.8.1	LIMITS OF RADIATED EMISSION MEASUREMENT .....	49
4.8.2	TEST INSTRUMENTS.....	50
4.8.3	TEST PROCEDURES .....	52
4.8.4	DEVIATION FROM TEST STANDARD .....	52
4.8.5	TEST SETUP .....	53
4.8.6	EUT OPERATING CONDITIONS.....	54
4.8.7	TEST RESULTS .....	55
4.9	CONDUCTED EMISSION MEASUREMENT .....	62
4.9.1	LIMITS OF CONDUCTED EMISSION MEASUREMENT.....	62
4.9.2	TEST INSTRUMENTS.....	62
4.9.3	TEST PROCEDURES .....	63
4.9.4	DEVIATION FROM TEST STANDARD .....	63
4.9.5	TEST SETUP .....	63
4.9.6	EUT OPERATING CONDITIONS.....	64
4.9.7	TEST RESULTS .....	65
5	TEST TYPES AND RESULTS (DTS) .....	67
5.1	CONDUCTED OUTPUT POWER MEASUREMENT .....	67
5.1.1	LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT.....	67
5.1.2	INSTRUMENTS .....	67
5.1.3	TEST PROCEDURES .....	67
5.1.4	DEVIATION FROM TEST STANDARD .....	67
5.1.5	TEST SETUP .....	68
5.1.6	EUT OPERATING CONDITIONS.....	68
5.1.7	TEST RESULTS .....	69
5.2	POWER SPECTRAL DENSITY MEASUREMENT .....	70



A D T

5.2.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT .....	70
5.2.2	TEST INSTRUMENTS.....	70
5.2.3	TEST PROCEDURE.....	70
5.2.4	DEVIATION FROM TEST STANDARD .....	70
5.2.5	TEST SETUP .....	70
5.2.6	EUT OPERATING CONDITION .....	70
5.2.7	TEST RESULTS .....	71
5.3	6dB BANDWIDTH MEASUREMENT .....	72
5.3.1	LIMITS OF 6DB BANDWIDTH MEASUREMENT .....	72
5.3.2	TEST INSTRUMENTS.....	72
5.3.3	TEST PROCEDURE.....	72
5.3.4	DEVIATION FROM TEST STANDARD .....	72
5.3.5	TEST SETUP .....	72
5.3.6	EUT OPERATING CONDITIONS.....	72
5.3.7	TEST RESULTS .....	73
5.4	CONDUCTED OUT-BAND EMISSION MEASUREMENT.....	74
5.4.1	LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT.....	74
5.4.2	TEST INSTRUMENTS.....	74
5.4.3	TEST PROCEDURE.....	74
5.4.4	DEVIATION FROM TEST STANDARD .....	75
5.4.5	EUT OPERATING CONDITION .....	75
5.4.6	TEST RESULTS .....	76
5.5	UNWANTED EMISSION MEASUREMENT(RADIATED VERSUS CONDUCTED).....	78
5.5.1	LIMITS OF UNWANTED EMISSION MEASUREMENT .....	78
5.5.2	TEST INSTRUMENTS.....	79
5.5.3	TEST PROCEDURES .....	81
5.5.4	DEVIATION FROM TEST STANDARD .....	81
5.5.5	TEST SETUP .....	82
5.5.6	EUT OPERATING CONDITIONS.....	83
5.5.7	TEST RESULTS .....	84
5.6	AC POWER LINE CONDUCTED EMISSION MEASUREMENT .....	88
5.6.1	LIMITS OF AC POWER LINE CONDUCTED EMISSION MEASUREMENT .....	88
5.6.2	TEST INSTRUMENTS.....	88
5.6.3	TEST PROCEDURES .....	89
5.6.4	DEVIATION FROM TEST STANDARD .....	89
5.6.5	TEST SETUP .....	90
5.6.6	EUT OPERATING CONDITIONS.....	90
5.6.7	TEST RESULTS .....	91
6	PHOTOGRAPHS OF THE TEST CONFIGURATION .....	93
7	INFORMATION ON THE TESTING LABORATORIES.....	94
8	APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB.....	95



## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF140508E01-2	Original release	July 08, 2014



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# 1 CERTIFICATION

**PRODUCT :** 802.11 a/b/g/n/ac+ BT 4.1 M.2 2226 Type Card  
**BRAND NAME :** Qualcomm Atheros  
**MODEL NO. :** QCNFA354  
**TEST SAMPLE :** ENGINEERING SAMPLE  
**APPLICANT :** Qualcomm Atheros, Inc.  
**TESTED :** May 14 to July 02, 2014  
**STANDARDS :** FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10-2009

The above equipment (Model: QCNFA354) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and was in 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 :** Midoli Peng , **DATE:** July 08, 2014  
( Midoli Peng, Specialist )

**APPROVED BY :** May Chen , **DATE:** July 08, 2014  
( May Chen, Manager )



## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

**For BT-EDR mode:**

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -7.70dB at 0.17344MHz.
15.247(a)(1) (iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1) (iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.247(d)	Transmitter Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -4.9dB at 99.74MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.



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**For BT-LE mode:**

<b>APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)</b>			
<b>STANDARD SECTION</b>	<b>TEST TYPE AND LIMIT</b>	<b>RESULT</b>	<b>REMARK</b>
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -9.29dB at 0.17344MHz
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -4.9dB at 99.74MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

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



## 2.1 MEASUREMENT UNCERTAINTY

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

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

Measurement	Value
Conducted emissions	2.86 dB
Radiated emissions (30MHz-1GHz)	5.43 dB
Radiated emissions (1GHz -6GHz)	3.65 dB
Radiated emissions (6GHz -18GHz)	3.88 dB
Radiated emissions (18GHz -40GHz)	4.11 dB



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT(BLUETOOTH/DTS)

<b>PRODUCT</b>	802.11 a/b/g/n/ac+ BT 4.1 M.2 2226 Type Card
<b>MODEL NO.</b>	QCNFA354
<b>POWER SUPPLY</b>	DC 3.3V from host equipment
<b>MODULATION TYPE</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK for FHSS 16QAM, QPSK, BPSK for OFDM GFSK for DTS
<b>MODULATION TECHNOLOGY</b>	FHSS, OFDM, DTS
<b>DATE RATE</b>	Up to 3Mbps for BT-EDR mode Up to 24Mbps for BT-HS mode Up to 1Mbps for BT-LE mode
<b>FREQUENCY RANGE</b>	BT-EDR, BT-LE mode: 2402MHz ~ 2480MHz BT-HS mode: 2412MHz ~ 2462MHz
<b>NUMBER OF CHANNEL</b>	BT-EDR mode: 79 BT-HS mode: 11 BT-LE mode: 40
<b>MAX. OUTPUT POWER</b>	BT-EDR mode: 12.050 mW BT-LE mode: 2.061 mW
<b>ANTENNA TYPE</b>	See item 3.2
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	Refer to user's manual
<b>ASSOCIATED DEVICES</b>	NA

**NOTE:**

1. There are Bluetooth technology and WLAN technology used for the EUT.
2. The Bluetooth supports version 4.1.
3. The EUT is a combo module, therefore the WLAN OFDM will be cover BT OFDM (low power) scenario.

4. WLAN/BT coexistence mode:

- 2TX 5GHz WLAN (Main + Aux) + BT (Main) concurrent.
- 2TX 2.4GHz WLAN+ BT timely shared at Main antenna.

5. Spurious Emission (radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11ac(VHT20)) + Bluetooth (GFSK)	36 to 165	120	OFDM
	0 to 78	78	FHSS

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

### 3.2 DESCRIPTION OF ANTENNA

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

Brand	Model	Antenna Type	2.4G Gain with cable loss (dBi)	5G Gain with cable loss (dBi)	2.4G Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
WNC	81.EBJ15.005	PIFA	3.62	Band 1&2: 3.08 Band 3: 4.76 Band 4: 4.76	1.15	Band1&2: 1.70 Band 3: 1.74 Band 4: 1.79	IPEX	300

- Note: 1. Above antenna gains of antenna are Total (H+V).  
2. All of antenna can be application for WLAN and Bluetooth.



### 3.3 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		

40 channels are provided for BT-LE mode:

CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



### 3.4 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

For BT-EDR mode:

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

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

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

#### 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 Type	Packet Type
0 to 78	78	GFSK	DH5

#### Radiated Emission Test (Below 1 GHz):

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

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	78	GFSK	DH5

#### Radiated Emission Test (Above 1 GHz):

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

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0, 39, 78	GFSK	DH5
0 to 78	0, 39, 78	8DPSK	3DH5

**Antenna Port Conducted Measurement:**

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

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0, 39, 78	GFSK	DH5
0 to 78	0, 39, 78	8DPSK	3DH5

**Conducted Out-Band Measurement:**

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

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0, 39, 78	GFSK	DH5
0 to 78	0, 39, 78	8DPSK	3DH5

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	27deg. C, 56%RH	120Vac, 60Hz	Ping Liu
RE<1G	26deg. C, 69%RH	120Vac, 60Hz	Gary Cheng
RE <sup>3</sup> 1G	23deg. C, 65%RH	120Vac, 60Hz	Gary Cheng
APCM	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee
OB	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee



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### For BT-LE mode:

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

Where **PLC**: Power Line Conducted Emission      **RE < 1G**: Radiated Emission below 1GHz  
**RE <sup>3</sup> 1G**: Radiated Emission above 1GHz      **APCM**: Antenna Port Conducted Measurement  
**OB**: Conducted Out-Band Emission Measurement

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

### **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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	39	GFSK	1

### **RADIATED EMISSION TEST (BELOW 1 GHz):**

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

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	39	GFSK	1

### **RADIATED EMISSION TEST (ABOVE 1 GHz):**

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

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	GFSK	1

**ANTENNA PORT CONDUCTED MEASUREMENT:**

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	GFSK	1

**CONDUCTED OUT-BAND EMISSION MEASUREMENT:**

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	GFSK	1

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	27deg. C, 56%RH	120Vac, 60Hz	Ping Liu
RE<1G	26deg. C, 69%RH	120Vac, 60Hz	Gary Cheng
RE <sup>3</sup> 1G	23deg. C, 65%RH	120Vac, 60Hz	Gary Cheng
APCM	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee
OB	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee





### **3.5 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 (Section 15.247)**

**558074 D01 DTS Meas Guidance v03r01**

**ANSI C63.10-2009**

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



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### 3.6 DUTY CYCLE OF TEST SIGNAL

Duty cycle of test signal is < 98 %, duty factor shall be considered.

For BT\_LE-GFSK:

Duty cycle =  $0.408 \text{ ms} / 0.625 \text{ ms} = 0.653$ , Duty factor =  $10 * \log(1/0.653) = 1.9$

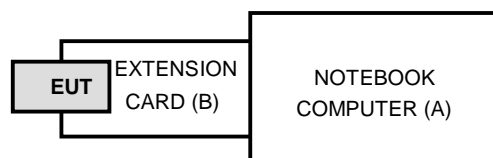


### 3.7 DESCRIPTION OF SUPPORT UNITS

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

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	GM1SKV1	FCC DoC	Provided by Lab
B	EXTENSION CARD	Qualcomm Atheros	HPCBM194-0	NA	NA	Supplied by Client

### 3.8 CONFIGURATION OF SYSTEM UNDER TEST



## 4 TEST PROCEDURES AND RESULTS (BLUETOOTH)

### 4.1 MAXIMUM PEAK OUTPUT POWER

#### 4.1.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Limit is 125mW.

#### 4.1.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

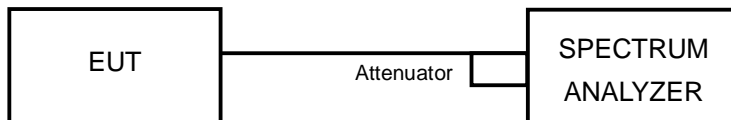
#### 4.1.3 TEST PROCEDURES

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.5 TEST SETUP



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

#### 4.1.6 EUT OPERATING CONDITION

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

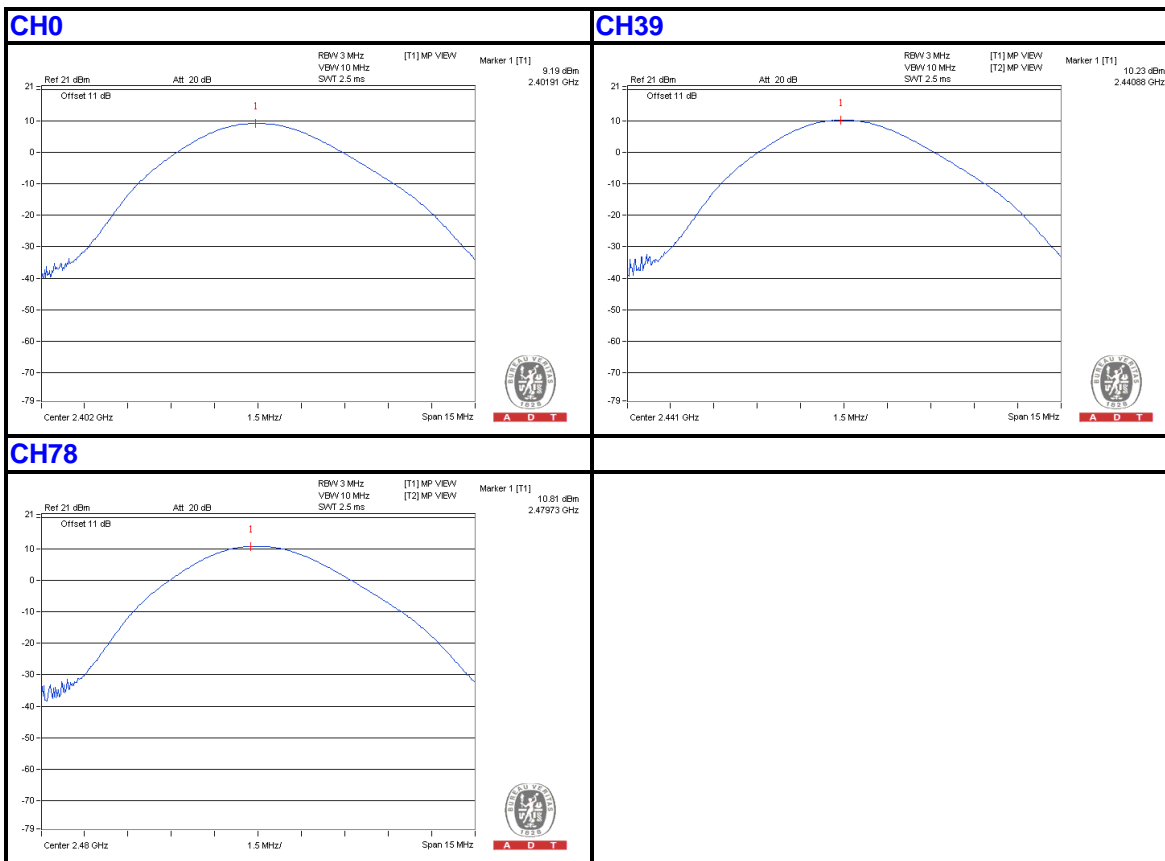


A D T

### 4.1.7 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	OUTPUT POWER (mW)		OUTPUT POWER (dBm)		POWER LIMIT (mW)	PASS / FAIL
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	8.299	7.112	9.19	8.52	125	PASS
39	2441	10.544	9.290	10.23	9.68	125	PASS
78	2480	12.050	10.691	10.81	10.29	125	PASS

