

# TEST REPORT

Reference No..... : WTS13S1109478E  
FCC ID ..... : V8VCES8239CL  
Applicant..... : SKYPINE ELECTRONICS (SHEN ZHEN) CO.,LTD.  
Address..... : A1 Building, No.6 Xinxing Industrial Park, Xinhe Village, Fuyong  
Town, Baoan District, Shenzhen City  
Manufacturer ..... : The same as above  
Address..... : The same as above  
Product Name..... : ALL IN ONE DVD PLAYER  
Model No ..... : VX404  
Trademark..... : Clarion  
Standards..... : FCC CFR47 Part 15 Subpart C: 2012  
Date of Receipt sample .... : Nov.19, 2013  
Date of Test ..... : Dec.09~13, 2013  
Date of Issue..... : Dec.19, 2013  
Test Result..... : **Pass \***

**\*Remarks:**

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

**Prepared By:**

**Waltek Services (Shenzhen) Co., Ltd.**

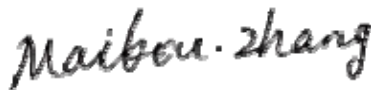
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Testing location: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

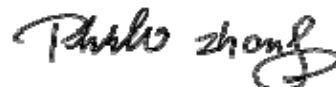
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Compiled by:



Maikou Zhang / Project Engineer

Approved by:



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## 2 Test Summary

Test Items	Test Requirement	Result
Spurious Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge Emissions	15.247(d)	PASS
Spurious RF Conducted Emissions from out of band	15.247(d)	PASS
Conducted Emissions	15.207	N/A
20dB Bandwidth	15.215c 15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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## 4 General Information

### 4.1 General Description of E.U.T.

<b>Product Name</b>	: ALL IN ONE DVD PLAYER
<b>Model No.</b>	: VX404
<b>Trademark</b>	: Clarion
<b>Operation Frequency</b>	: 2402MHz ~ 2480MHz, 79 channels in total, separated by 1MHz
<b>Oscillator Frequency</b>	: 8MHz
<b>Type of Modulation</b>	: GFSK, Pi/4DQPSK, 8DPSK
<b>Antenna installation</b>	: PCB Printed Antenna
<b>Antenna Gain</b>	: 0dBi

### 4.2 Details of E.U.T.

<b>Technical Data</b>	: DC 12V, 15A Max
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### 4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

### 4.4 Description of Support Units

The EUT has been tested as an independent unit.

#### 4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

#### 4.6 Test Location

All the tests were performed at:

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd.,Songgang Street, Baoan District, Shenzhen, China

## 5 Equipment Used during Test

### 5.1 Equipments List

3m Semi-anechoic Chamber for Radiation						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.18,2013	Sep.17,2014
2	Active Loop Antenna (9kHz-30MHz)	Beijing Dazhi	ZN30900A	-	Sep.18,2013	Sep.17,2014
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.20,2013	Apr.19,2014
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.18,2013	Sep.17,2014
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.20,2013	Apr.19,2014
6	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7	Coaxial Cable (above 1GHz)	Top	25MHz-18GHz	EW02014-7	Apr.20,2013	Apr.19,2014

### 5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
RF Power	$\pm 1.0$ dB
RF Power Density	$\pm 2.2$ dB
Temperature	$\pm 1$ °C
DC Source	$\pm 0.05\%$
Radiated Emissions test	$\pm 5.03$ dB (Bilog antenna 30M~1000MHz)
	$\pm 4.74$ dB (Horn antenna 1000M~25000MHz)

### 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

## 6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit
Test Result:	N/A
Remark:	This device is powered by battery, this item do not be required.



## 7 Spurious Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

### 7.1 EUT Operation:

Operating Environment:

Temperature: 25.5 °C

Humidity: 51.3 % RH

Atmospheric Pressure: 1010 mbar

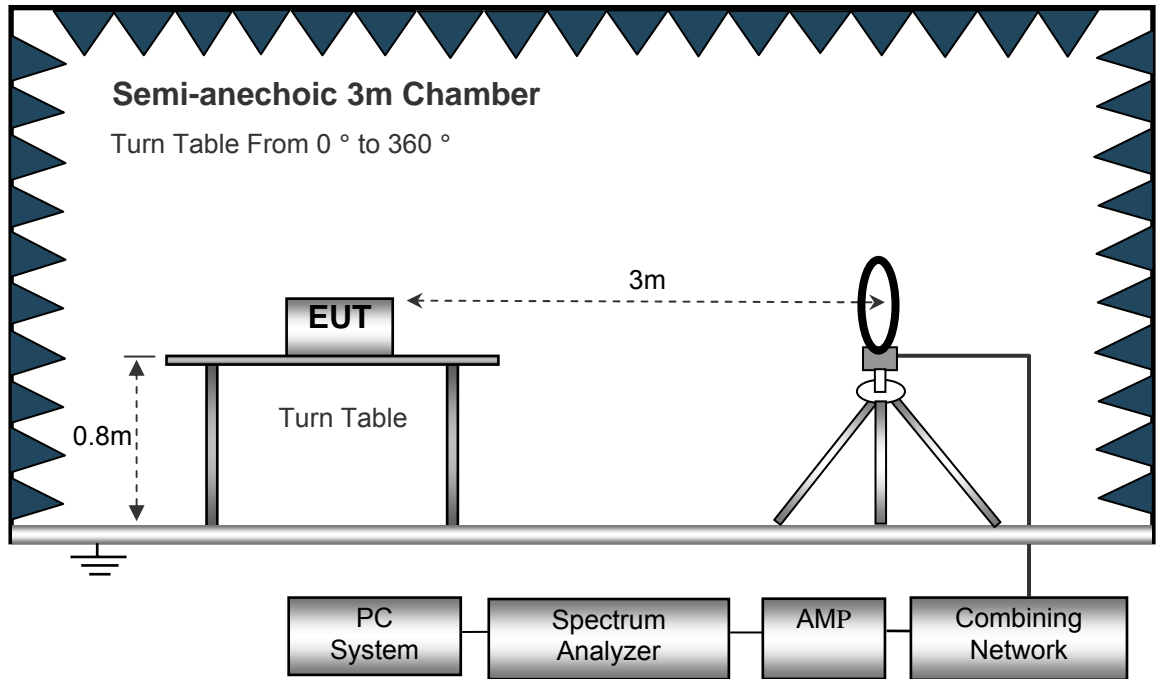
#### Operation Mode:

The EUT was tested in transmitting mode, and the data were shown as follow.

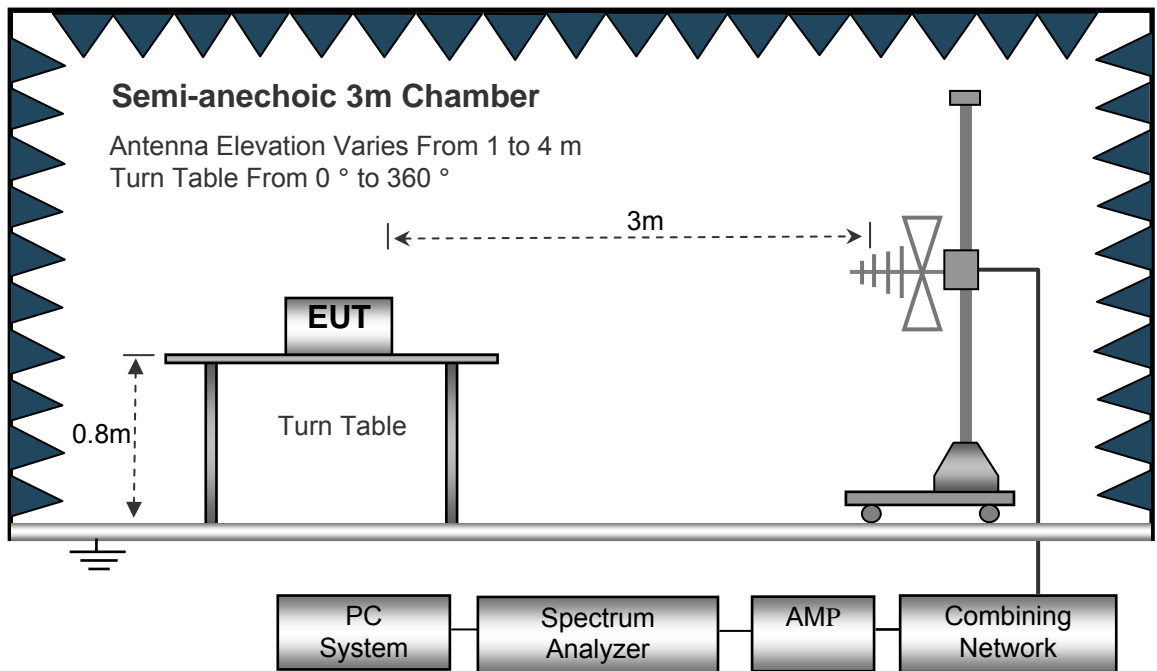
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

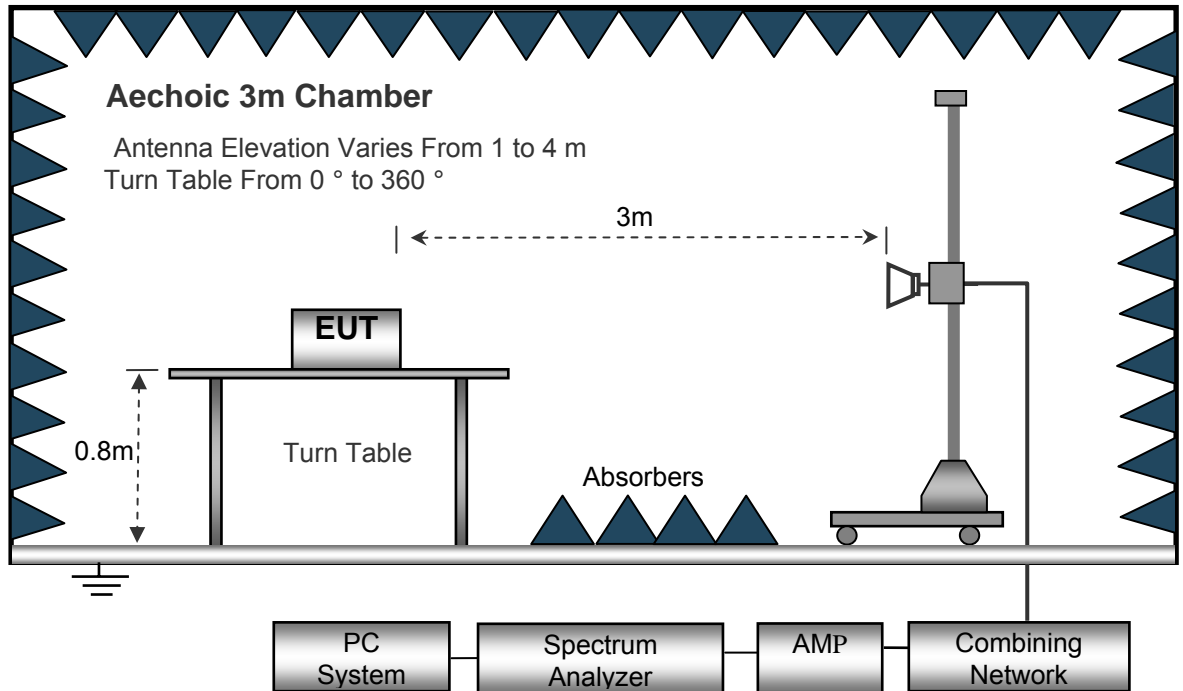
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



### 7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested 8MHz to 25000MHz.

Below 30MHz

Sweep Speed ..... Auto  
 IF Bandwidth..... 10kHz  
 Video Bandwidth..... 10kHz  
 Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto  
 Detector ..... PK  
 Resolution Bandwidth..... 100kHz  
 Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto  
 Detector ..... PK  
 Resolution Bandwidth..... 1MHz  
 Video Bandwidth..... 3MHz  
 Detector ..... Ave.  
 Resolution Bandwidth..... 1MHz  
 Video Bandwidth..... 10Hz

## 7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

## 7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## 7.6 Summary of Test Results

### Test Frequency: Below 30MHz

The measurements were more than 20 dB below the limit and not reported.

### Test Frequency: 30MHz ~ 18GHz

Test mode: transmitting

All the modulation modes were tested. The data of the worst mode (GFSK) were recorded in the following pages.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
33.45	15.85	PK	182	1.7	H	15.46	31.31	40.00	-8.69
33.45	13.42	PK	101	1.2	V	15.46	28.88	40.00	-11.12
4804.00	54.02	PK	33	1.0	H	-1.06	52.96	74.00	-21.04
4804.00	45.62	Ave	33	1.0	H	-1.06	44.56	54.00	-9.44
7206.00	43.52	PK	327	1.3	H	1.33	44.85	74.00	-29.15
7206.00	38.52	Ave	327	1.3	H	1.33	39.85	54.00	-14.15
2317.73	45.98	PK	127	1.9	V	-13.19	32.79	74.00	-41.21
2317.73	39.34	Ave	127	1.9	V	-13.19	26.15	54.00	-27.85
2376.84	43.40	PK	9	1.5	H	-13.14	30.26	74.00	-43.74
2376.84	36.07	Ave	9	1.5	H	-13.14	22.93	54.00	-31.07
2487.48	42.37	PK	240	1.5	V	-13.08	29.29	74.00	-44.71
2487.48	37.32	Ave	240	1.5	V	-13.08	24.24	54.00	-29.76

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Center Channel 2441MHz									
33.45	16.03	PK	185	1.2	H	15.46	31.49	40.00	-8.51
33.45	13.61	PK	23	1.4	V	15.46	29.07	40.00	-10.93
4882.00	53.87	PK	265	1.7	H	-0.62	53.25	74.00	-20.75
4882.00	45.56	Ave	265	1.7	H	-0.62	44.94	54.00	-9.06
7323.00	44.02	PK	179	1.9	H	2.21	46.23	74.00	-27.77
7323.00	38.84	Ave	179	1.9	H	2.21	41.05	54.00	-12.95
2311.35	46.07	PK	234	1.7	V	-13.19	32.88	74.00	-41.12
2311.35	37.82	Ave	234	1.7	V	-13.19	24.63	54.00	-29.37
2370.57	44.89	PK	219	2.0	H	-13.14	31.75	74.00	-42.25
2370.57	37.29	Ave	219	2.0	H	-13.14	24.15	54.00	-29.85
2494.96	42.67	PK	195	1.0	V	-13.08	29.59	74.00	-44.41
2494.96	38.34	Ave	195	1.0	V	-13.08	25.26	54.00	-28.74

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
33.45	15.74	PK	285	1.6	H	15.46	31.20	40.00	-8.80
33.45	13.51	PK	8	1.7	V	15.46	28.97	40.00	-11.03
4960.00	54.32	PK	304	1.5	H	-0.24	54.08	74.00	-19.92
4960.00	45.87	Ave	304	1.5	H	-0.24	45.63	54.00	-8.37
7440.00	43.65	PK	30	1.9	H	2.84	46.49	74.00	-27.51
7440.00	38.92	Ave	30	1.9	H	2.84	41.76	54.00	-12.24
2326.44	45.84	PK	220	1.9	V	-13.19	32.65	74.00	-41.35
2326.44	38.35	Ave	220	1.9	V	-13.19	25.16	54.00	-28.84
2373.38	44.18	PK	85	1.3	H	-13.14	31.04	74.00	-42.96
2373.38	37.61	Ave	85	1.3	H	-13.14	24.47	54.00	-29.53
2497.49	42.03	PK	19	1.8	V	-13.08	28.95	74.00	-45.05
2497.49	38.01	Ave	19	1.8	V	-13.08	24.93	54.00	-29.07

**Test Frequency: Above 18GHz**

The measurements were more than 20 dB below the limit and not reported.

## 8 Spurious RF Conducted Emissions from out of band

Test Requirement: FCC Part 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method: DA 00-705

Test Status: TX mode

### 8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4. mark the worst point and record.

### 8.2 Test Result

#### Test Frequency: Below 30MHz

Remark: For emissions below 30MHz,no emission higher than background level, so the data does not show in the report.

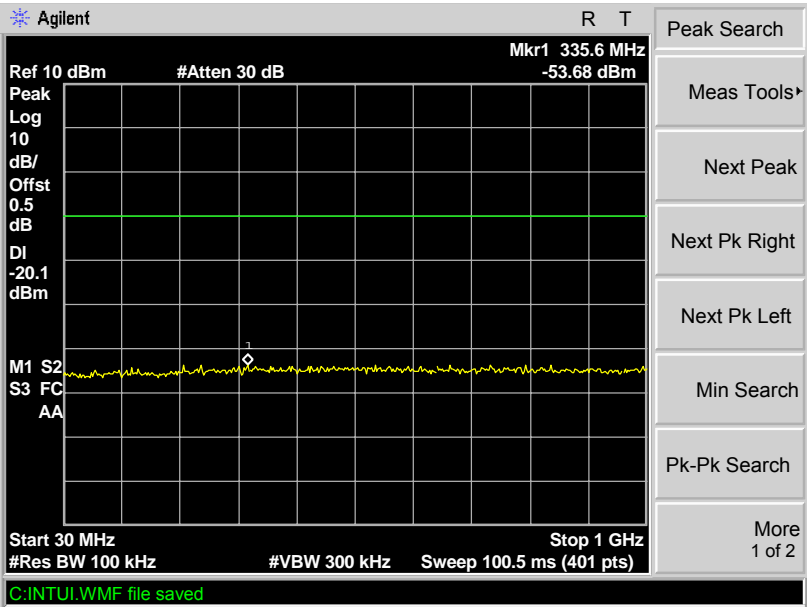
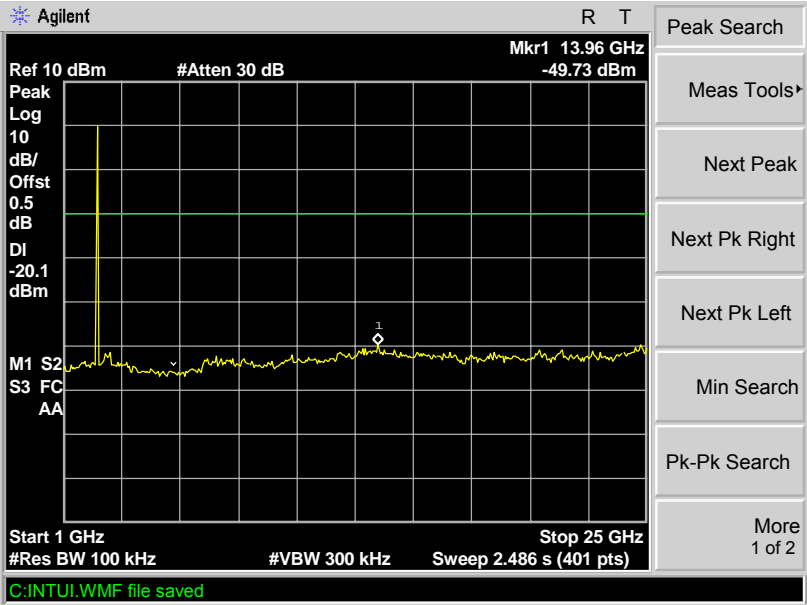
#### Test Frequency: 30MHz ~ 25GHz

Remark: All the modulation modes were tested, the data of the worst mode (GFSK) were recorded in the following pages.

