

TEST REPORT

Reference No. : WTS13S1109073E
FCC ID : IKQBTSPK3
Applicant : Scosche Industries, Inc.
Address : 1550 Pacific Ave, Oxnard, CA
Manufacturer : CCA ELECTRONIC FACTORY
Address : 1-3F Building 120-121TH, PingHuan Industrial City, PingShan, LongGang, Shenzhen, China

Equipment Under Test (EUT) :

Product Name : Scosche BOOM STREAM MINI
Model No. : BTSPK3, BTSPK3BK, BTSPK3BL, BTSPK3W, BTSPK3RD
Brand Name : Scosche

Standards : FCC CFR47 Part 15 C Section 15.247:2012

Date of Test : Nov 18~23, 2013

Date of Issue : Dec 11, 2013

Test Result : **PASS**

Remark:

* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

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

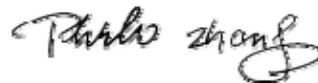
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Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Spurious Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge Emissions	15.247(d)	PASS
Spurious RF Conducted Emissions	15.247(d)	PASS
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

3 Contents

	Page
1 COVER PAGE	1
2 TEST SUMMARY	2
3 CONTENTS	3
4 GENERAL INFORMATION	5
4.1 GENERAL DESCRIPTION OF E.U.T.....	5
4.2 DETAILS OF E.U.T.....	5
4.3 CHANNEL LIST	5
4.4 TEST FACILITY	6
4.5 TEST LOCATION.....	6
4.6 GENERAL CONDITION	6
4.6.2 <i>Test Mode</i>	6
5 EQUIPMENT USED DURING TEST	7
5.1 EQUIPMENTS LIST	7
5.2 MEASUREMENT UNCERTAINTY.....	7
5.3 TEST EQUIPMENT CALIBRATION	7
6 CONDUCTED EMISSION	8
2	8
3	8
4	8
5	8
6	8
6.1 E.U.T. OPERATION.....	8
6.2 EUT SETUP	8
6.3 CONDUCTED EMISSION TEST RESULT.....	9
7 SPURIOUS RADIATED EMISSIONS	11
7.1 EUT OPERATION :	11
7.2 TEST SETUP	12
7.3 SPECTRUM ANALYZER SETUP	13
7.4 TEST PROCEDURE.....	14
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	14
7.6 SUMMARY OF TEST RESULTS	15
8 BAND EDGE EMISSIONS	18
8.1 TEST PROCEDURE.....	18
8.2 TEST RESULT	18
9 SPURIOUS RF CONDUCTED EMISSIONS	22
9.1 TEST PROCEDURE.....	22
10 20 DB BANDWIDTH MEASUREMENT	26
10.1 TEST PROCEDURE:.....	26
10.2 TEST RESULT:.....	26
11 MAXIMUM PEAK OUTPUT POWER	32
11.1 TEST PROCEDURE:.....	32
11.2 TEST RESULT:.....	32
12 HOPPING CHANNEL SEPARATION	38
12.1 TEST PROCEDURE:.....	38

12.2	TEST RESULT:.....	38
13	NUMBER OF HOPPING FREQUENCY	44
13.1	TEST PROCEDURE:.....	44
13.2	TEST RESULT:.....	44
14	DWELL TIME.....	46
14.1	TEST PROCEDURE:.....	46
14.2	TEST RESULT:.....	46
15	ANTENNA REQUIREMENT.....	62
16	RF EXPOSURE	63
16.1	REQUIREMENTS:	63
16.2	THE PROCEDURES / LIMIT	63
16.3	MPE CALCULATION METHOD.....	64
17	PHOTOGRAPHS – TEST SETUP	65
17.1	RADIATED EMISSIONS.....	65
18	PHOTOGRAPHS - CONSTRUCTIONAL DETAILS.....	67
18.1	EUT – EXTERNAL VIEW1	67
18.2	EUT – INTERNAL VIEW.....	71

4 General Information

4.1 General Description of E.U.T.

Product Name	: Scosche BOOM STREAM MINI
Model No.	: BTSPK3, BTSPK3BK, BTSPK3BL, BTSPK3W, BTSPK3RD
Model Description	: Five samples are same but only different colour, BTSPK3 is tested model.
Brand Name	: Scosche
Operation Frequency	: 2402MHz ~ 2480MHz, 79 channels in total, separated by 1MHz
Type of Modulation	: GFSK, Pi/4DQPSK, 8DPSK
Lowest OSC Frequency	: 7MHz
Antenna installation	: PCB Printed Antenna
Antenna Gain	: 2dBi

4.2 Details of E.U.T.

Technical Data	: (1) DC 5V Power supply by USB port (2) DC 3.7V Power supply by lithium battery
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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 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.

4.5 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

4.6 General condition

Ambient Condition: 25.5 °C 51 %RH

4.6.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	2402MHz	2441MHz	2480MHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.21,2013	Sep.20,2014
2.	LISN	R&S	ENV216	101215	Sep.21,2013	Sep.20,2014
3.	Cable	Top	TYPE16(3.5M)	-	Sep.21,2013	Sep.20,2014
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.21,2013	Sep.20,2014
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.21,2013	Sep.20,2014
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Sep.21,2013	Sep.20,2014
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Sep.21,2013	Sep.20,2014
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Sep.21,2013	Sep.20,2014
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Sep.21,2013	Sep.20,2014
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Sep.21,2013	Sep.20,2014
8.	Cable	Top	EWO2014-7	-	Sep.21,2013	Sep.20,2014
9.	Cable	Top	TYPE16(13M)	-	Sep.21,2013	Sep.20,2014
10.	DC POWER SUPPLY	LWDQGS	PS-303D	-	Sep.21,2013	Sep.20,2014
11.	Humidity Chamber	GTH-225-40-1P	IAA061213	-	Sep.21,2013	Sep.20,2014
12.	Spectrum Analyzer	ROHDE & SCHWARZ	FSL6	100959	Sep.21,2013	Sep.20,2014

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Temperature	± 1 °C
DC Source	$\pm 0.05\%$
Radiated Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (150kHz~30MHz)

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 μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Operation

Operating Environment:

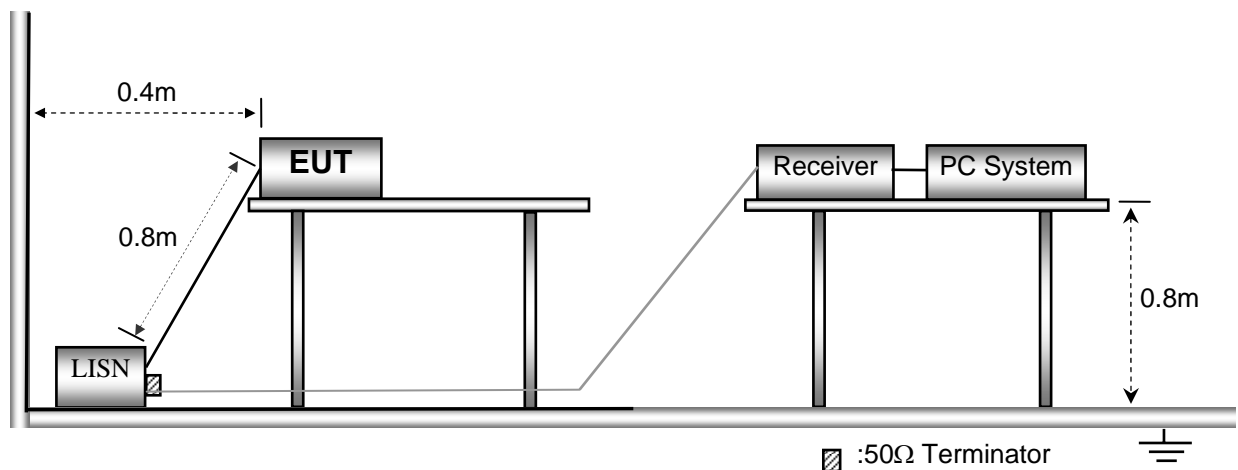
Temperature:	25.5 °C
Humidity:	50 % RH
Atmospheric Pressure:	1010 mbar

EUT Operation:

The pre-test was performed in BT transmission mode, and the test data were shown as follow. The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.2 EUT Setup

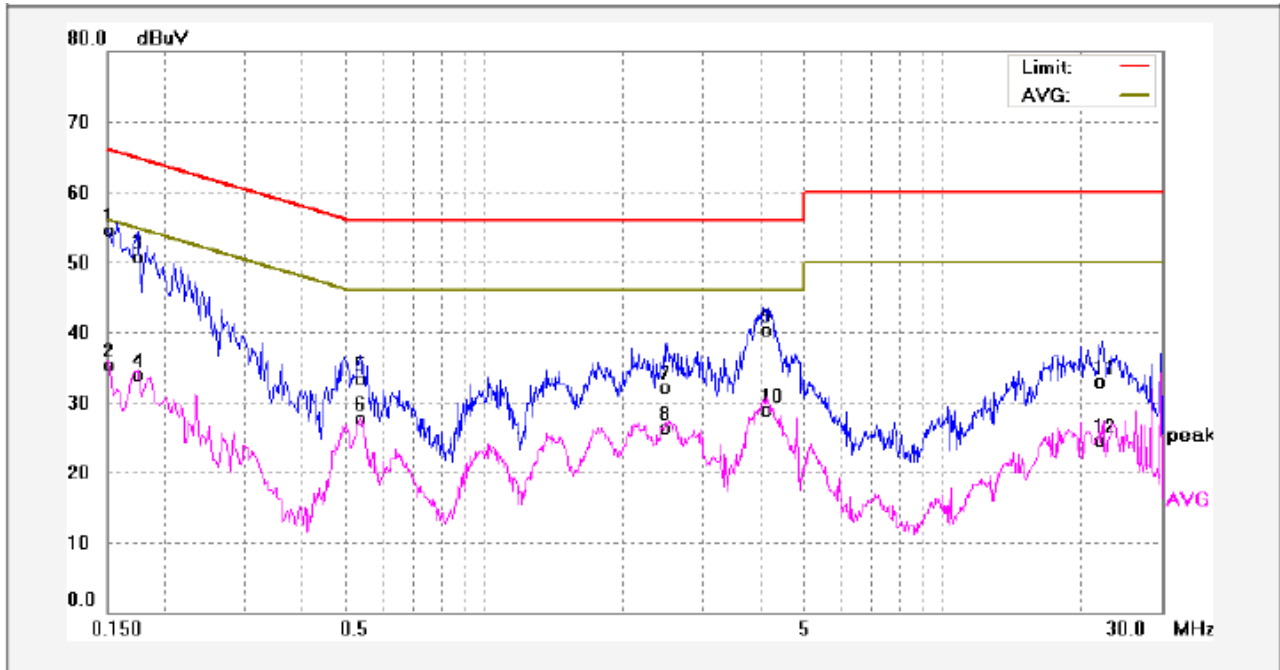
The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



6.3 Conducted Emission Test Result

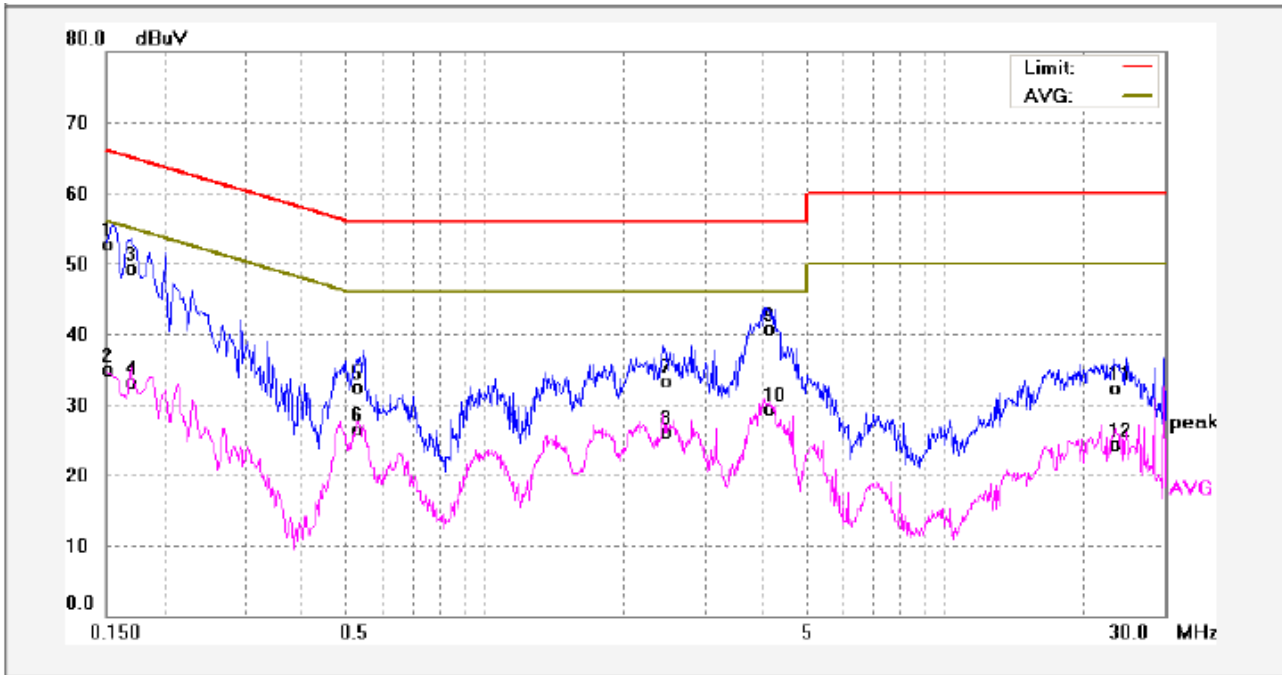
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	44.62	9.80	54.42	65.99	-11.57	QP	
2	0.1500	25.60	9.80	35.40	55.99	-20.59	AVG	
3	0.1740	40.98	9.82	50.80	64.76	-13.96	QP	
4	0.1740	24.17	9.82	33.99	54.76	-20.77	AVG	
5	0.5340	23.35	9.93	33.28	56.00	-22.72	QP	
6	0.5340	17.82	9.93	27.75	46.00	-18.25	AVG	
7	2.4940	22.01	10.02	32.03	56.00	-23.97	QP	
8	2.4940	16.30	10.02	26.32	46.00	-19.68	AVG	
9	4.0739	30.19	10.07	40.26	56.00	-15.74	QP	
10	4.0739	18.78	10.07	28.85	46.00	-17.15	AVG	
11	22.2099	21.44	11.38	32.82	60.00	-27.18	QP	
12	22.2099	13.05	11.38	24.43	50.00	-25.57	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	42.91	9.80	52.71	65.99	-13.28	QP	
2	0.1500	25.14	9.80	34.94	55.99	-21.05	AVG	
3	0.1700	39.52	9.82	49.34	64.96	-15.62	QP	
4	0.1700	23.20	9.82	33.02	54.96	-21.94	AVG	
5	0.5299	22.66	9.93	32.59	56.00	-23.41	QP	
6	0.5299	16.67	9.93	26.60	46.00	-19.40	AVG	
7	2.4739	23.29	10.02	33.31	56.00	-22.69	QP	
8	2.4739	16.13	10.02	26.15	46.00	-19.85	AVG	
9	4.1140	30.67	10.07	40.74	56.00	-15.26	QP	
10	4.1140	19.31	10.07	29.38	46.00	-16.62	AVG	
11	23.5300	20.91	11.48	32.39	60.00	-27.61	QP	
12	23.5300	12.75	11.48	24.23	50.00	-25.77	AVG	

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(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
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 % RH

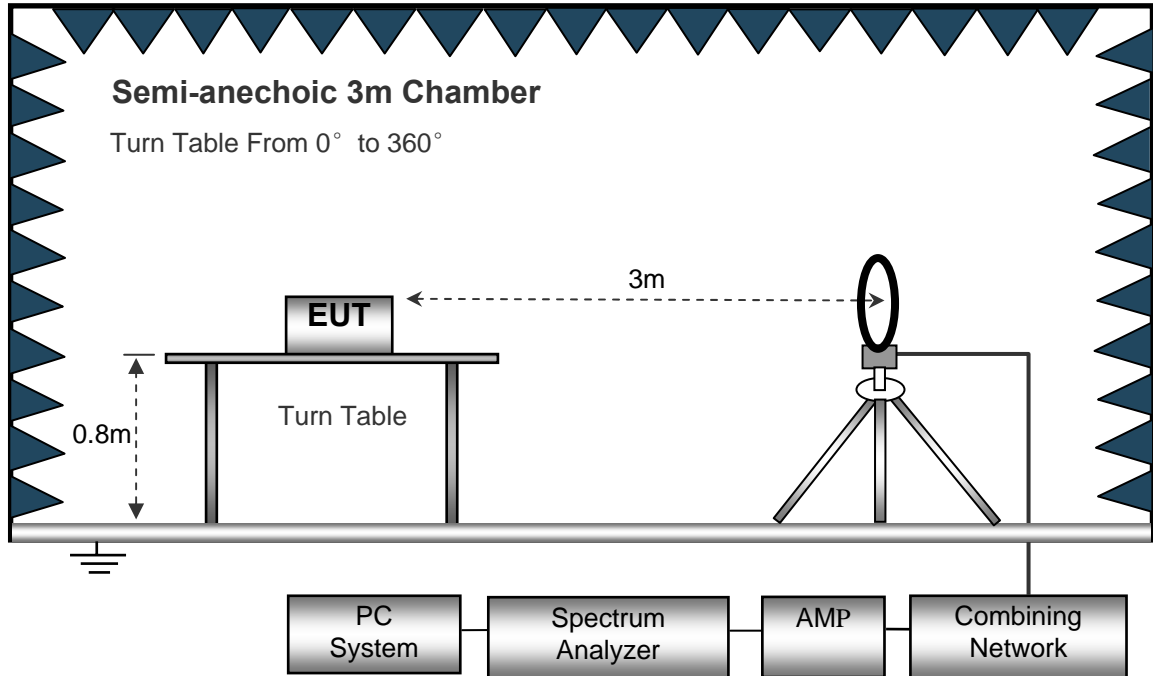
Atmospheric Pressure:1008 mbar

EUT Operation:

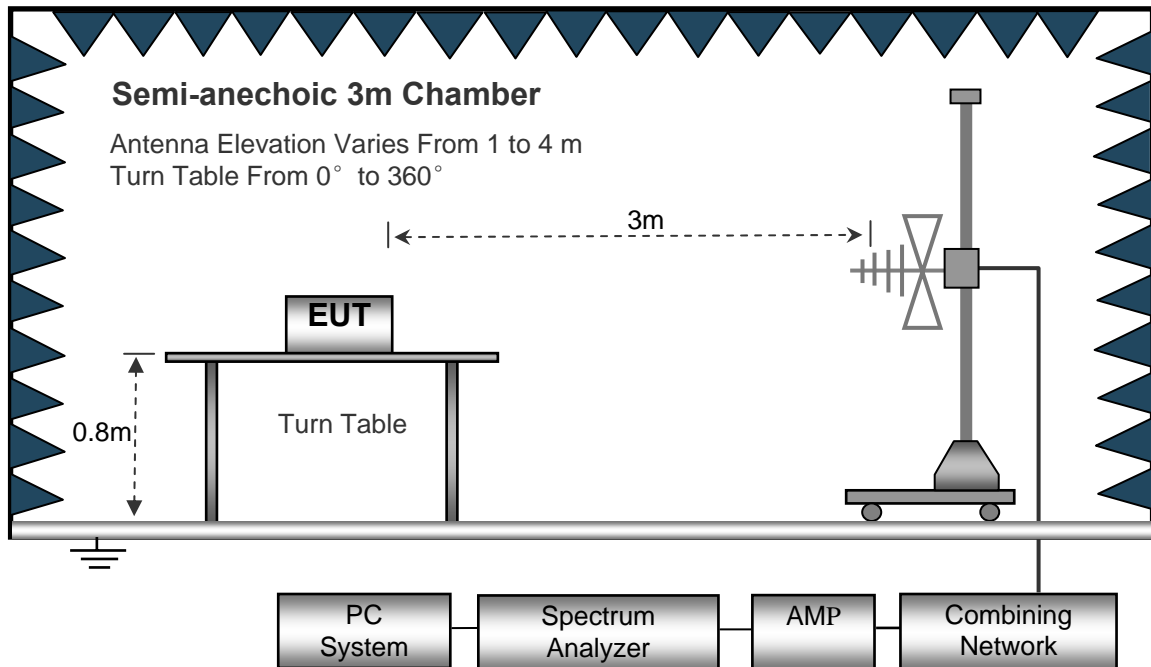
The test was performed in bluetooth transmission mode, and the data is show in the report.