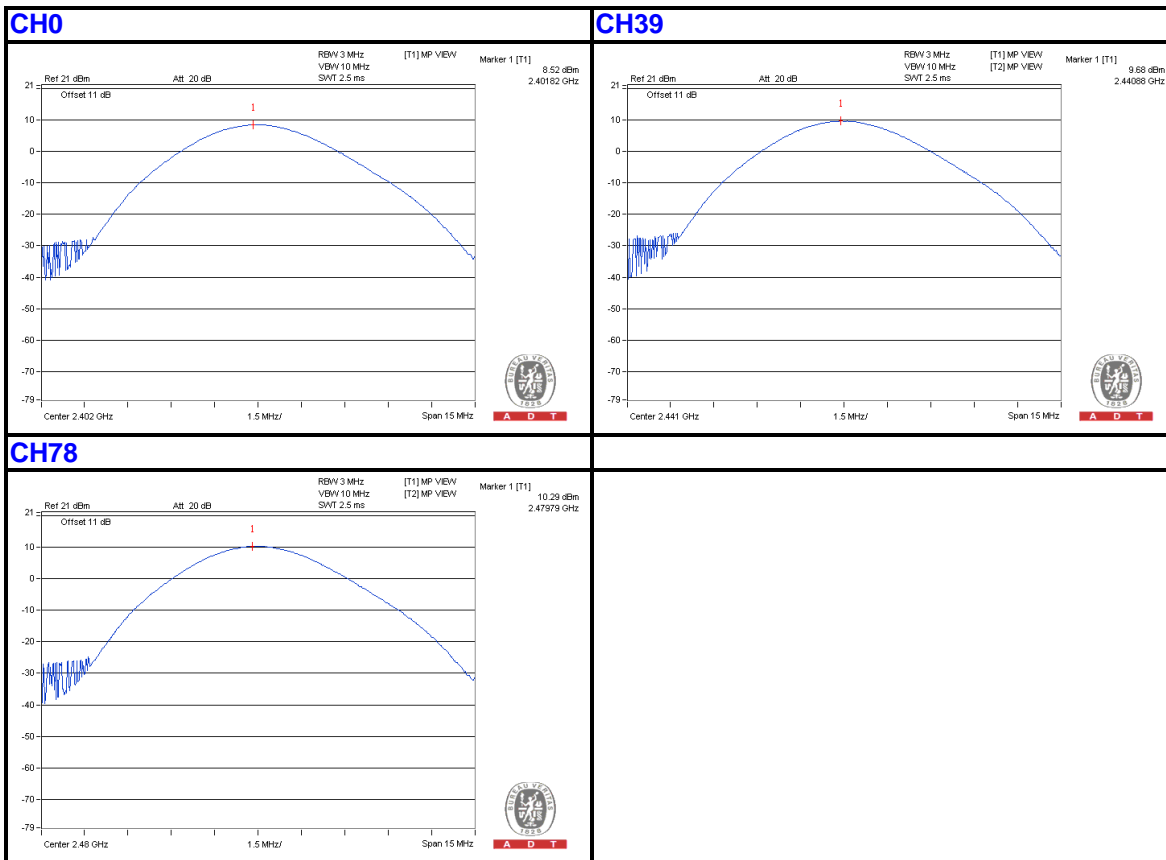
#### For GFSK





A D T

### For 8DPSK



## 4.2 AVERAGE OUTPUT POWER

### 4.2.1 FOR REFERENCE.

### 4.2.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power Meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power Sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 2015

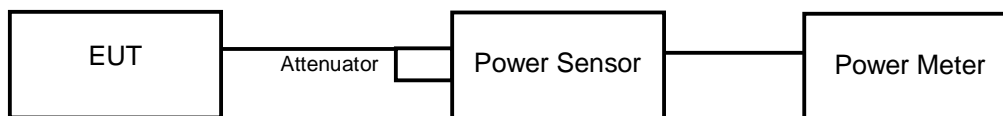
**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

### 4.2.3 TEST PROCEDURES

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

### 4.2.4 TEST SETUP



### 4.2.5 EUT OPERATING CONDITION

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



#### 4.2.6 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER OUTPUT (dBm)	
		GFSK	8DPSK
0	2402	9.04	6.24
39	2441	10.05	7.54
78	2480	10.57	8.26

### 4.3 CHANNEL BANDWIDTH

#### 4.3.1 LIMITS OF CHANNEL BANDWIDTH

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

#### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

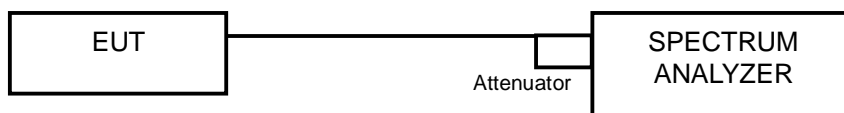
#### 4.3.3 TEST PROCEDURE

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

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.3.5 TEST SETUP



#### 4.3.6 EUT OPERATING CONDITION

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

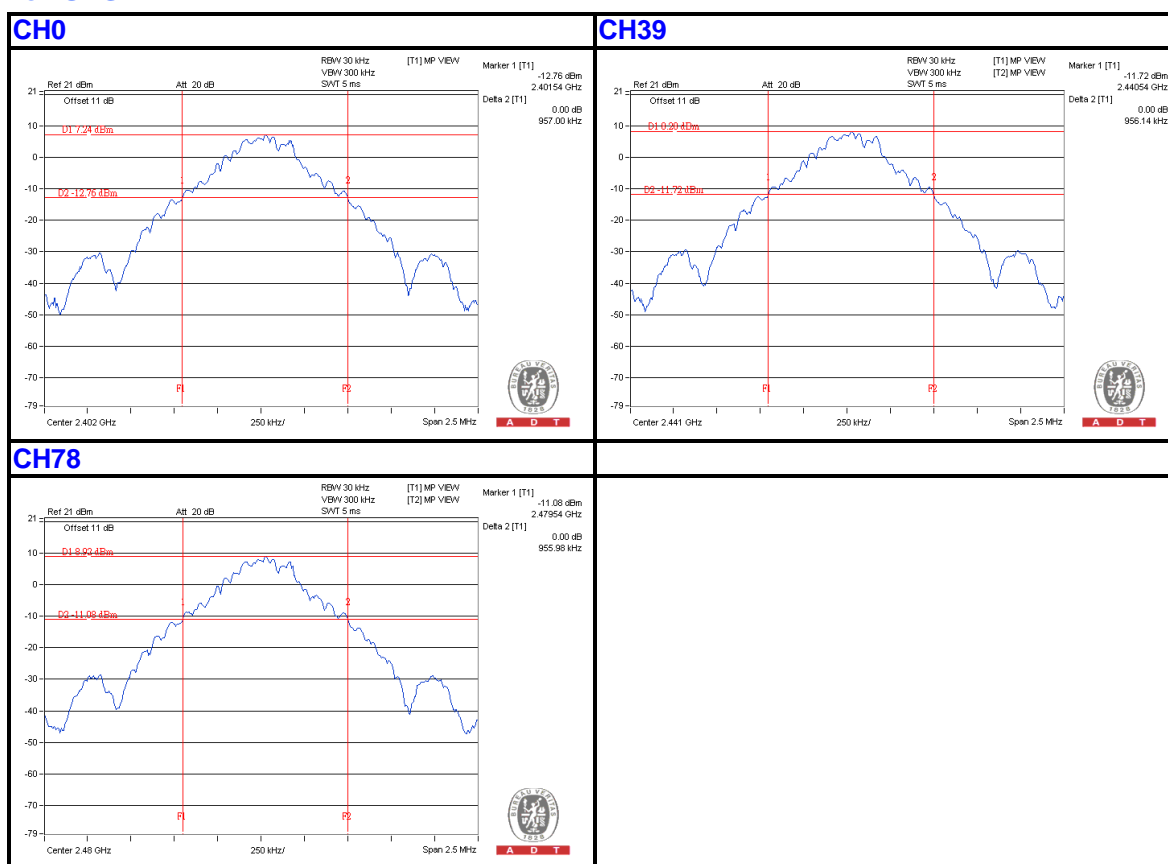


A D T

### 4.3.7 TEST RESULTS

CHANNEL	FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	
		GFSK	8DPSK
0	2402	0.95	1.30
39	2441	0.95	1.30
78	2480	0.95	1.30

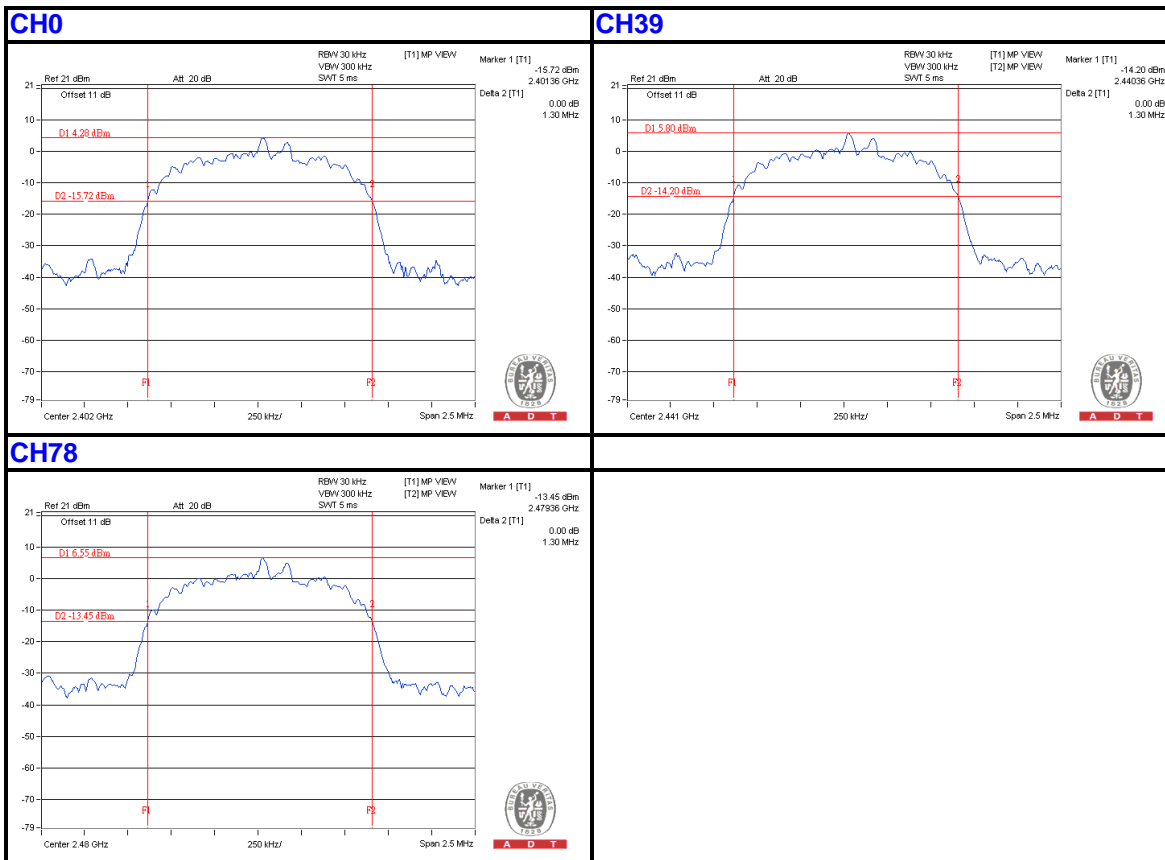
#### For GFSK





A D T

### For 8DPSK



#### 4.4 HOPPING CHANNEL SEPARATION

##### 4.4.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

##### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

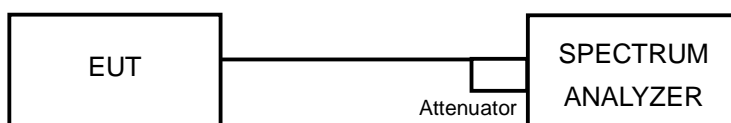
##### 4.4.3 TEST PROCEDURES

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

##### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

##### 4.4.5 TEST SETUP





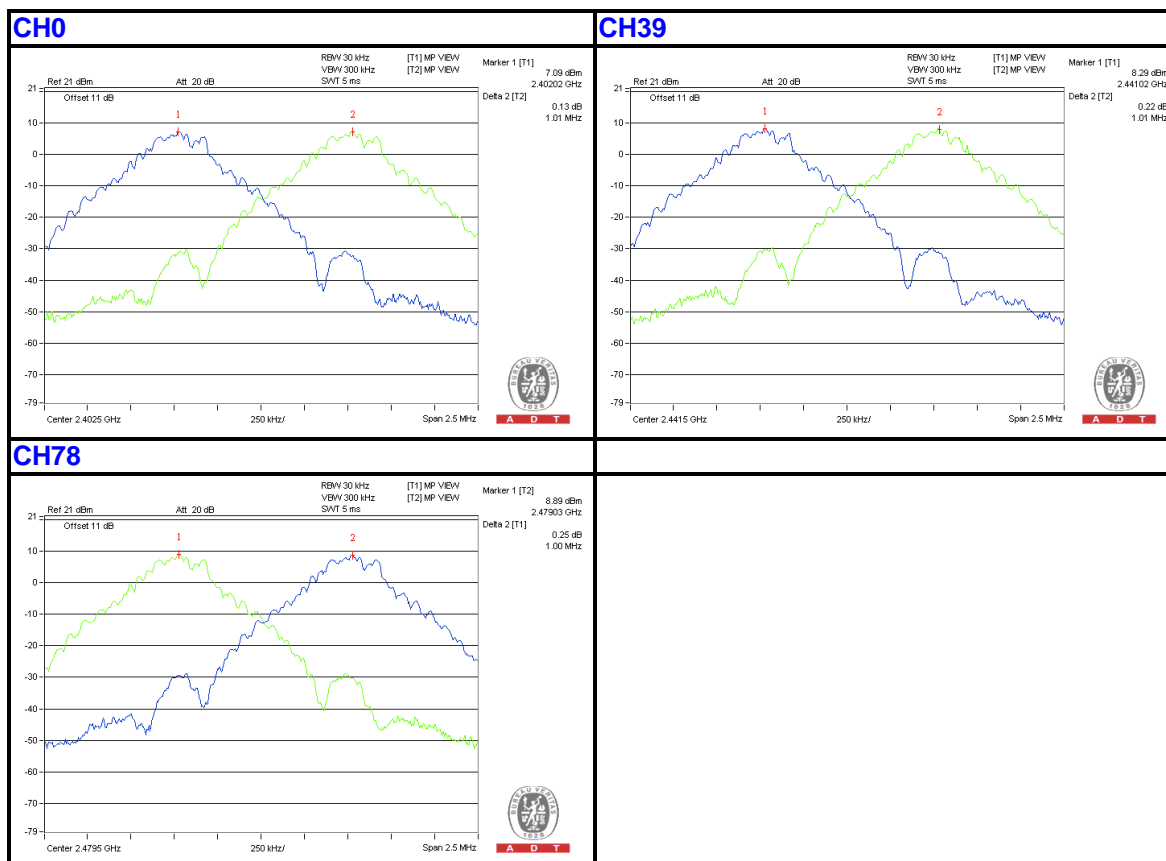
A D T

### 4.4.6 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	1.30	0.64	0.87	PASS
39	2441	1.01	1.00	0.95	1.30	0.64	0.87	PASS
78	2480	1.00	1.00	0.95	1.30	0.64	0.87	PASS