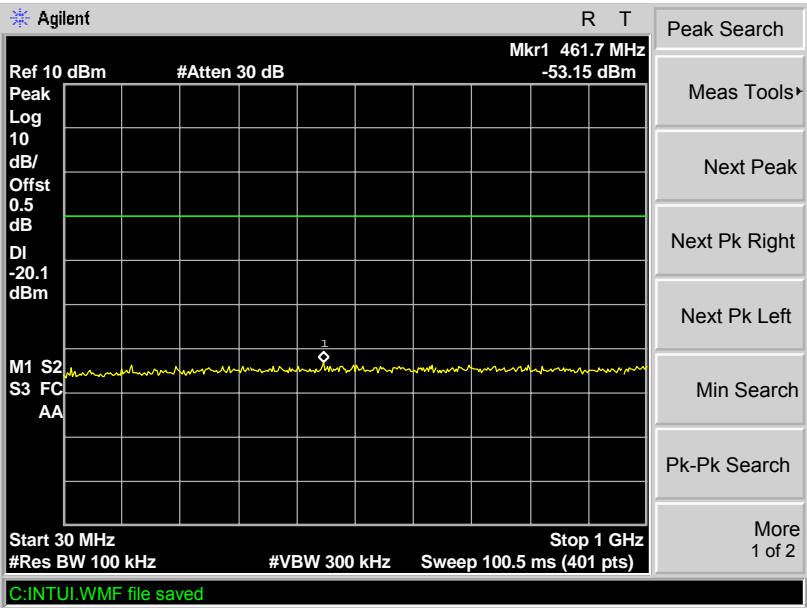
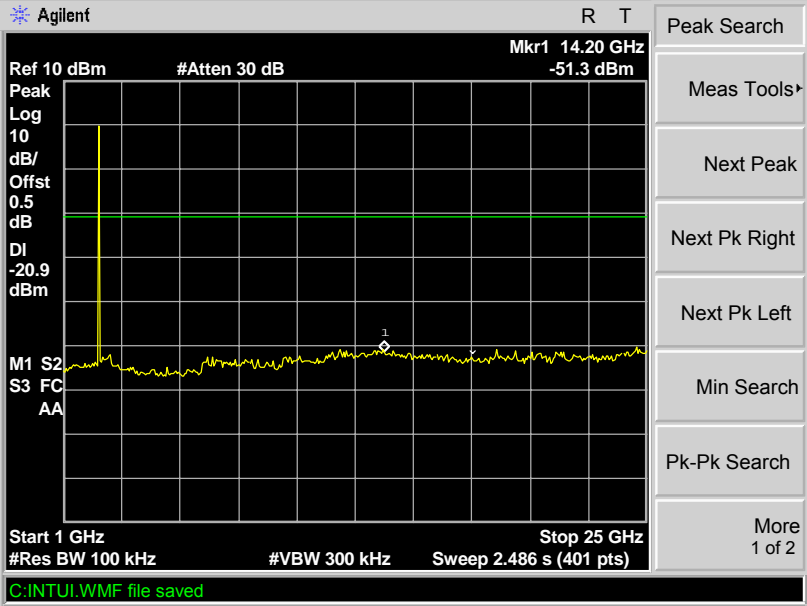


Modulation: GFSK

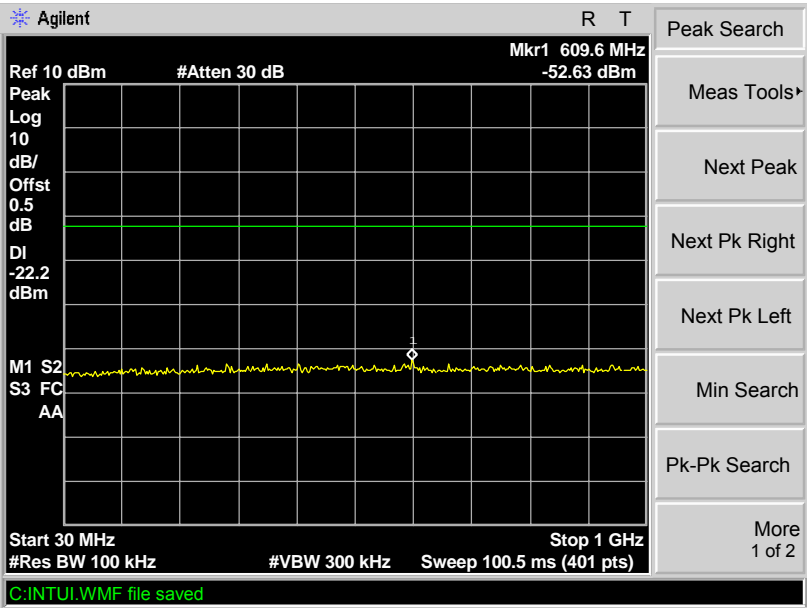
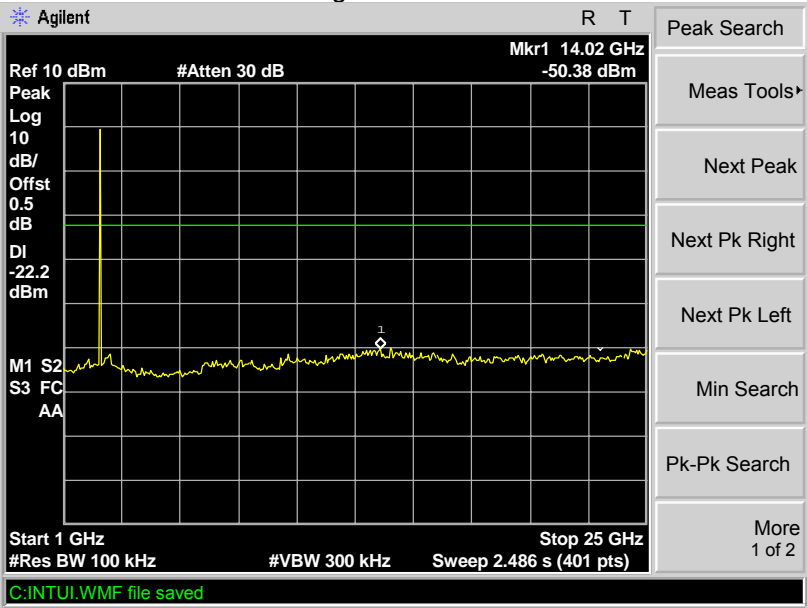
Low Channel



Middle Channel



High Channel



## 9 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz

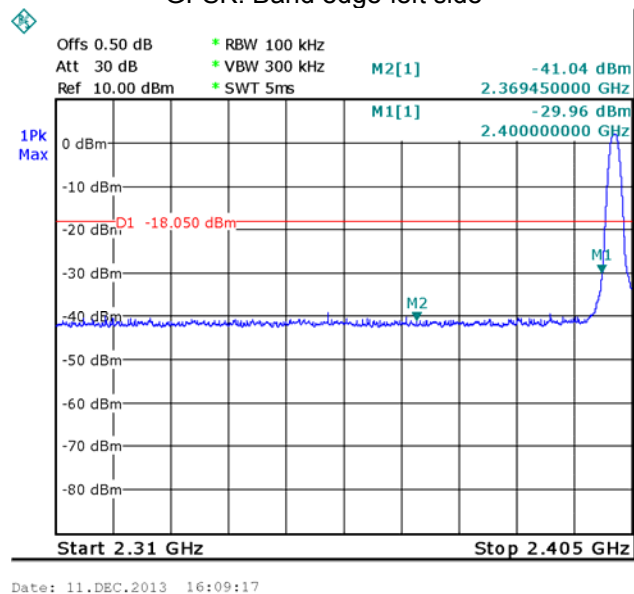
### 9.1 Test Procedure

1. The EUT was placed on a turntable which is 0.8m above ground plane
2. Measurement Distance is 3m
3. Detector:
  - For Peak value:  
RBW = 1 MHz for  $f \geq 1$  GHz  
VBW  $\geq$  RBW; Sweep = auto  
Detector function = peak  
Trace = max hold
  - For AVG value:  
RBW = 1 MHz for  $f \geq 1$  GHz  
VBW = 10Hz; Sweep = auto  
Detector function = AVG  
Trace = max hold
4. Continuous transmitting

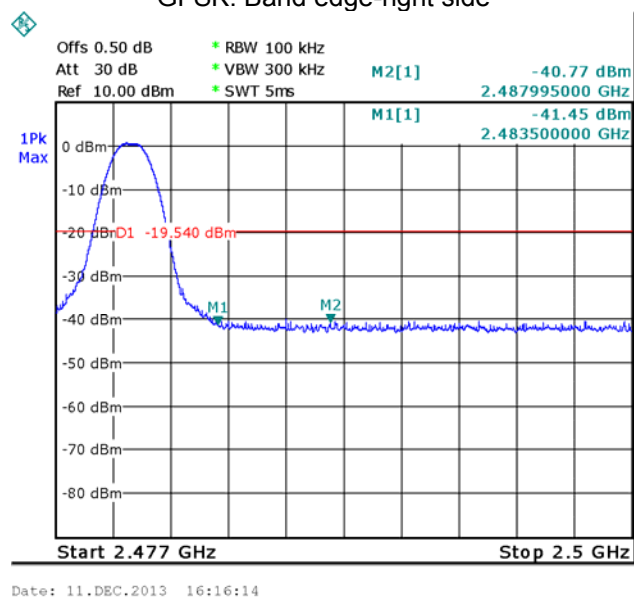
## 9.2 Test Result:

Test result plots shown as follows:

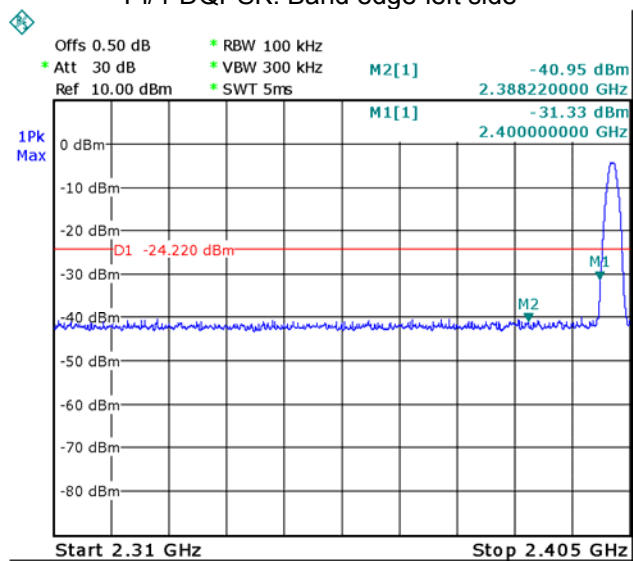
GFSK: Band edge-left side



GFSK: Band edge-right side

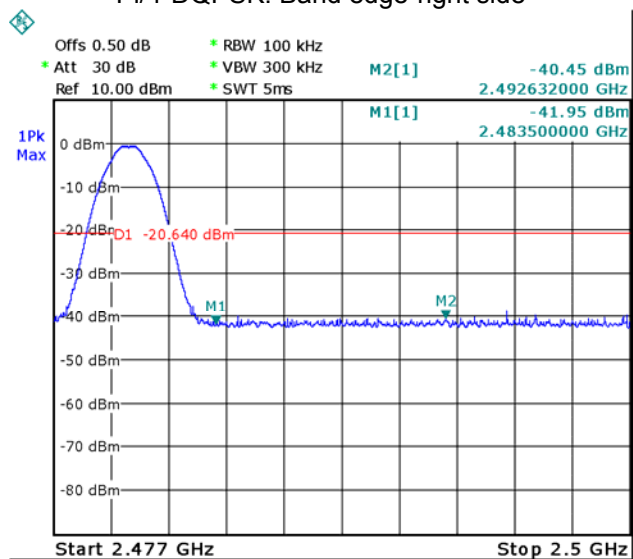


Pi/4-DQPSK: Band edge-left side



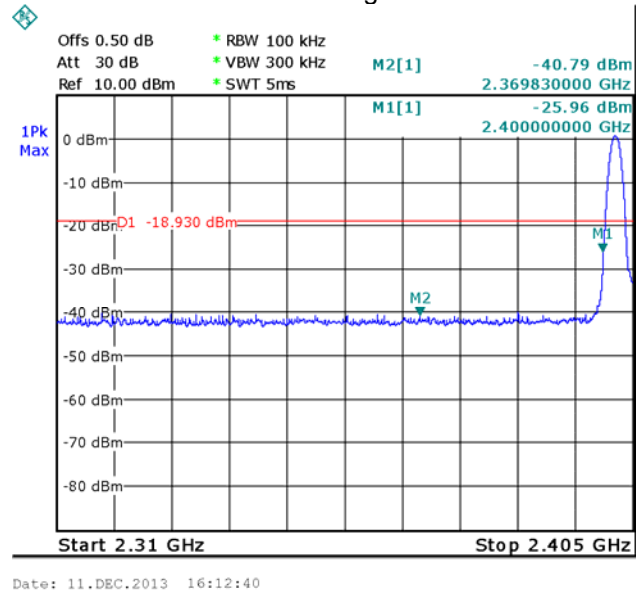
Date: 11.DEC.2013 16:18:30

Pi/4-DQPSK: Band edge-right side

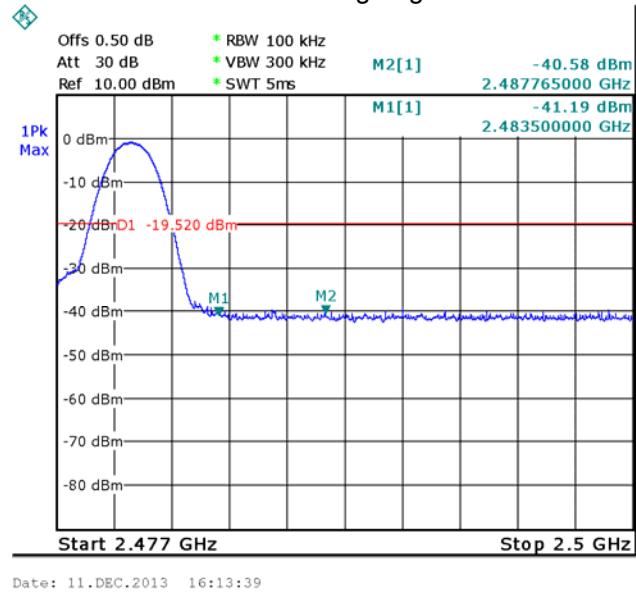


Date: 11.DEC.2013 16:21:59

8-DPSK: Band edge-left side



8-DPSK: Band edge-right side



## 10 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

### 10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

### 10.2 Test Result:

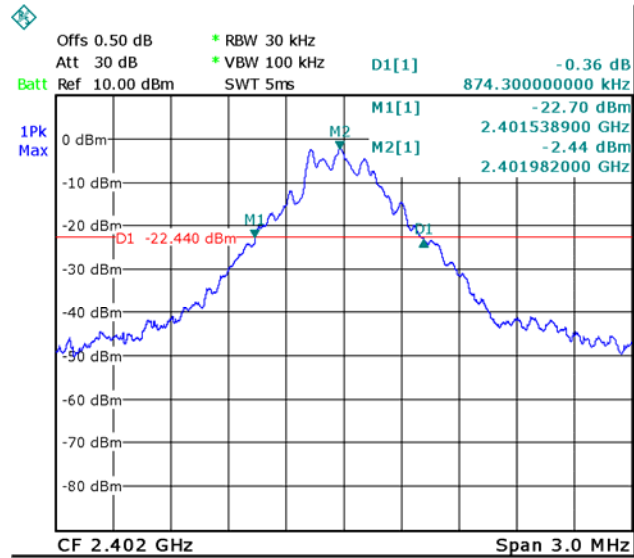
Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.874
	Middle	0.916
	High	0.922
Pi/4DQPSK	Low	1.251
	Middle	1.257
	High	1.251
8DPSK	Low	1.222
	Middle	1.227
	High	1.215

Test result plot as follows:



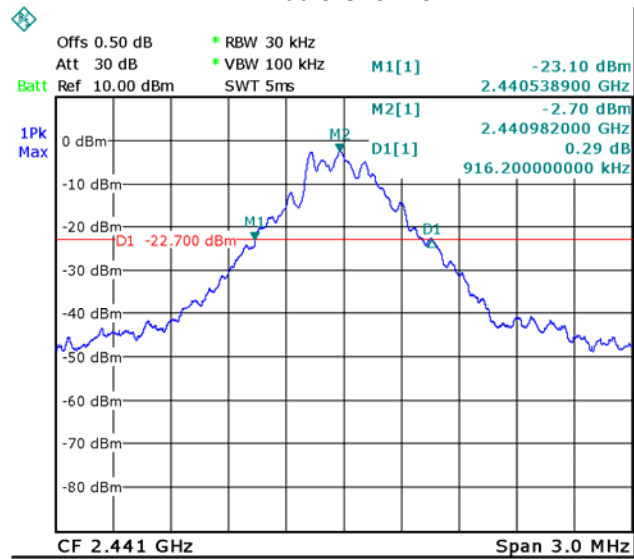
Modulation:GFSK

Low Channel

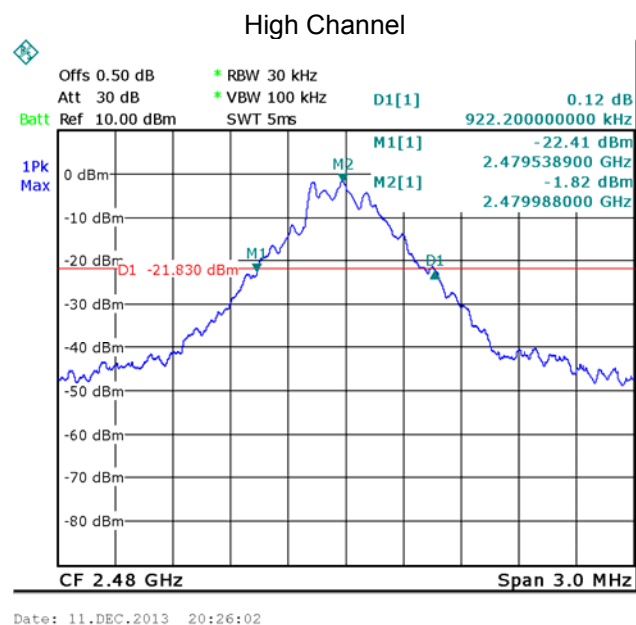


Date: 11.DEC.2013 20:24:11

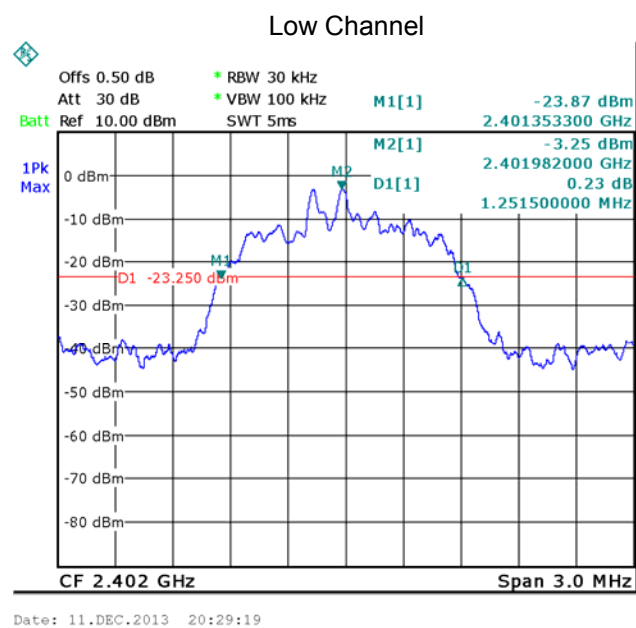
Middle Channel

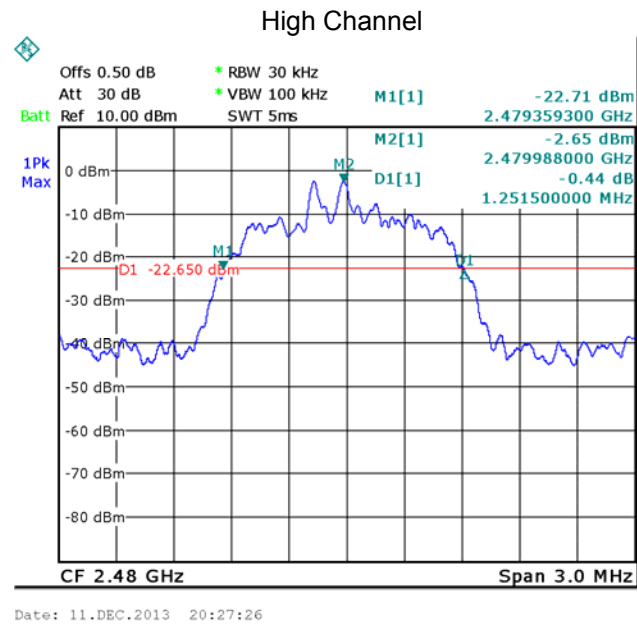
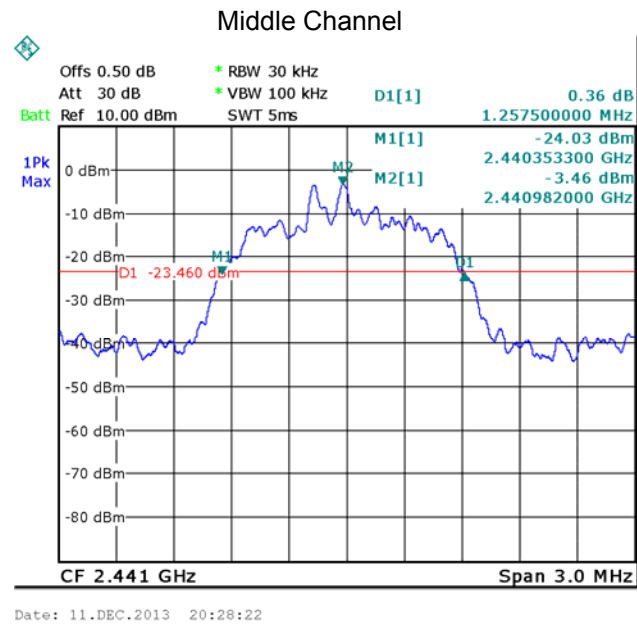


Date: 11.DEC.2013 20:25:07



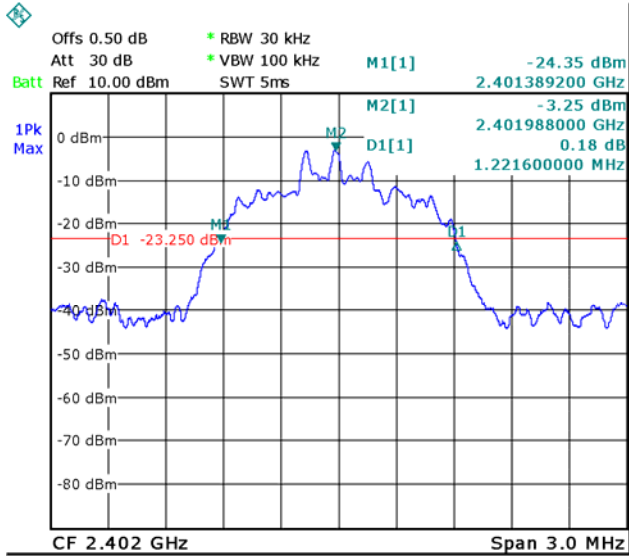
Modulation: Pi/4DQPSK





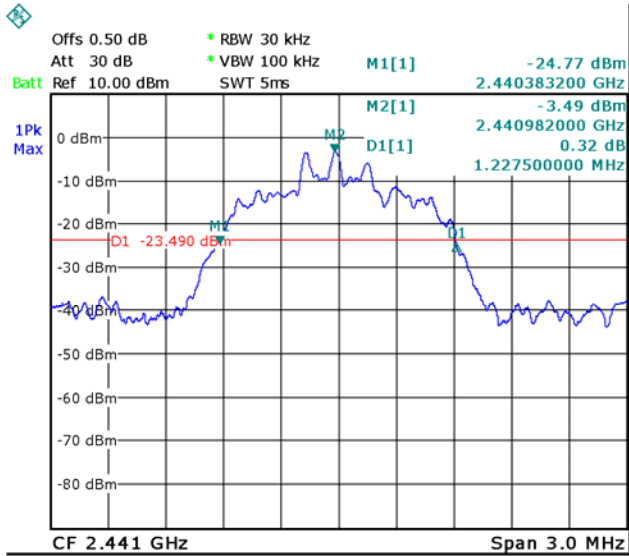
Modulation: 8DPSK

Low Channel

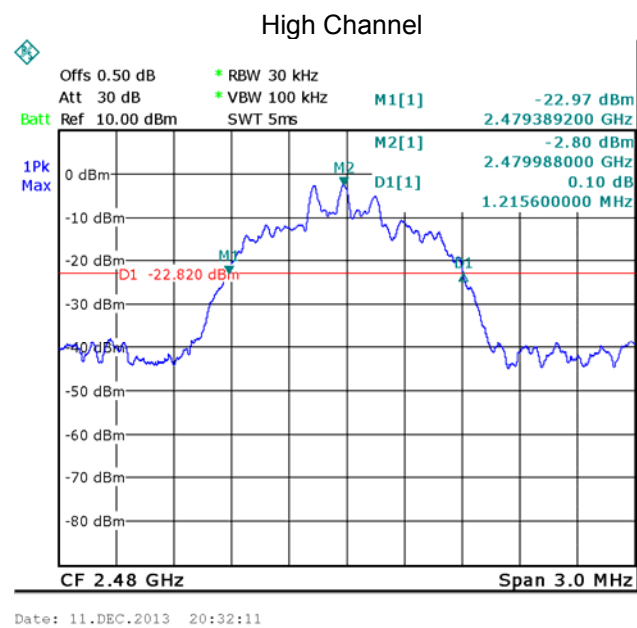


Date: 11.DEC.2013 20:30:20

Middle Channel



Date: 11.DEC.2013 20:31:10



## 11 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watts.  Refer to the result "Number of Hopping Frequency" of this document. The 1watts (30 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

### 11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

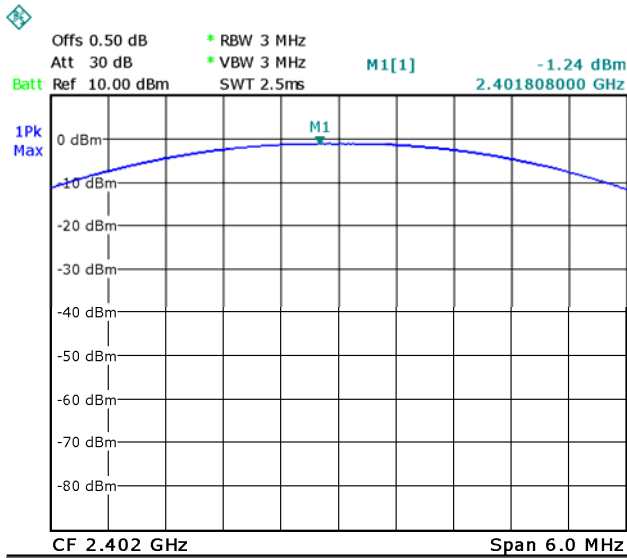
### 11.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-1.240	30
	Middle	-1.290	30
	High	-0.350	30
Pi/4DQPSK	Low	-1.880	30
	Middle	-1.960	30
	High	-1.210	30
8DPSK	Low	-1.800	30
	Middle	-1.910	30
	High	-1.110	30

Test result plot as follows:

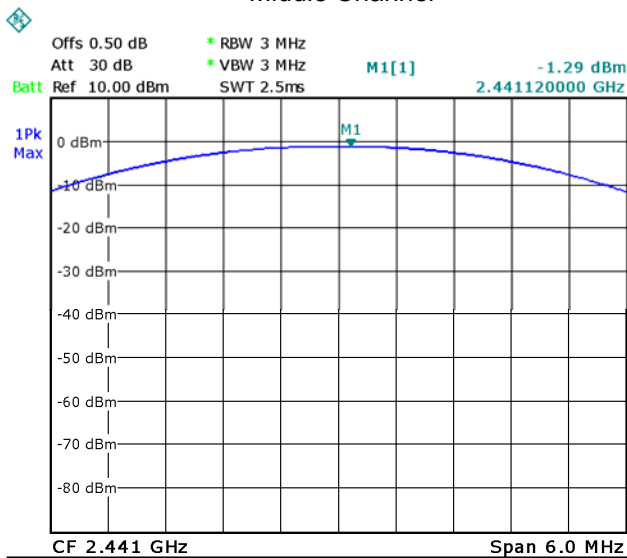
Modulation: GFSK

Low Channel

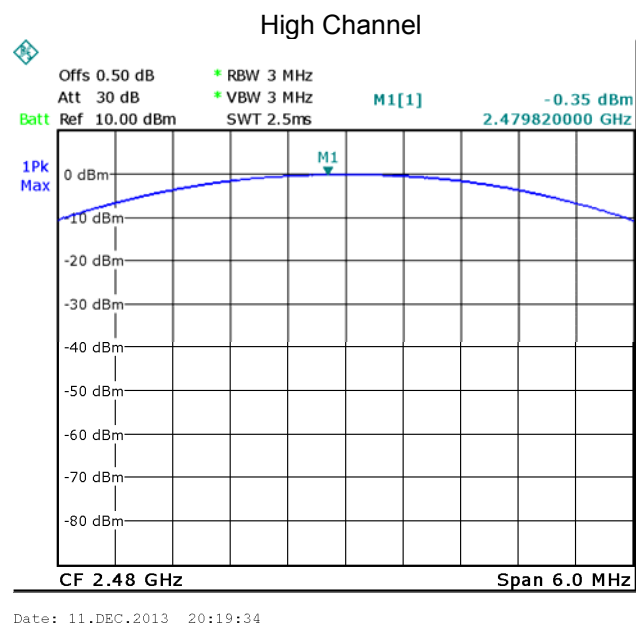


Date: 11.DEC.2013 20:18:52

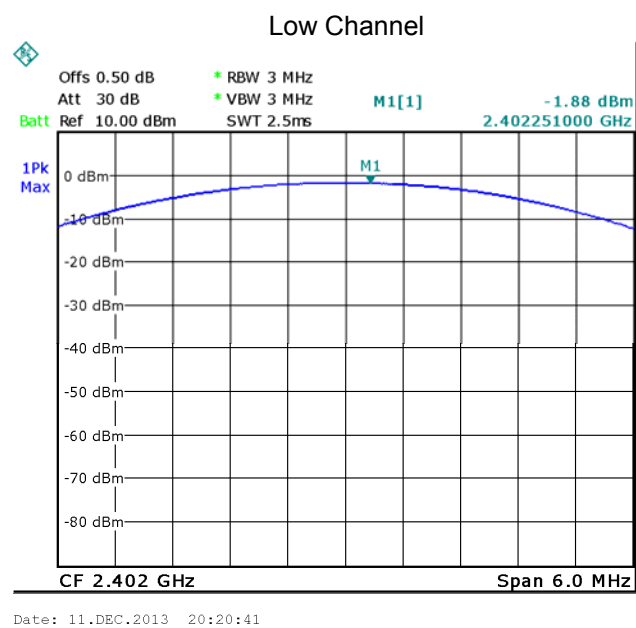
Middle Channel



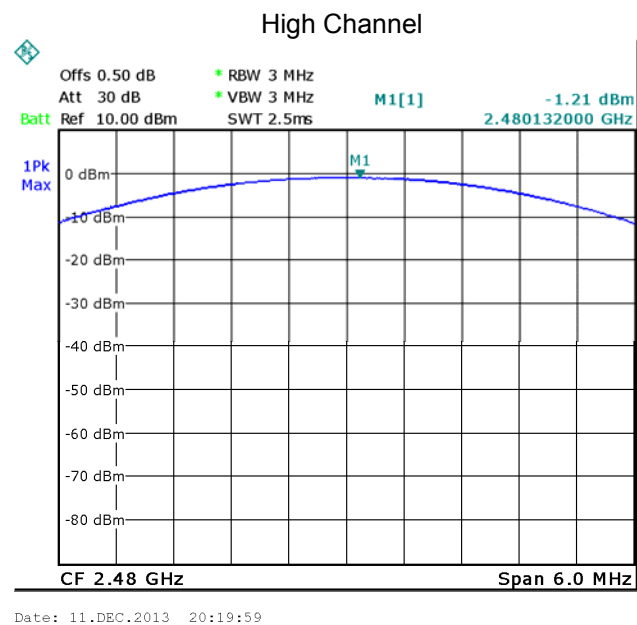
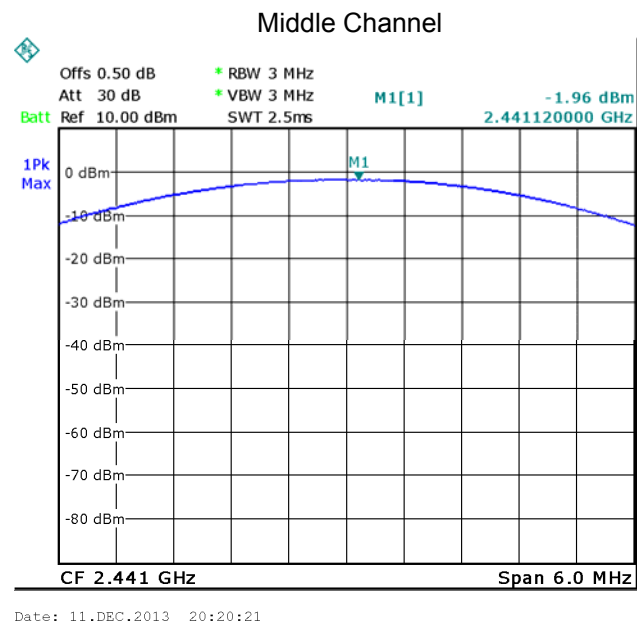
Date: 11.DEC.2013 20:19:17



**Modulation: Pi/4DQPSK**

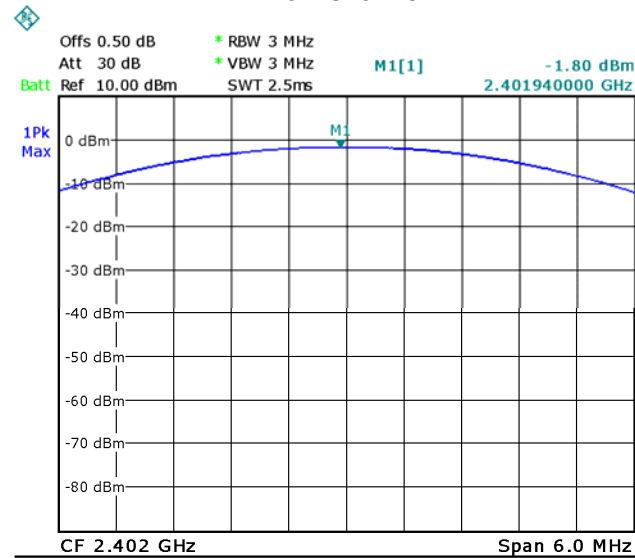






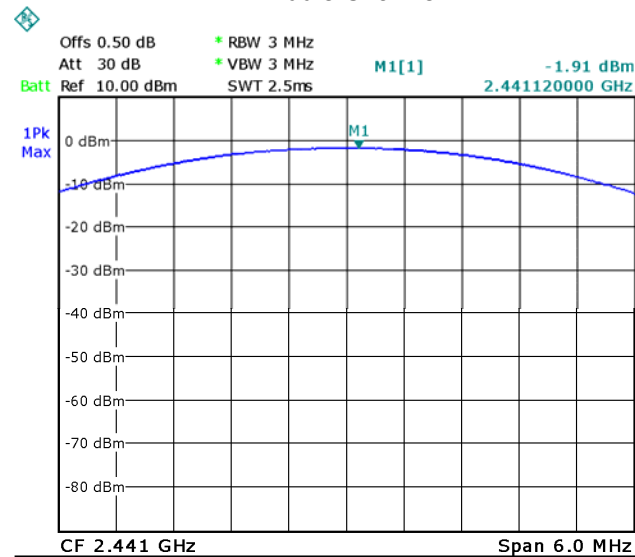
Modulation: 8DPSK

Low Channel

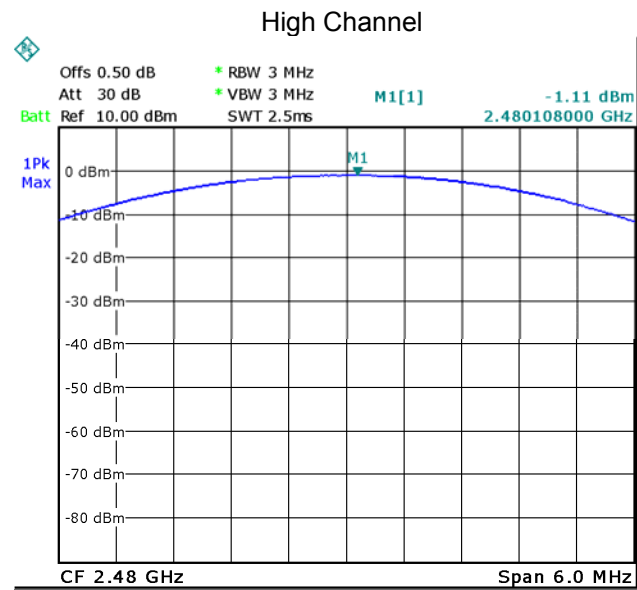


Date: 11.DEC.2013 20:21:04

Middle Channel



Date: 11.DEC.2013 20:21:21



Date: 11.DEC.2013 20:21:38

## 12 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode:	Test in hopping transmitting operating mode.

### 12.1 Test Procedure:

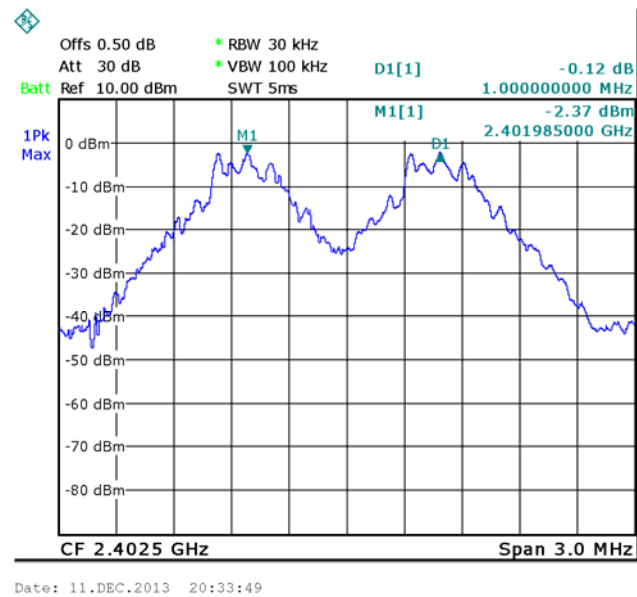
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section  
Submit this plot.