7.2 Test Setup

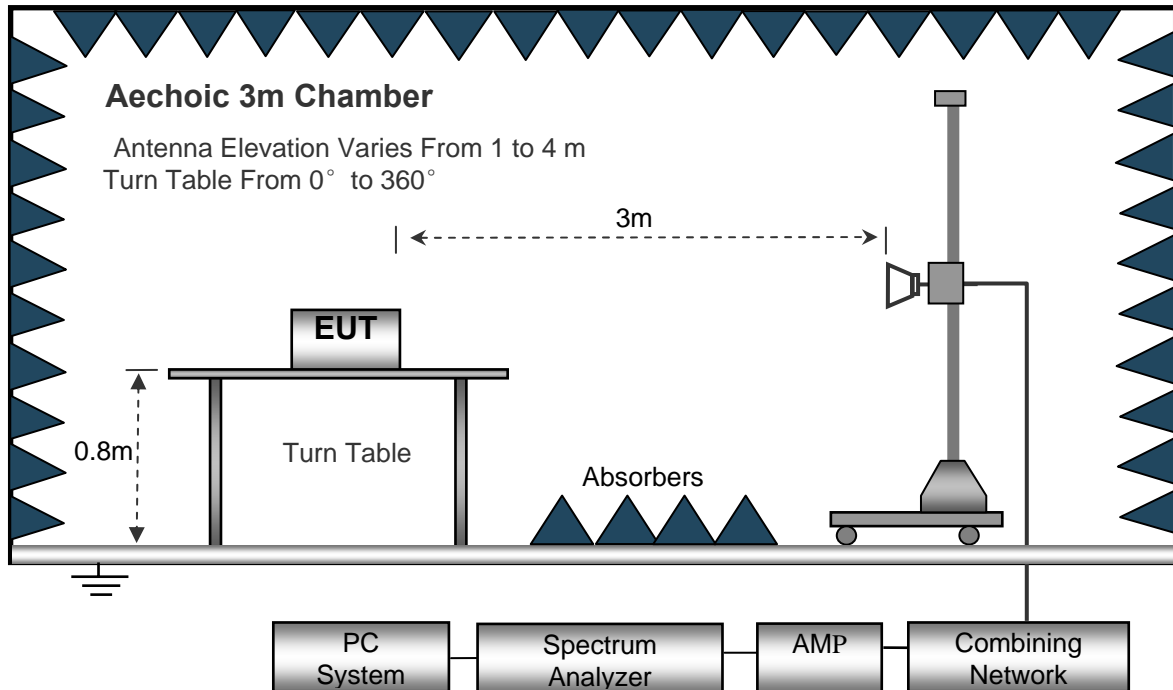
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.
 The test setup for emission measurement below 30MHz.



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 7MHz to 25000MHz.

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth10KHz
 Resolution Bandwidth10KHz
 Video Bandwidth10KHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth100KHz
 Video Bandwidth300KHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth1MHz
 Video Bandwidth3MHz
 DetectorAve.
 Resolution Bandwidth1MHz
 Video Bandwidth10Hz

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:

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

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 ~ 25GHz

Remark: Scan with GFSK, Pi/4-DQPSK, 8-DPSK,The worst case is GFSK mode.

Test Mode: transmitting

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Lower Channel 2402MHz									
307.20	10.52	PK	213	1.7	H	17.01	27.53	40.00	-12.47
307.20	11.33	PK	173	1.1	V	17.01	28.34	40.00	-11.66
4804.00	53.22	PK	137	1.9	H	-1.06	52.16	74.00	-21.84
4804.00	44.56	Ave	137	1.9	V	-1.06	43.50	54.00	-10.50
7206.00	42.33	PK	234	1.3	H	1.33	43.66	74.00	-30.34
7206.00	39.48	Ave	234	1.3	V	1.33	40.81	54.00	-13.19
2339.40	46.53	PK	282	1.0	H	-13.19	33.34	74.00	-40.66
2339.40	38.26	Ave	282	1.0	V	-13.19	25.07	54.00	-28.93
2376.98	42.88	PK	353	1.9	H	-13.14	29.74	74.00	-44.26
2376.98	36.26	Ave	353	1.9	V	-13.14	23.12	54.00	-30.88
2489.32	42.58	PK	102	1.0	H	-13.08	29.50	74.00	-44.50
2489.32	38.32	Ave	102	1.0	V	-13.08	25.24	54.00	-28.76

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Center Channel 2441MHz									
307.20	11.24	PK	278	1.1	H	17.01	28.25	40.00	-11.75
307.20	10.98	PK	37	1.7	V	17.01	27.99	40.00	-12.01
4882.00	49.86	PK	8	1.8	H	-0.62	49.24	74.00	-24.76
4882.00	41.47	Ave	8	1.8	V	-0.62	40.85	54.00	-13.15
7323.00	45.98	PK	337	1.4	H	2.21	48.19	74.00	-25.81
7323.00	39.23	Ave	337	1.4	V	2.21	41.44	54.00	-12.56
2344.69	45.61	PK	160	1.9	H	-13.19	32.42	74.00	-41.58
2344.69	37.36	Ave	160	1.9	V	-13.19	24.17	54.00	-29.83
2387.24	42.36	PK	210	1.7	H	-13.14	29.22	74.00	-44.78
2387.24	37.02	Ave	210	1.7	V	-13.14	23.88	54.00	-30.12
2491.78	42.61	PK	256	1.9	H	-13.08	29.53	74.00	-44.47
2491.78	38.45	Ave	256	1.9	V	-13.08	25.37	54.00	-28.63

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Upper Channel 2480MHz									
307.20	11.23	PK	130	2.0	H	17.01	28.24	40.00	-11.76
307.20	12.49	PK	354	1.3	V	17.01	29.50	40.00	-10.50
4960.00	51.31	PK	18	1.9	H	-0.24	51.07	74.00	-22.93
4960.00	43.74	Ave	18	1.9	V	-0.24	43.50	54.00	-10.50
7440.00	48.31	PK	236	1.9	H	2.84	51.15	74.00	-22.85
7440.00	39.50	Ave	236	1.9	V	2.84	42.34	54.00	-11.66
2321.18	46.89	PK	292	2.0	H	-13.19	33.70	74.00	-40.30
2321.18	38.27	Ave	292	2.0	V	-13.19	25.08	54.00	-28.92
2350.63	43.74	PK	350	1.9	H	-13.14	30.60	74.00	-43.40
2350.63	38.02	Ave	350	1.9	V	-13.14	24.88	54.00	-29.12
2494.45	42.81	PK	283	1.4	H	-13.08	29.73	74.00	-44.27
2494.45	38.72	Ave	283	1.4	V	-13.08	25.64	54.00	-28.36

Test Frequency :Above 18GHz

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

8 Band edge Emissions

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

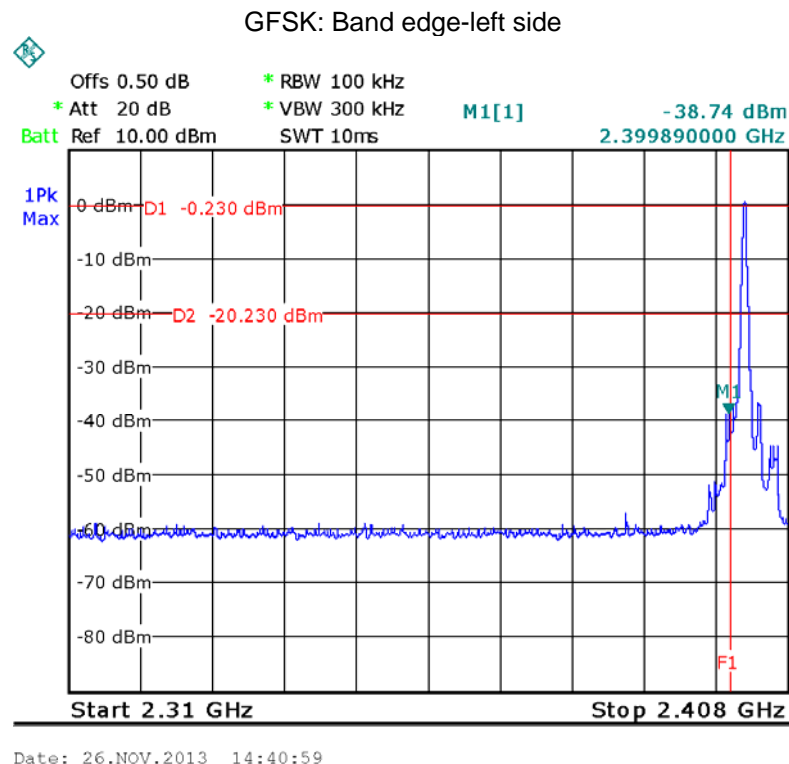
Test Status: Transmitting mode

8.1 Test Procedure

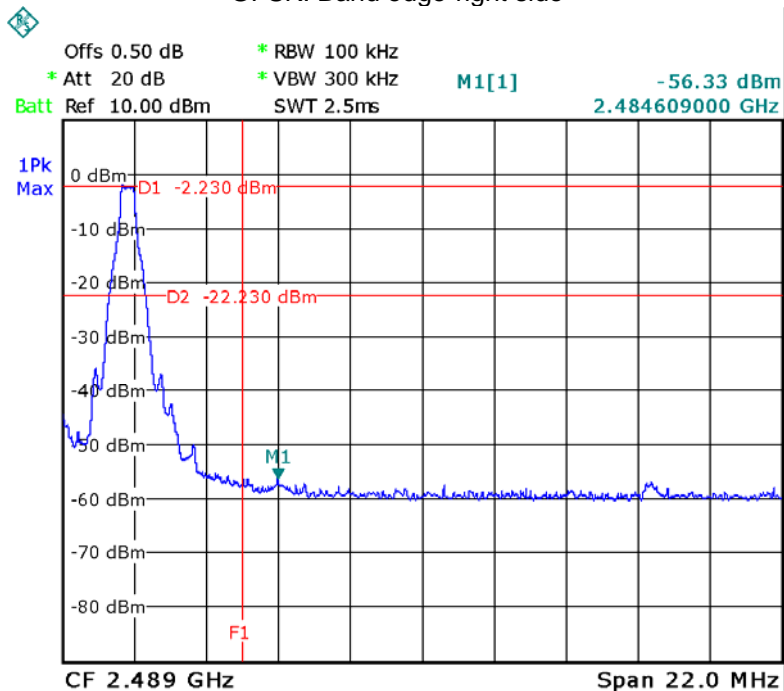
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4.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

8.2 Test Result

Test result plots shown as follows:

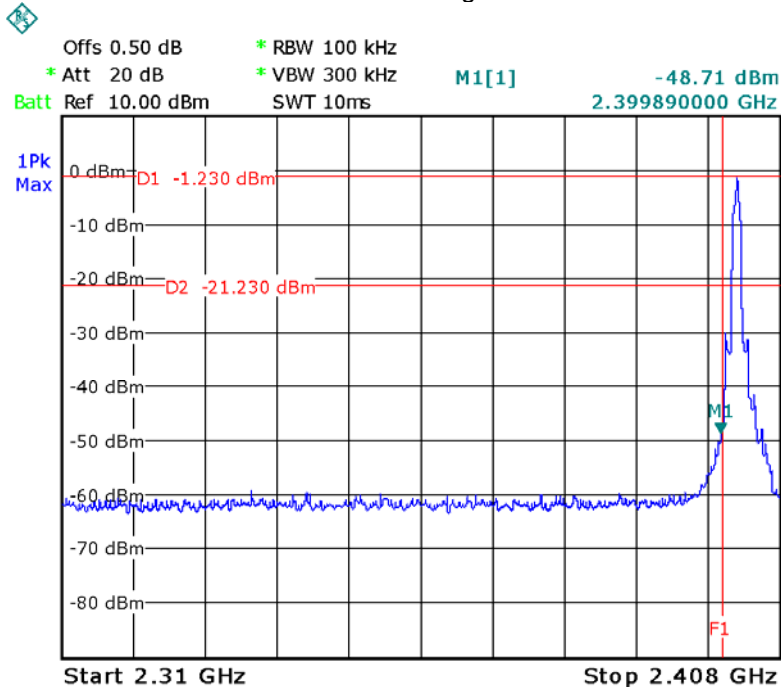


GFSK: Band edge-right side

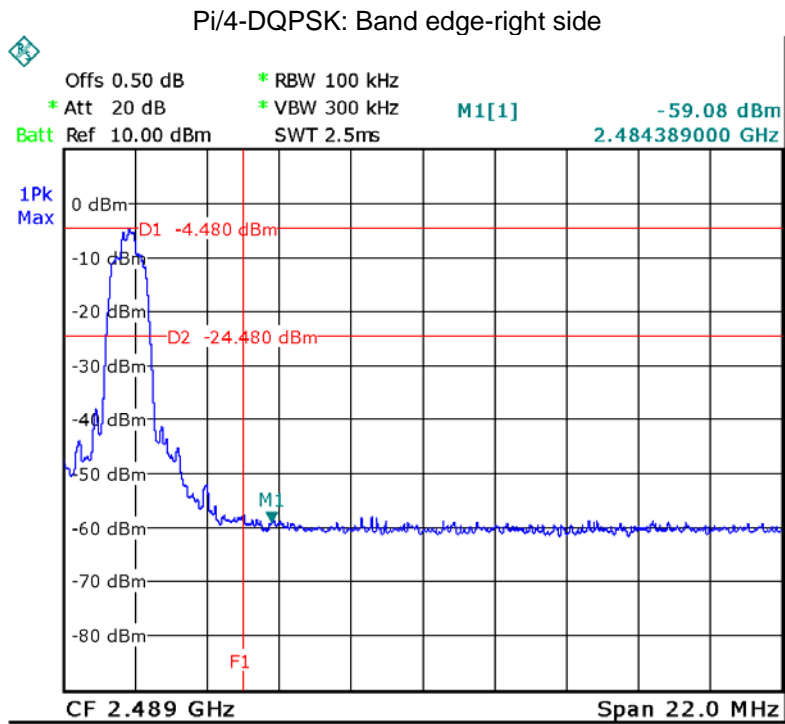


Date: 26.NOV.2013 14:24:26

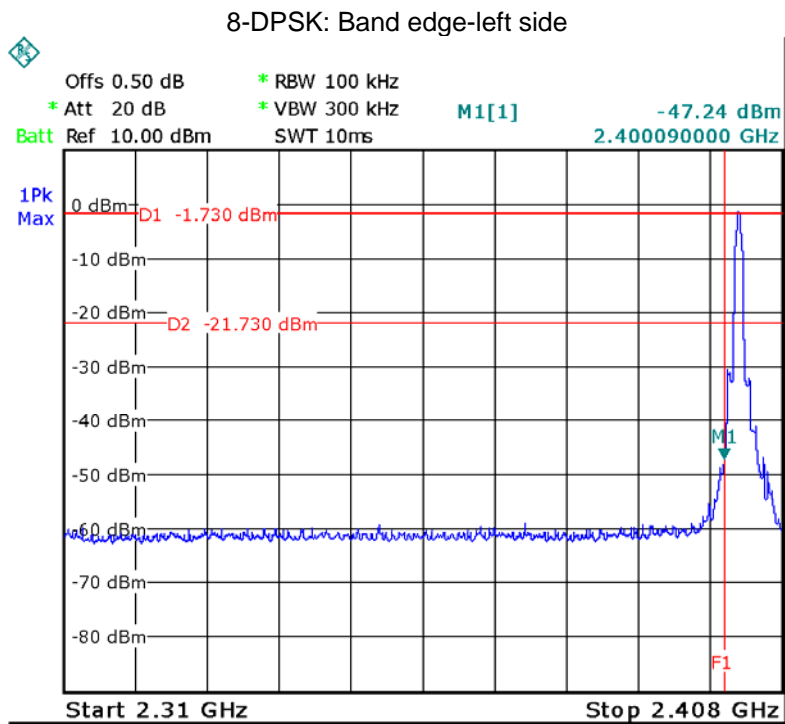
Pi/4-DQPSK: Band edge-left side



Date: 26.NOV.2013 14:32:53

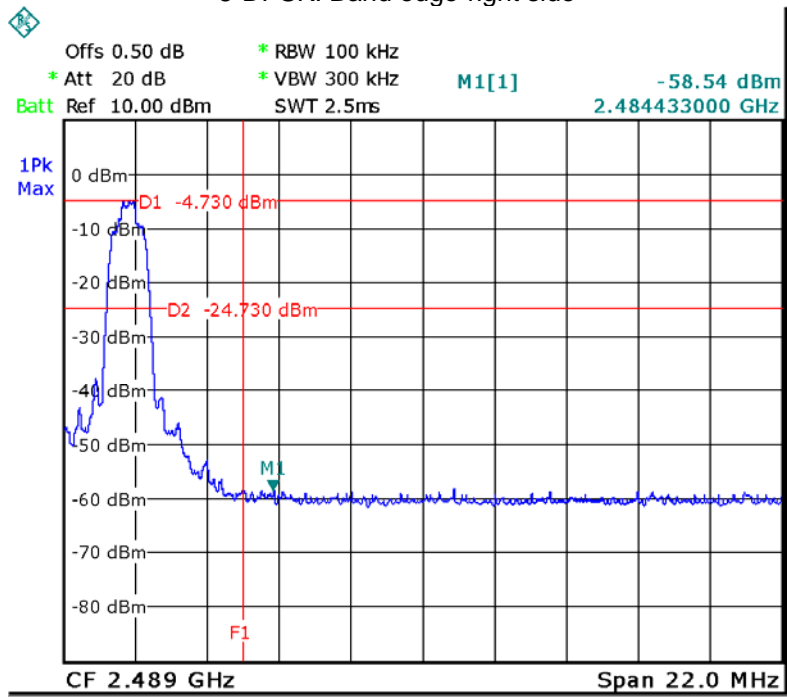


Date: 26.NOV.2013 14:27:50



Date: 26.NOV.2013 14:31:57

8-DPSK: Band edge-right side



Date: 26.NOV.2013 14:29:53

9 Spurious RF Conducted Emissions

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.