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

#### For GFSK

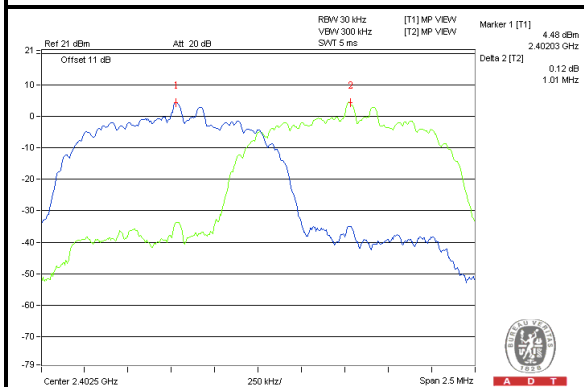




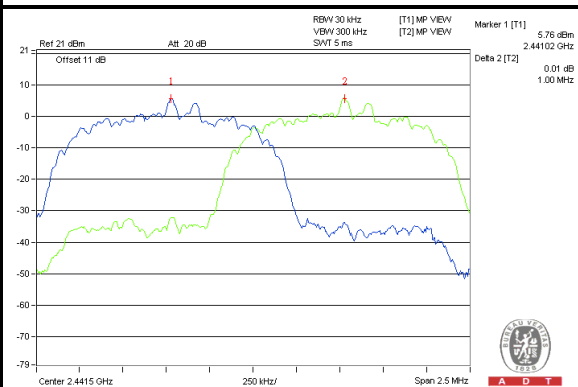
A D T

### For 8DPSK

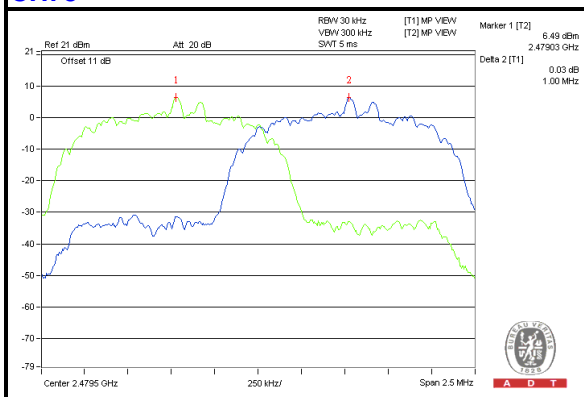
#### CH0



#### CH39



#### CH78





## 4.5 NUMBER OF HOPPING FREQUENCY USED

### 4.5.1 LIMIT OF HOPPING FREQUENCY USED

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

### 4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

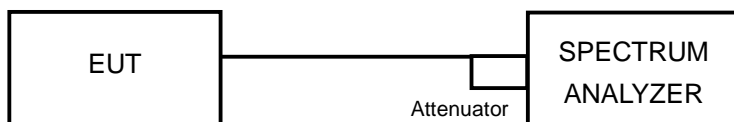
### 4.5.3 TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

### 4.5.4 DEVIATION FROM TEST STANDARD

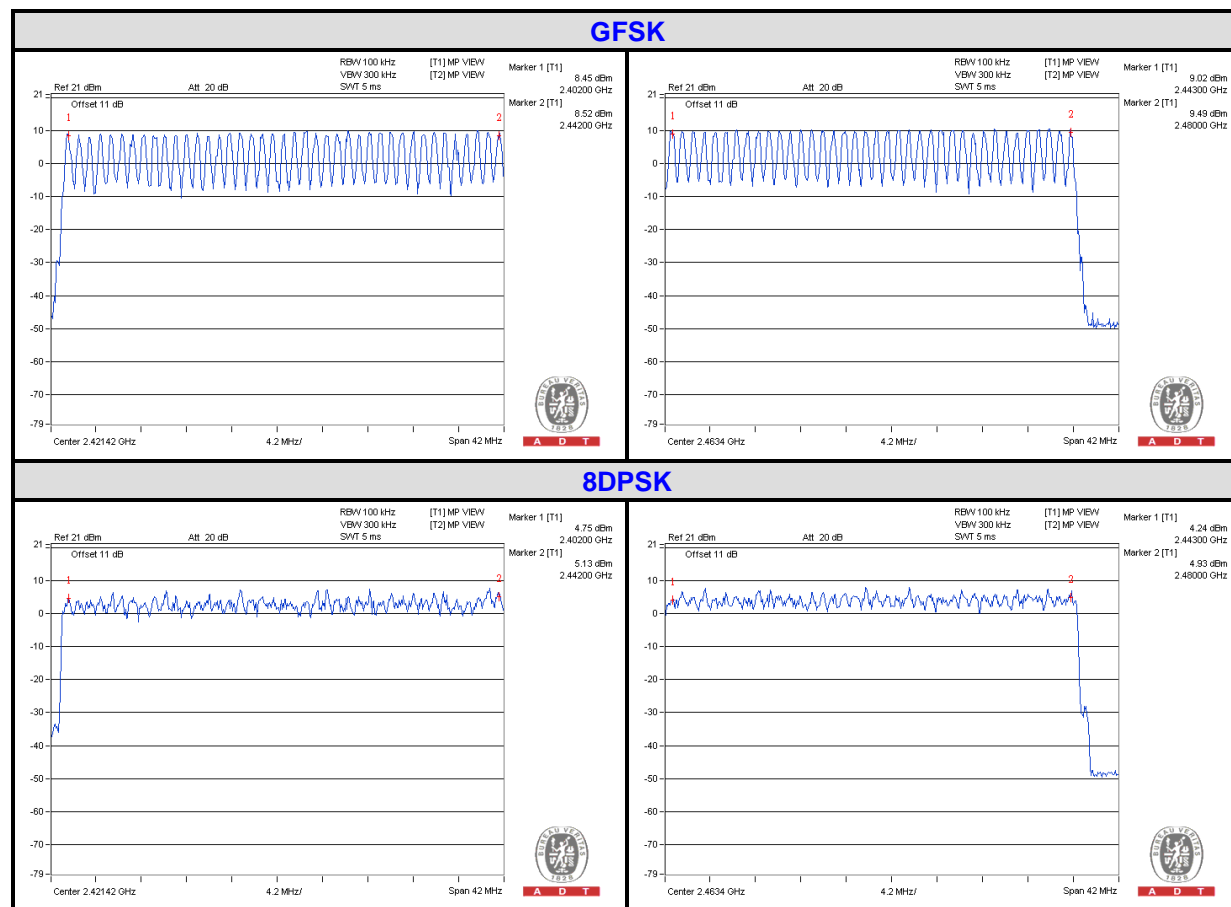
No deviation

### 4.5.5 TEST SETUP



### 4.5.6 TEST RESULTS

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



## 4.6 DWELL TIME ON EACH CHANNEL

### 4.6.1 LIMIT OF DWELL TIME USED

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

### 4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

### 4.6.3 TEST PROCEDURES

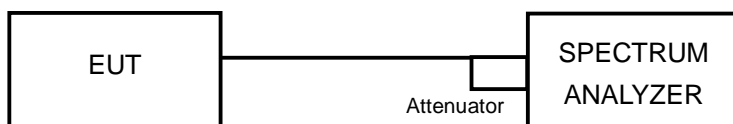
- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- e. Repeat above procedures until all different time-slot modes have been completed.

### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation



#### 4.6.5 TEST SETUP



#### 4.6.6 TEST RESULTS

For GFSK:

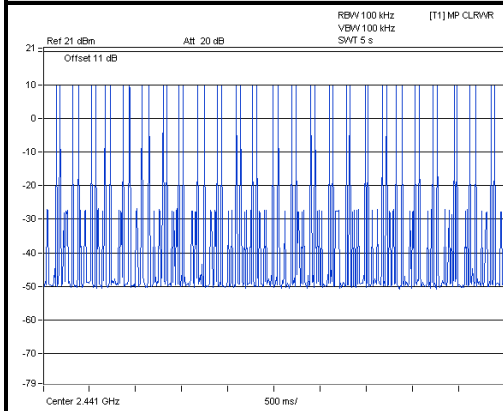
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316 times	0.426	134.62	400
DH3	25 (times / 5 sec) *6.32=158 times	1.7	268.6	400
DH5	18 (times / 5 sec) *6.32=113.76 times	2.96	336.73	400

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

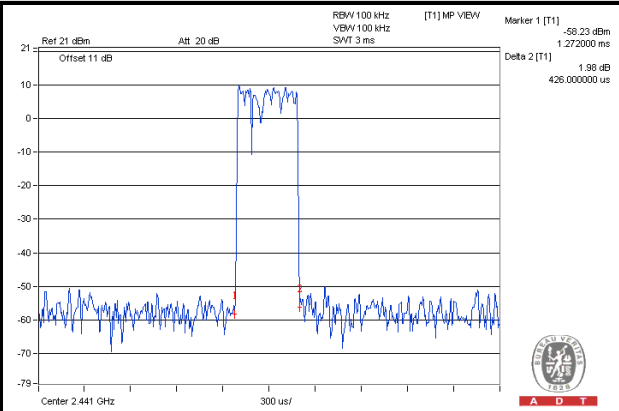


A D T

### DH1

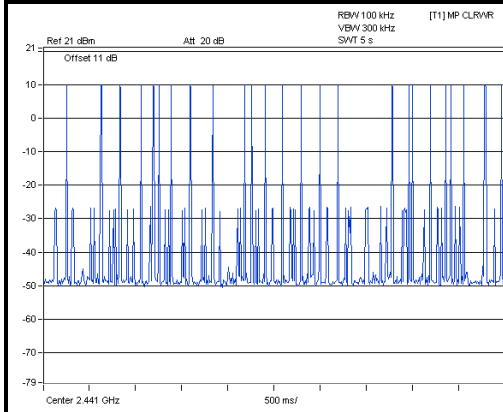


A D T

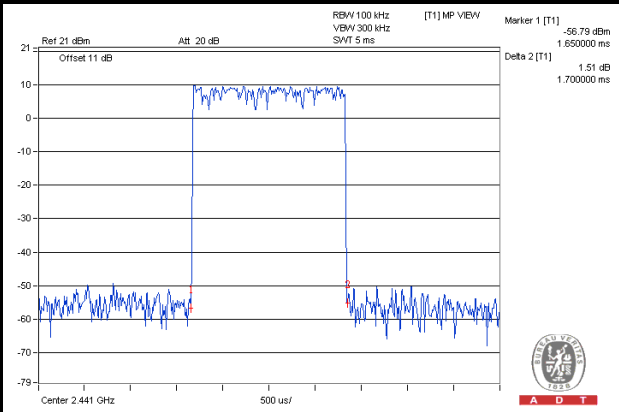


A D T

### DH3

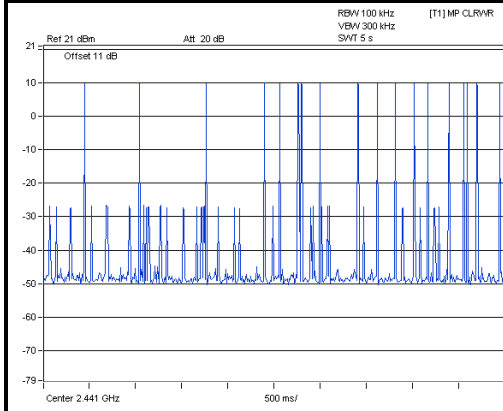


A D T

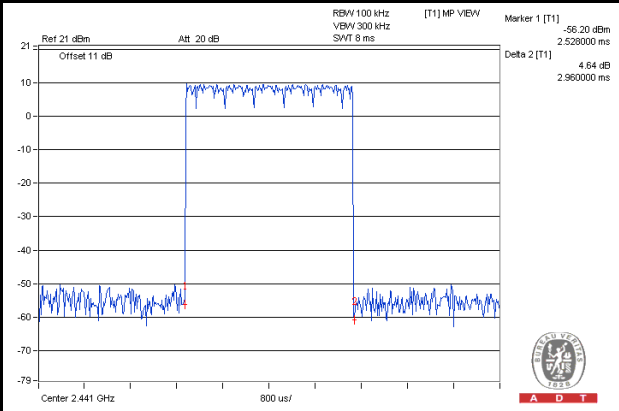


A D T

### DH5



A D T



A D T



A D T

**For GFSK(AFH):**

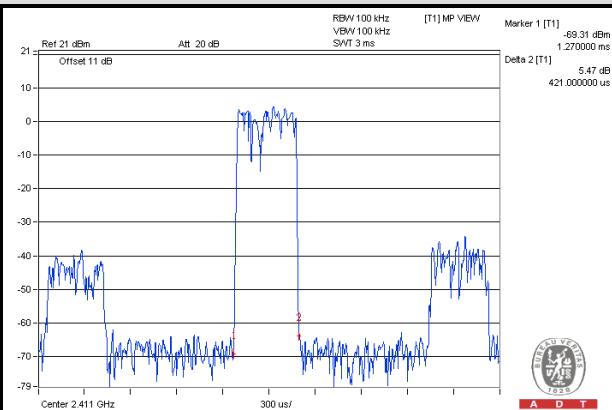
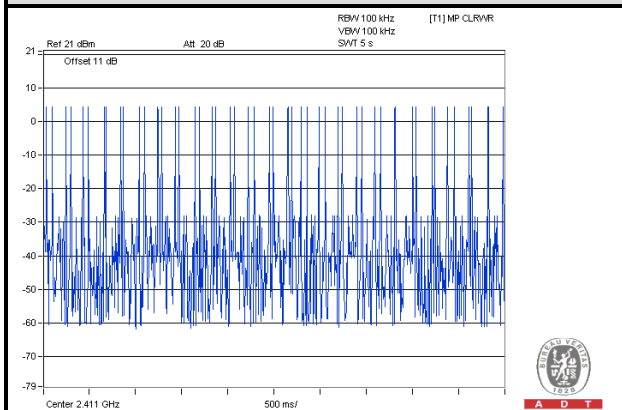
Mode	Number of transmission in a 8 (20Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *1.6=80 times	0.421	33.68	400
DH3	25 (times / 5 sec) *1.6=40 times	1.696	67.84	400
DH5	16 (times / 5 sec) *1.6=25.6 times	3.038	77.773	400

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

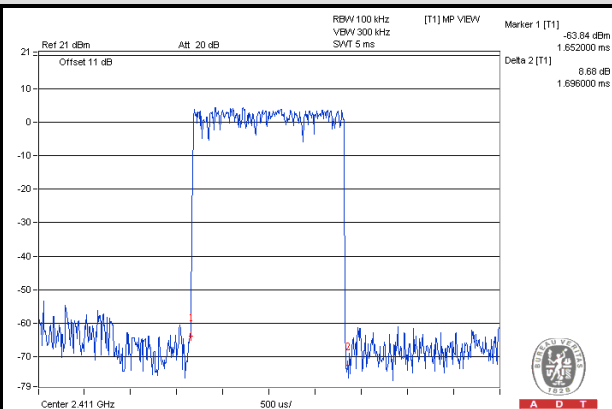
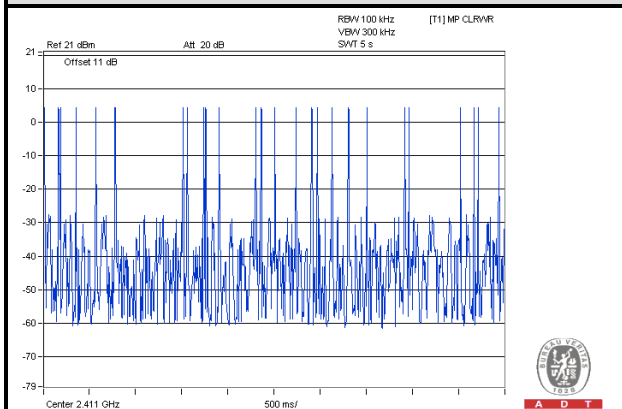