### 12.2 Test Result:

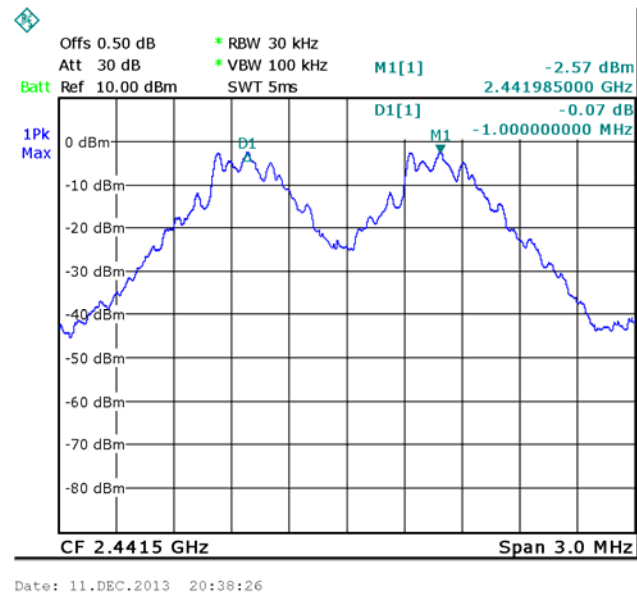
Modulation	Test Channel	Separation (MHz)
GFSK	Low	1.000
	Middle	1.000
	High	1.000
Pi/4DQPSK	Low	1.000
	Middle	1.000
	High	1.000
8DPSK	Low	1.000
	Middle	1.000
	High	1.000

Test result plot as follows:

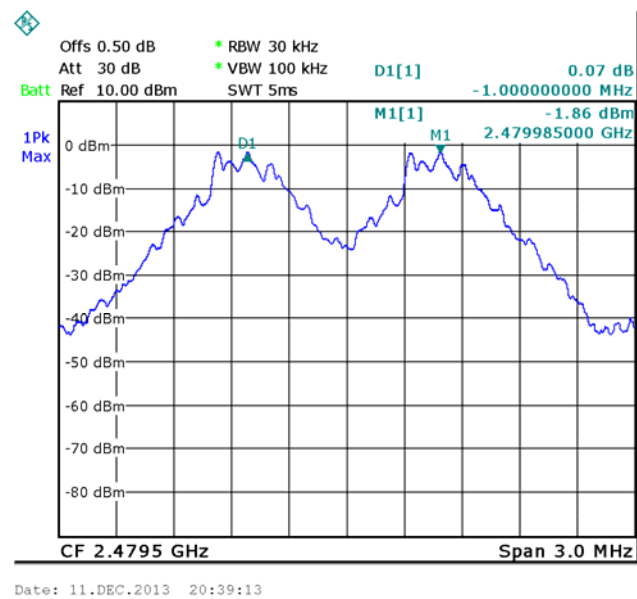
Modulation: GFSK  
Low Channel



Middle Channel

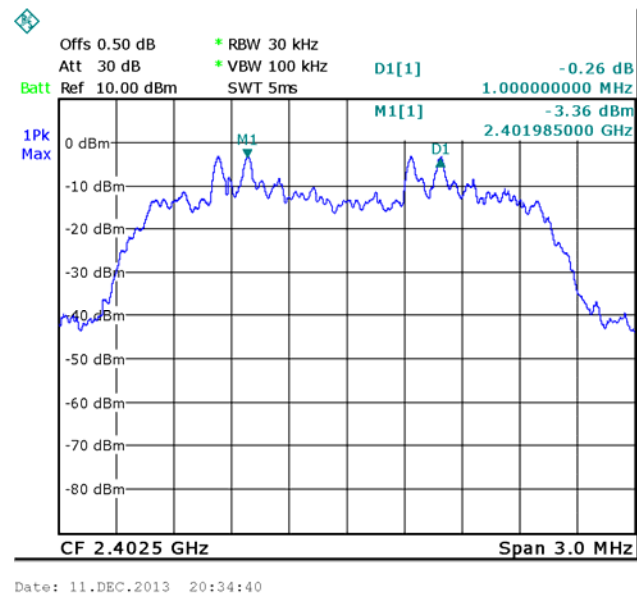


High Channel

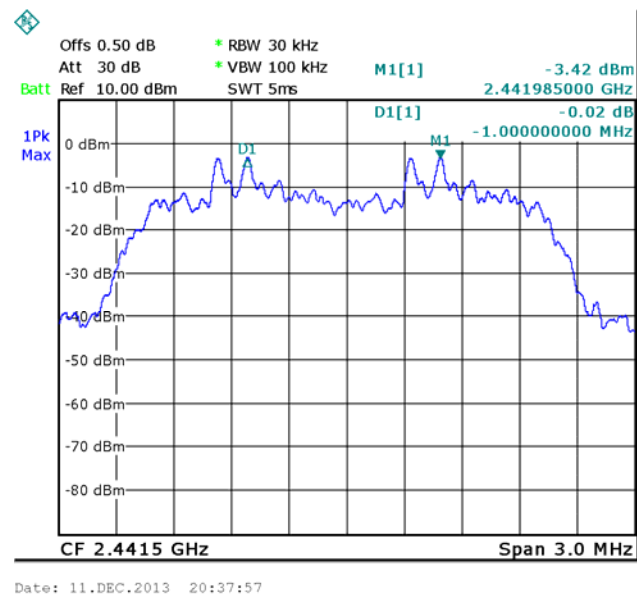


Modulation: Pi/4DQPSK

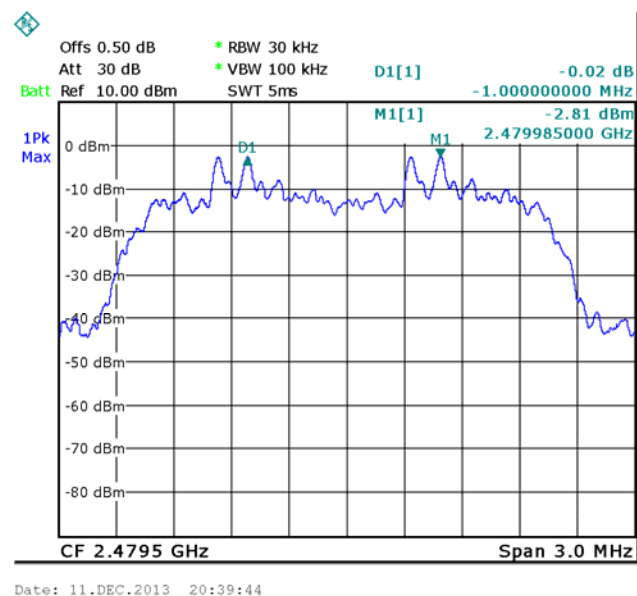
Low Channel



Middle Channel

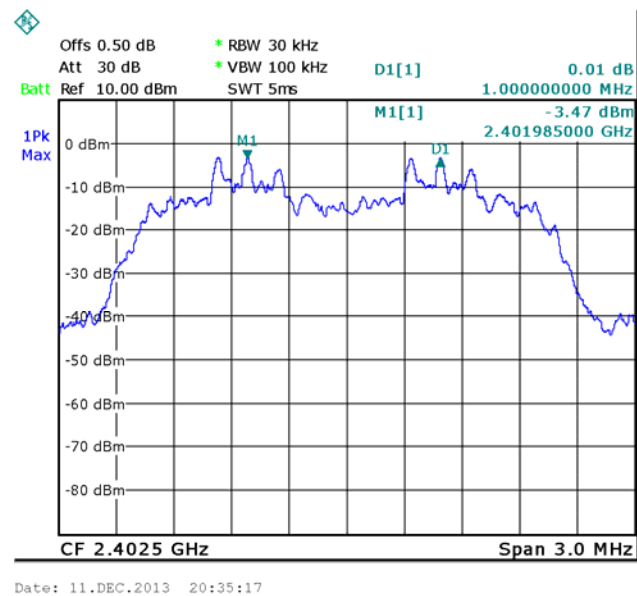


High Channel

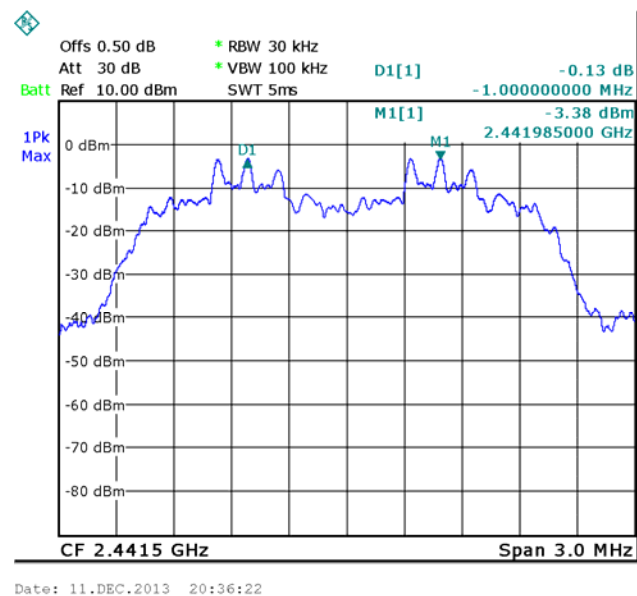


Modulation: 8DPSK

Low Channel

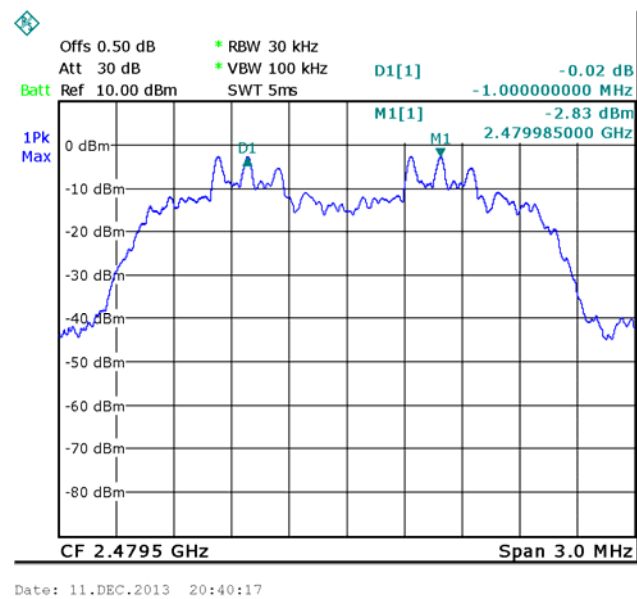


Middle Channel





High Channel



### 13 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

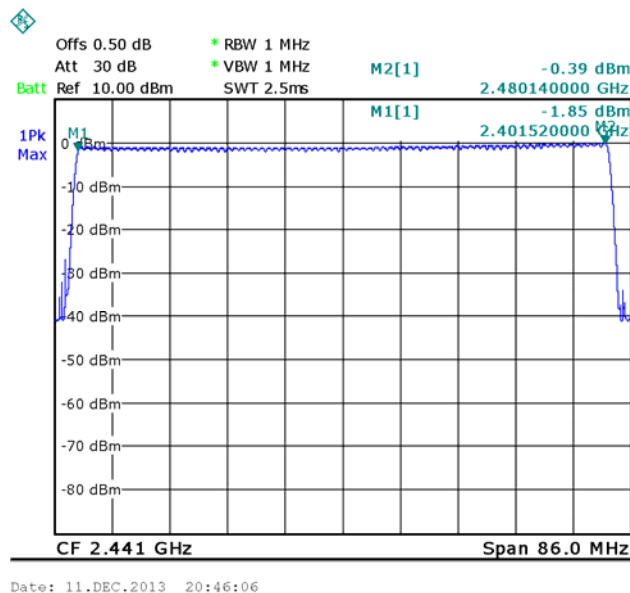
#### 13.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Centre Frequency = 2.441GHz, Span = 86MHz. Sweep=auto;

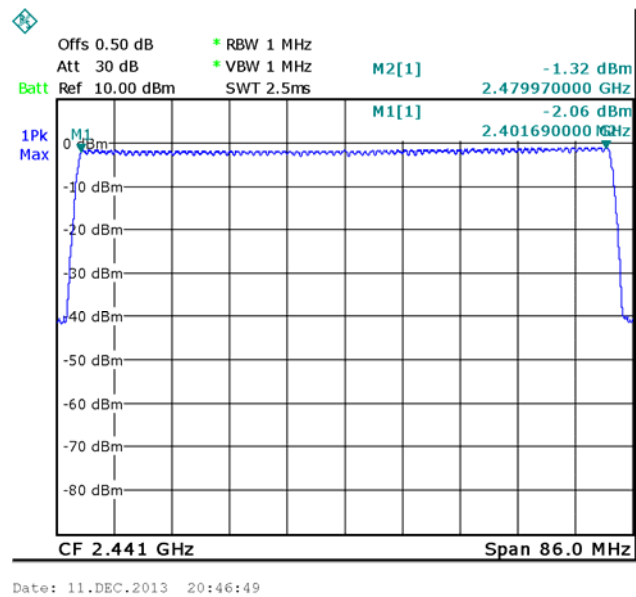
#### 13.2 Test Result:

**Total Channels are 79 Channels.**

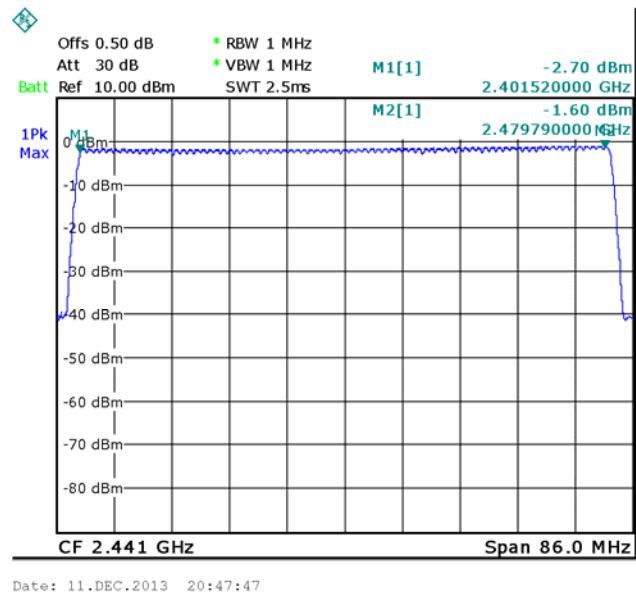
Modulation: GFSK



## Modulation: Pi/4DQPSK



## Modulation: 8DPSK



## 14 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

### 14.1 Test Procedure:

- 1.Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
- 2.Set spectrum analyzer span = 0. centred on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 1MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.
- 4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

### 14.2 Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period:  $T = 0.4(s) * 79 = 31.6 (s)$

DH5 Packet permit maximum  $1600 / 79 / 6$  hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum  $1600 / 79 / 4$  hops per second in each channel (3 time slots RX, 1 time slot TX).

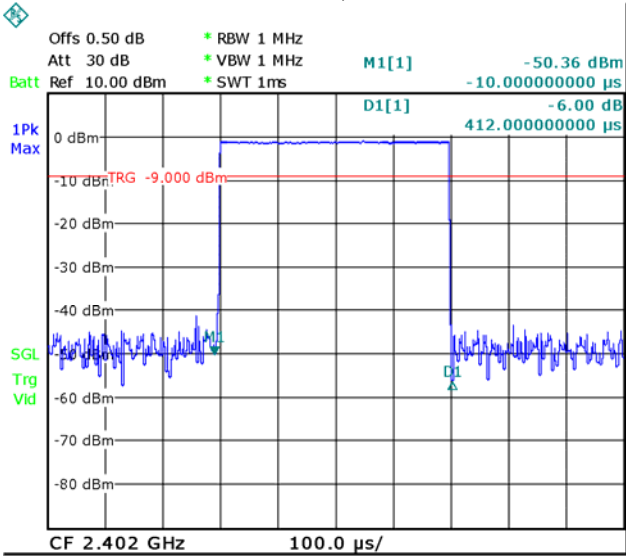
DH1 Packet permit maximum  $1600 / 79 / 2$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
DH5	$1600/79/6*31.6*(MkrDelta)/1000$
DH3	$1600/79/4*31.6*(MkrDelta)/1000$
DH1	$1600/79/2*31.6*(MkrDelta)/1000$
Remark	Mkr Delta is single pulse time.