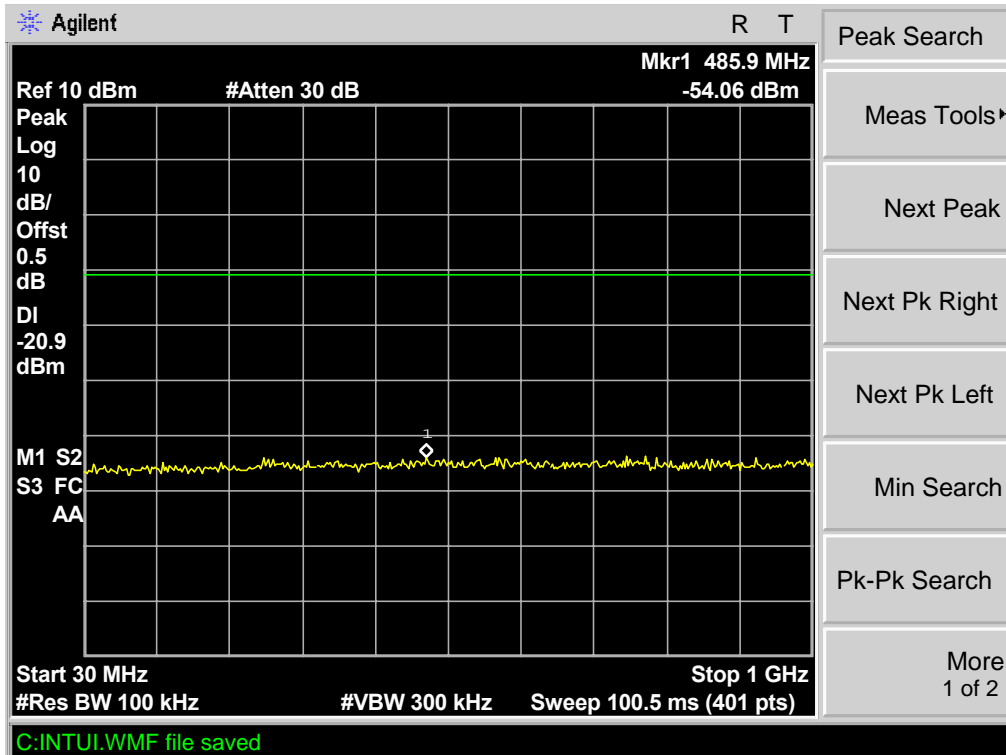
Test Method: DA 00-705

Test Status: Transmitting mode

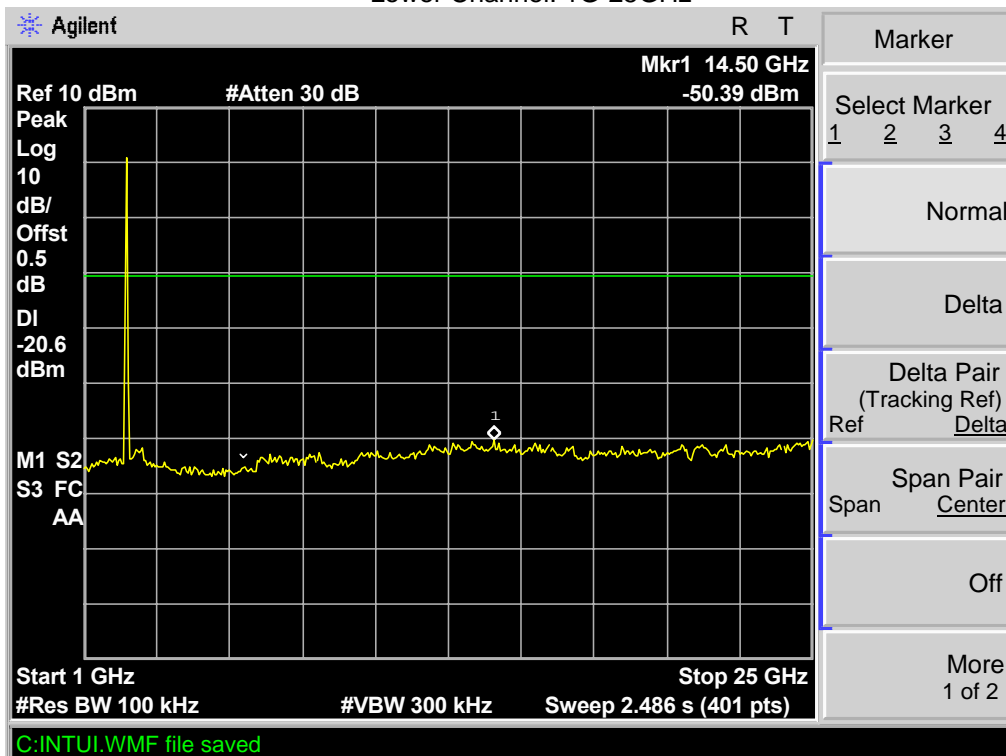
9.1 Test Procedure

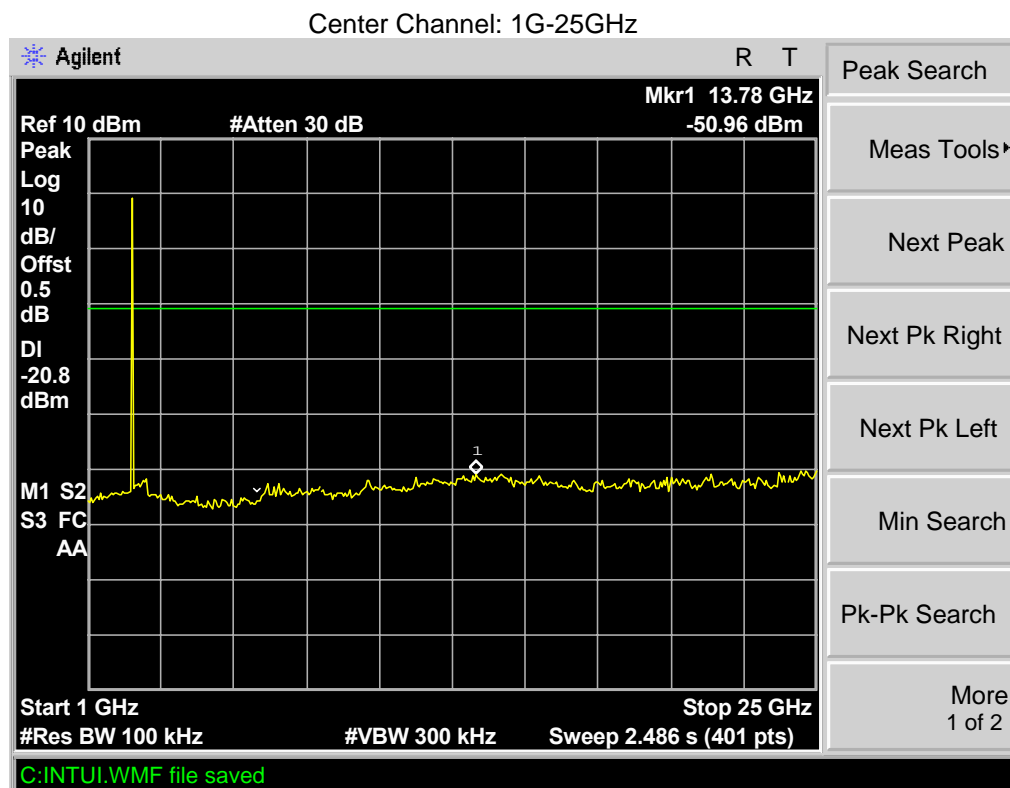
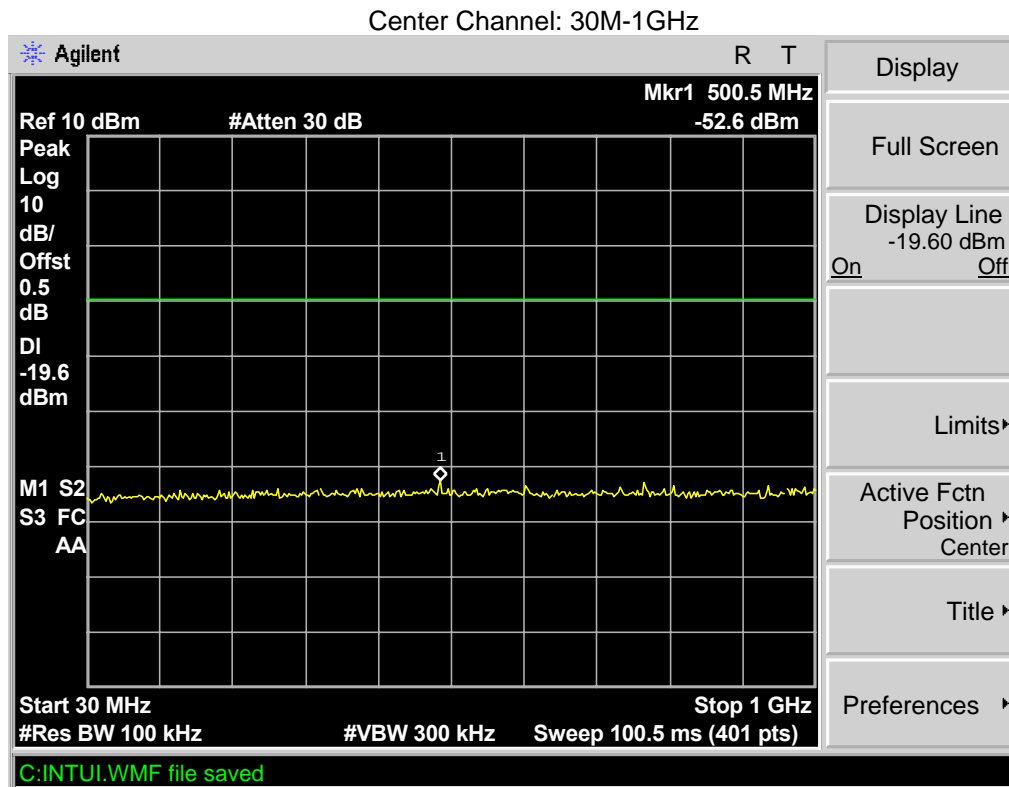
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4. mark the worst point and record.
5. Scan with GFSK, Pi/4-DQPSK, 8DPSK,The worst case is GFSK mode.

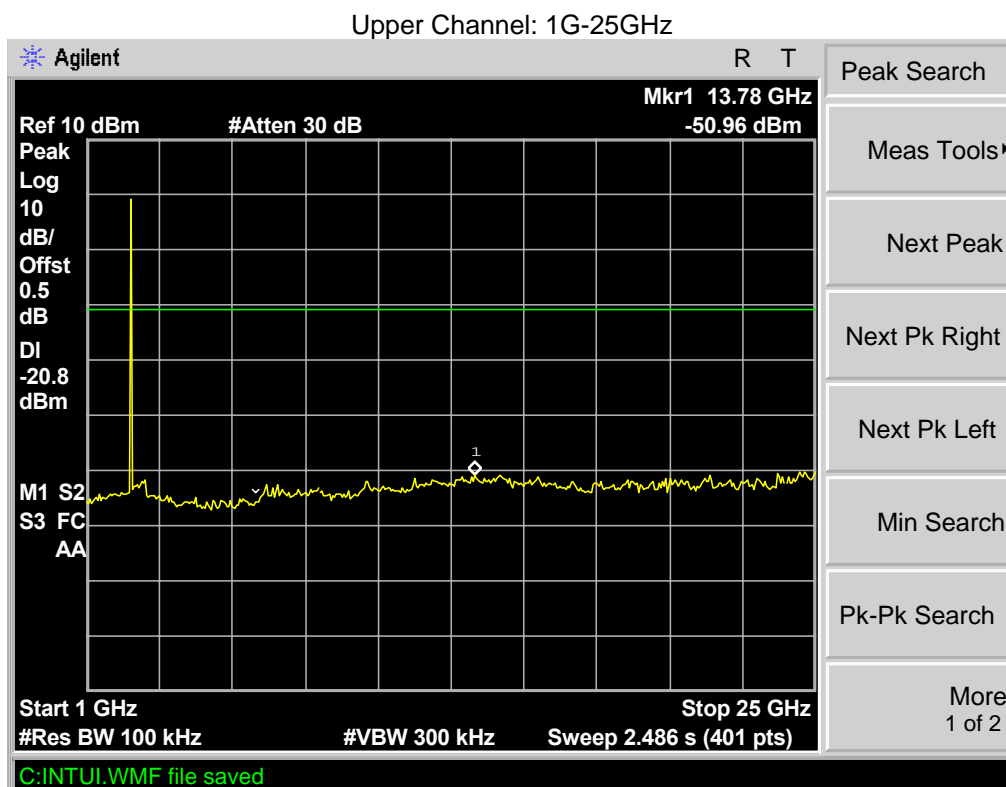
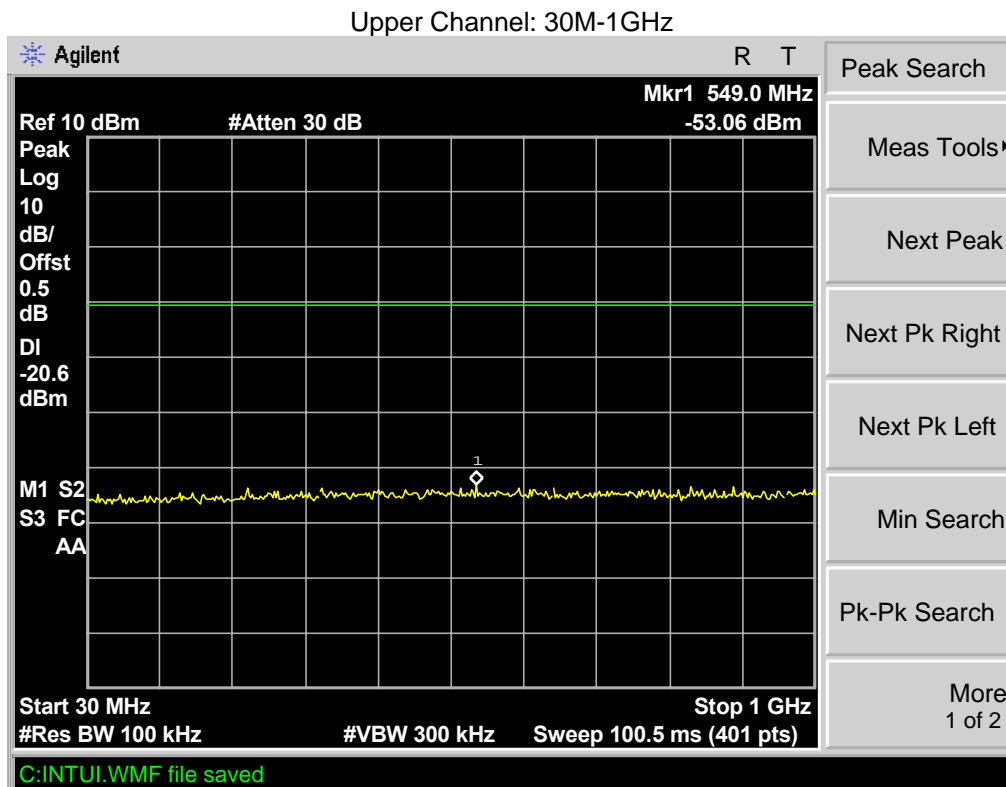
Lower Channel: 30M-1GHz



Lower Channel: 1G-25GHz







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

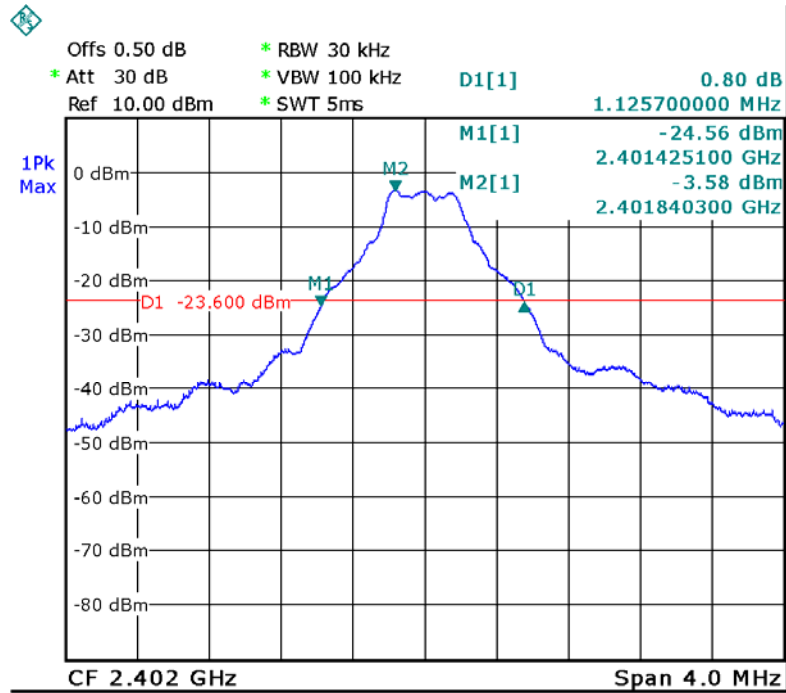
10.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Lower	1.126
	Middle	1.126
	Upper	1.118
Pi/4-DQPSK	Lower	1.349
	Middle	1.349
	Upper	1.333
8-DPSK	Lower	1.341
	Middle	1.341
	Upper	1.341

Test result plot as follows:

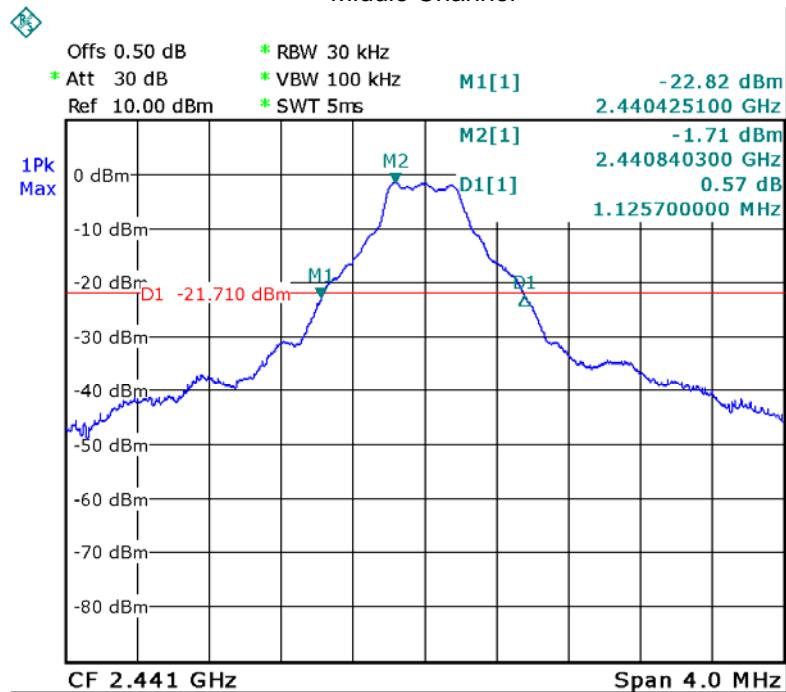
Modulation: GFSK

Lower Channel



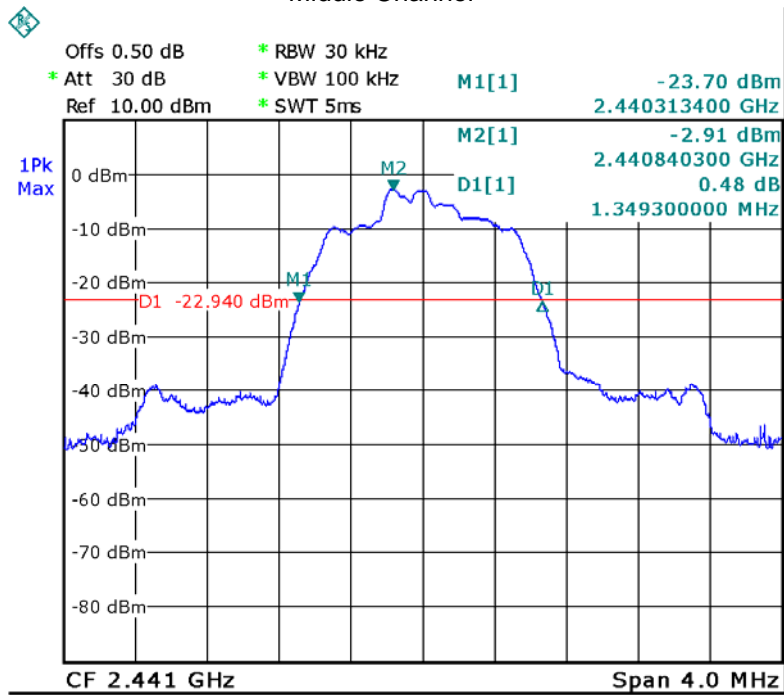
Date: 26.NOV.2013 15:50:55

Middle Channel



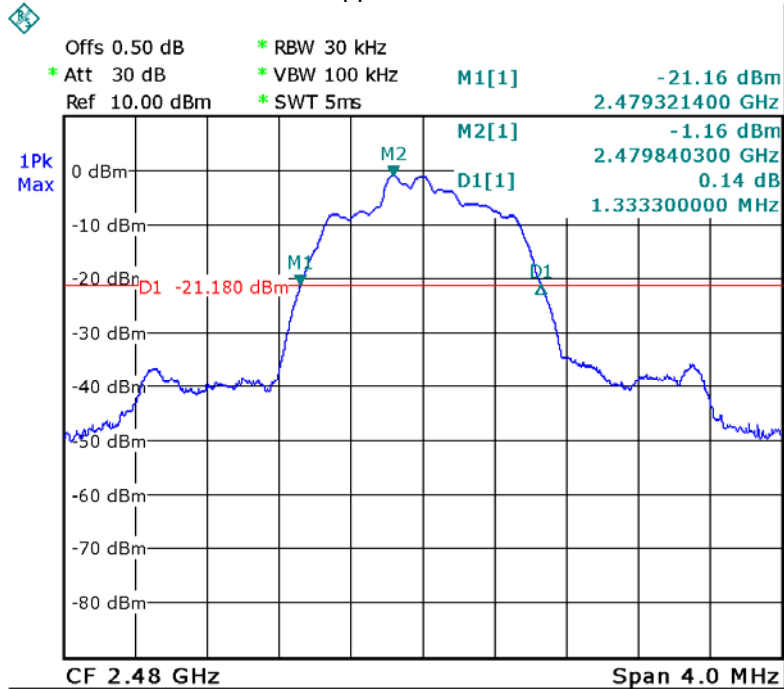
Date: 26.NOV.2013 15:51:33

Middle Channel



Date: 26.NOV.2013 15:53:26

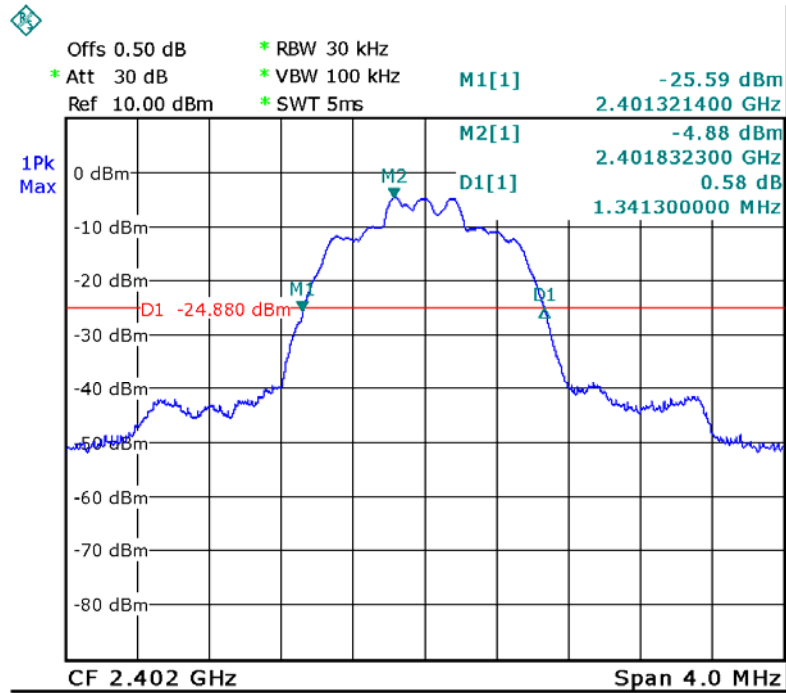
Upper Channel



Date: 26.NOV.2013 15:52:48

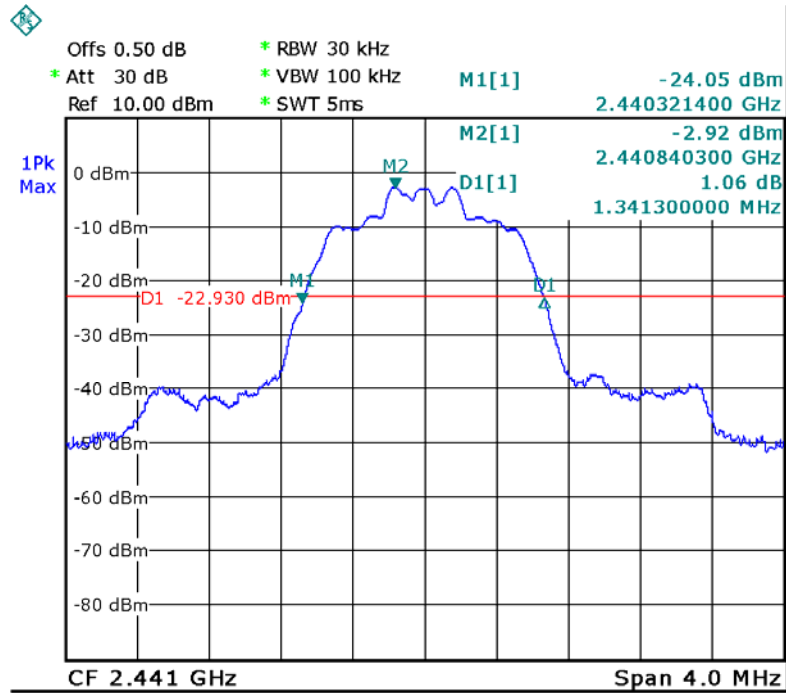
Modulation: 8-DPSK

Lower Channel

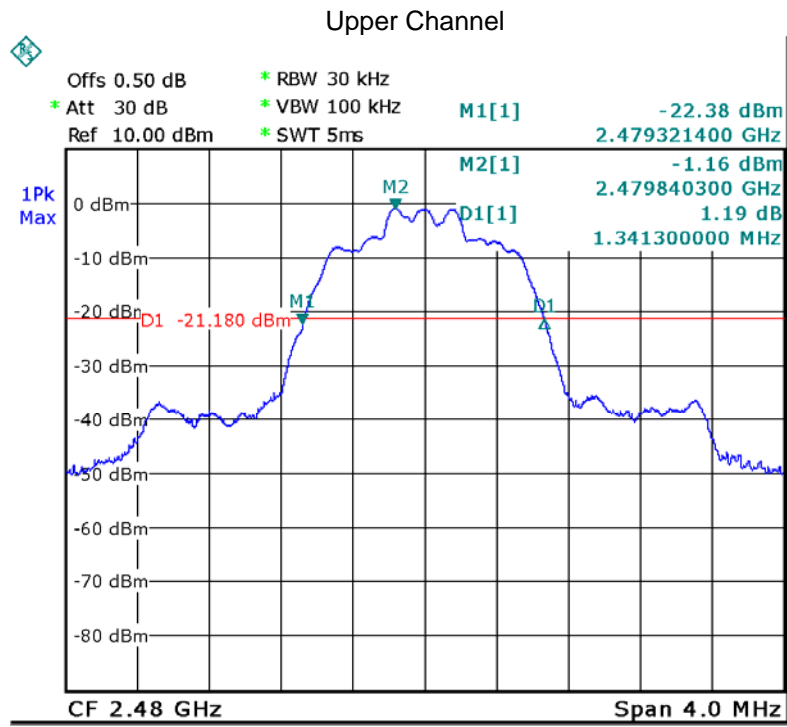


Date: 26.NOV.2013 15:54:29

Middle Channel



Date: 26.NOV.2013 15:55:01



Date: 26.NOV.2013 15:55:33

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 2400-2483.5 MHz band: 0.125 watts. Refer to the result "Number of Hopping Frequency" of this document. The 1watts (30 dBm) limit applies.
Test mode:	Transmitting

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.

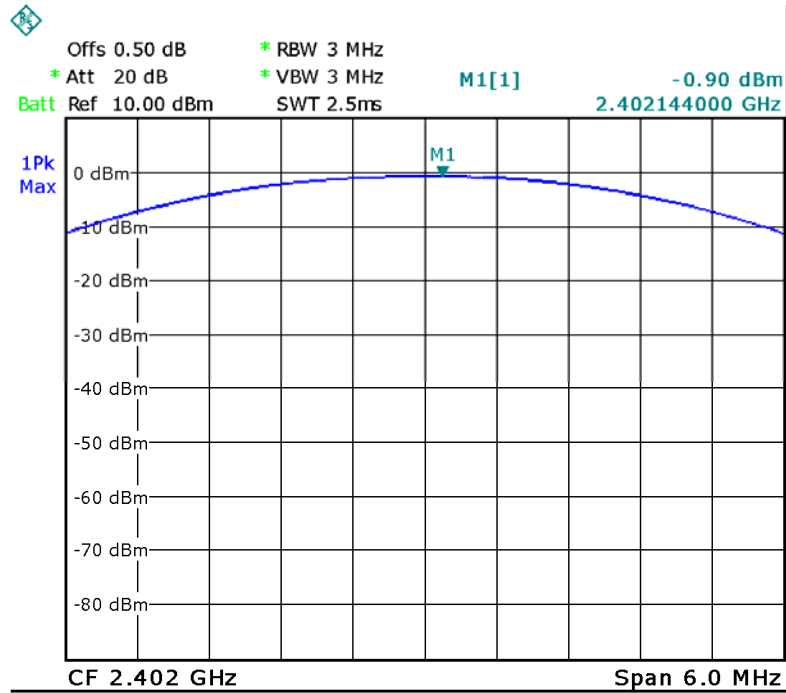
11.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Lower	-0.90	30
	Middle	-0.33	30
	Upper	-2.01	30
Pi/4-DQPSK	Lower	-1.50	30
	Middle	-1.42	30
	Upper	-1.98	30
8-DPSK	Lower	-0.96	30
	Middle	-0.29	30
	Upper	-2.02	30

Test result plot as follows:

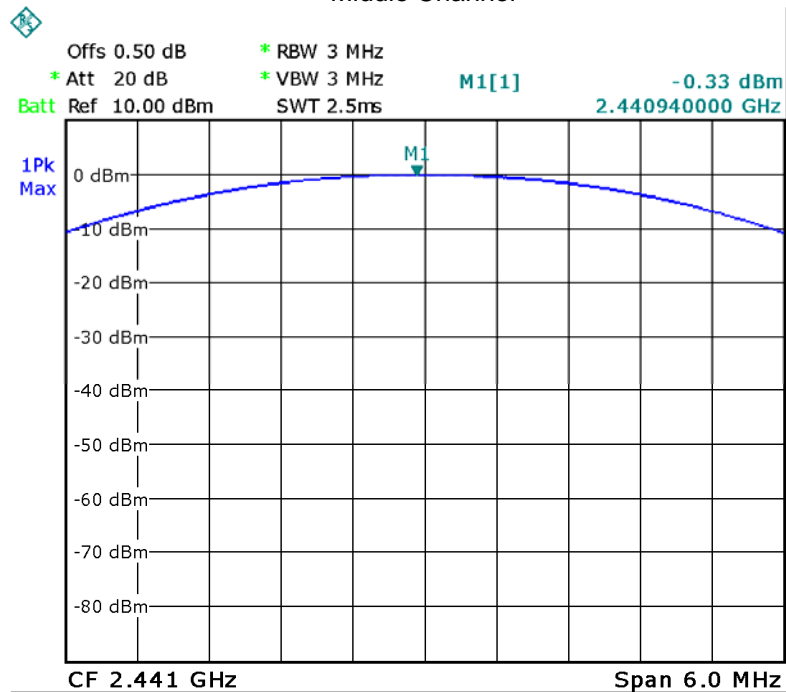
Modulation: GFSK

Lower Channel



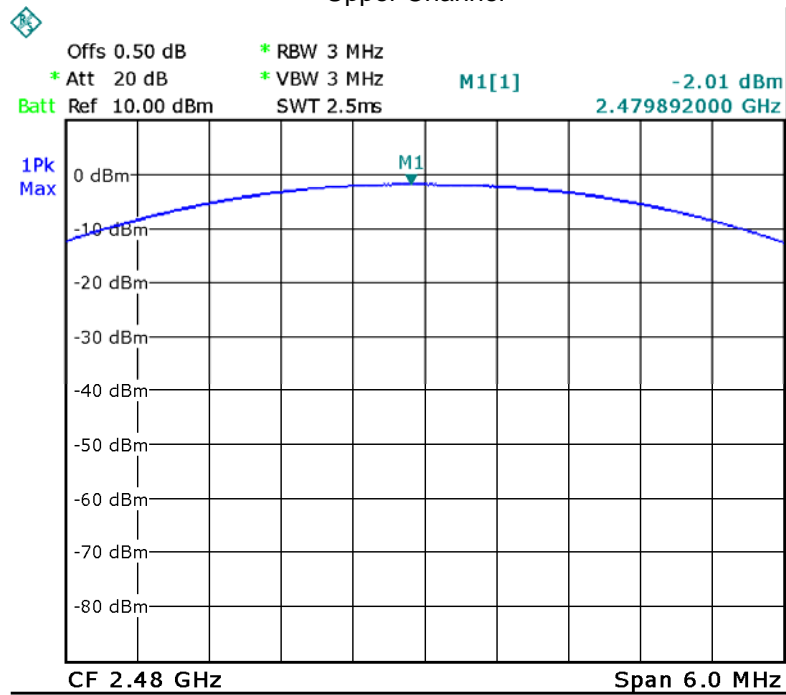
Date: 26.NOV.2013 09:44:29

Middle Channel



Date: 26.NOV.2013 09:46:33

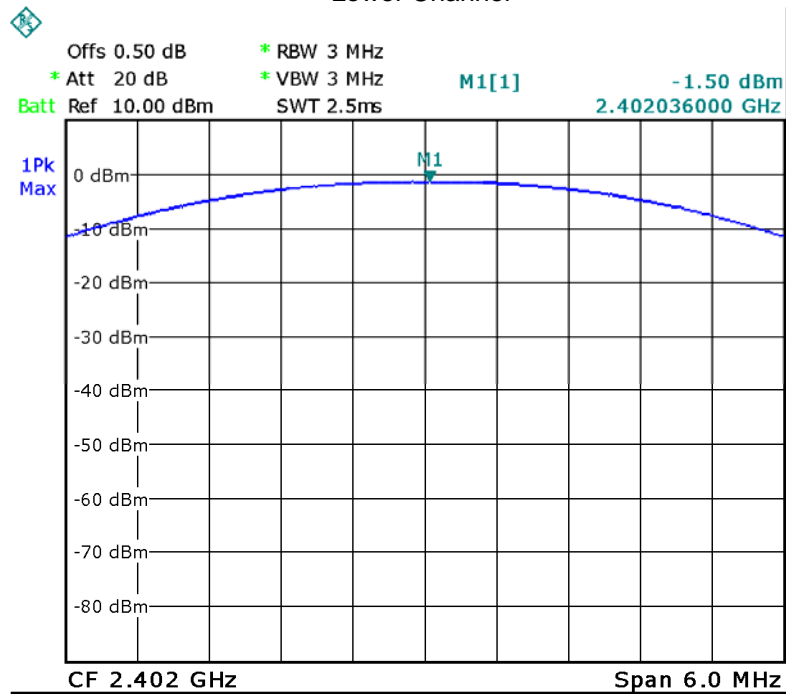
Upper Channel



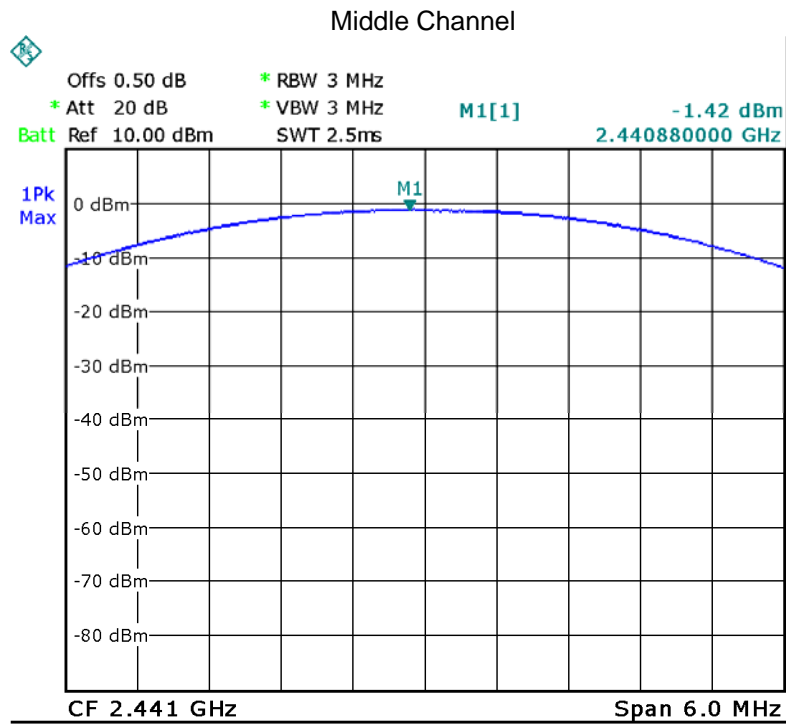
Date: 26.NOV.2013 09:48:15

Modulation: Pi/4-DQPSK

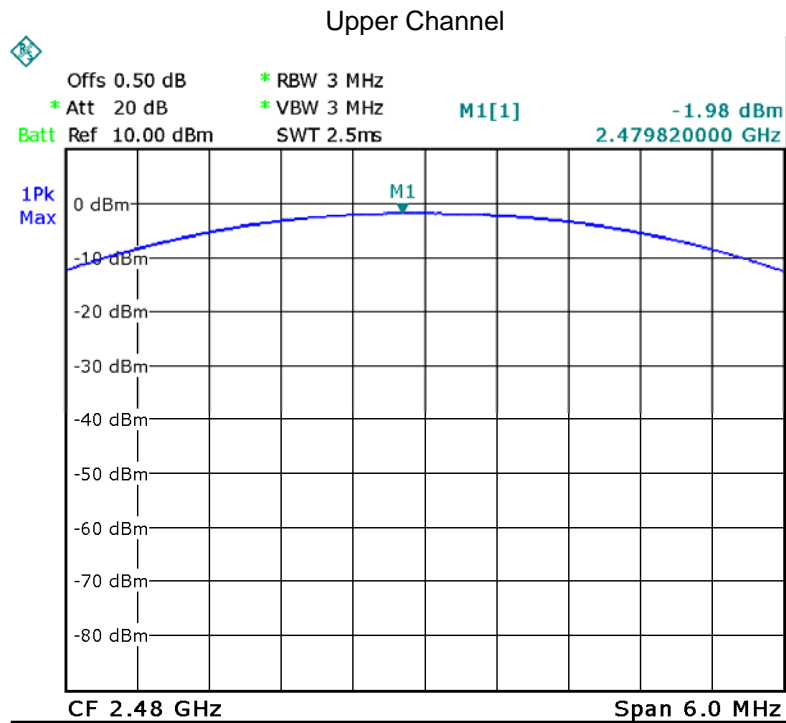
Lower Channel



Date: 26.NOV.2013 09:57:02



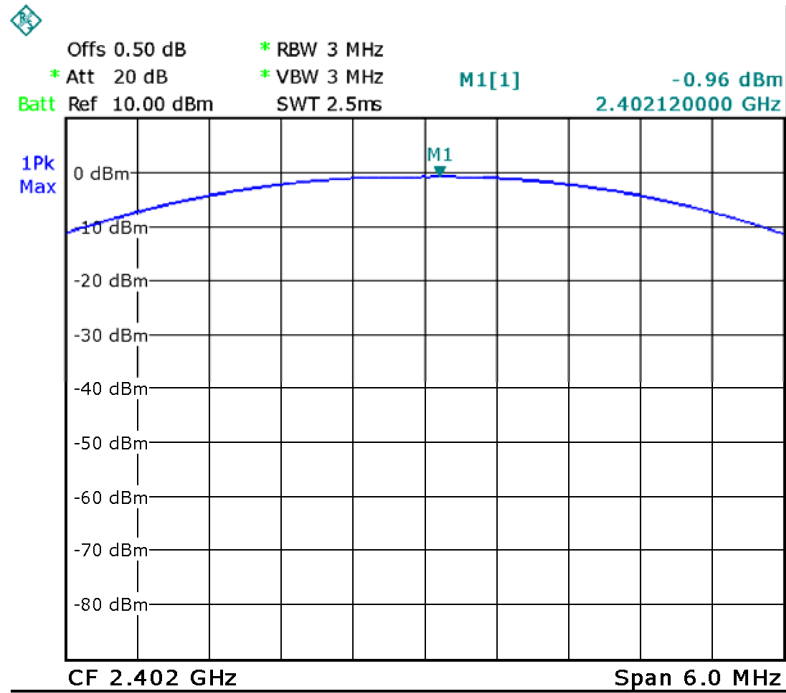
Date: 26.NOV.2013 09:57:25



Date: 26.NOV.2013 09:58:01

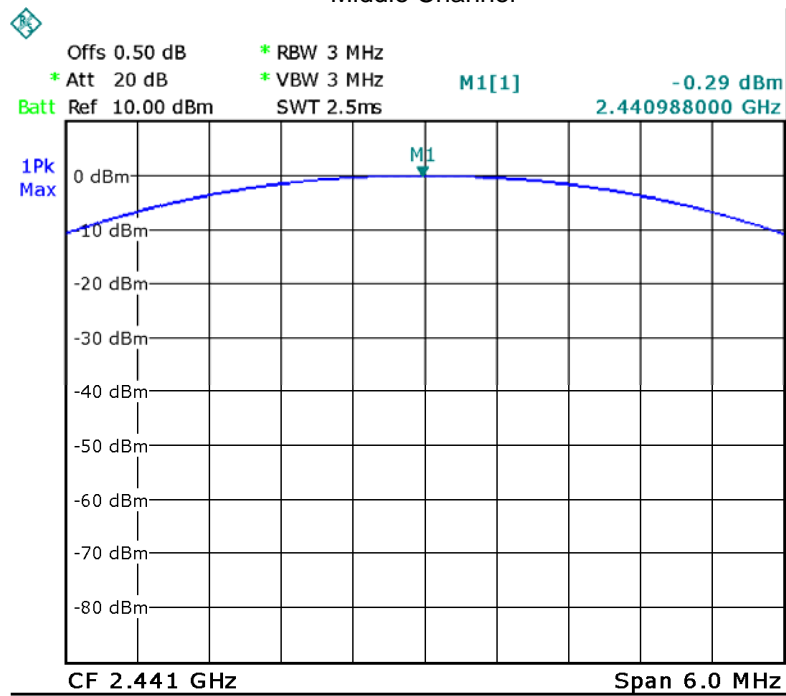
Modulation: 8-DPSK

Lower Channel

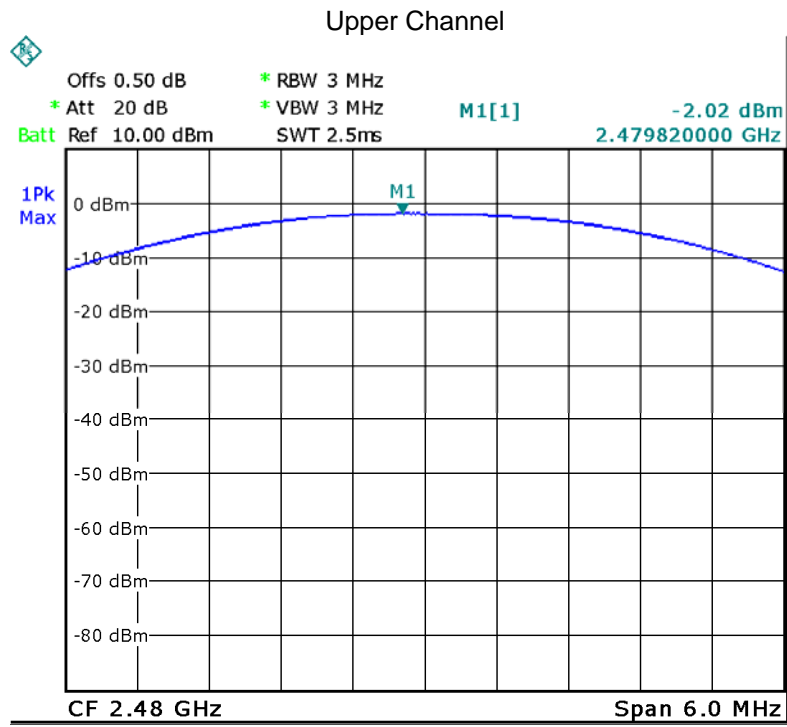


Date: 26.NOV.2013 10:11:16

Middle Channel



Date: 26.NOV.2013 10:10:38



Date: 26.NOV.2013 10:07:47

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 two-thirds of 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 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 = 100KHz. VBW = 100KHz , Span = 6MHz. 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.

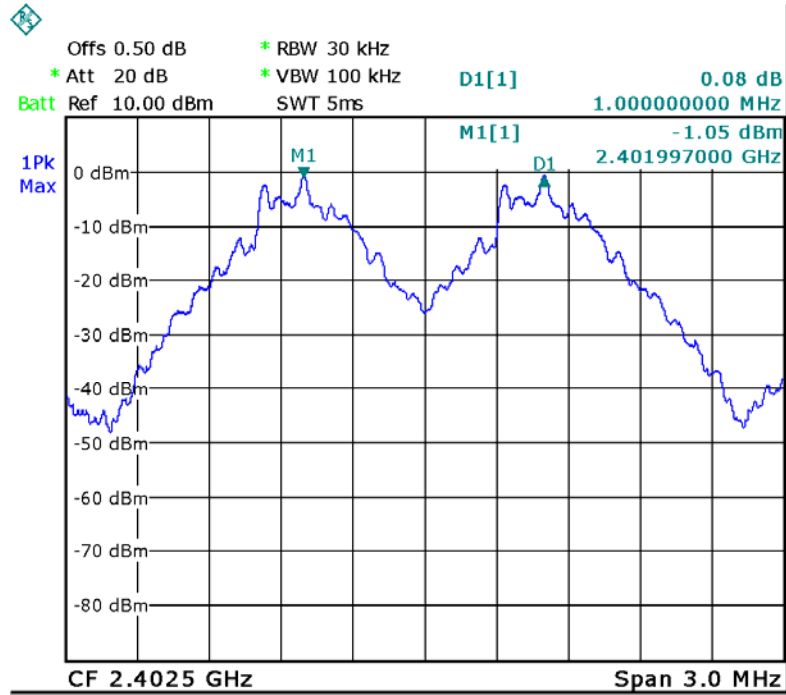
12.2 Test Result:

Modulation	Test Channel	Separation (MHz)	Limit(MHz)
GFSK	Lower	1.000	0.751
	Middle	1.000	0.751
	Upper	1.000	0.745
Pi/4-DQPSK	Lower	1.000	0.899
	Middle	1.000	0.899
	Upper	1.000	0.889
8-DPSK	Lower	1.000	0.894
	Middle	1.000	0.894
	Upper	1.000	0.894

Test result plot as follows:

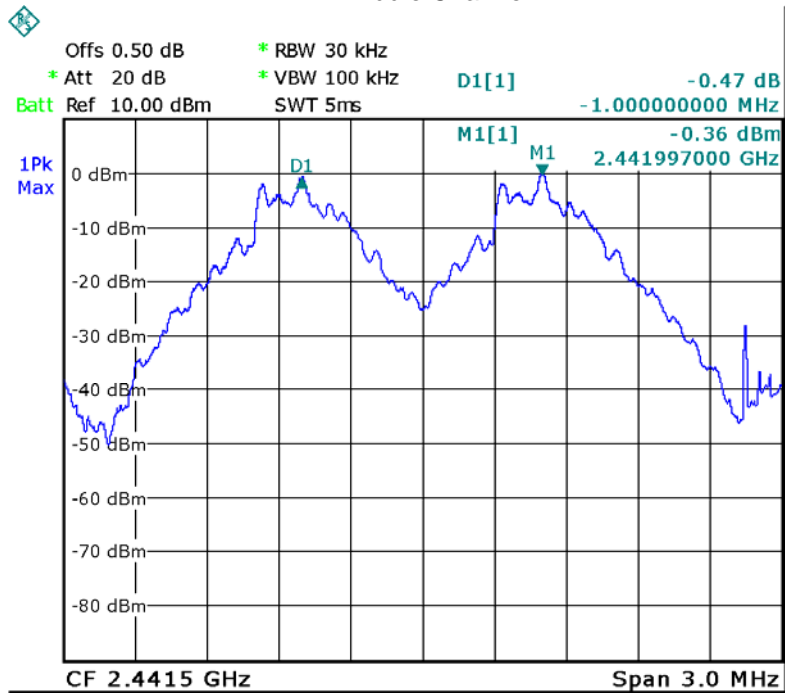
Modulation: GFSK

Lower Channel

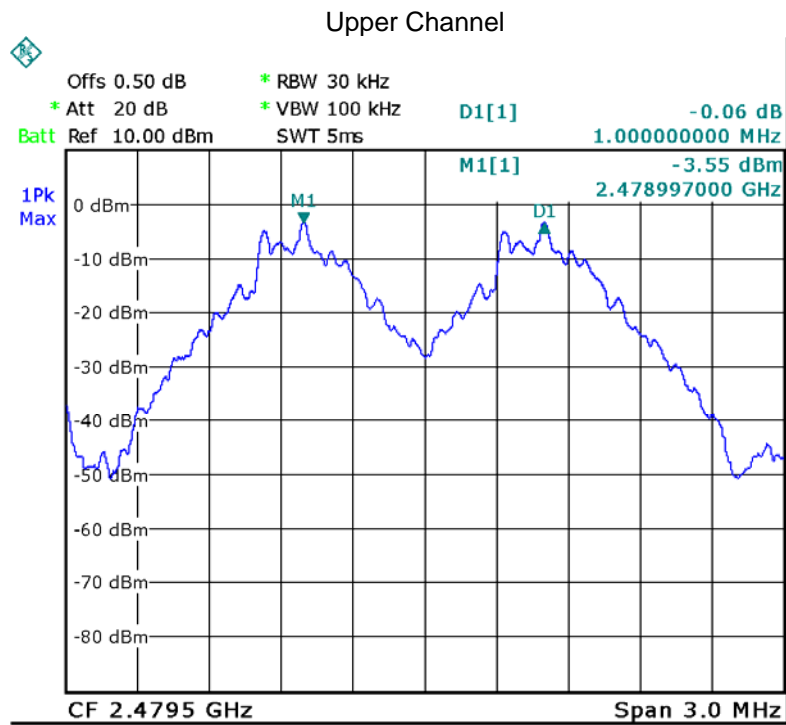


Date: 26.NOV.2013 10:36:56

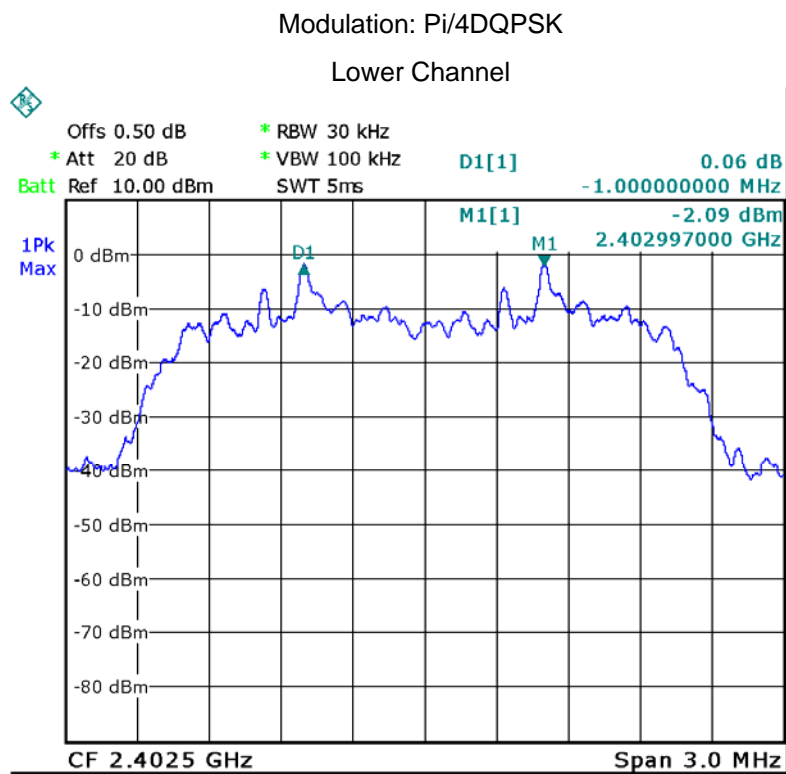
Middle Channel



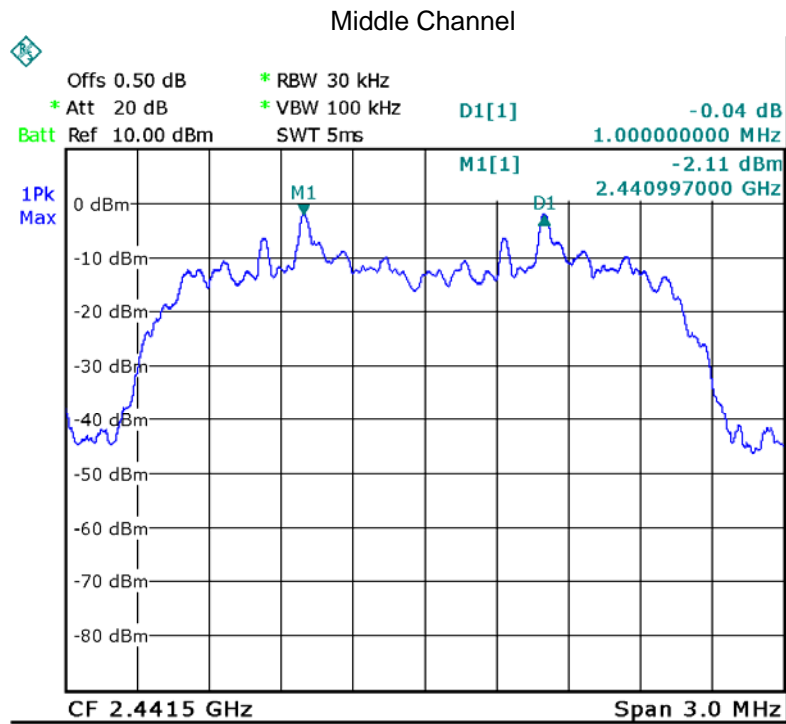
Date: 26.NOV.2013 10:41:09



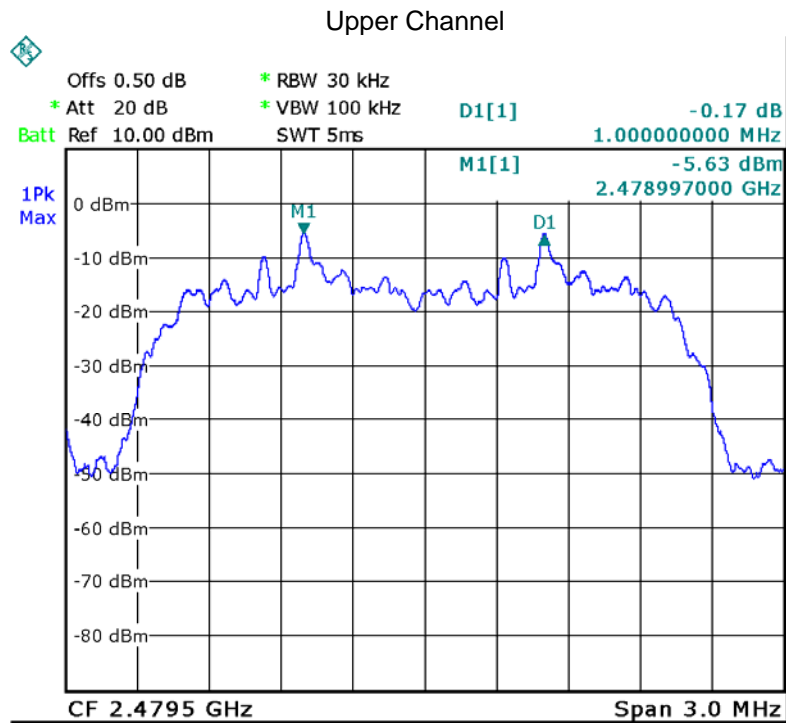
Date: 26.NOV.2013 11:00:02



Date: 26.NOV.2013 11:02:48



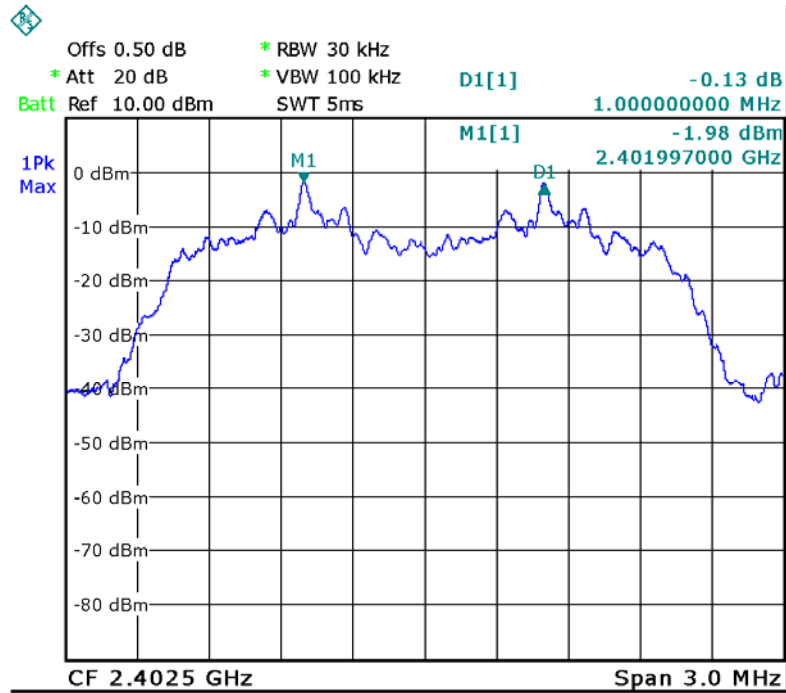
Date: 26.NOV.2013 11:03:39



Date: 26.NOV.2013 11:04:25

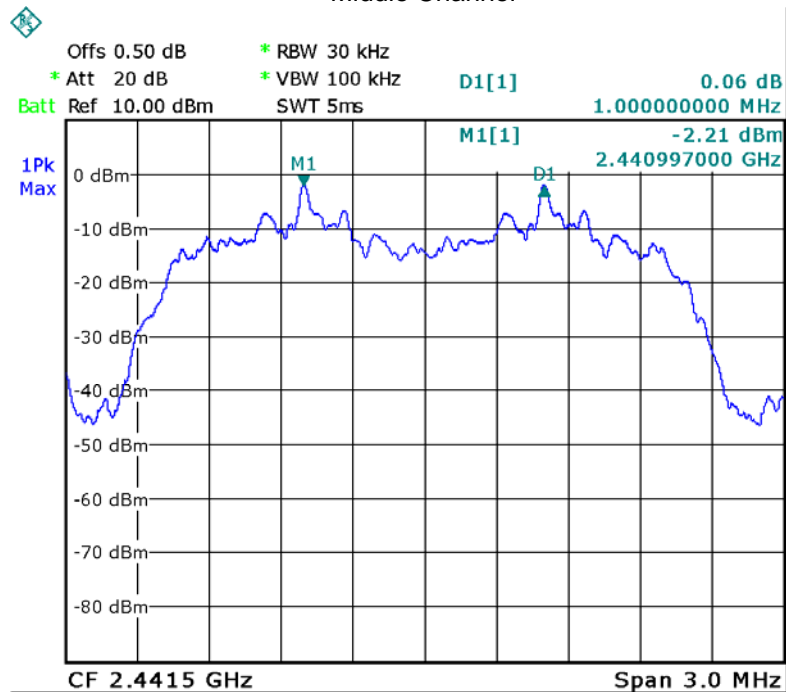
Modulation: 8DPSK

Lower Channel

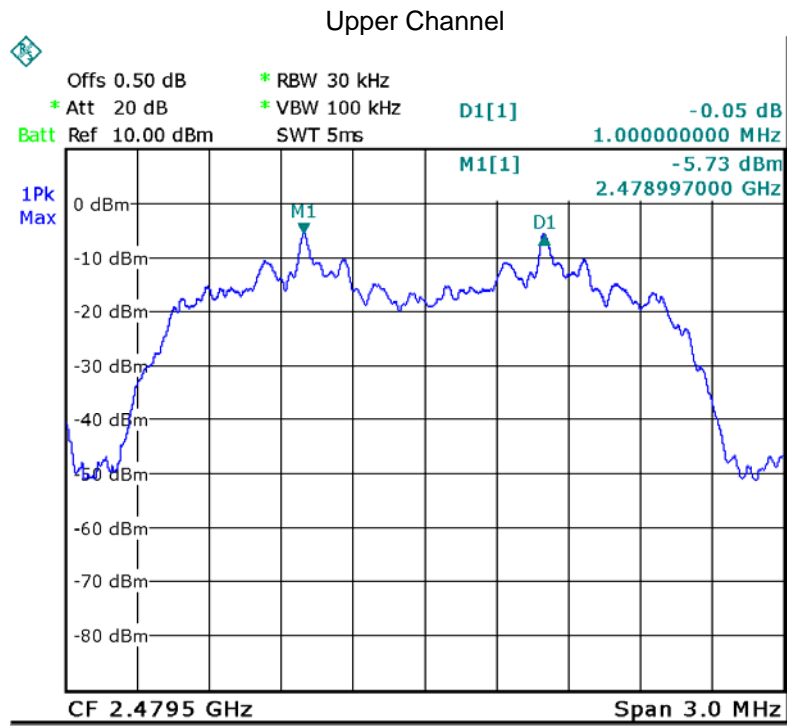


Date: 26.NOV.2013 11:06:41

Middle Channel



Date: 26.NOV.2013 11:07:38



Date: 26.NOV.2013 11:08:35

13 Number of Hopping Frequency

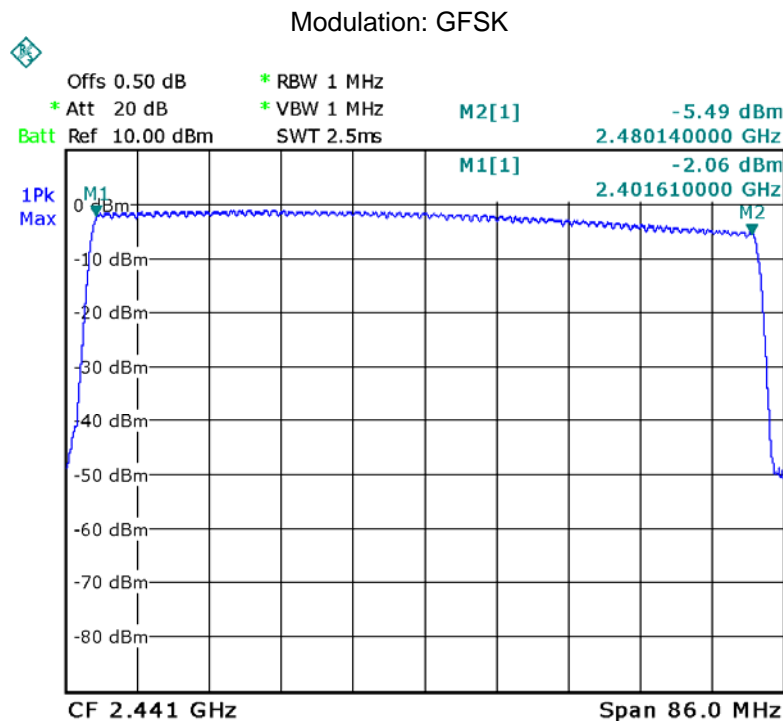
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping mode.

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;

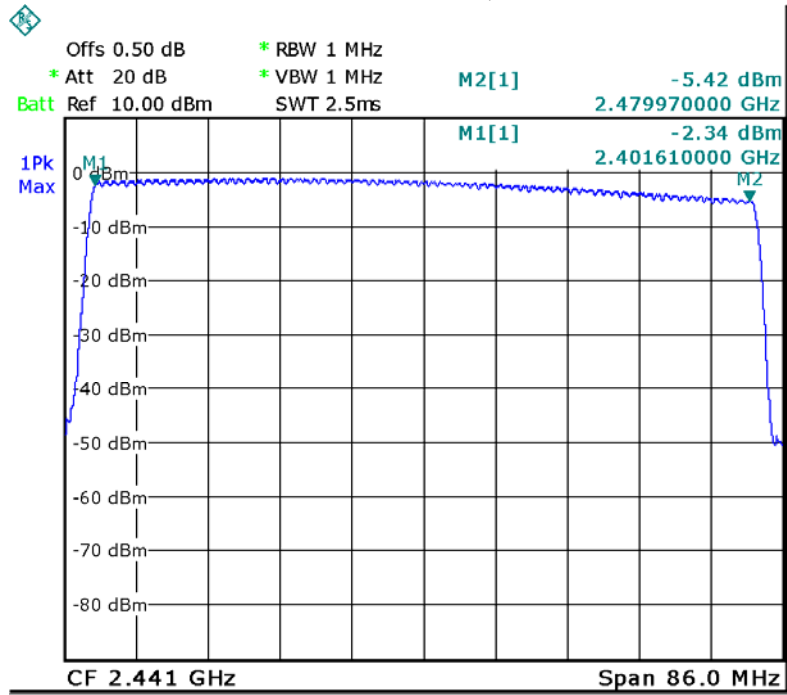
13.2 Test Result:

Total Channels are 79 Channels.



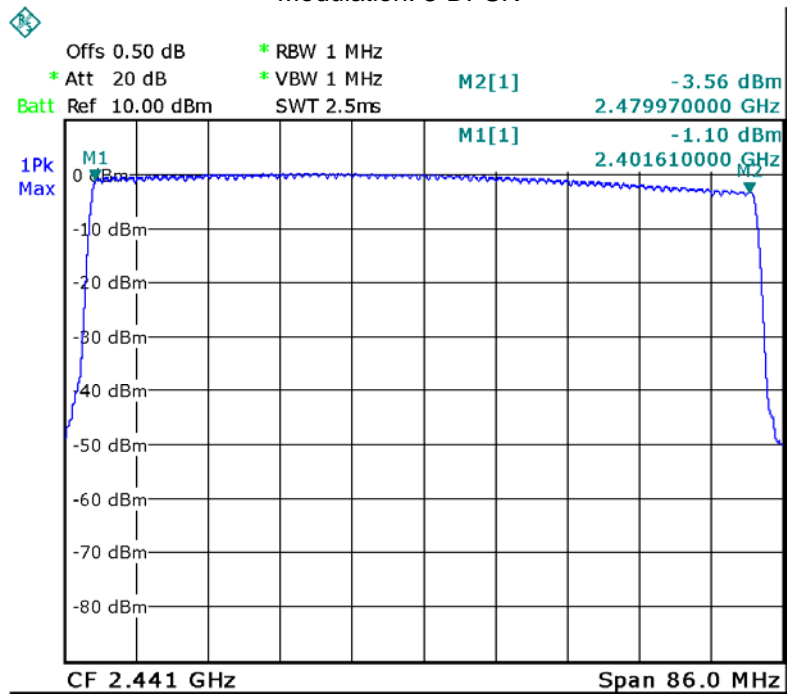
Date: 26.NOV.2013 10:17:04

Modulation: Pi/4-DQPSK



Date: 26.NOV.2013 10:15:51

Modulation: 8-DPSK



Date: 26.NOV.2013 10:14:15

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).

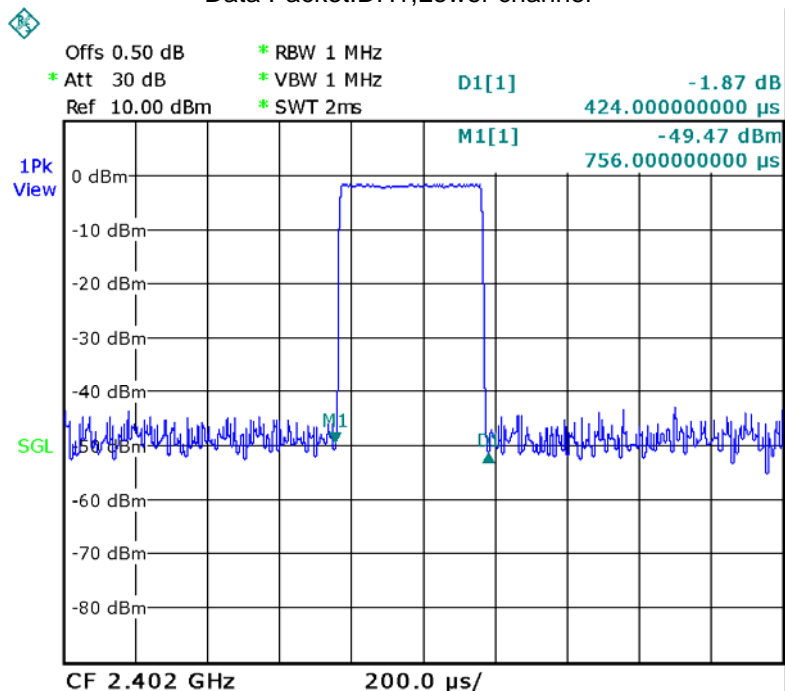
DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

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.

Dwell Time					
Ambient temperature: 22 °C			Relative humidity: 55%		
Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH1	lower	0.424	0.136	0.4
		middle	0.432	0.138	0.4
		upper	0.428	0.137	0.4
	DH3	lower	1.694	0.271	0.4
		middle	1.712	0.274	0.4
		upper	1.706	0.273	0.4
	DH5	lower	2.934	0.313	0.4
		middle	2.966	0.316	0.4
		upper	2.966	0.316	0.4
Pi/4DQPSK	DH1	lower	0.440	0.141	0.4
		middle	0.456	0.146	0.4
		upper	0.456	0.146	0.4
	DH3	lower	1.718	0.275	0.4
		middle	1.724	0.276	0.4
		upper	1.712	0.274	0.4
	DH5	lower	2.950	0.315	0.4
		middle	2.958	0.316	0.4
		upper	2.974	0.317	0.4
8DPSK	DH1	lower	0.440	0.141	0.4
		middle	0.456	0.146	0.4
		upper	0.440	0.141	0.4
	DH3	lower	1.694	0.271	0.4
		middle	1.706	0.273	0.4
		upper	1.718	0.275	0.4
	DH5	lower	2.950	0.315	0.4
		middle	2.958	0.316	0.4
		upper	2.966	0.316	0.4