A D T

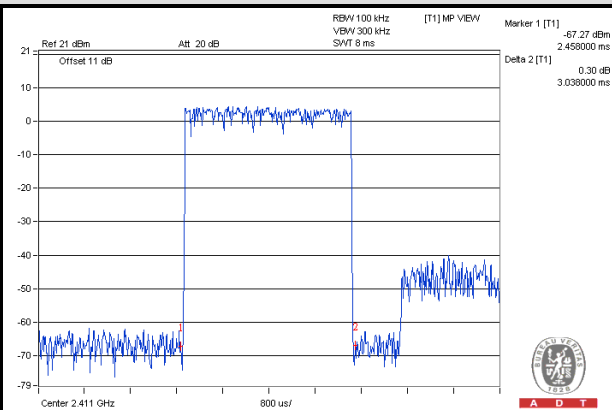
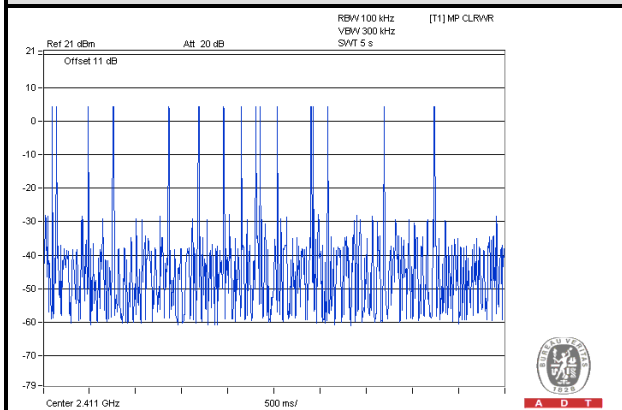
### DH1



### DH3



### DH5







A D T

**For 8DPSK:**

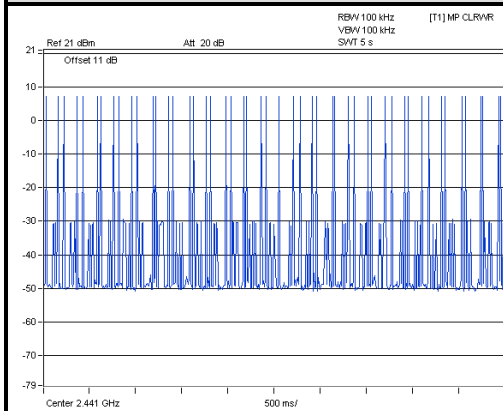
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316 times	0.432	136.51	400
DH3	27 (times / 5 sec) *6.32=170.64 times	1.69	288.38	400
DH5	16 (times / 5 sec) *6.32=101.12 times	2.992	302.55	400

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

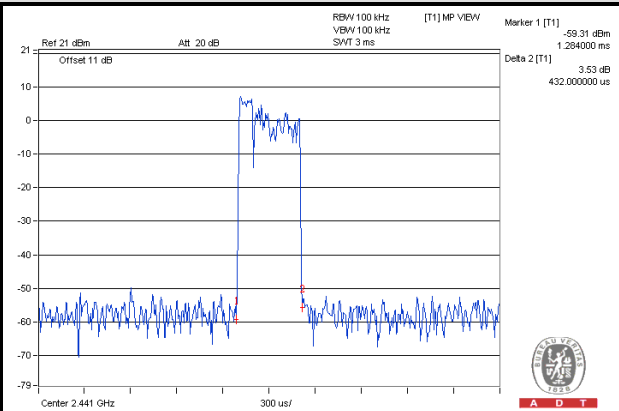


A D T

### DH1

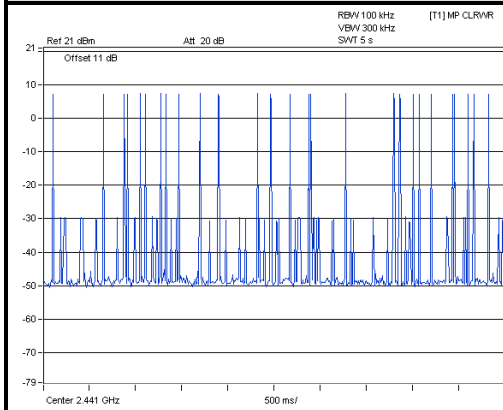


A D T

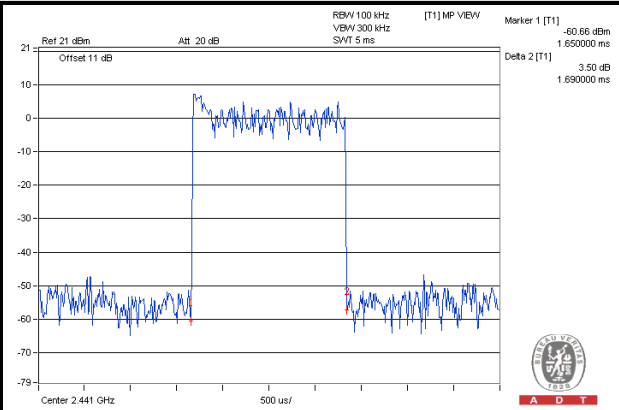


A D T

### DH3

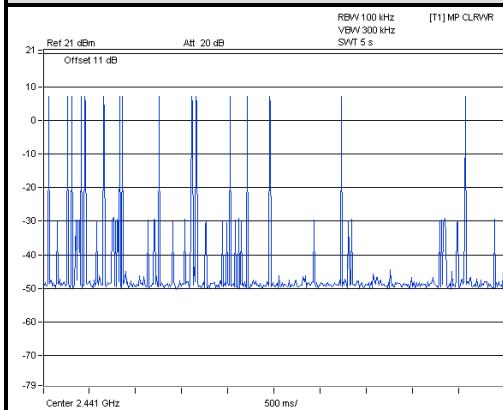


A D T

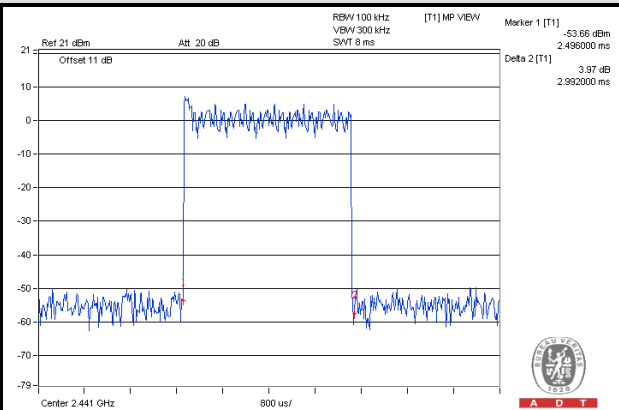


A D T

### DH5



A D T



A D T



A D T

**For 8DPSK(AFH):**

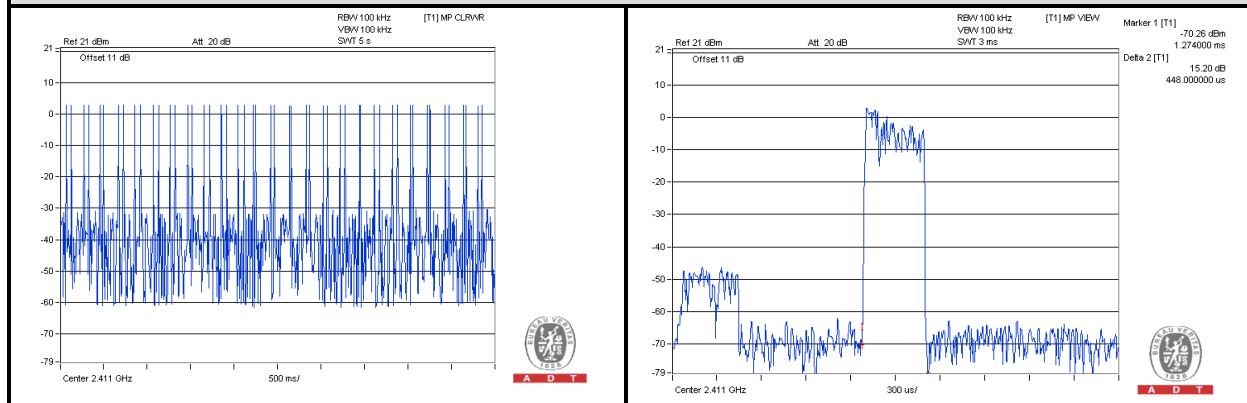
Mode	Number of transmission in a 8 (20Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *1.6=80 times	0.448	35.84	400
DH3	26 (times / 5 sec) *1.6=41.6 times	1.703	70.845	400
DH5	16 (times / 5 sec) *1.6=25.6 times	2.991	76.57	400

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

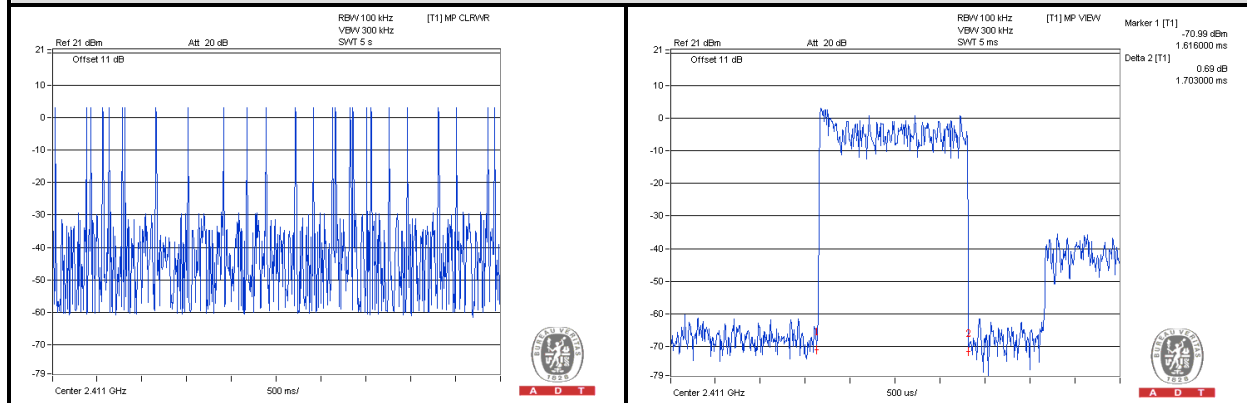


A D T

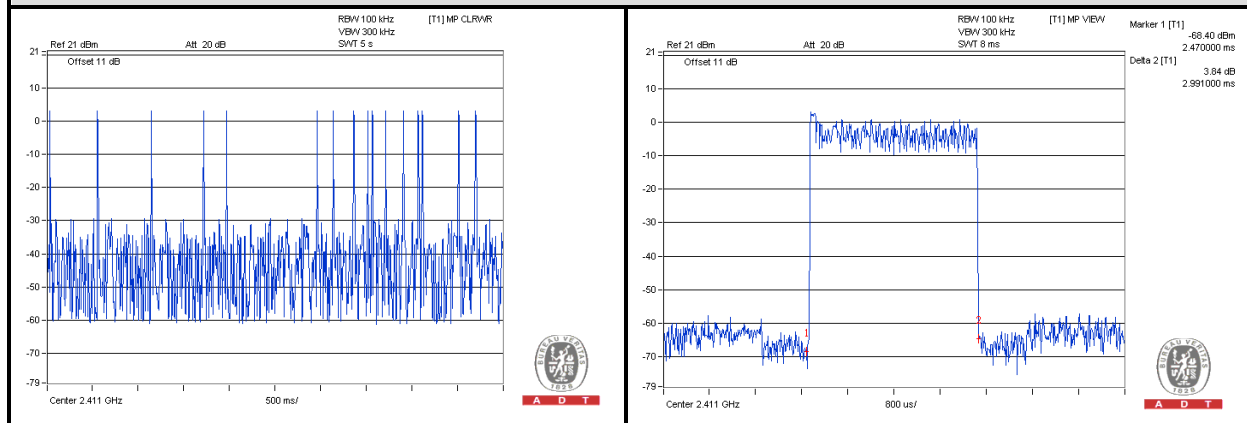
### DH1



### DH3



### DH5



## 4.7 CONDUCTED OUT-BAND EMISSION MEASUREMENT

### 4.8.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  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	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

### 4.8.3 TEST PROCEDURE

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

### 4.8.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.7.1 TEST SETUP



### 4.8.5 EUT OPERATING CONDITION

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

#### 4.8.6 TEST RESULTS

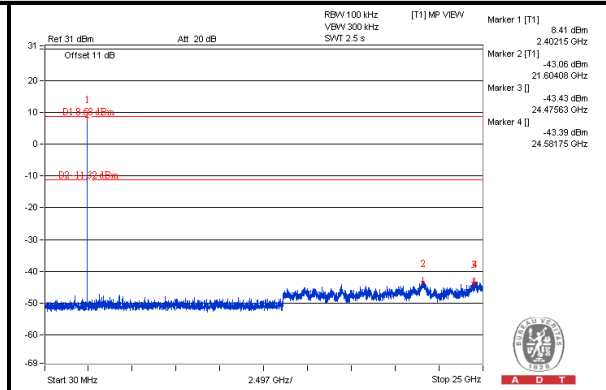
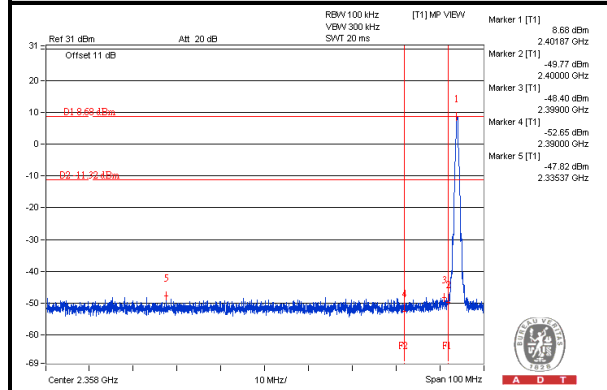
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



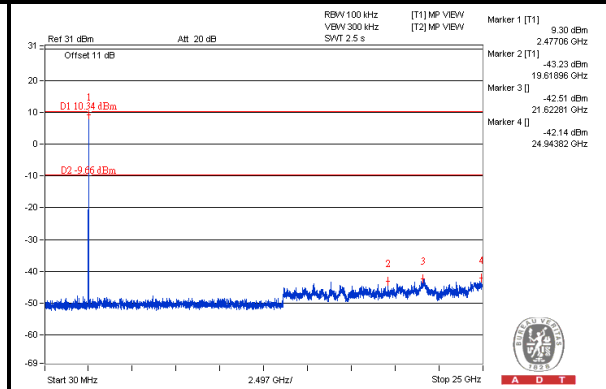
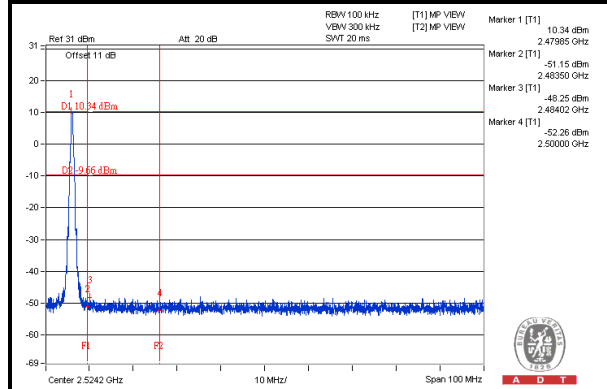
A D T