Modulation	Frequency	Data Packet	Mkr Delta(ms)	Dwell Time(s)	Limits(s)
GFSK	Low	DH1	0.412	0.132	0.400
	Middle		0.412	0.132	0.400
	High		0.412	0.132	0.400
	Low	DH3	1.682	0.269	0.400
	Middle		1.682	0.269	0.400
	High		1.682	0.269	0.400
	Low	DH5	2.926	0.312	0.400
	Middle		2.926	0.312	0.400
	High		2.926	0.312	0.400
Pi/4DQPSK	Low	DH1	0.426	0.136	0.400
	Middle		0.426	0.136	0.400
	High		0.426	0.136	0.400
	Low	DH3	1.694	0.271	0.400
	Middle		1.694	0.271	0.400
	High		1.694	0.271	0.400
	Low	DH5	2.942	0.314	0.400
	Middle		2.942	0.314	0.400
	High		2.942	0.314	0.400
8DPSK	Low	DH1	0.422	0.135	0.400
	Middle		0.422	0.135	0.400
	High		0.422	0.135	0.400
	Low	DH3	1.694	0.271	0.400
	Middle		1.694	0.271	0.400
	High		1.694	0.271	0.400
	Low	DH5	2.942	0.314	0.400
	Middle		2.942	0.314	0.400
	High		2.942	0.314	0.400

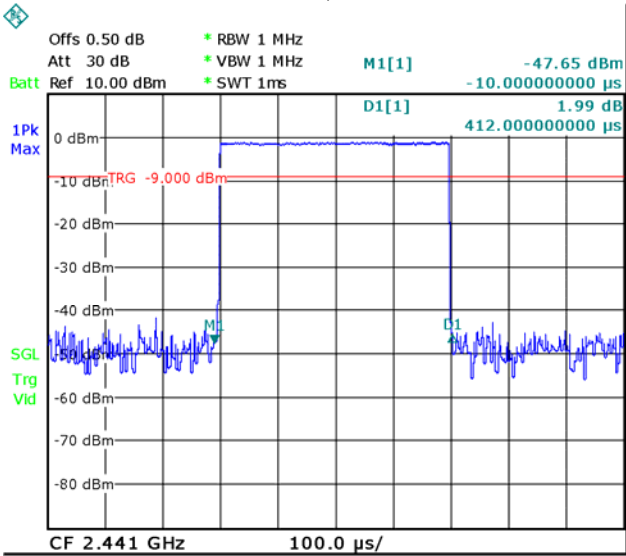
Modulation:GFSK

Data Packet: DH1, Low channel

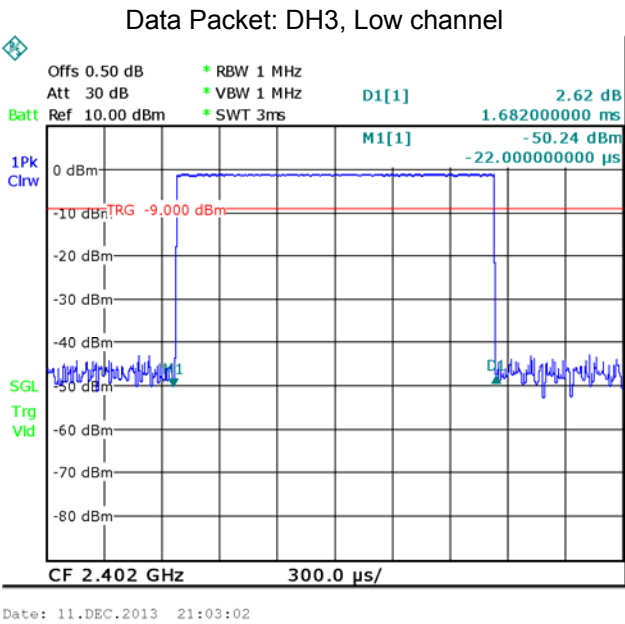
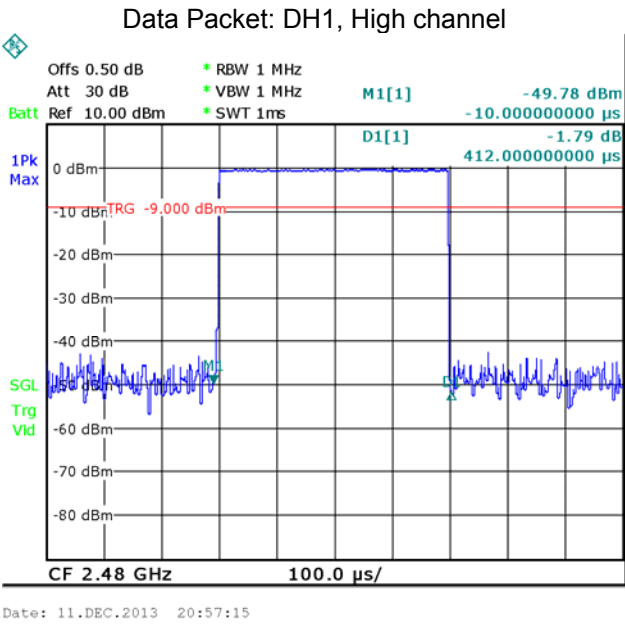


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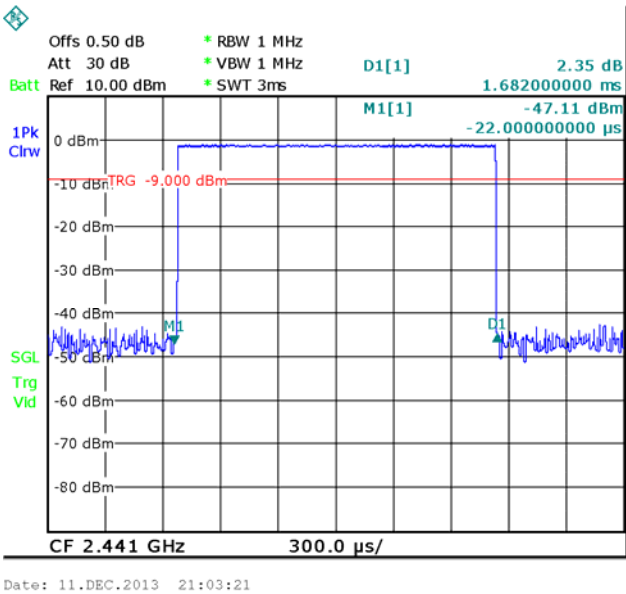
Data Packet: DH1, Middle channel



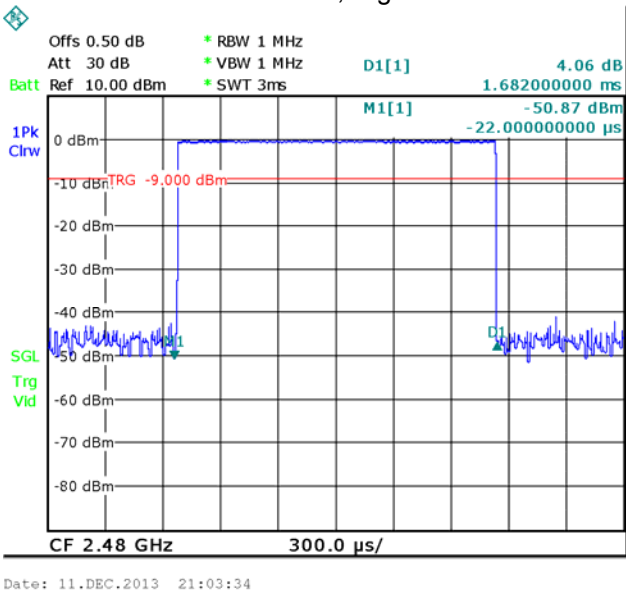
Date: 11.DEC.2013 20:56:59



Data Packet: DH3, Middle channel

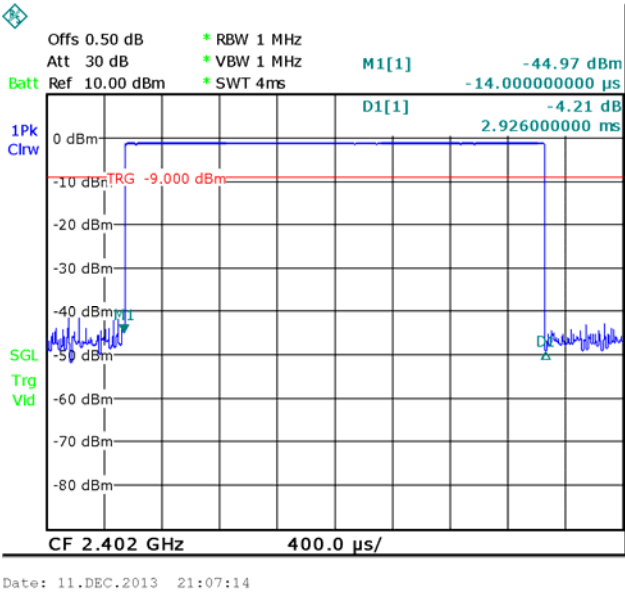


Data Packet: DH3, High channel

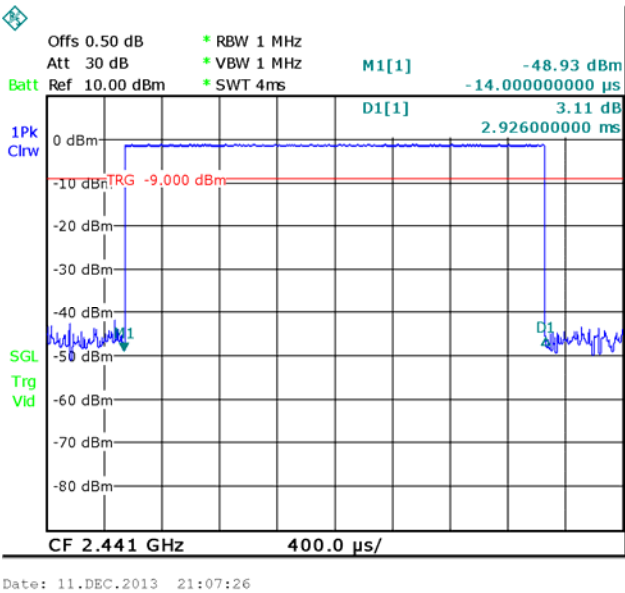




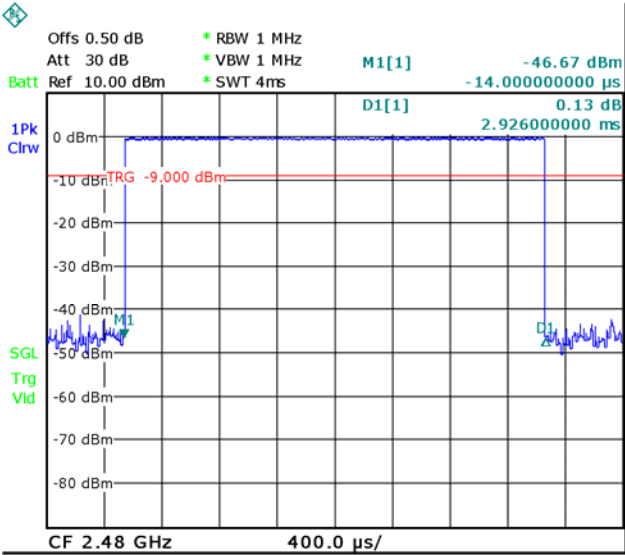
Data Packet: DH5, Low channel



Data Packet: DH5, Middle channel



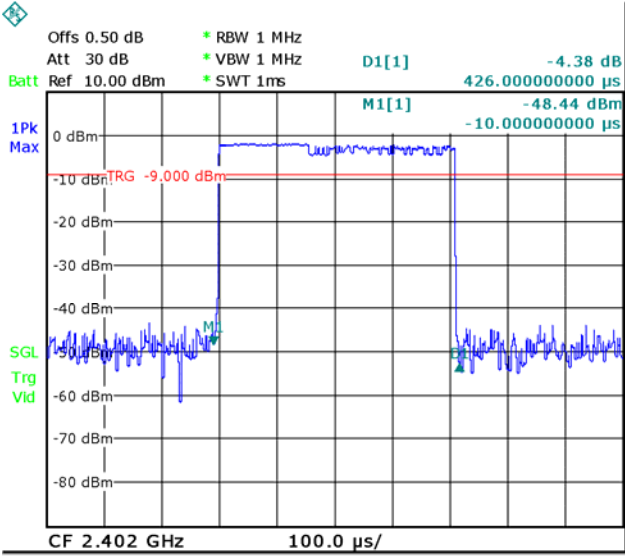
Data Packet: DH5, High channel



Date: 11.DEC.2013 21:07:43

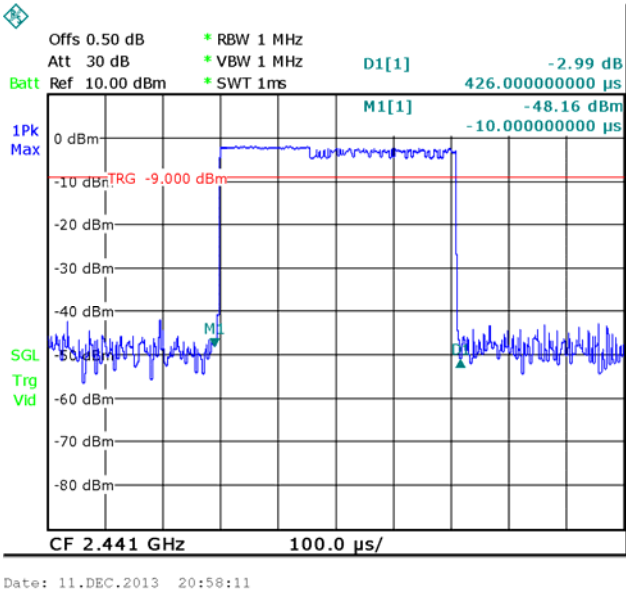
Modulation: Pi/4DQPSK

Data Packet: DH1, Low channel

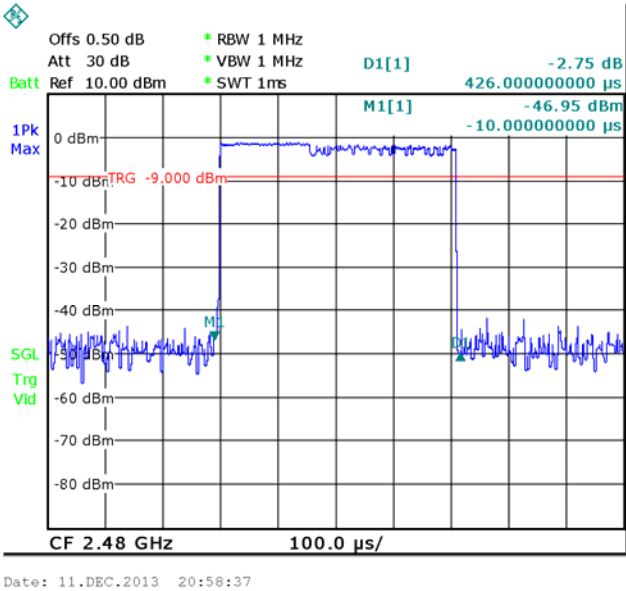


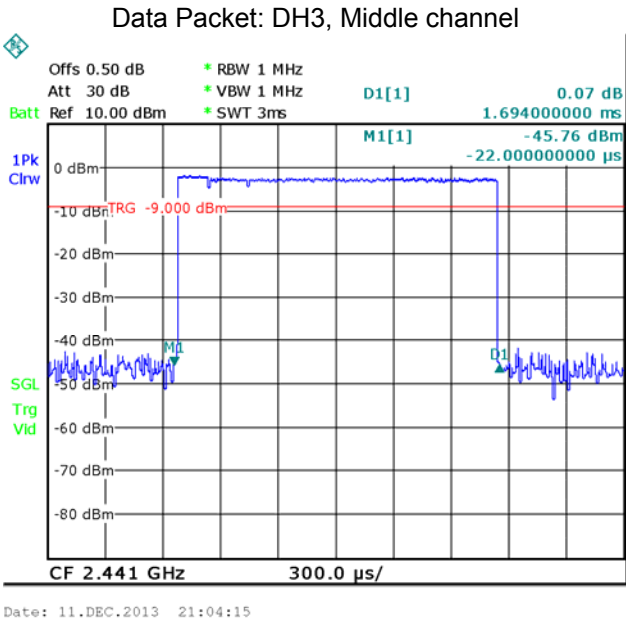
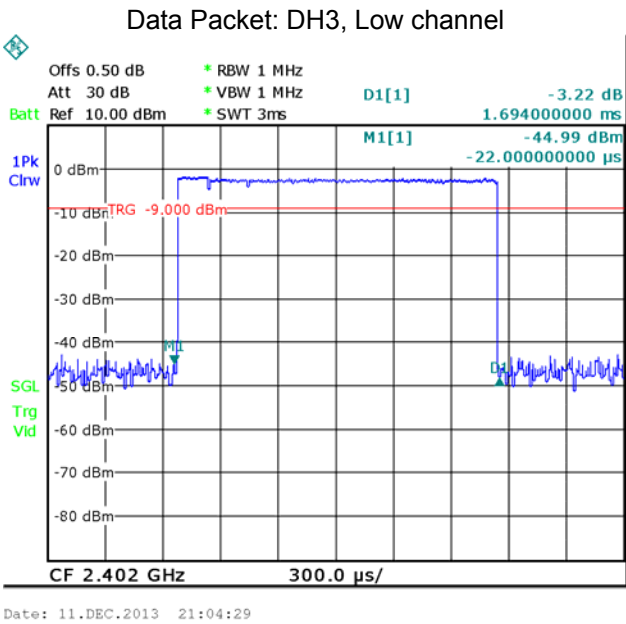
Date: 11.DEC.2013 20:57:57