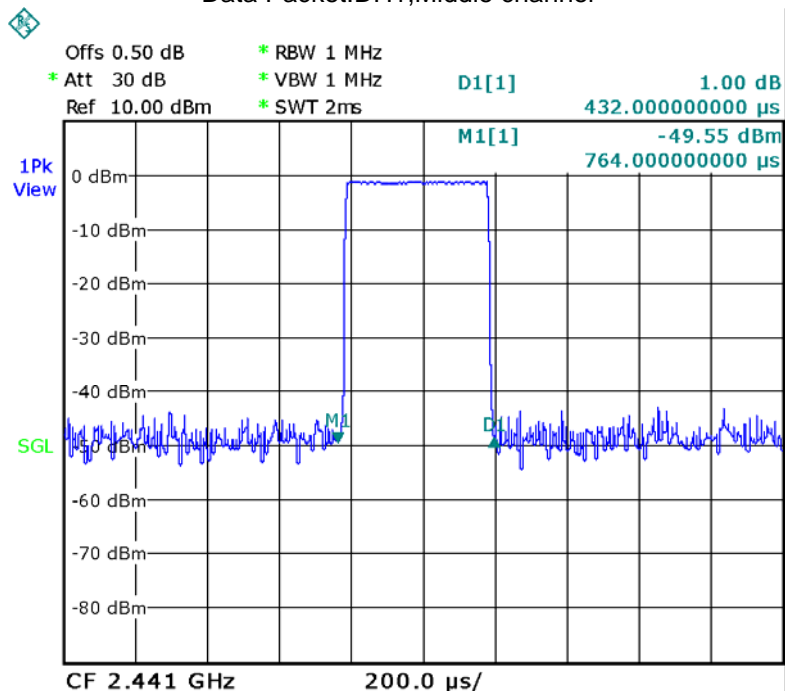
Modulation: GFSK

Data Packet:DH1,Lower channel



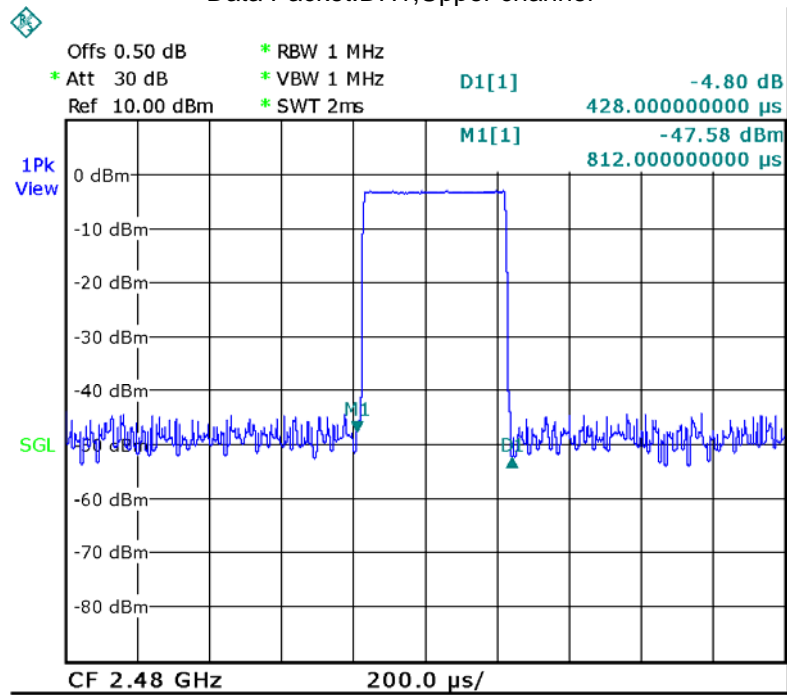
Date: 26.NOV.2013 17:13:32

Data Packet:DH1,Middle channel



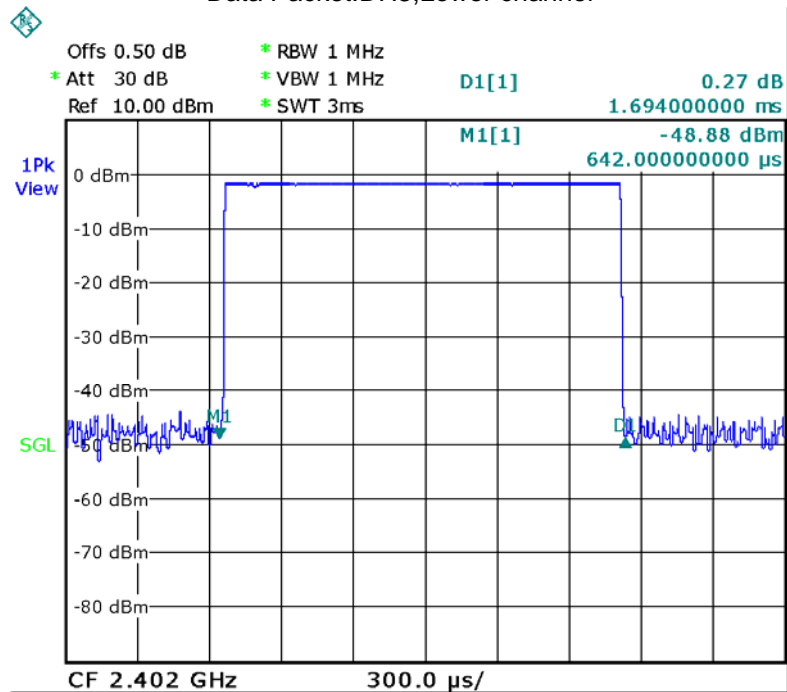
Date: 26.NOV.2013 17:16:23

Data Packet:DH1,Upper channel



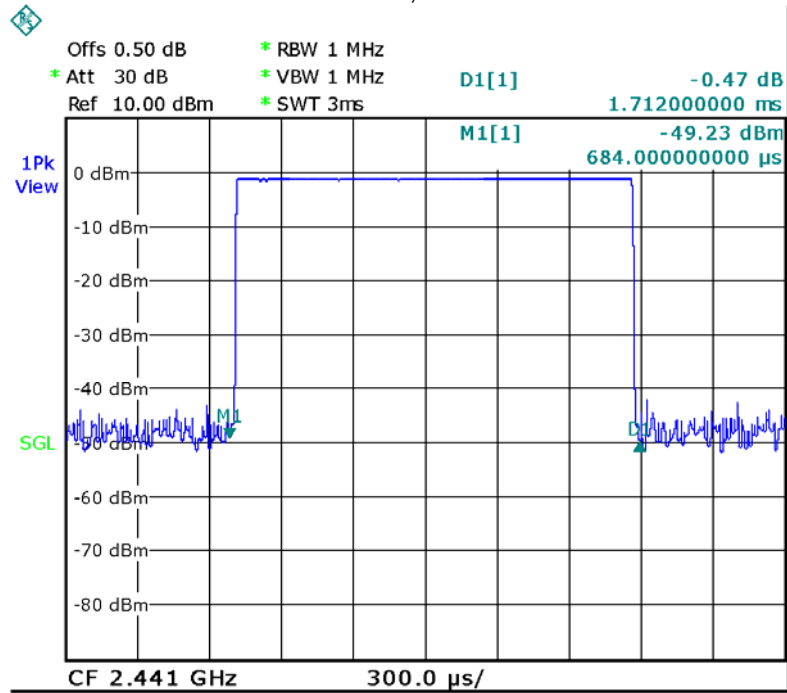
Date: 26.NOV.2013 17:17:49

Data Packet:DH3,Lower channel



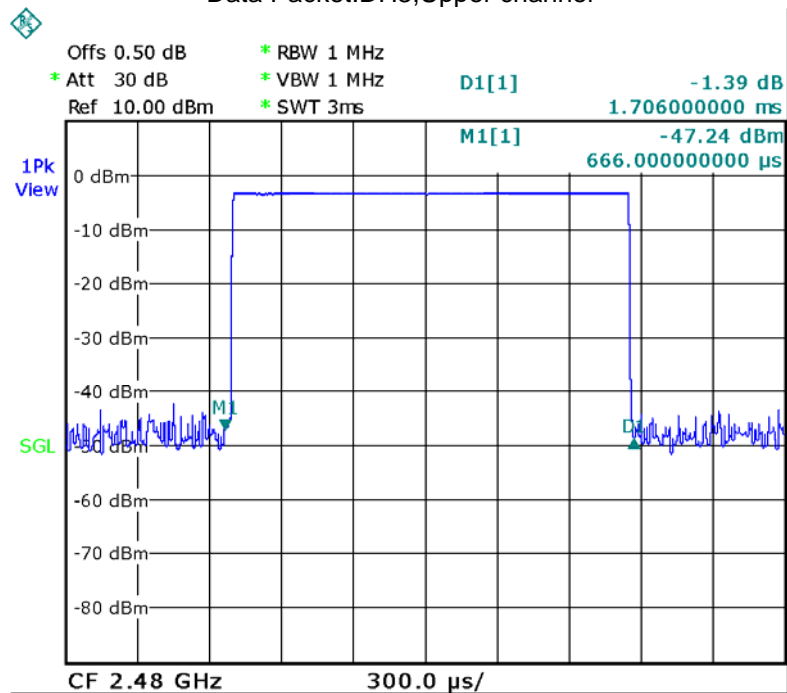
Date: 26.NOV.2013 17:46:41

Data Packet:DH3,Middle channel



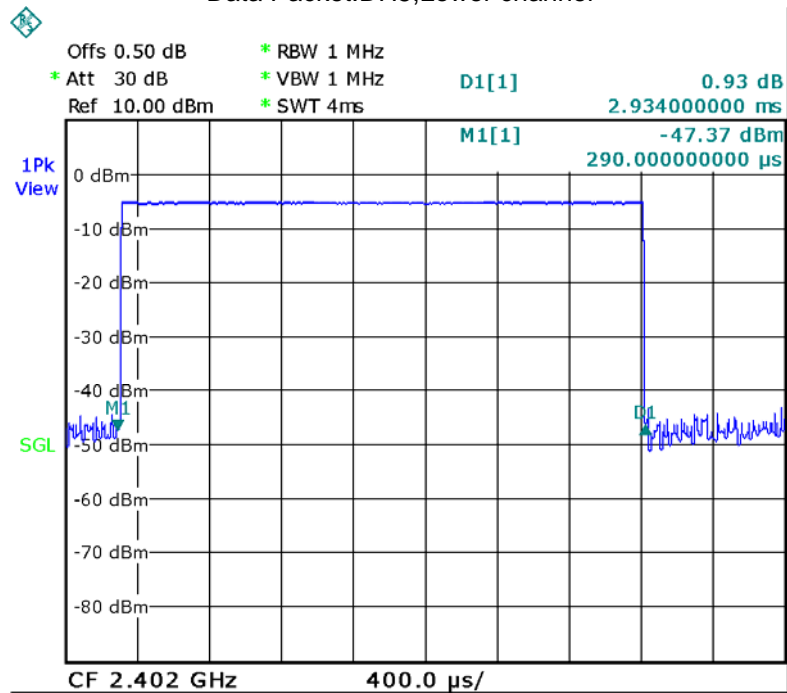
Date: 26.NOV.2013 17:47:46

Data Packet:DH3,Upper channel



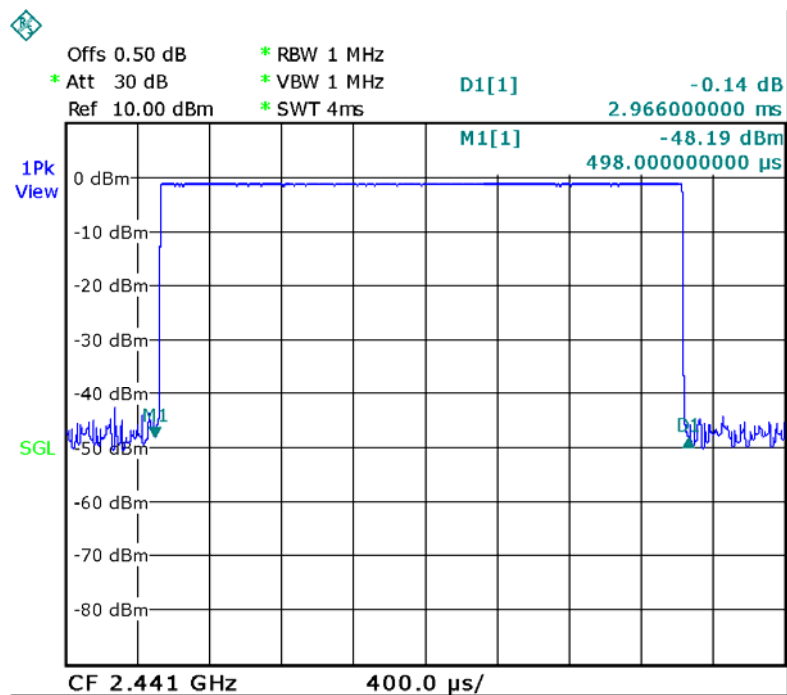
Date: 26.NOV.2013 17:48:48

Data Packet:DH5,Lower channel



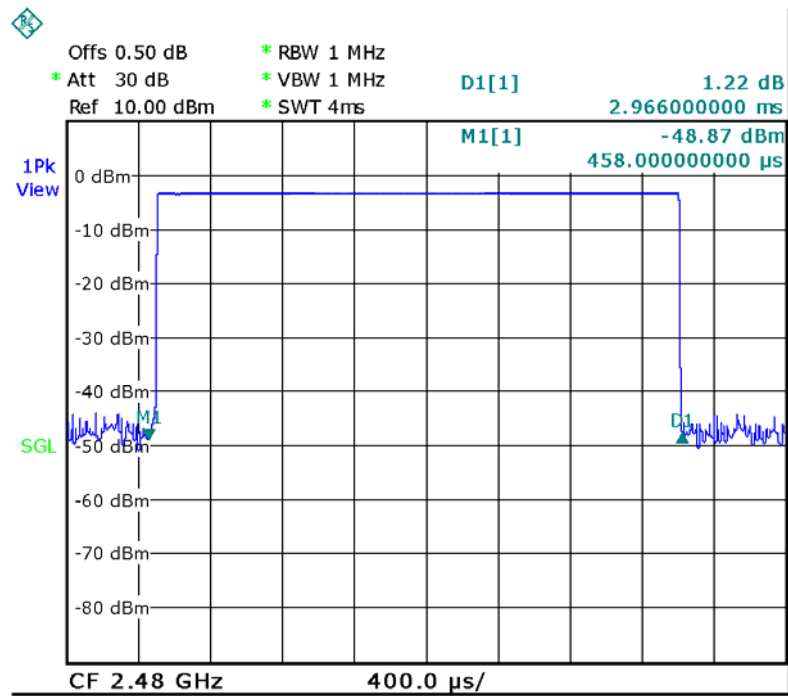
Date: 26.NOV.2013 17:58:54

Data Packet:DH5,Middle channel



Date: 26.NOV.2013 18:00:16

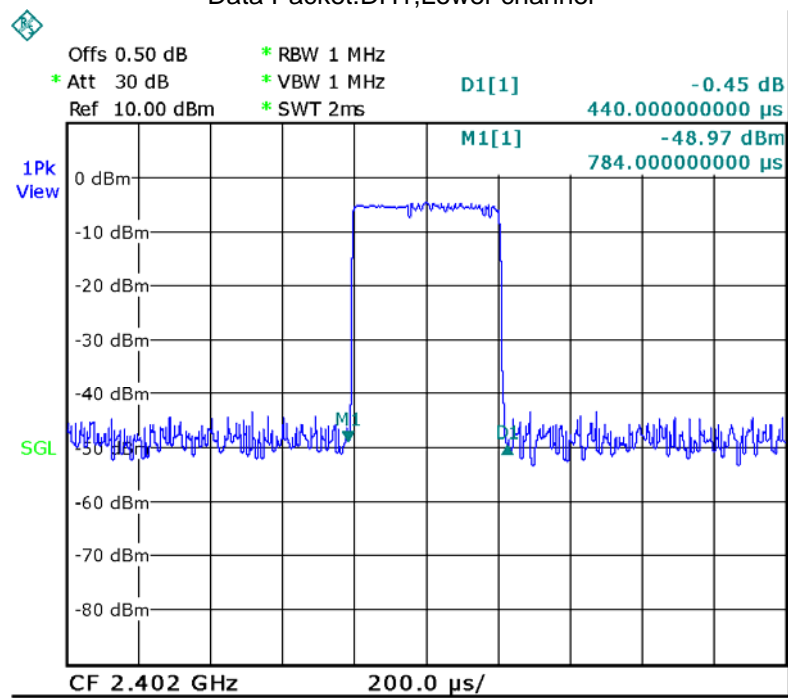
Data Packet:DH5,Upper channel



Date: 26.NOV.2013 18:01:22

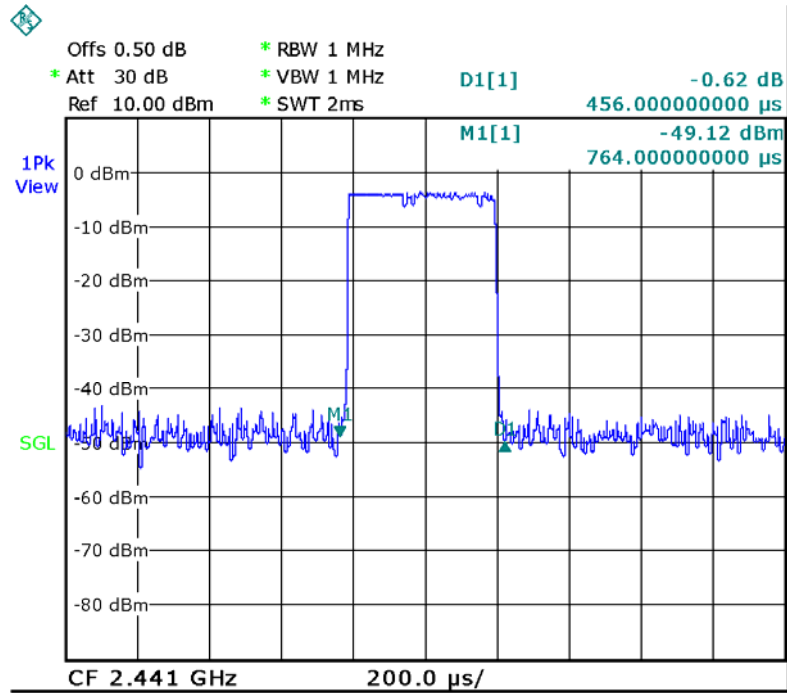
Modulation: Pi/4DQPSK

Data Packet:DH1,Lower channel



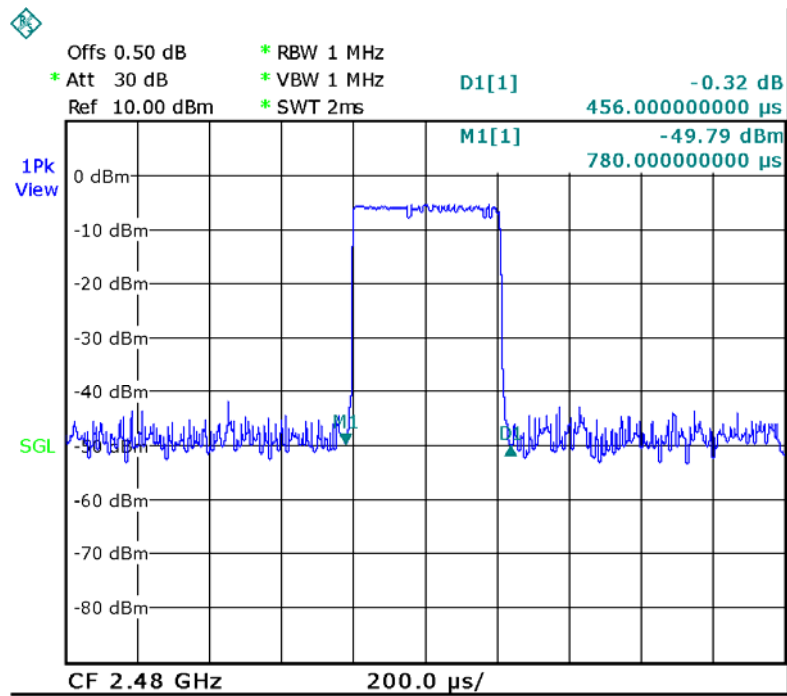