### For GFSK

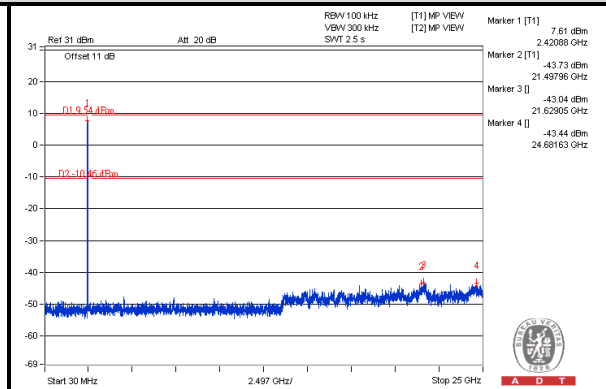
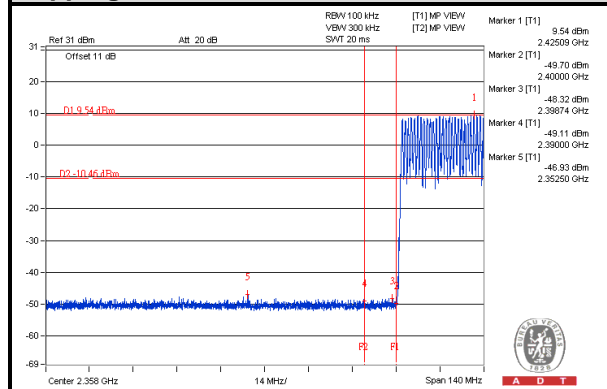
### Hopping disabled\_Low Channel



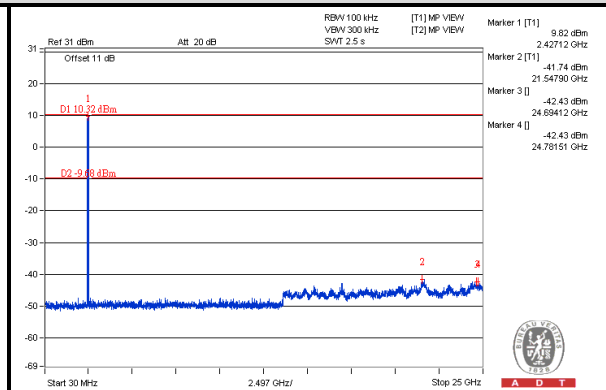
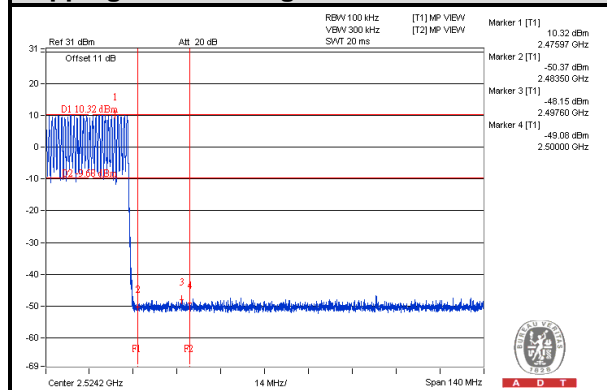
### Hopping disabled\_High Channel



### Hopping enabled\_Low Channel



### Hopping enabled\_High Channel

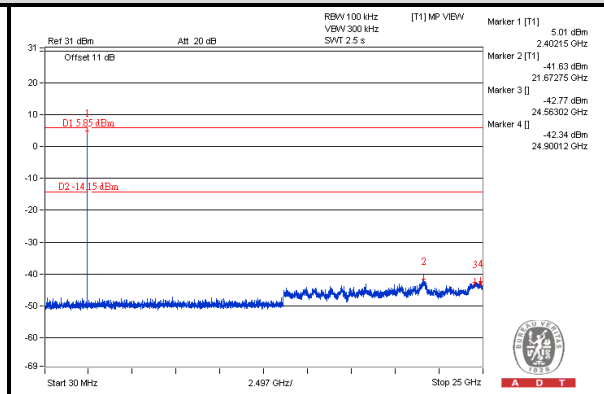
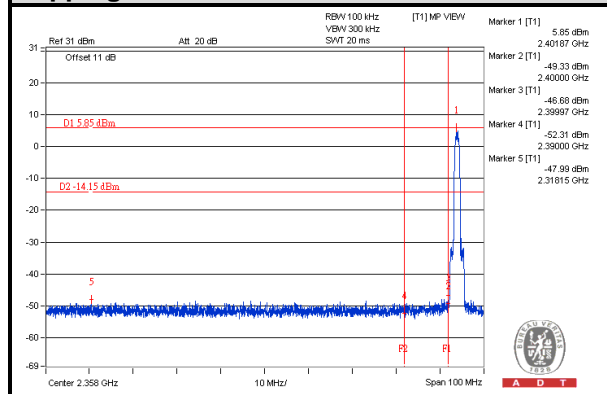




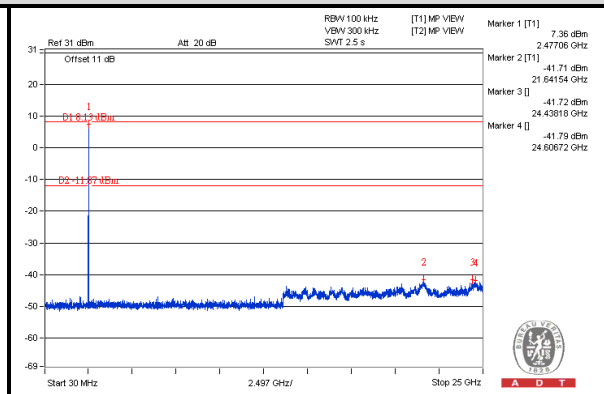
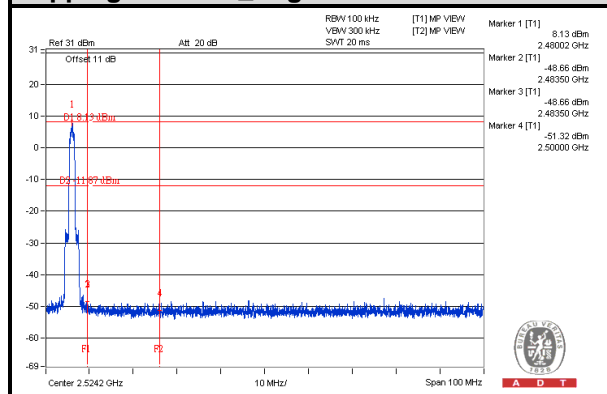
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### For 8DPSK

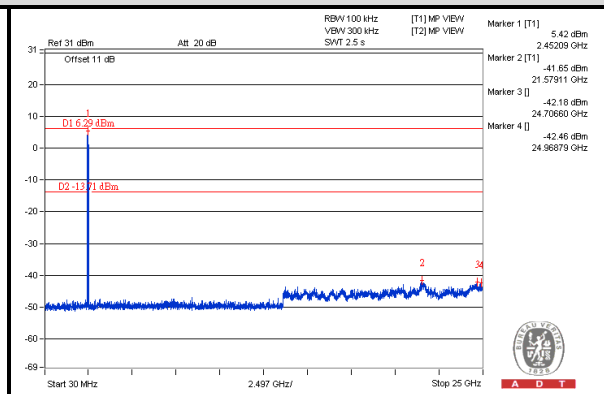
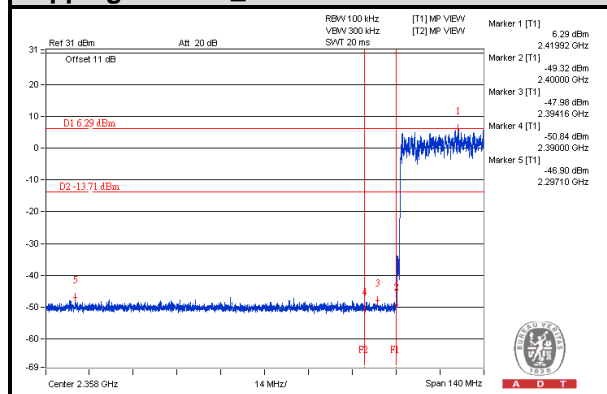
#### Hopping disabled\_ Low Channel



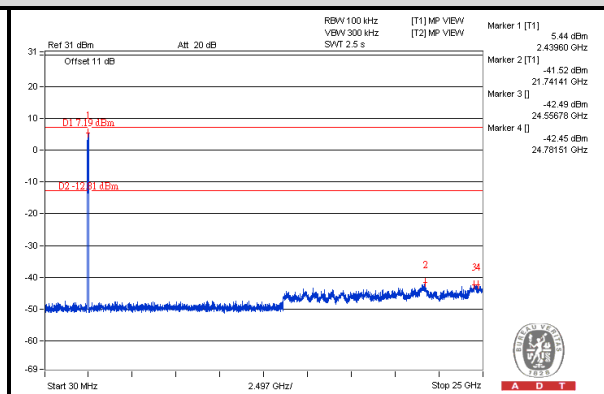
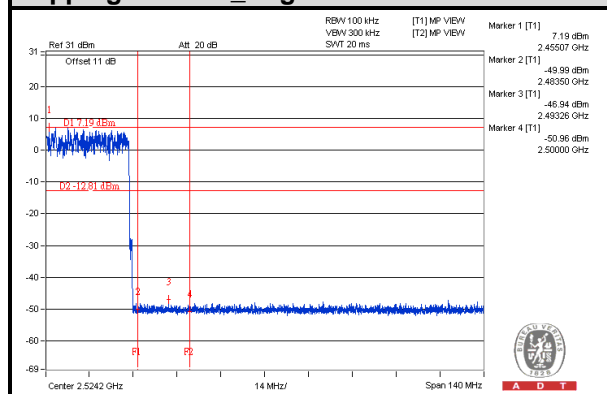
#### Hopping disabled\_ High Channel



#### Hopping enabled\_ Low Channel



#### Hopping enabled\_ High Channel





## 4.8 RADIATED EMISSION MEASUREMENT

### 4.8.1 LIMITS OF RADIATED EMISSION 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. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



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## 4.8.2 TEST INSTRUMENTS

### Below 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 15, 2014	Jan. 14, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISI	AIH.8018	0000220091110	Dec. 06, 2013	Dec. 05, 2014
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 29, 2013	Oct. 28, 2014
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKA-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

### Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: June 07, 2014



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**Above 1GHz test:**

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	Jan. 21, 2014	Jan. 20, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 05, 2013	Oct. 04, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISI	AIH.8018	0000320091110	Nov. 18, 2013	Nov. 17, 2014
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	RF104-201 RF104-203 RF104-204	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
5. The VCCI Site Registration No. is G-137.
6. The CANADA Site Registration No. is IC 7450H-2.
7. Tested Date: July 01, 2014

### 4.8.3 TEST PROCEDURES

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

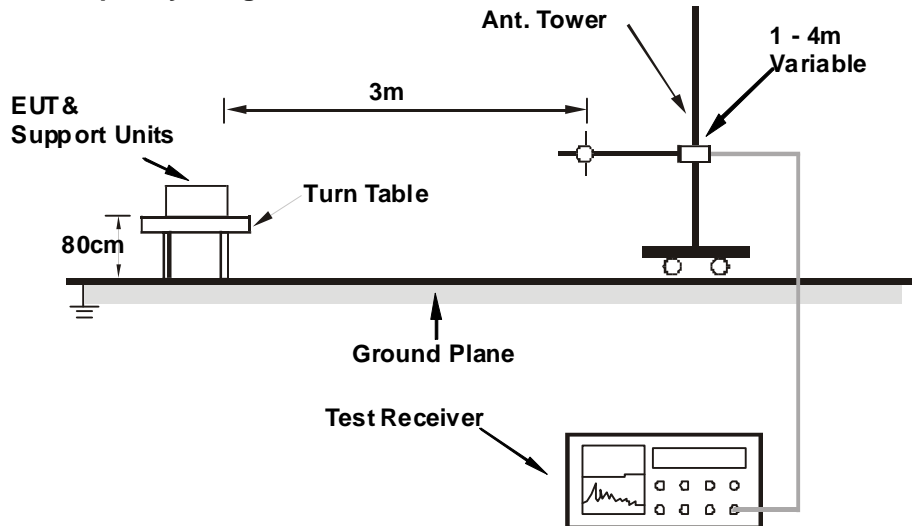
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

### 4.8.4 DEVIATION FROM TEST STANDARD

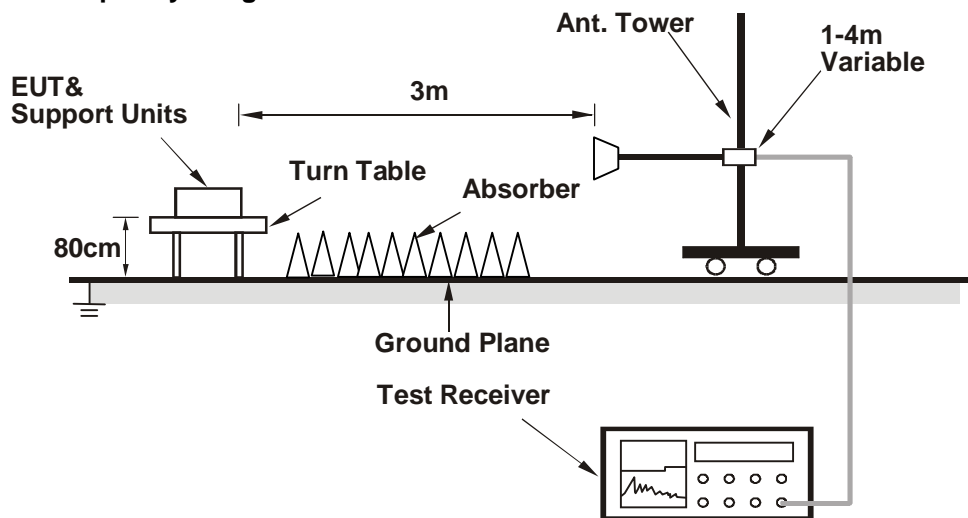
No deviation

#### 4.8.5 TEST SETUP

##### <Frequency Range below 1GHz>



##### <Frequency Range above 1GHz>



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

#### 4.8.6 EUT OPERATING CONDITIONS

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program “QCRT Version3.0 29.0” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

## 4.8.7 TEST RESULTS

### BELOW 1GHz WORST-CASE DATA

#### BT\_GFSK

<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	Below 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.74	38.6 QP	43.5	-4.9	1.50 H	142	55.97	-17.35
2	165.99	37.1 QP	43.5	-6.4	1.50 H	186	50.00	-12.88
3	232.39	39.5 QP	46.0	-6.5	1.50 H	332	54.13	-14.62
4	240.00	39.1 QP	46.0	-6.9	1.00 H	187	52.90	-13.80
5	431.97	35.4 QP	46.0	-10.6	2.00 H	117	43.50	-8.09
6	796.59	40.8 QP	46.0	-5.2	1.50 H	271	41.71	-0.94
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.59	27.9 QP	43.5	-15.6	1.00 V	301	45.23	-17.37
2	165.99	35.6 QP	43.5	-7.9	1.00 V	162	48.50	-12.88
3	186.12	27.4 QP	43.5	-16.1	1.00 V	157	42.30	-14.88
4	232.34	30.9 QP	46.0	-15.1	1.00 V	190	45.54	-14.63
5	432.05	33.1 QP	46.0	-12.9	1.00 V	139	41.19	-8.09
6	796.59	37.5 QP	46.0	-8.5	1.00 V	360	38.44	-0.94

#### REMARKS:

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



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## ABOVE 1GHz DATA

### BT\_GFSK

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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	45.4 PK	74.0	-28.6	1.00 H	304	47.87	-2.47
2	2390.00	32.4 AV	54.0	-21.6	1.00 H	304	34.87	-2.47
3	*2402.00	99.3 PK			1.00 H	304	101.71	-2.41
4	*2402.00	98.4 AV			1.00 H	304	100.81	-2.41
5	4804.00	46.5 PK	74.0	-27.5	1.51 H	326	40.88	5.62
6	4804.00	34.4 AV	54.0	-19.6	1.51 H	326	28.78	5.62
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	46.4 PK	74.0	-27.6	1.04 V	116	48.87	-2.47
2	2390.00	35.2 AV	54.0	-18.8	1.04 V	116	37.67	-2.47
3	*2402.00	101.3 PK			1.04 V	116	103.71	-2.41
4	*2402.00	100.2 AV			1.04 V	116	102.61	-2.41
5	4804.00	47.6 PK	74.0	-26.4	1.00 V	100	41.98	5.62
6	4804.00	35.4 AV	54.0	-18.6	1.00 V	100	29.78	5.62