Data Packet: DH1, Middle channel

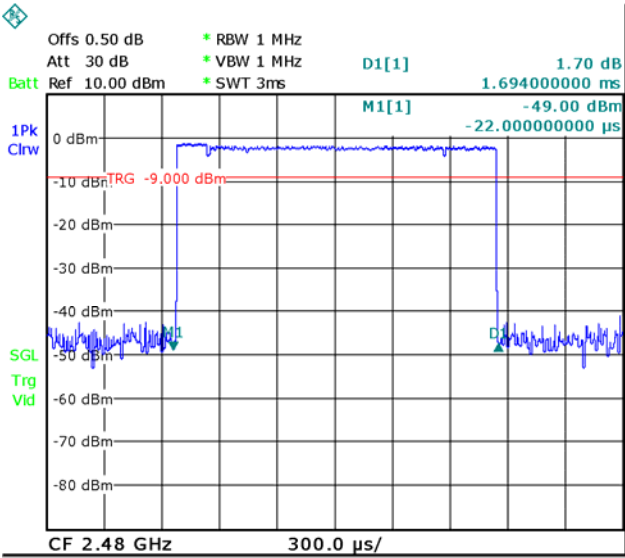


Data Packet: DH1, High channel



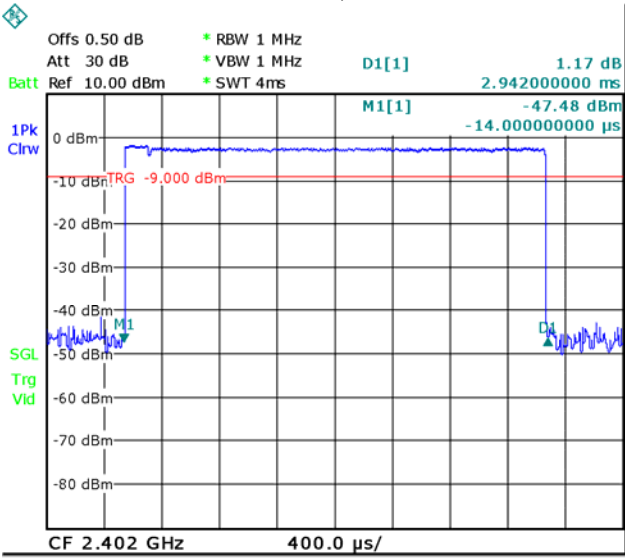


Data Packet: DH3, High channel



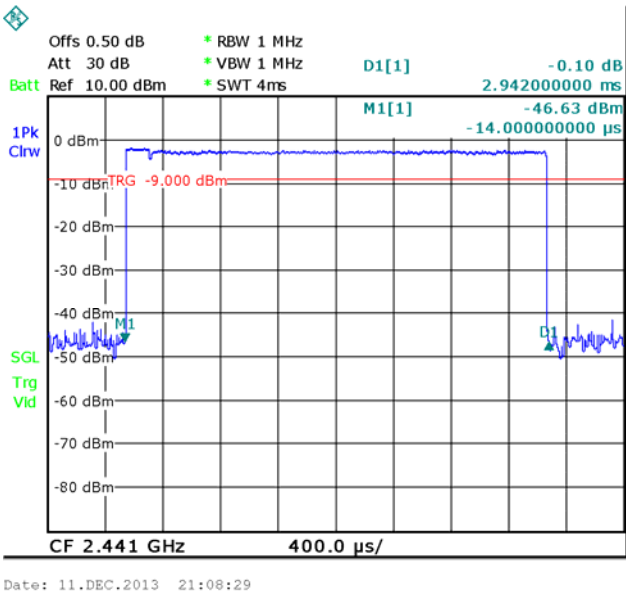
Date: 11.DEC.2013 21:03:59

Data Packet: DH5, Low channel

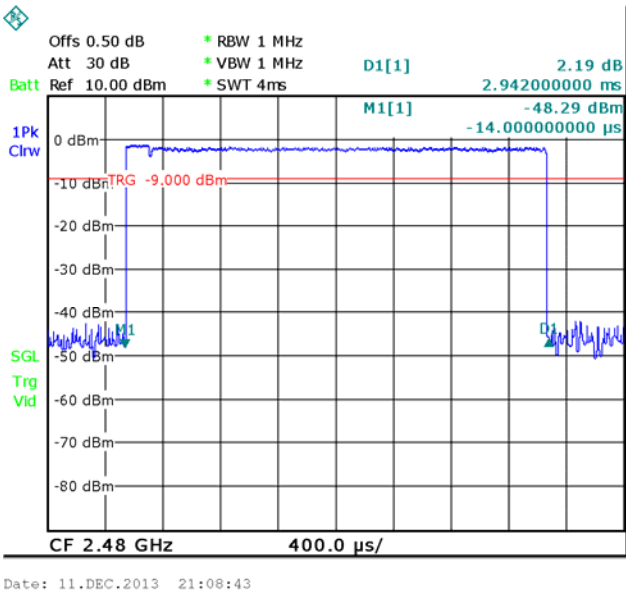


Date: 11.DEC.2013 21:08:15

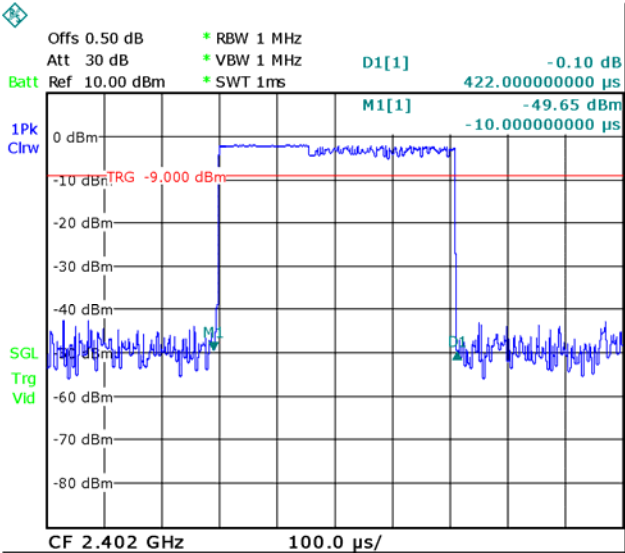
Data Packet: DH5, Middle channel



Data Packet: DH5, High channel

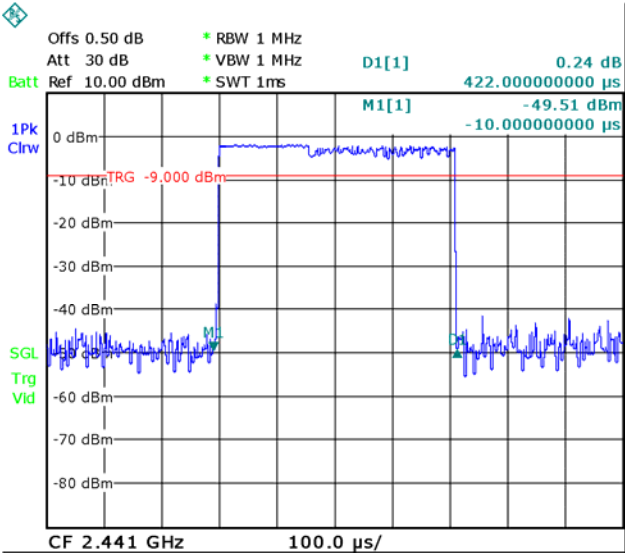


Modulation: 8DPSK  
Data Packet: DH1, Low channel



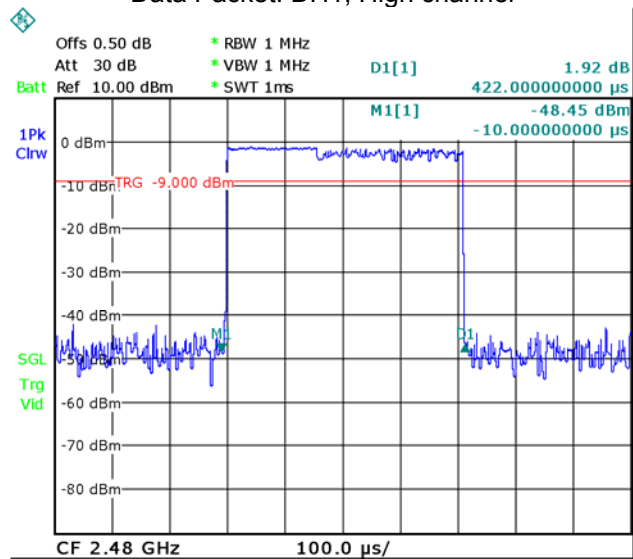
Date: 11.DEC.2013 20:59:18

Data Packet: DH1, Middle channel



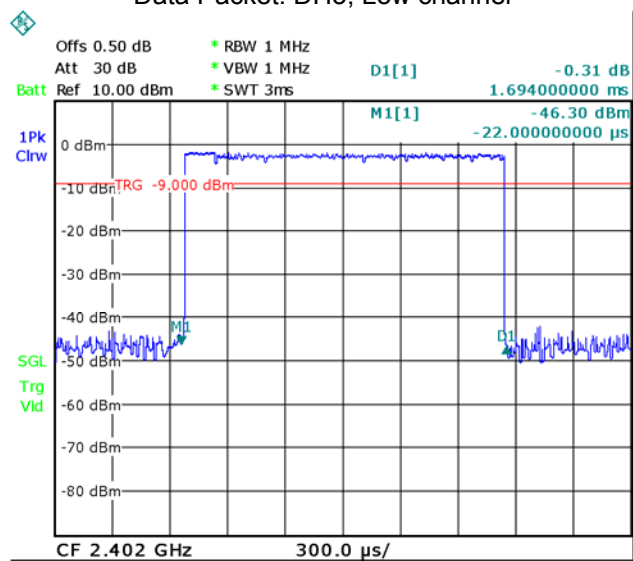
Date: 11.DEC.2013 20:59:31

Data Packet: DH1, High channel



Date: 11.DEC.2013 20:59:50

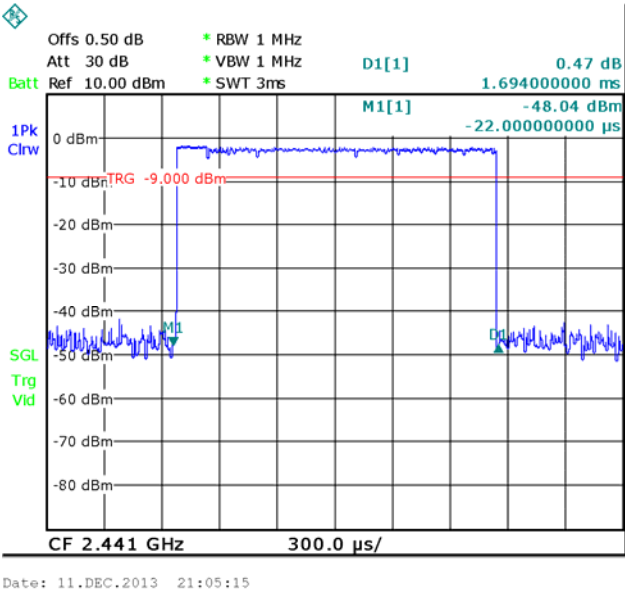
Data Packet: DH3, Low channel



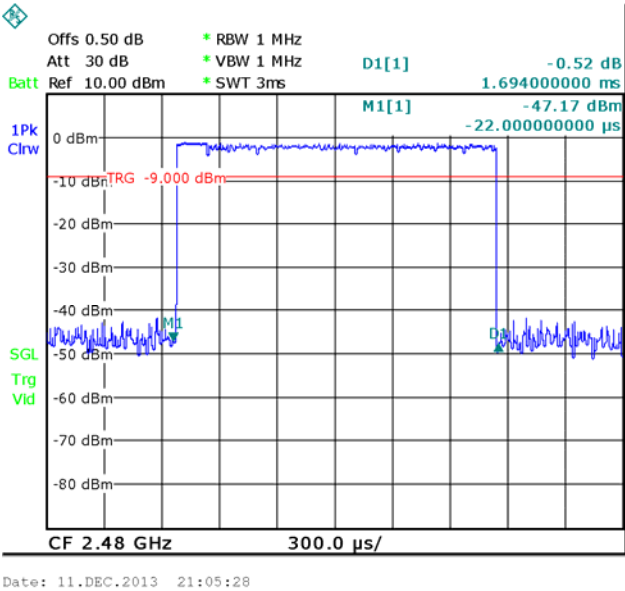
Date: 11.DEC.2013 21:04:56



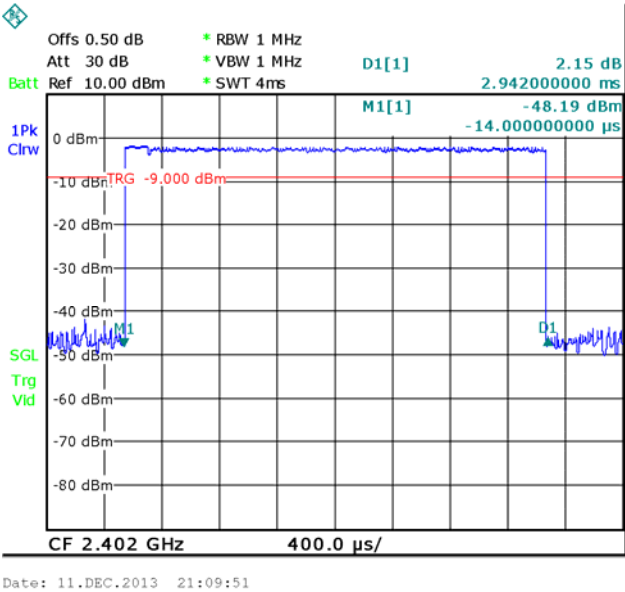
Data Packet: DH3, Middle channel



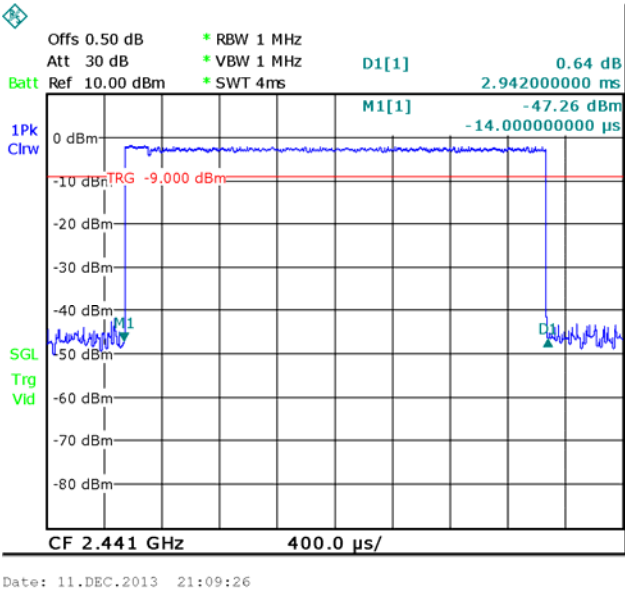
Data Packet: DH3, High channel



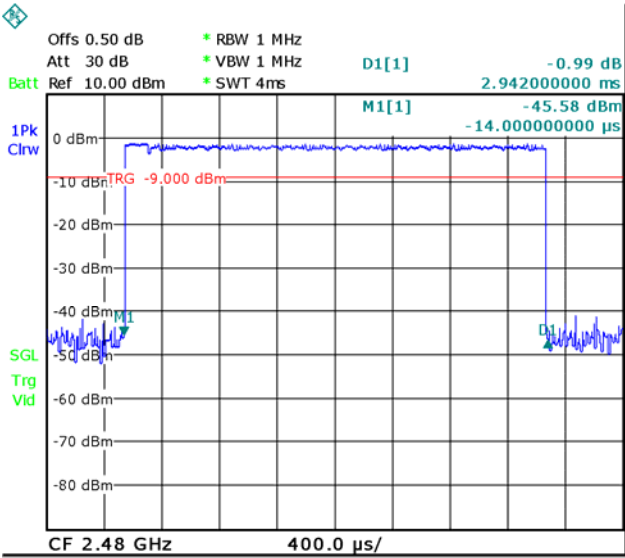
Data Packet: DH5, Low channel



Data Packet: DH5, Middle channel



Data Packet: DH5, High channel



Date: 11.DEC.2013 21:09:12

## **15 Antenna Requirement**

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a PCB printed antenna, fulfill the requirement of this section.

## 16 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in transmitting mode.

### 16.1 Requirements:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

### 16.2 The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 16.3 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = Peak RF output power (W)

**G** = EUT Antenna numeric gain (numeric) ,  $\text{Gain}_{\text{numeric}} = 10^{(\text{dBi}/10)}$

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance,  $d=0.2\text{m}$ , as well as the gain of the used antenna, the RF power density can be obtained

Modulation	Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )
GFSK	0	1	-0.35	0.92	0.0002	1.0
Pi/4DQPSK	0	1	-1.21	0.76	0.0002	1.0
8DPSK	0	1	-1.11	0.77	0.0002	1.0