#### REMARKS:

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





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<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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	98.0 PK			1.03 H	293	100.24	-2.24
2	*2441.00	96.8 AV			1.03 H	293	99.04	-2.24
3	4882.00	47.0 PK	74.0	-27.0	1.49 H	336	41.06	5.94
4	4882.00	34.9 AV	54.0	-19.1	1.49 H	336	28.96	5.94
5	7323.00	53.2 PK	74.0	-20.8	1.20 H	332	40.02	13.18
6	7323.00	40.7 AV	54.0	-13.3	1.20 H	332	27.52	13.18
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	101.9 PK			1.02 V	119	104.14	-2.24
2	*2441.00	101.2 AV			1.02 V	119	103.44	-2.24
3	4882.00	47.5 PK	74.0	-26.5	1.06 V	118	41.56	5.94
4	4882.00	35.3 AV	54.0	-18.7	1.06 V	118	29.36	5.94
5	7323.00	53.1 PK	74.0	-20.9	1.00 V	275	39.92	13.18
6	7323.00	40.8 AV	54.0	-13.2	1.00 V	275	27.62	13.18

**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.



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<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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	98.4 PK			1.01 H	315	100.46	-2.06
2	*2480.00	97.2 AV			1.01 H	315	99.26	-2.06
3	2483.50	47.2 PK	74.0	-26.8	1.01 H	300	49.23	-2.03
4	2483.50	33.2 AV	54.0	-20.8	1.01 H	300	35.23	-2.03
5	4960.00	47.1 PK	74.0	-26.9	1.53 H	331	40.84	6.26
6	4960.00	34.8 AV	54.0	-19.2	1.53 H	331	28.54	6.26
7	7440.00	53.3 PK	74.0	-20.7	1.17 H	325	40.17	13.13
8	7440.00	40.8 AV	54.0	-13.2	1.17 H	325	27.67	13.13

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	101.7 PK			1.05 V	123	103.76	-2.06
2	*2480.00	101.4 AV			1.05 V	123	103.46	-2.06
3	2483.50	49.3 PK	74.0	-24.7	1.00 V	360	51.33	-2.03
4	2483.50	33.2 AV	54.0	-20.8	1.00 V	360	35.23	-2.03
5	4960.00	47.5 PK	74.0	-26.5	1.01 V	115	41.24	6.26
6	4960.00	35.5 AV	54.0	-18.5	1.01 V	115	29.24	6.26
7	7440.00	53.7 PK	74.0	-20.3	1.00 V	275	40.57	13.13
8	7440.00	41.3 AV	54.0	-12.7	1.00 V	275	28.17	13.13

**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.



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## BT\_8DPSK

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

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	46.0 PK	74.0	-28.0	1.02 H	340	48.47	-2.47
2	2390.00	33.4 AV	54.0	-20.6	1.02 H	340	35.87	-2.47
3	*2402.00	96.6 PK			1.02 H	340	99.01	-2.41
4	*2402.00	92.8 AV			1.02 H	340	95.21	-2.41
5	4804.00	46.4 PK	74.0	-27.6	1.00 H	347	40.78	5.62
6	4804.00	35.0 AV	54.0	-19.0	1.00 H	347	29.38	5.62
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	46.4 PK	74.0	-27.6	1.04 V	117	48.87	-2.47
2	2390.00	34.2 AV	54.0	-19.8	1.04 V	117	36.67	-2.47
3	*2402.00	100.4 PK			1.04 V	117	102.81	-2.41
4	*2402.00	97.1 AV			1.04 V	117	99.51	-2.41
5	4804.00	46.5 PK	74.0	-27.5	1.00 V	145	40.88	5.62
6	4804.00	34.8 AV	54.0	-19.2	1.00 V	145	29.18	5.62

## REMARKS:

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



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<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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	96.4 PK			1.00 H	332	98.64	-2.24
2	*2441.00	92.4 AV			1.00 H	332	94.64	-2.24
3	4882.00	46.2 PK	74.0	-27.8	1.00 H	355	40.26	5.94
4	4882.00	35.1 AV	54.0	-18.9	1.00 H	355	29.16	5.94
5	7323.00	53.6 PK	74.0	-20.4	1.00 H	324	40.42	13.18
6	7323.00	42.1 AV	54.0	-11.9	1.00 H	324	28.92	13.18
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	100.6 PK			1.09 V	121	102.84	-2.24
2	*2441.00	97.2 AV			1.09 V	121	99.44	-2.24
3	4882.00	46.4 PK	74.0	-27.6	1.00 V	132	40.46	5.94
4	4882.00	34.6 AV	54.0	-19.4	1.00 V	132	28.66	5.94
5	7323.00	53.9 PK	74.0	-20.1	1.05 V	98	40.72	13.18
6	7323.00	42.0 AV	54.0	-12.0	1.05 V	98	28.82	13.18

**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.



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<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

**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	95.8 PK			1.00 H	336	97.86	-2.06
2	*2480.00	92.0 AV			1.00 H	336	94.06	-2.06
3	2483.50	46.1 PK	74.0	-27.9	1.00 H	336	48.13	-2.03
4	2483.50	33.4 AV	54.0	-20.6	1.00 H	336	35.43	-2.03
5	4960.00	46.0 PK	74.0	-28.0	1.00 H	341	39.74	6.26
6	4960.00	34.6 AV	54.0	-19.4	1.00 H	341	28.34	6.26
7	7440.00	53.9 PK	74.0	-20.1	1.01 H	314	40.77	13.13
8	7440.00	42.2 AV	54.0	-11.8	1.01 H	314	29.07	13.13

**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	100.3 PK			1.06 V	110	102.36	-2.06
2	*2480.00	97.0 AV			1.06 V	110	99.06	-2.06
3	2483.50	46.2 PK	74.0	-27.8	1.06 V	110	48.23	-2.03
4	2483.50	33.7 AV	54.0	-20.3	1.06 V	110	35.73	-2.03
5	4960.00	46.1 PK	74.0	-27.9	1.02 V	142	39.84	6.26
6	4960.00	34.2 AV	54.0	-19.8	1.02 V	142	27.94	6.26
7	7440.00	53.9 PK	74.0	-20.1	1.07 V	90	40.77	13.13
8	7440.00	41.9 AV	54.0	-12.1	1.07 V	90	28.77	13.13

**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.

## 4.9 CONDUCTED EMISSION MEASUREMENT

### 4.9.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. All emanations from a class B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.9.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 12, 2013	Sep. 11, 2014
Line-Impedance Stabilization Network (for Peripheral)	ENV216	100071	Nov. 13, 2013	Nov. 12, 2014
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10, 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 24, 2013	Sep. 23, 2014
50 ohms Terminator	N/A	EMC-02	Oct. 01, 2013	Sep. 30, 2014
Software ADT	BV ADT_Cond_V7.3.7. 3	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: May 14, 2014

### 4.9.3 TEST PROCEDURES

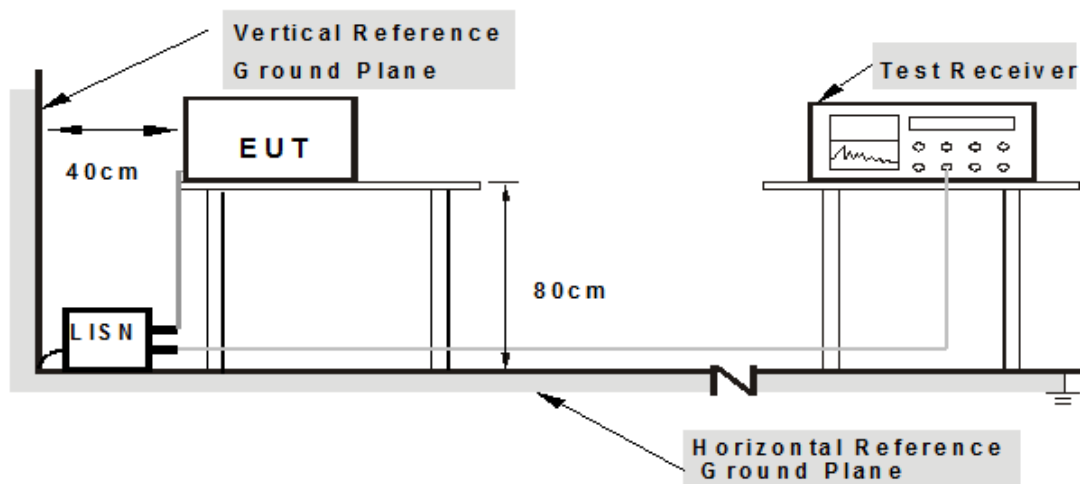
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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) were not recorded.

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

### 4.9.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.9.5 TEST SETUP



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

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



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#### 4.9.6 EUT OPERATING CONDITIONS

Same as Item 4.8.6



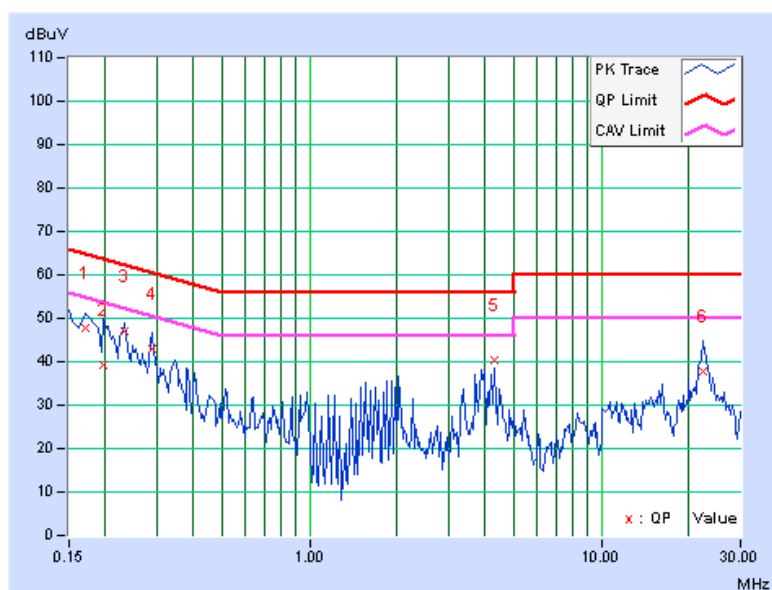
### 4.9.7 TEST RESULTS

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

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16953	0.06	47.89	43.24	47.95	43.30	64.98	54.98	-17.03	-11.68
2	0.19687	0.06	39.09	14.85	39.15	14.91	63.74	53.74	-24.59	-38.83
3	0.23203	0.06	47.03	40.70	47.09	40.76	62.38	52.38	-15.29	-11.62
4	0.29063	0.06	42.93	34.93	42.99	34.99	60.51	50.51	-17.51	-15.51
5	4.28125	0.21	40.05	25.94	40.26	26.15	56.00	46.00	-15.74	-19.85
6	22.17969	0.73	36.97	30.92	37.70	31.65	60.00	50.00	-22.30	-18.35

**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





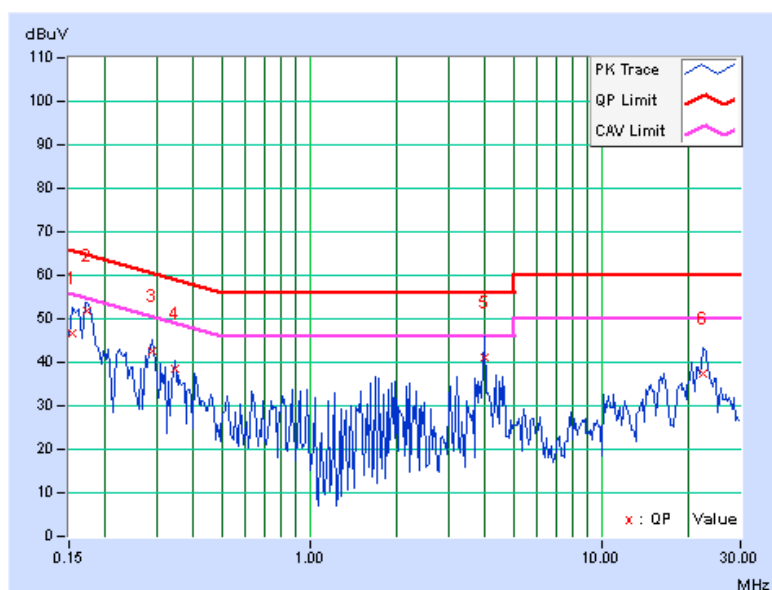
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<b>PHASE</b>	Neutral (N)	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP) / Average (AV)
--------------	-------------	--------------------------	--------------------------------

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	0.07	46.65	30.19	46.72	30.26	65.79	55.79	-19.07	-25.53
<b>2</b>	<b>0.17344</b>	<b>0.07</b>	<b>51.75</b>	<b>47.03</b>	<b>51.82</b>	<b>47.10</b>	<b>64.79</b>	<b>54.79</b>	<b>-12.98</b>	<b>-7.70</b>
3	0.29063	0.06	42.57	35.66	42.63	35.72	60.51	50.51	-17.87	-14.78
4	0.34531	0.07	38.55	31.17	38.62	31.24	59.07	49.07	-20.46	-17.84
5	3.99609	0.20	40.80	26.57	41.00	26.77	56.00	46.00	-15.00	-19.23
6	22.37891	0.72	36.82	30.09	37.54	30.81	60.00	50.00	-22.46	-19.19

**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



## 5 TEST TYPES AND RESULTS (DTS)

### 5.1 CONDUCTED OUTPUT POWER MEASUREMENT

#### 5.1.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

#### 5.1.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power Meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power Sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 2015

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date :July 01, 2014

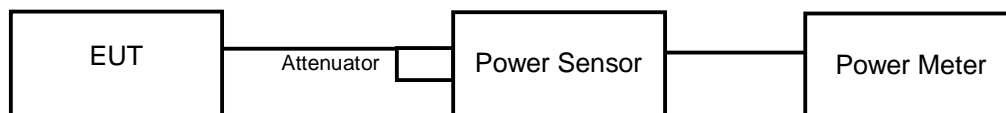
#### 5.1.3 TEST PROCEDURES

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

#### 5.1.4 DEVIATION FROM TEST STANDARD

No deviation

### 5.1.5 TEST SETUP



### 5.1.6 EUT OPERATING CONDITIONS

The software (QCRT Version3.0 29.0) provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



### 5.1.7 TEST RESULTS

#### FOR PEAK POWER BT\_LE-GFSK

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	1.824	2.61	30	PASS
19	2440	1.919	2.83	30	PASS
39	2480	2.061	3.14	30	PASS

#### FOR AVERAGE POWER BT\_LE-GFSK

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
0	2402	1.361	1.34
19	2440	1.432	1.56
39	2480	1.556	1.92

## 5.2 POWER SPECTRAL DENSITY MEASUREMENT

### 5.2.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

### 5.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

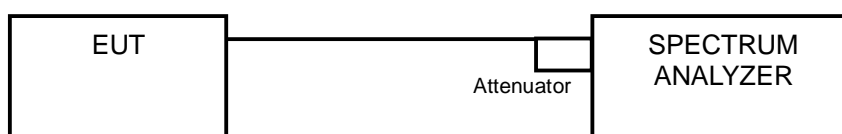
### 5.2.3 TEST PROCEDURE

1. Set the RBW = 3 kHz, VBW =10 kHz, Detector = peak.
2. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
3. Use the peak marker function to determine the maximum amplitude level.

### 5.2.4 DEVIATION FROM TEST STANDARD

No deviation

### 5.2.5 TEST SETUP



### 5.2.6 EUT OPERATING CONDITION

Same as Item 5.1.6

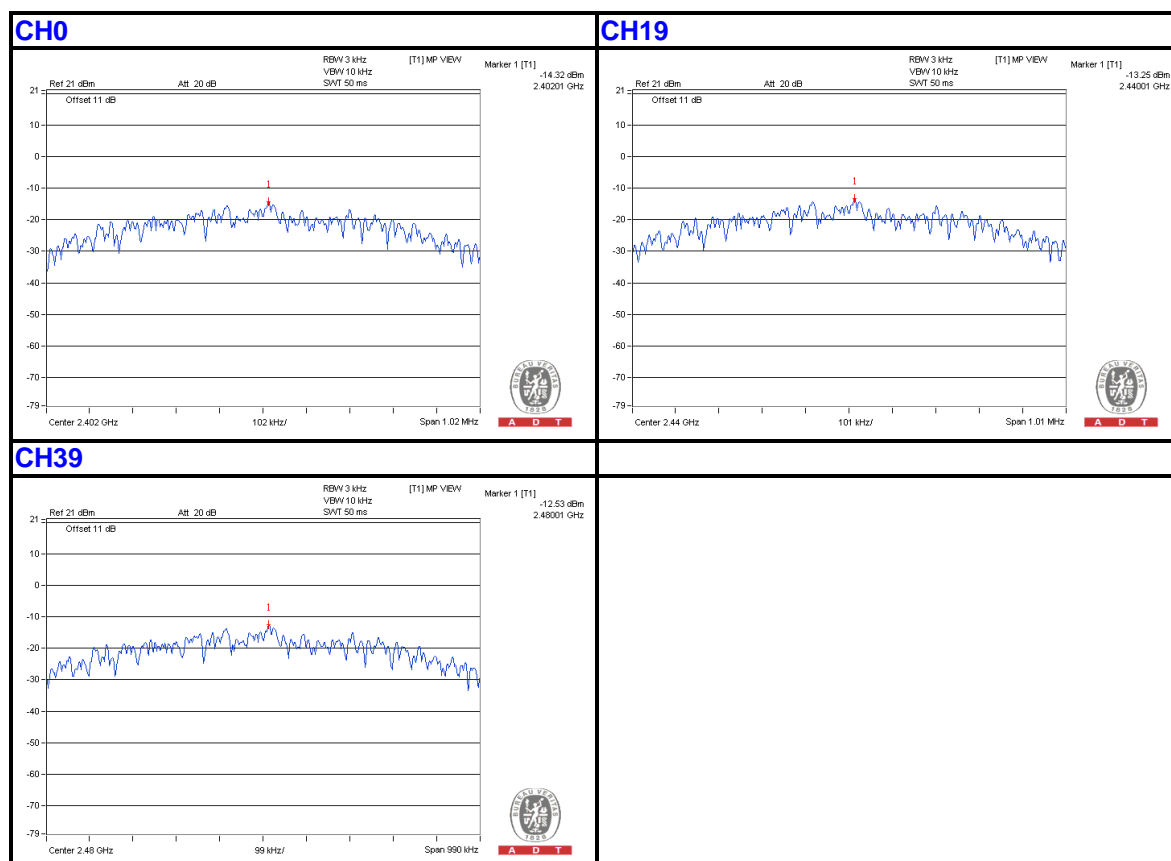


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## 5.2.7 TEST RESULTS

### BT\_LE-GFSK

Channel	FREQUENCY (MHz)	PSD (dBm)	Limit (dBm)	PASS /FAIL
0	2402	-14.32	8	PASS
19	2440	-13.25	8	PASS
39	2480	-12.53	8	PASS



### 5.3 6dB BANDWIDTH MEASUREMENT

#### 5.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

#### 5.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

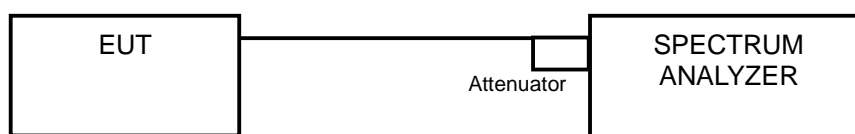
#### 5.3.3 TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 100kHz
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
3. Trace mode = max hold.
4. Sweep = auto couple.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

#### 5.3.4 DEVIATION FROM TEST STANDARD

No deviation

#### 5.3.5 TEST SETUP



#### 5.3.6 EUT OPERATING CONDITIONS

Same as Item 5.1.6



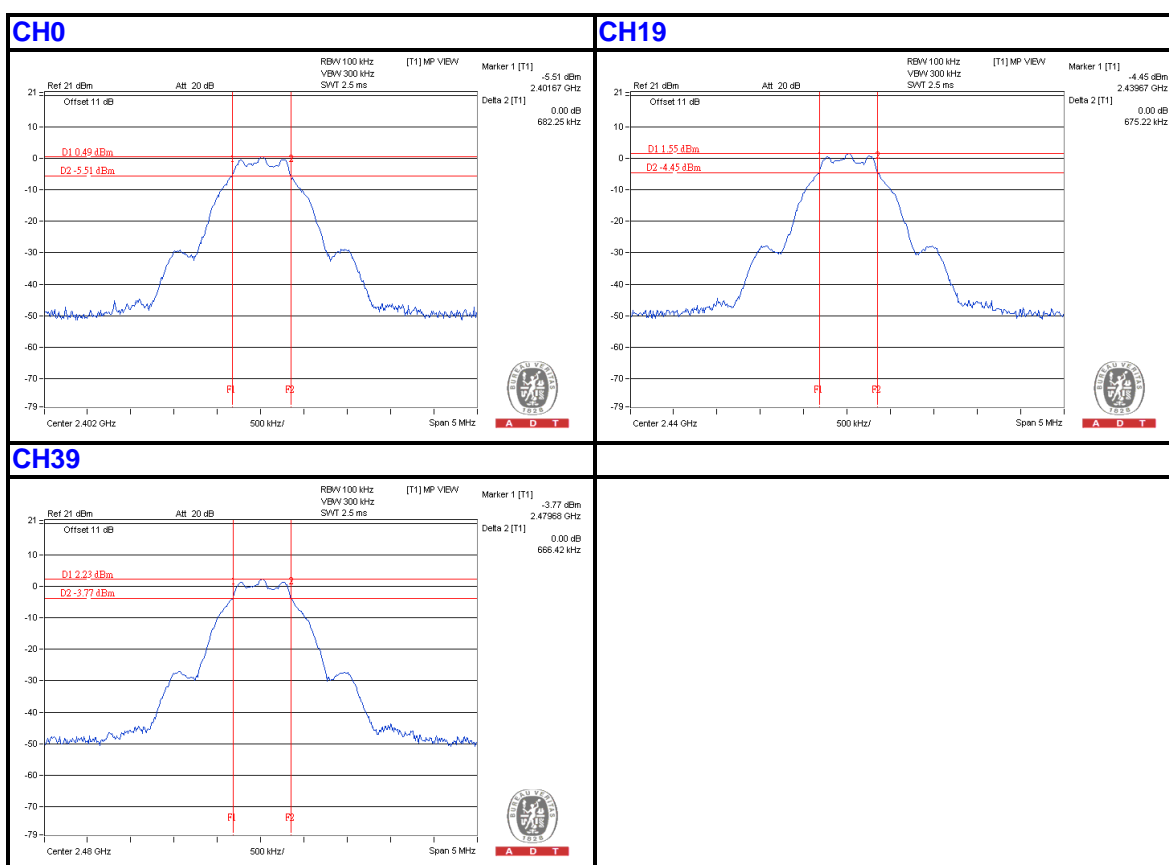


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### 5.3.7 TEST RESULTS

#### BT\_LE-GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)
0	2402	0.68
19	2440	0.68
39	2480	0.67



## 5.4 CONDUCTED OUT-BAND EMISSION MEASUREMENT

### 5.4.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 5.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : July 01, 2014

### 5.4.3 TEST PROCEDURE

#### Measurement Procedure - Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

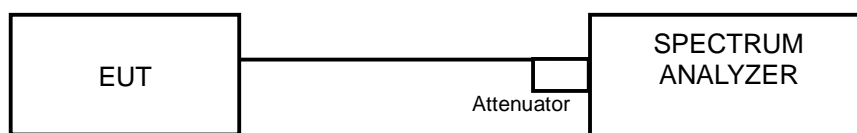
#### Measurement Procedure –Unwanted Emission Level

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

#### 5.4.4 DEVIATION FROM TEST STANDARD

No deviation

#### 5.4.5 EUT OPERATING CONDITION



#### 5.4.6 TEST RESULTS

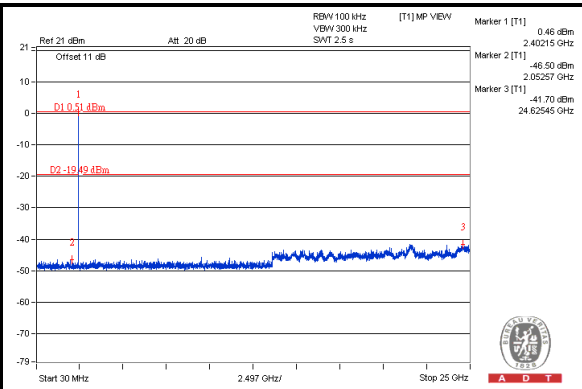
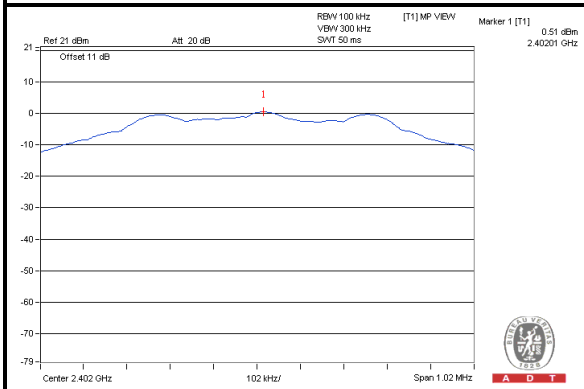
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



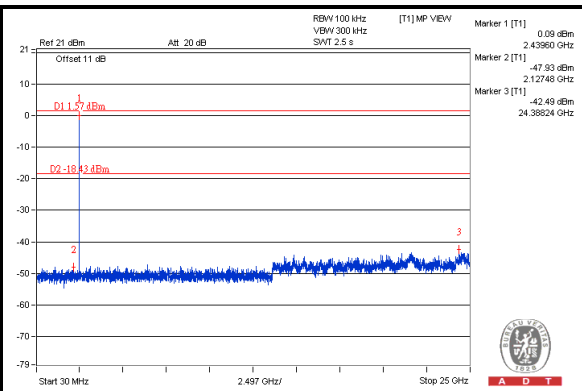
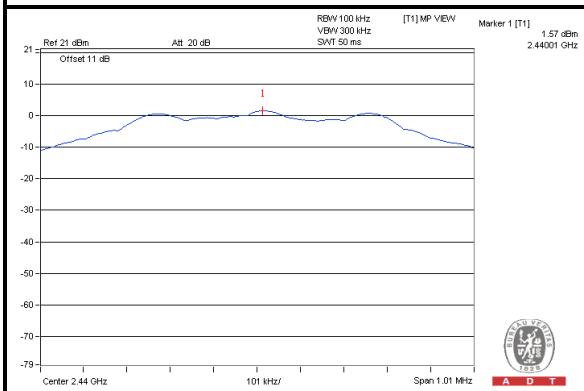
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# BT\_LE-GFSK

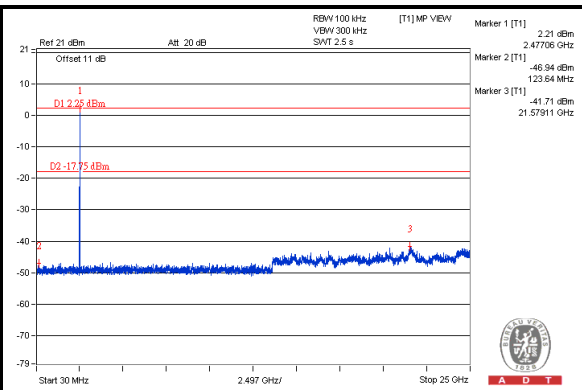
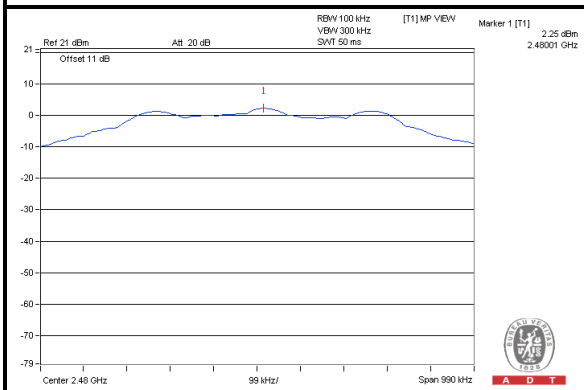
## CH 0



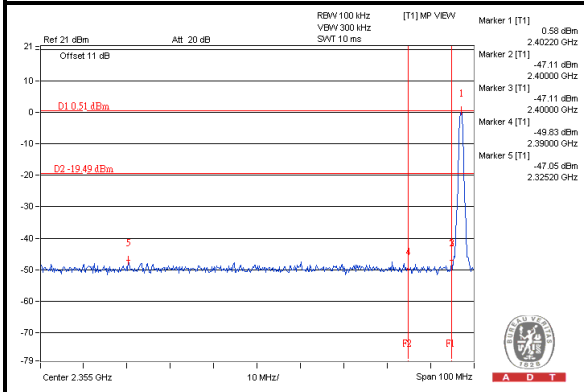
## CH 19



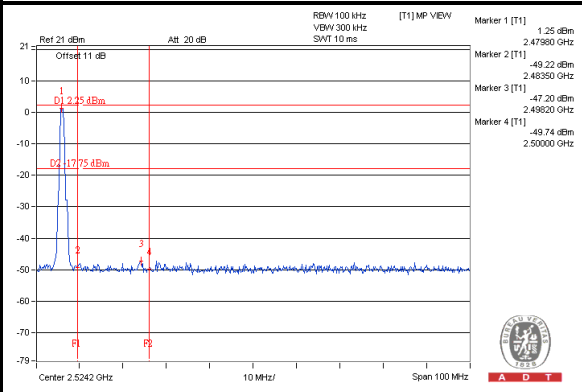
## CH 39



## CH 0 Band edge



## CH 39 Band edge



## 5.5 UNWANTED EMISSION MEASUREMENT(RADIATED VERSUS CONDUCTED)

### 5.5.1 LIMITS OF UNWANTED EMISSION 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.



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## 5.5.2 TEST INSTRUMENTS

### Below 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 15, 2014	Jan. 14, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISi	AiH.8018	0000220091110	Dec. 06, 2013	Dec. 05, 2014
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 29, 2013	Oct. 28, 2014
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKka-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

### Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: June 07, 2014



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**Above 1GHz test:**

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	Jan. 21, 2014	Jan. 20, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 05, 2013	Oct. 04, 2014
Spectrum Analyzer R&S	FSV40	100964	July 15, 2013	July 14, 2014
Horn_Antenna AISI	AIH.8018	0000320091110	Nov. 18, 2013	Nov. 17, 2014
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	RF104-201 RF104-203 RF104-204	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
5. The VCCI Site Registration No. is G-137.
6. The CANADA Site Registration No. is IC 7450H-2.
7. Tested Date: July 01 to 02, 2014