## 17 Photographs – Test Setup

### 17.1 Radiated Emissions

Below 30MHz



From 30-1000MHz



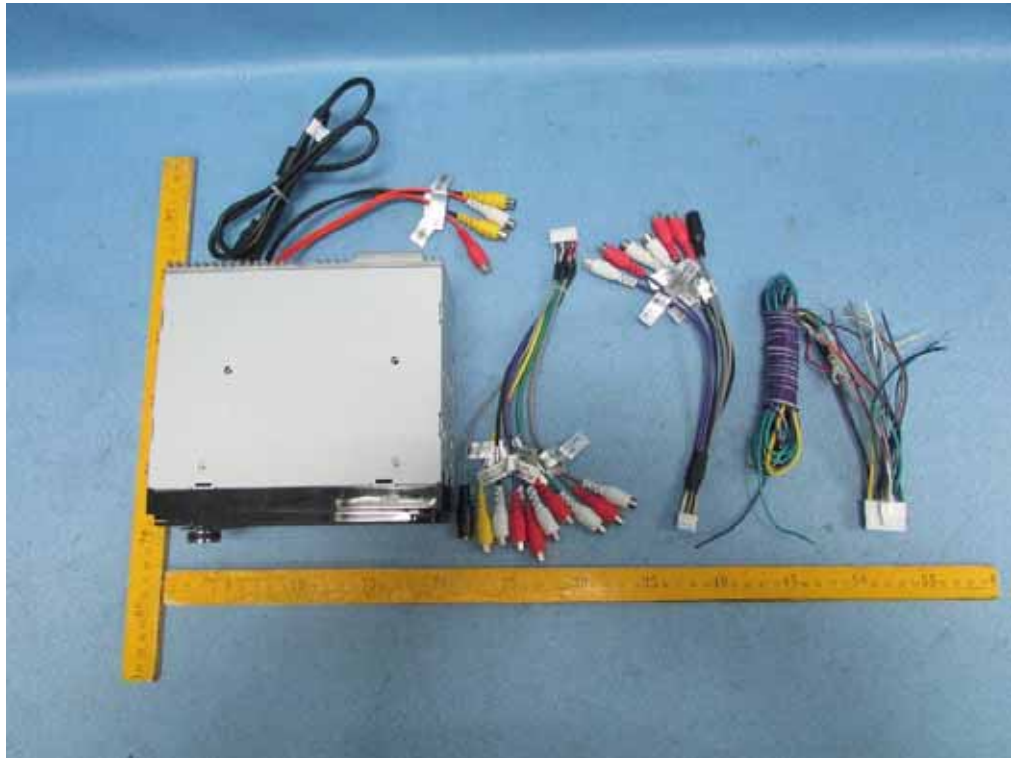
Above 1GHz





## 18 Photographs - Constructional Details

### 18.1 EUT – External View



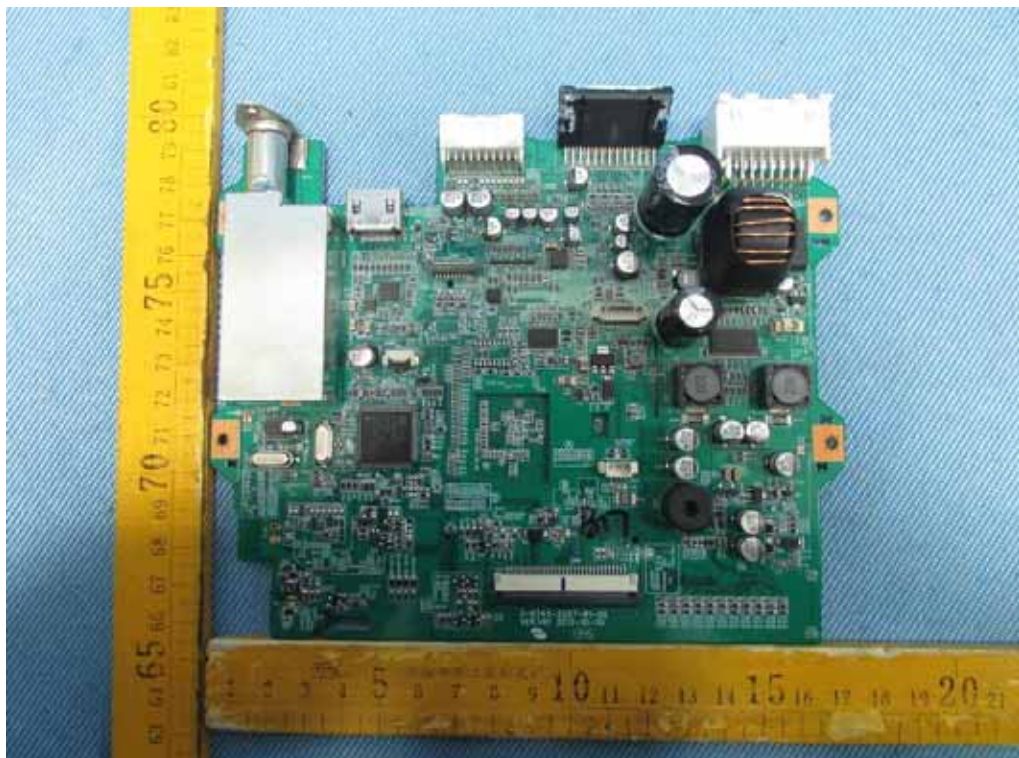




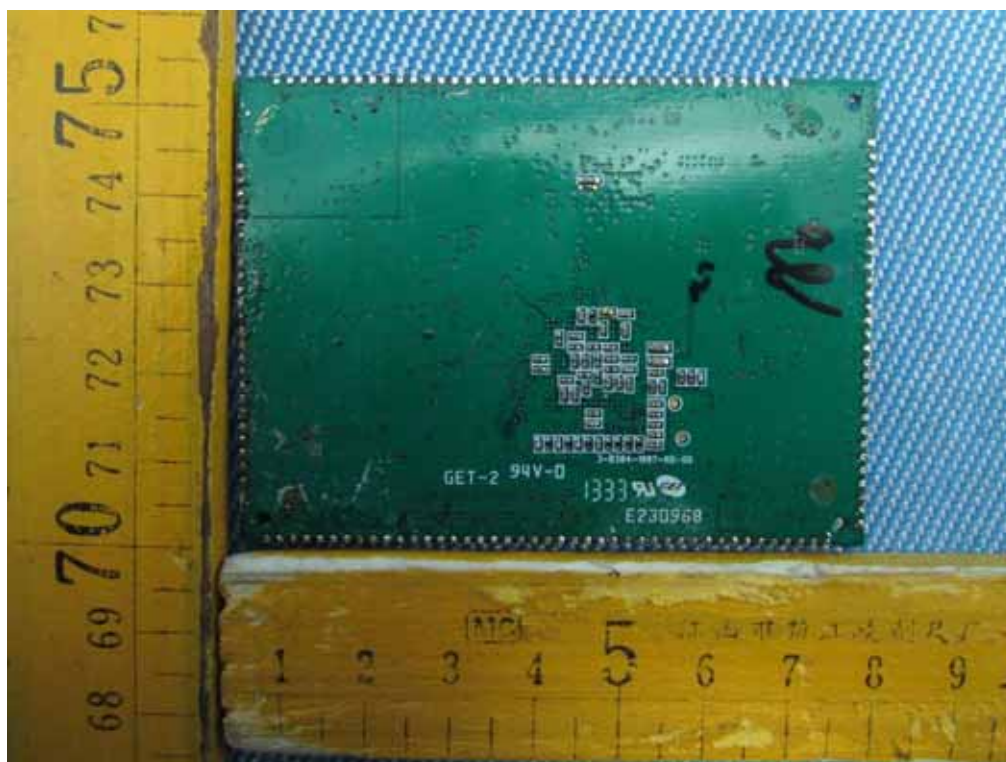
## 18.2 EUT – Internal View

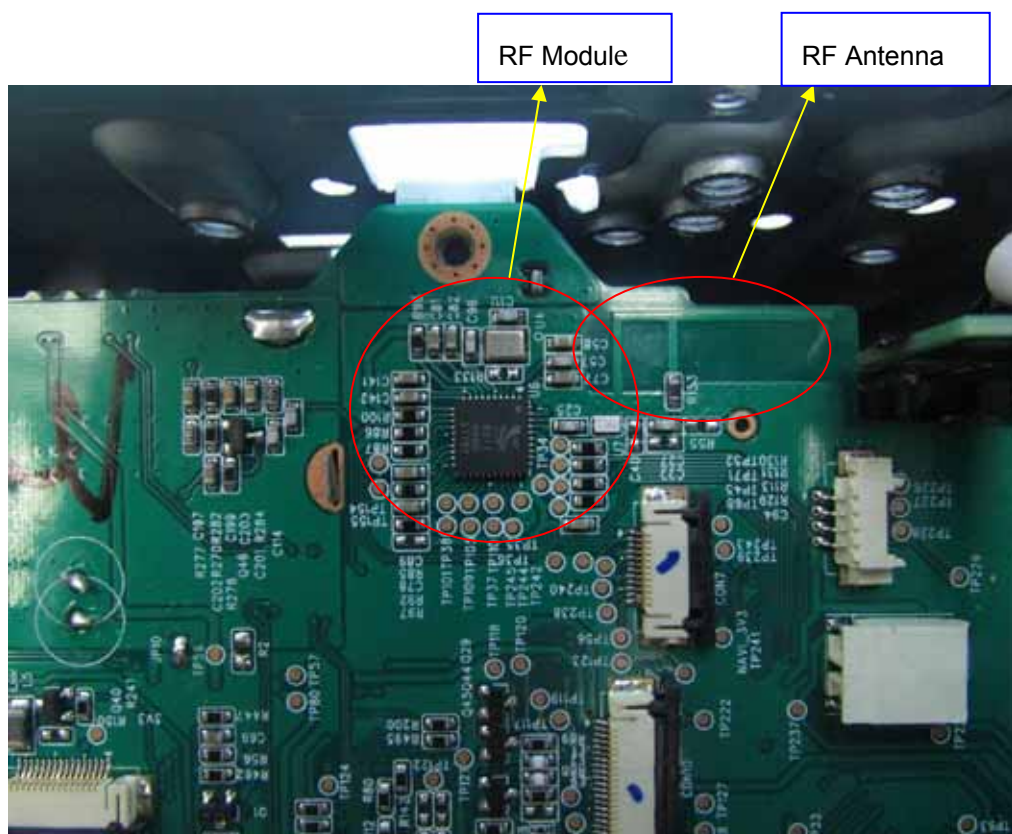
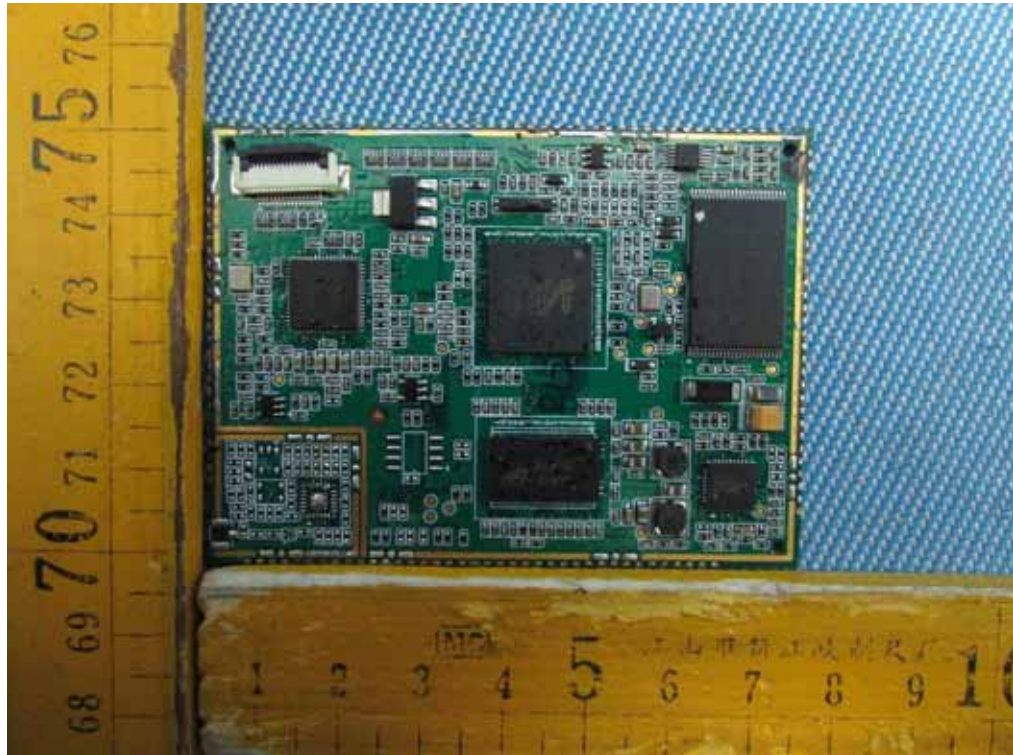




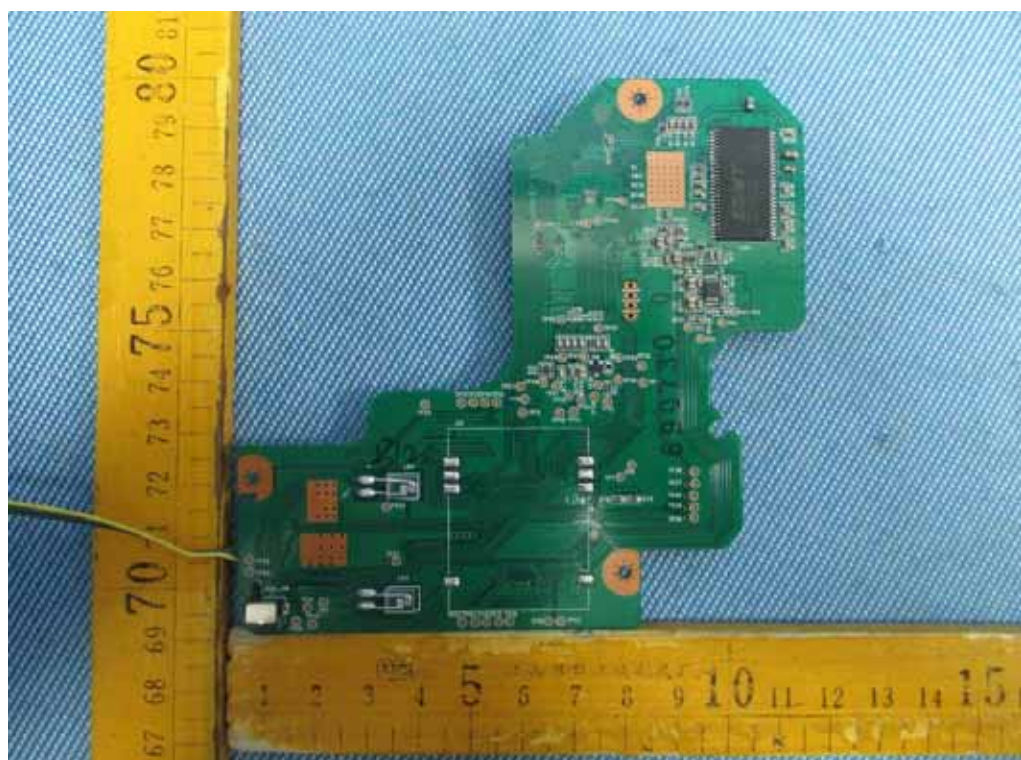
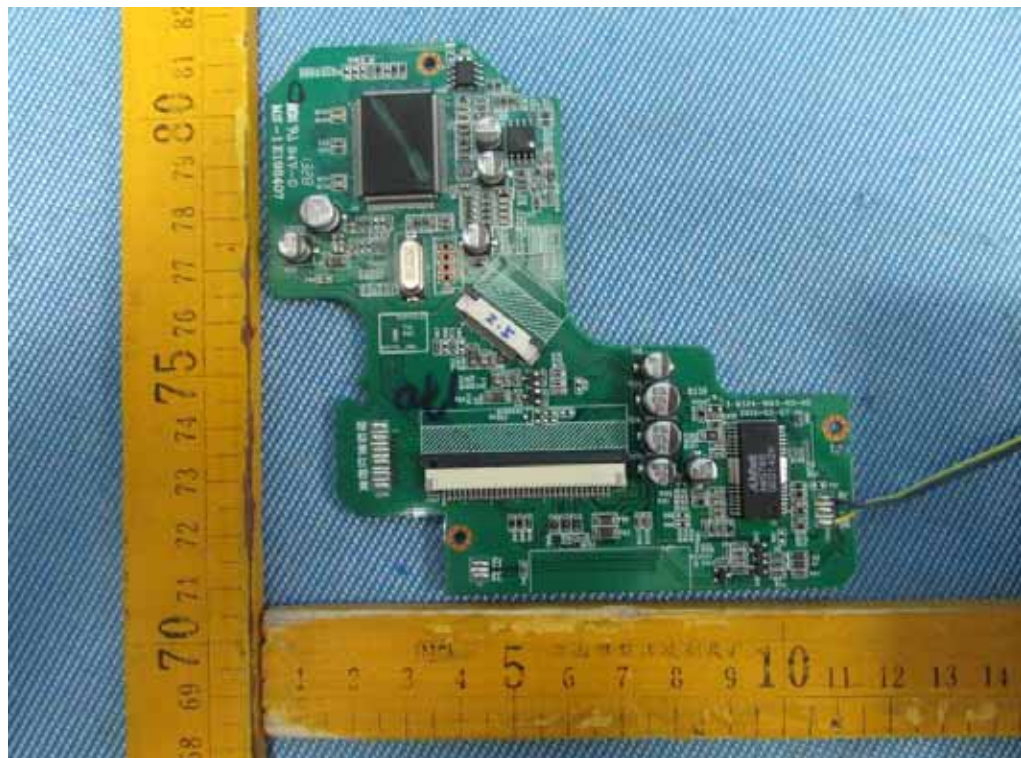




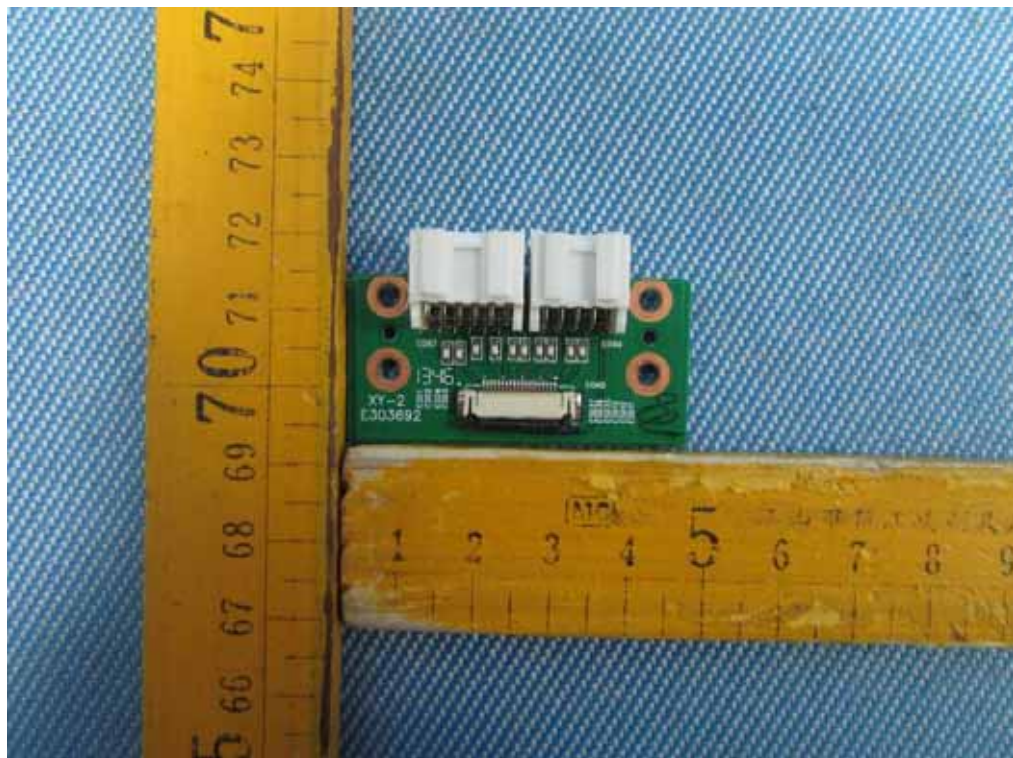




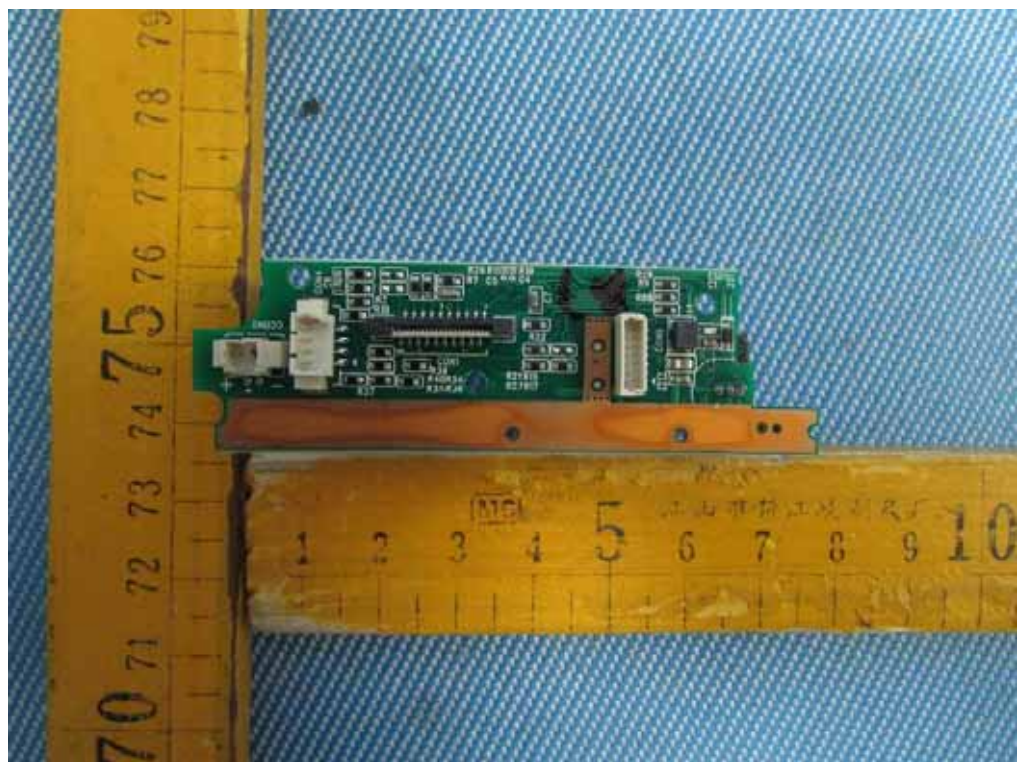
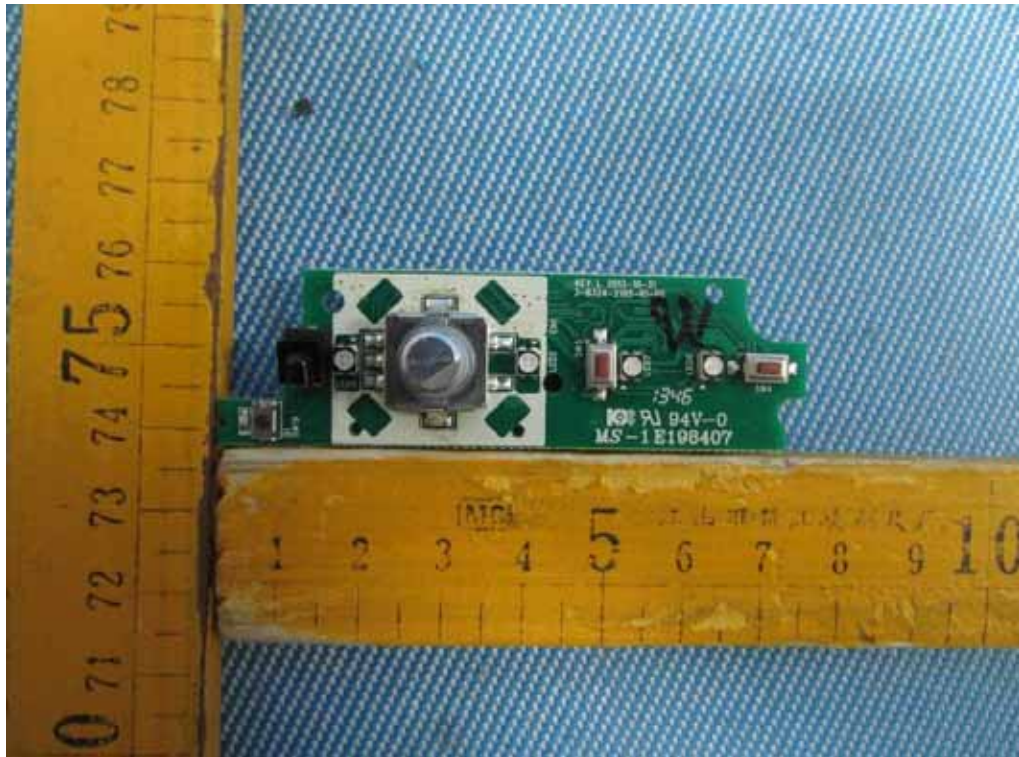