### 5.5.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters 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:**

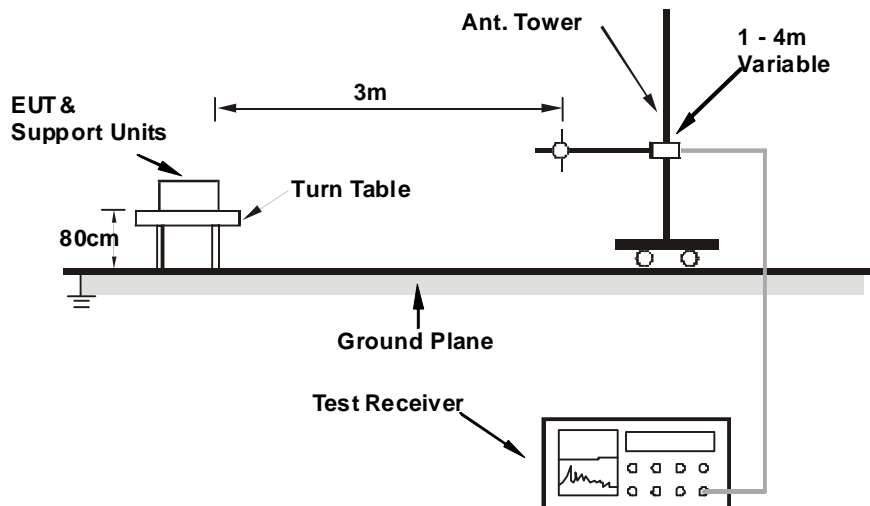
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

### 5.5.4 DEVIATION FROM TEST STANDARD

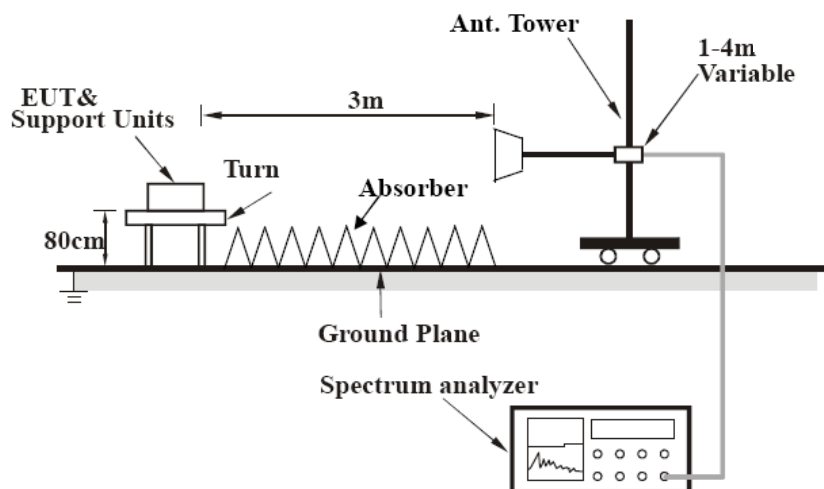
No deviation

### 5.5.5 TEST SETUP

#### <Frequency Range below 1GHz>



#### <Frequency Range above 1GHz>



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

#### 5.5.6 EUT OPERATING CONDITIONS

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program “QCRT Version3.0 29.0” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

## 5.5.7 TEST RESULTS

### BELOW 1GHz WORST-CASE DATA

#### BT\_LE-GFSK

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	Below 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.74	38.6 QP	43.5	-4.9	1.50 H	142	55.95	-17.35
2	165.99	37.1 QP	43.5	-6.4	1.50 H	186	50.00	-12.88
3	232.39	39.6 QP	46.0	-6.4	1.50 H	332	54.19	-14.62
4	240.00	39.1 QP	46.0	-6.9	1.00 H	187	52.92	-13.80
5	431.97	35.5 QP	46.0	-10.6	2.00 H	117	43.54	-8.09
6	796.59	40.8 QP	46.0	-5.2	1.50 H	271	41.74	-0.94
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.59	27.8 QP	43.5	-15.7	1.00 V	301	45.18	-17.37
2	165.99	35.6 QP	43.5	-7.9	1.00 V	162	48.48	-12.88
3	186.12	27.4 QP	43.5	-16.1	1.00 V	157	42.28	-14.88
4	232.34	30.9 QP	46.0	-15.1	1.00 V	190	45.57	-14.63
5	432.05	33.1 QP	46.0	-12.9	1.00 V	139	41.21	-8.09
6	796.59	37.5 QP	46.0	-8.5	1.00 V	360	38.46	-0.94

#### REMARKS:

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



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ABOVE 1GHz DATA

BT\_LE-GFSK

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

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	53.2 PK	74.0	-20.8	1.08 H	344	55.67	-2.47
2	2390.00	34.4 AV	54.0	-19.6	1.08 H	344	36.87	-2.47
3	*2402.00	86.2 PK			1.08 H	344	88.61	-2.41
4	*2402.00	82.9 AV			1.08 H	344	85.31	-2.41
5	4804.00	45.3 PK	74.0	-28.7	1.00 H	330	39.68	5.62
6	4804.00	34.1 AV	54.0	-19.9	1.00 H	330	28.48	5.62

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	45.7 PK	74.0	-28.3	1.11 V	136	48.17	-2.47
2	2390.00	34.1 AV	54.0	-19.9	1.11 V	136	36.57	-2.47
3	*2402.00	92.6 PK			1.11 V	136	95.01	-2.41
4	*2402.00	91.4 AV			1.11 V	136	93.81	-2.41
5	4804.00	46.1 PK	74.0	-27.9	1.00 V	155	40.48	5.62
6	4804.00	33.9 AV	54.0	-20.1	1.00 V	155	28.28	5.62

REMARKS:

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



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<b>CHANNEL</b>	TX Channel 19	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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	*2440.00	86.7 PK			1.08 H	340	54.87	31.83
2	*2440.00	83.4 AV			1.08 H	340	51.57	31.83
3	4880.00	46.2 PK	74.0	-27.8	1.00 H	355	7.12	39.08
4	4880.00	35.1 AV	54.0	-18.9	1.00 H	355	-3.98	39.08
5	7320.00	53.6 PK	74.0	-20.4	1.00 H	324	7.17	46.43
6	7320.00	42.1 AV	54.0	-11.9	1.00 H	324	-4.33	46.43
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	*2440.00	92.8 PK			1.11 V	140	60.97	31.83
2	*2440.00	91.3 AV			1.11 V	140	59.47	31.83
3	4880.00	46.5 PK	74.0	-27.5	1.00 V	124	7.42	39.08
4	4880.00	34.7 AV	54.0	-19.3	1.00 V	124	-4.38	39.08
5	7320.00	53.8 PK	74.0	-20.2	1.04 V	101	7.37	46.43
6	7320.00	41.7 AV	54.0	-12.3	1.04 V	101	-4.73	46.43

**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.



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<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

**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	86.3 PK			1.08 H	333	54.33	31.97
2	*2480.00	83.6 AV			1.08 H	333	51.63	31.97
3	2483.50	46.1 PK	74.0	-27.9	1.08 H	333	14.11	31.99
4	2483.50	34.3 AV	54.0	-19.7	1.08 H	333	2.31	31.99
5	4960.00	46.0 PK	74.0	-28.0	1.00 H	341	6.68	39.32
6	4960.00	34.6 AV	54.0	-19.4	1.00 H	341	-4.72	39.32
7	7440.00	53.9 PK	74.0	-20.1	1.01 H	314	7.49	46.41
8	7440.00	42.2 AV	54.0	-11.8	1.01 H	314	-4.21	46.41

**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	93.4 PK			1.11 V	135	61.43	31.97
2	*2480.00	91.6 AV			1.11 V	135	59.63	31.97
3	2483.50	46.2 PK	74.0	-27.8	1.11 V	135	14.21	31.99
4	2483.50	34.6 AV	54.0	-19.4	1.11 V	135	2.61	31.99
5	4960.00	46.7 PK	74.0	-27.3	1.00 V	147	7.38	39.32
6	4960.00	35.1 AV	54.0	-18.9	1.00 V	147	-4.22	39.32
7	7440.00	53.5 PK	74.0	-20.5	1.08 V	88	7.09	46.41
8	7440.00	41.8 AV	54.0	-12.2	1.08 V	88	-4.61	46.41

**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.



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## 5.6 AC POWER LINE CONDUCTED EMISSION MEASUREMENT

### 5.6.1 LIMITS OF AC POWER LINE CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 5.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK8127	8127-522	Sep. 12, 2013	Sep. 11, 2014
Line-Impedance Stabilization Network (for Peripheral)	ENV216	100071	Nov. 13, 2013	Nov. 12, 2014
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10, 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 24, 2013	Sep. 23, 2014
50 ohms Terminator	N/A	EMC-02	Oct. 01, 2013	Sep. 30, 2014
Software ADT	BV ADT_Cond_V7.3.7. 3	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: May 14, 2014



### 5.6.3 TEST PROCEDURES

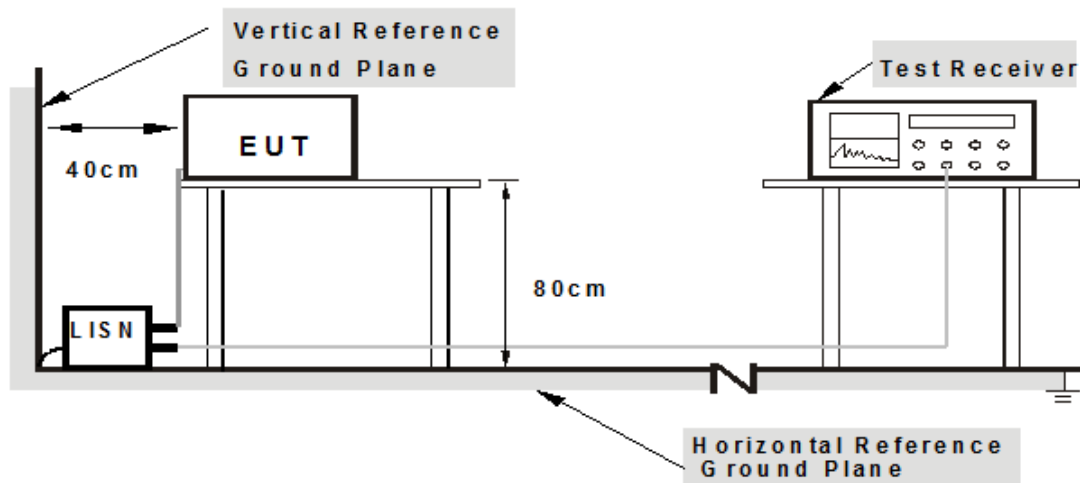
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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) were not recorded.

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

### 5.6.4 DEVIATION FROM TEST STANDARD

No deviation

### 5.6.5 TEST SETUP



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

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

### 5.6.6 EUT OPERATING CONDITIONS

Same as Item 5.5.6



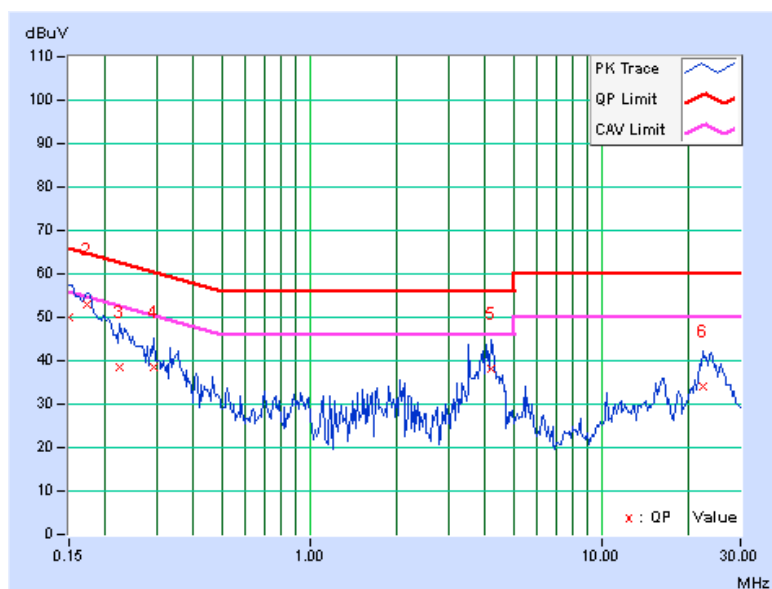
### 5.6.7 TEST RESULTS

PHASE	Line (L)	DETECTOR FUNCTION	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	0.06	49.81	28.72	49.87	28.78	66.00	56.00	-16.13	-27.22
2	0.17344	0.06	52.90	41.51	52.96	41.57	64.79	54.79	-11.83	-13.22
3	0.22422	0.06	38.57	23.09	38.63	23.15	62.66	52.66	-24.03	-29.51
4	0.29453	0.06	38.46	29.34	38.52	29.40	60.40	50.40	-21.87	-20.99
5	4.21484	0.21	37.89	24.18	38.10	24.39	56.00	46.00	-17.90	-21.61
6	22.37891	0.73	33.52	26.28	34.25	27.01	60.00	50.00	-25.75	-22.99

#### 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





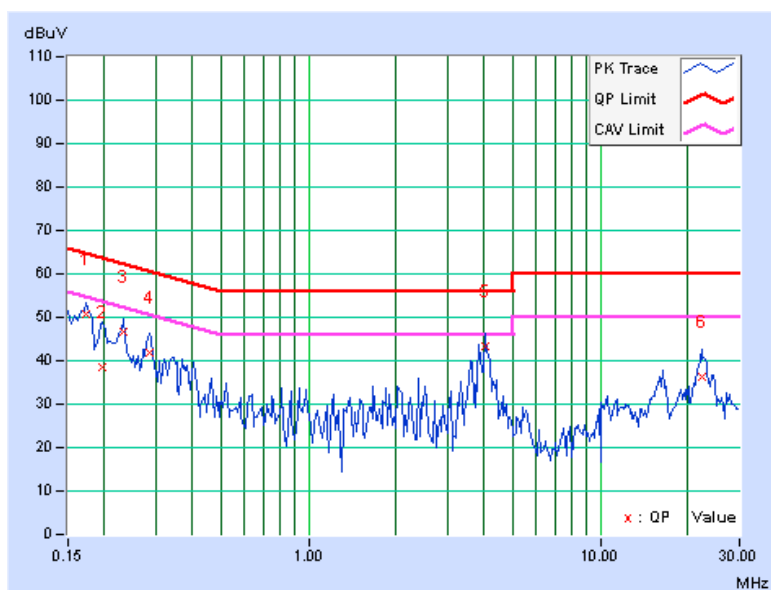
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<b>PHASE</b>	Neutral (N)	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	0.07	50.79	45.44	50.86	45.51	64.79	54.79	-13.94	-9.29
2	0.19687	0.06	38.39	15.15	38.45	15.21	63.74	53.74	-25.29	-38.53
3	0.23203	0.06	46.45	39.93	46.51	39.99	62.38	52.38	-15.87	-12.39
4	0.28672	0.06	41.65	33.93	41.71	33.99	60.62	50.62	-18.90	-16.62
5	4.05078	0.20	43.30	29.25	43.50	29.45	56.00	46.00	-12.50	-16.55
6	22.35938	0.72	35.47	29.99	36.19	30.71	60.00	50.00	-23.81	-19.29

**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





## 6 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



## 7 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](http://www.bureauveritas-adt.com)

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



## **8 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No modifications were made to the EUT by the lab during the test.

**--- END ---**