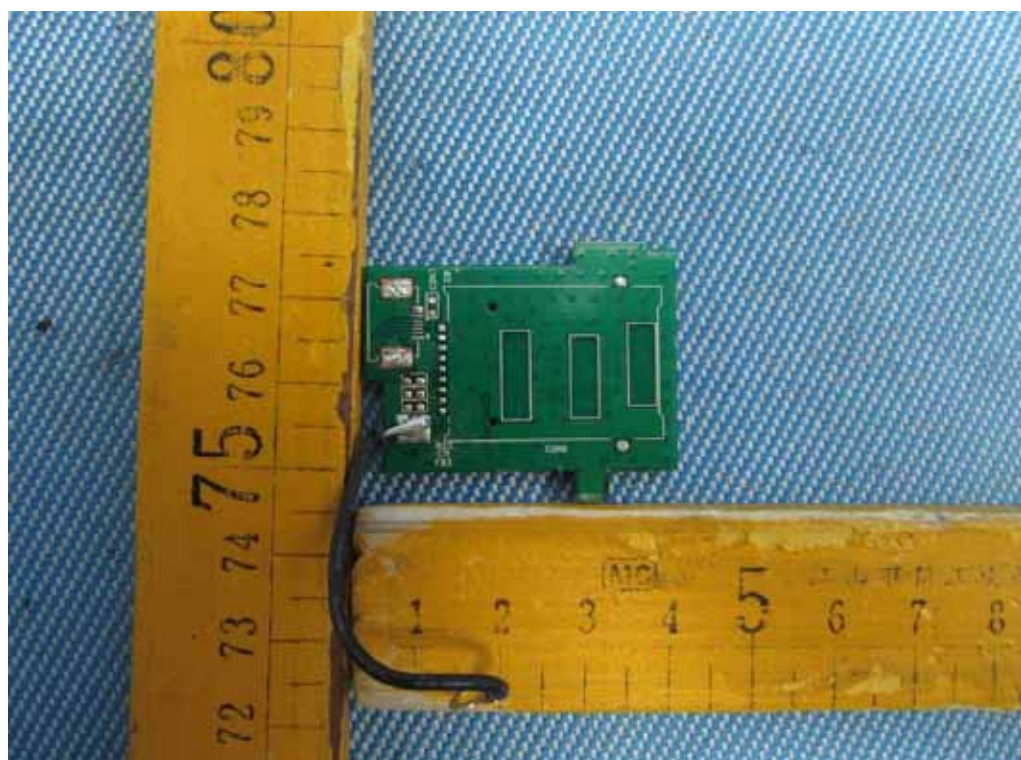
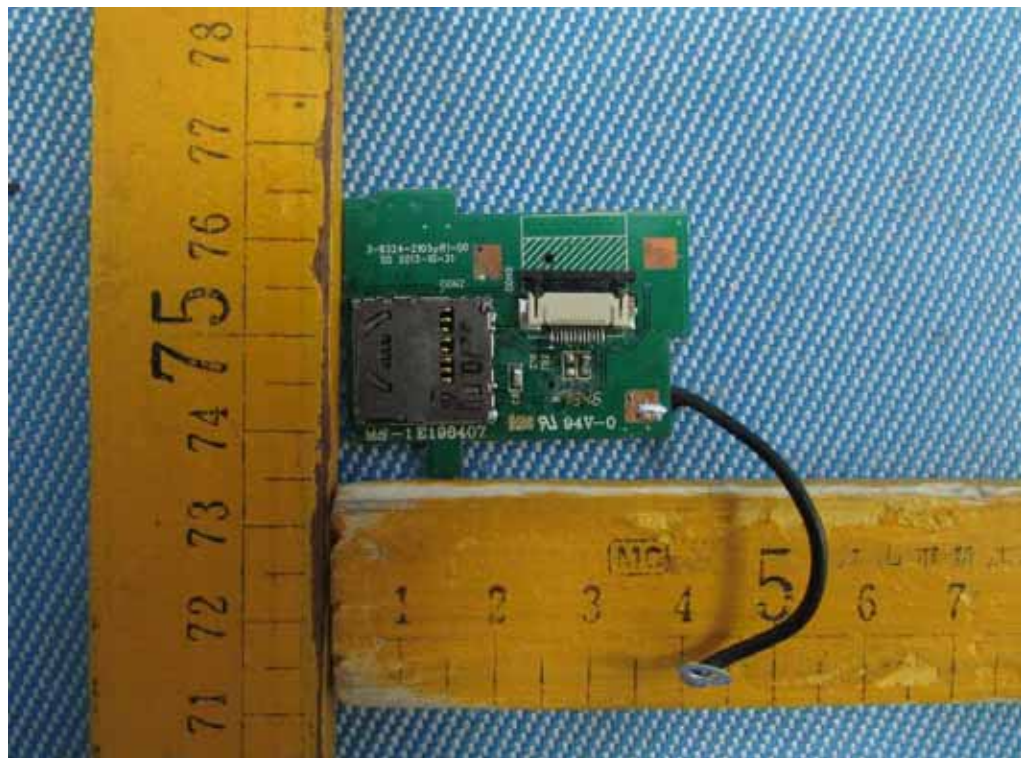




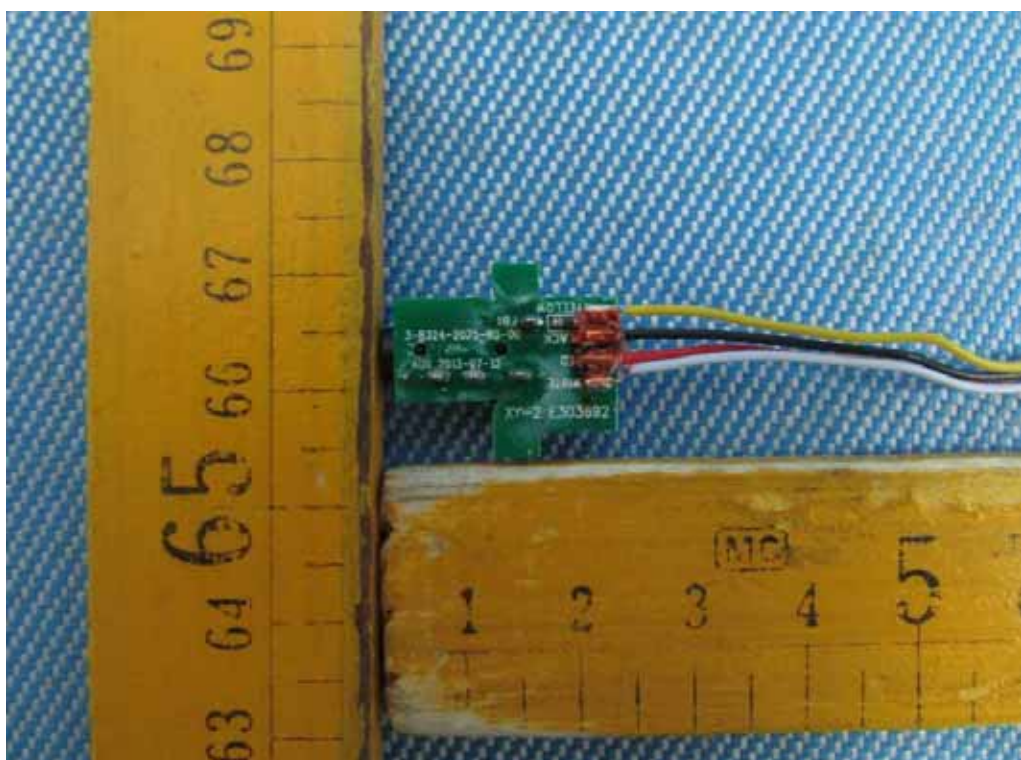
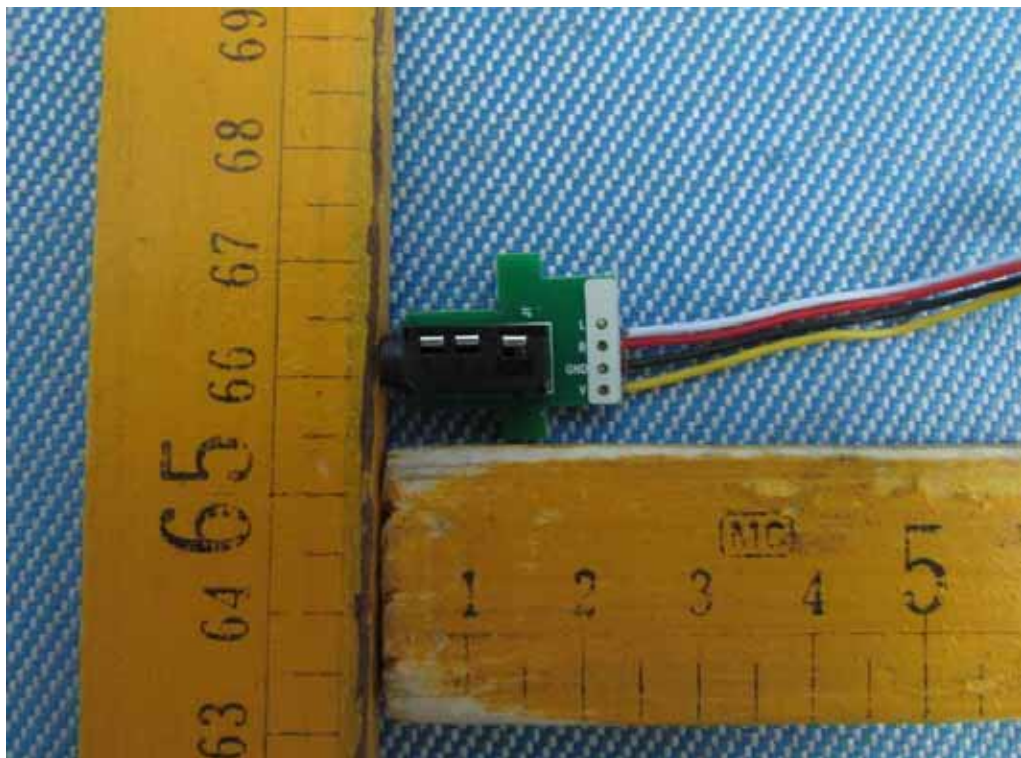


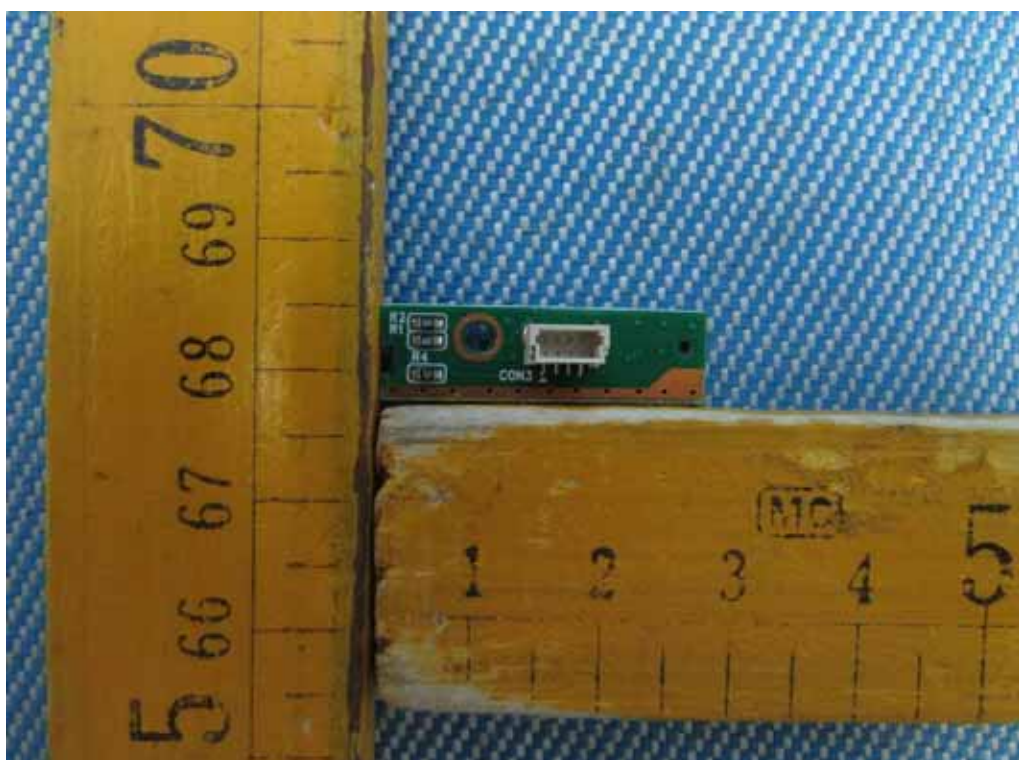
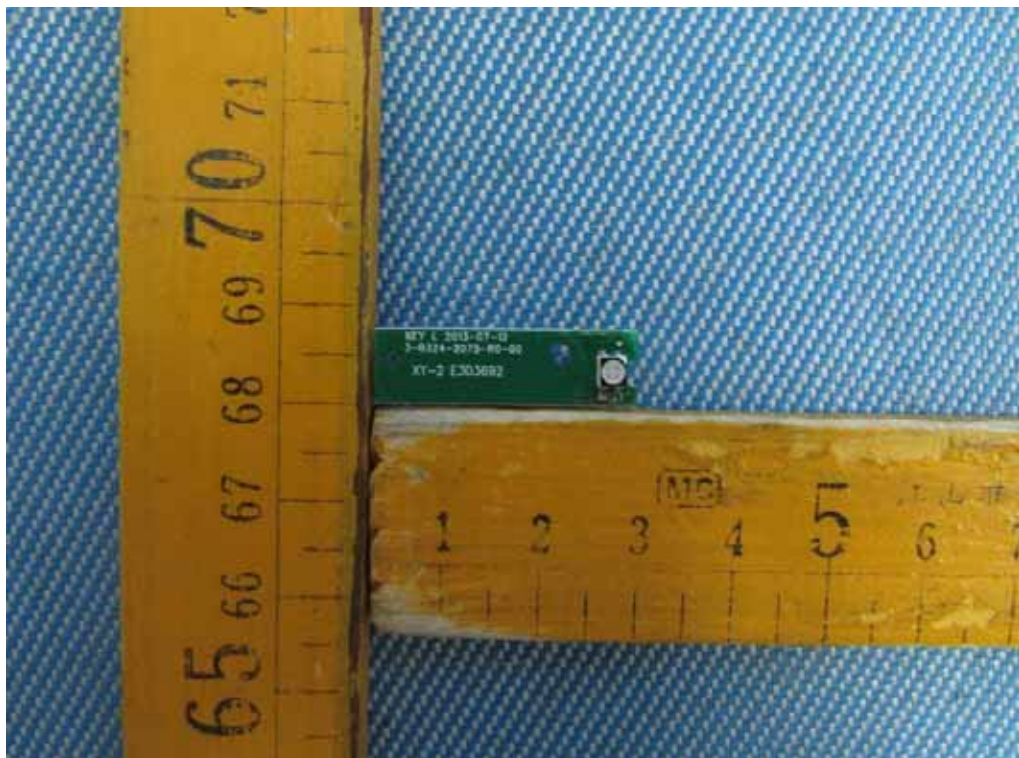




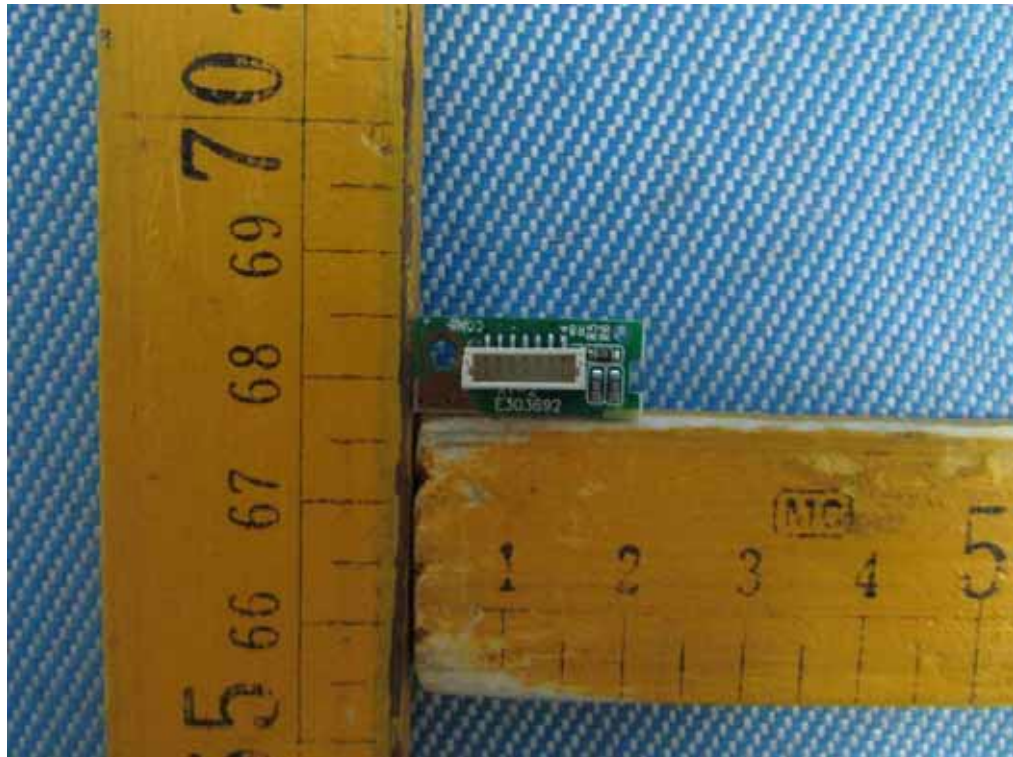












===== End of Test Report =====