Date: 26.NOV.2013 17:20:51

Data Packet:DH1,Middle channel



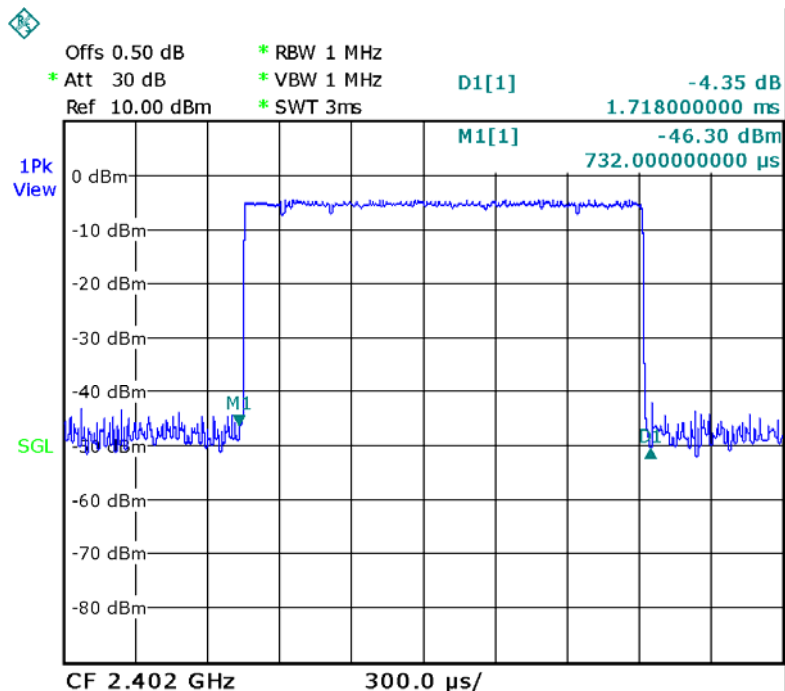
Date: 26.NOV.2013 17:22:05

Data Packet:DH1,Upper channel



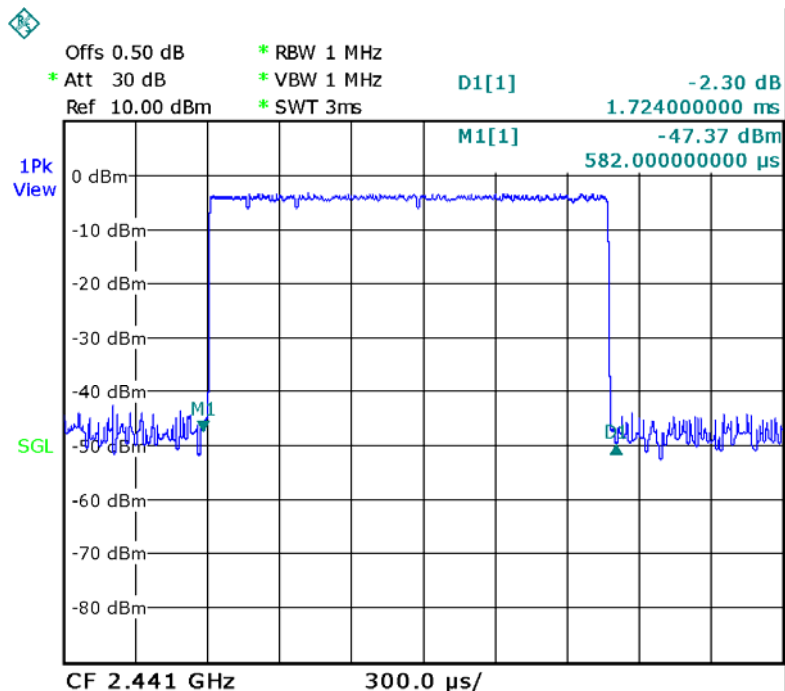
Date: 26.NOV.2013 17:23:09

Data Packet:DH3,Lower channel



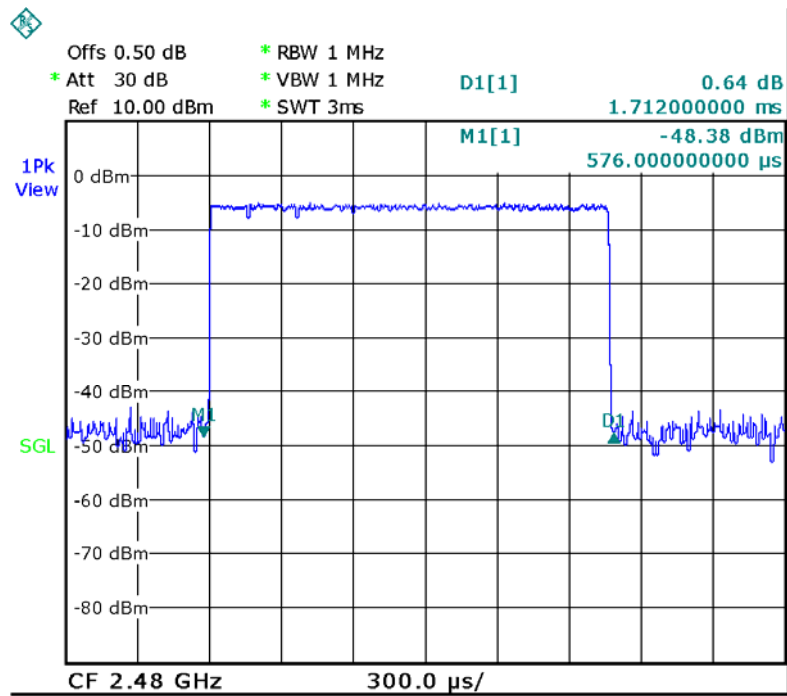
Date: 26.NOV.2013 17:52:44

Data Packet:DH3,Middle channel



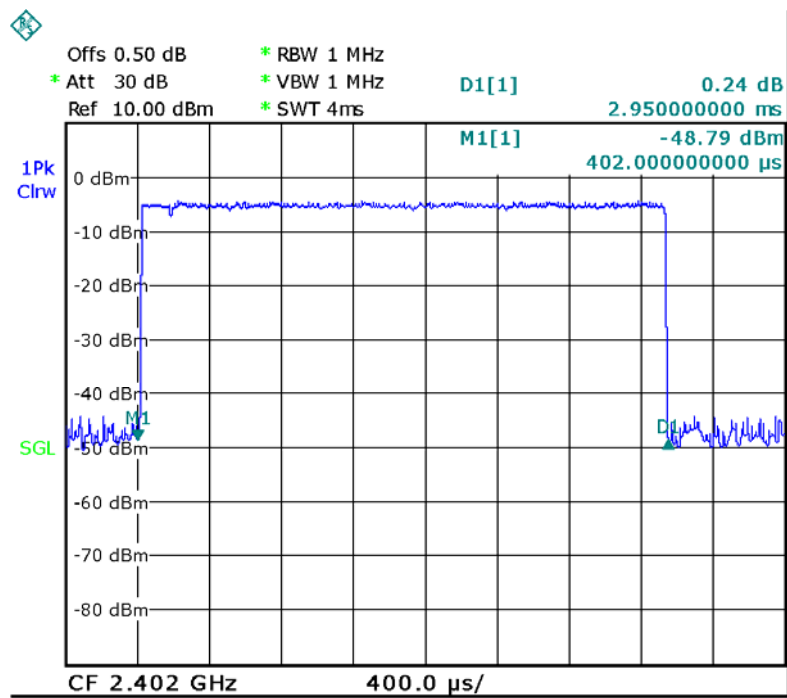
Date: 26.NOV.2013 17:51:35

Packet:DH3,Upper channel



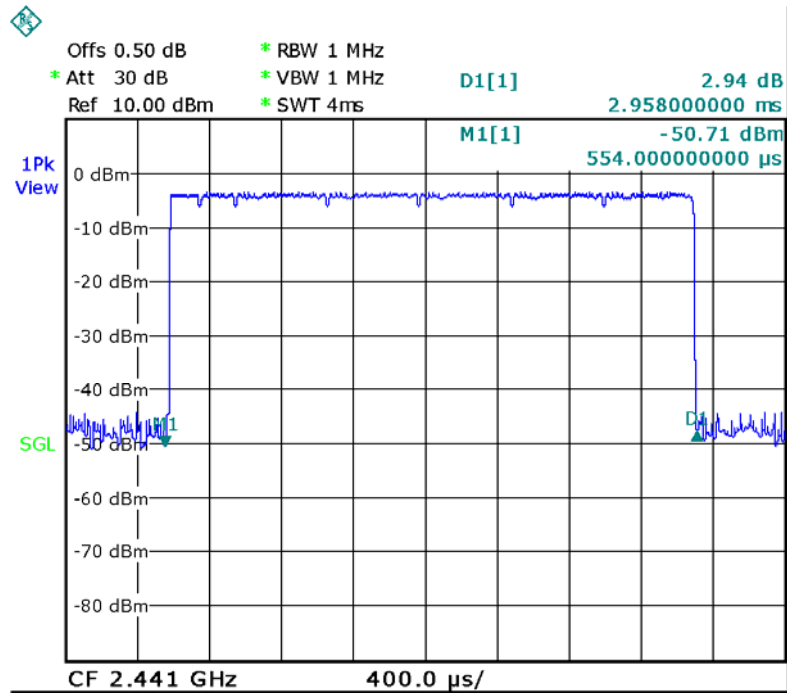
Date: 26.NOV.2013 17:50:12

Data Packet:DH5,Lower channel



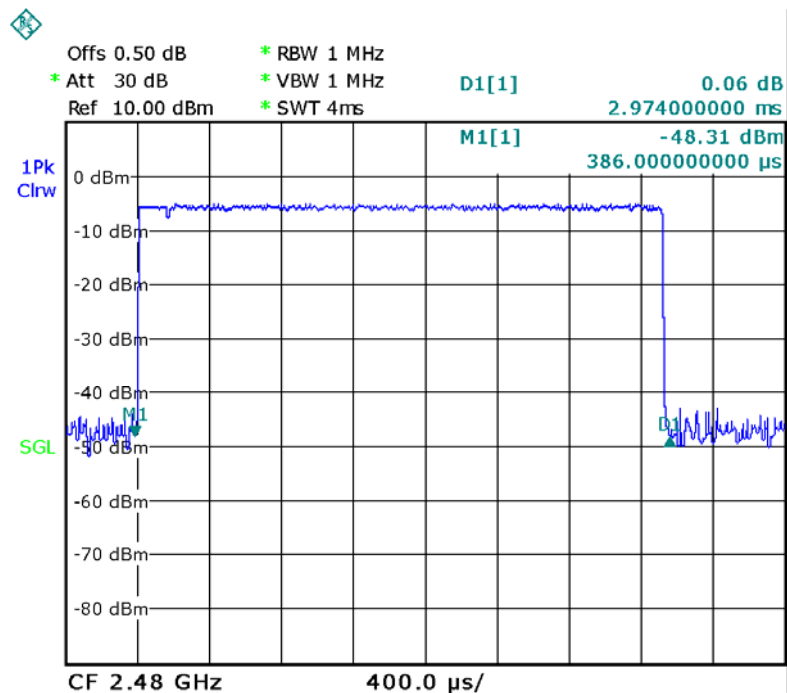
Date: 26.NOV.2013 18:03:32

Data Packet:DH5,Middle channel



Date: 26.NOV.2013 18:07:10

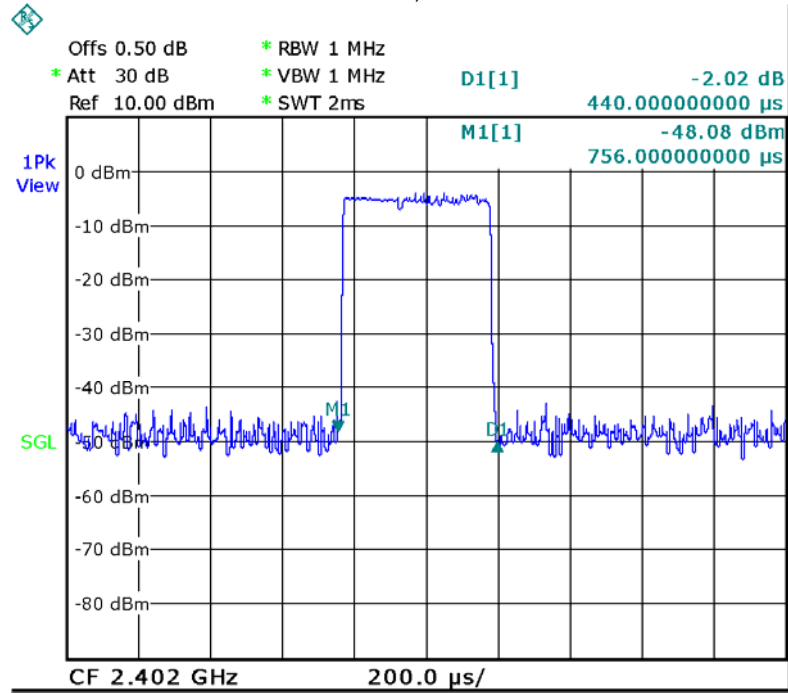
Data Packet:DH5,Upper channel



Date: 26.NOV.2013 18:11:08

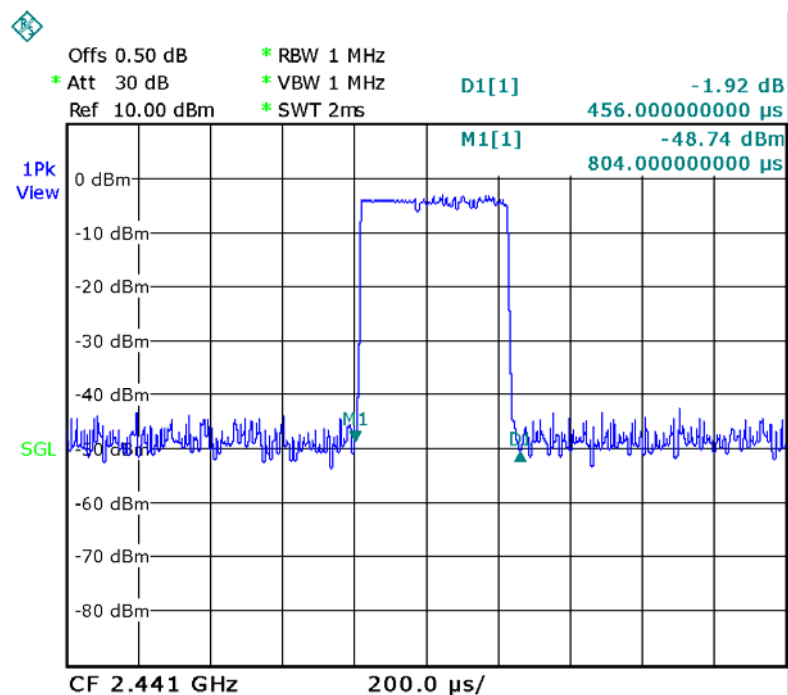
Modulation: 8DPSK

Data Packet:DH1,Lower channel



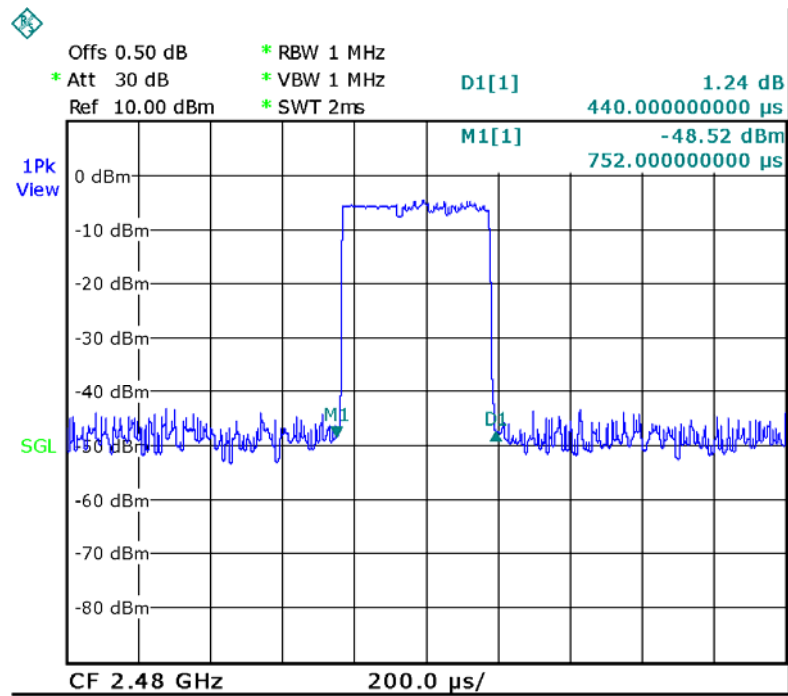
Date: 26.NOV.2013 17:44:53

Data Packet:DH1,Middle channel



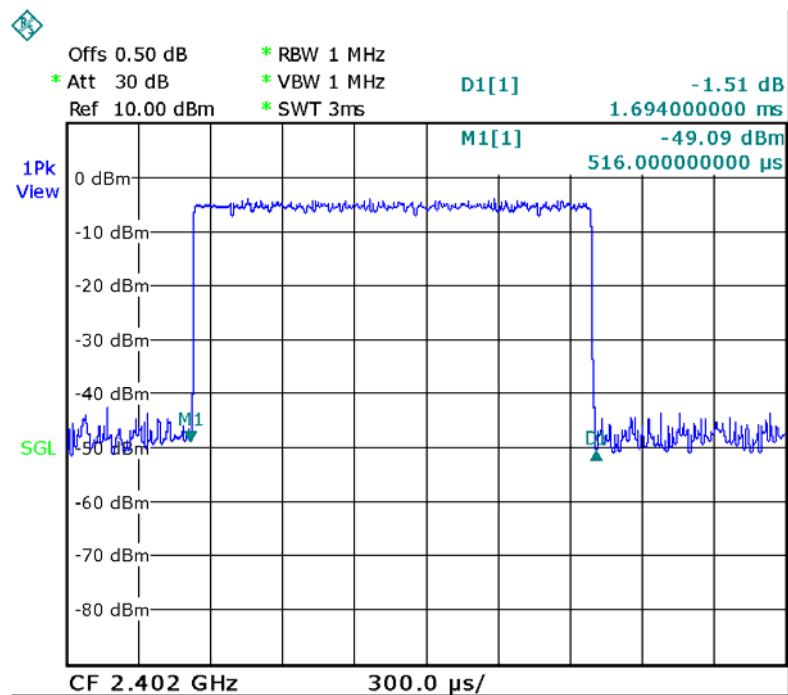
Date: 26.NOV.2013 17:41:14

Data Packet:DH1,Upper channel



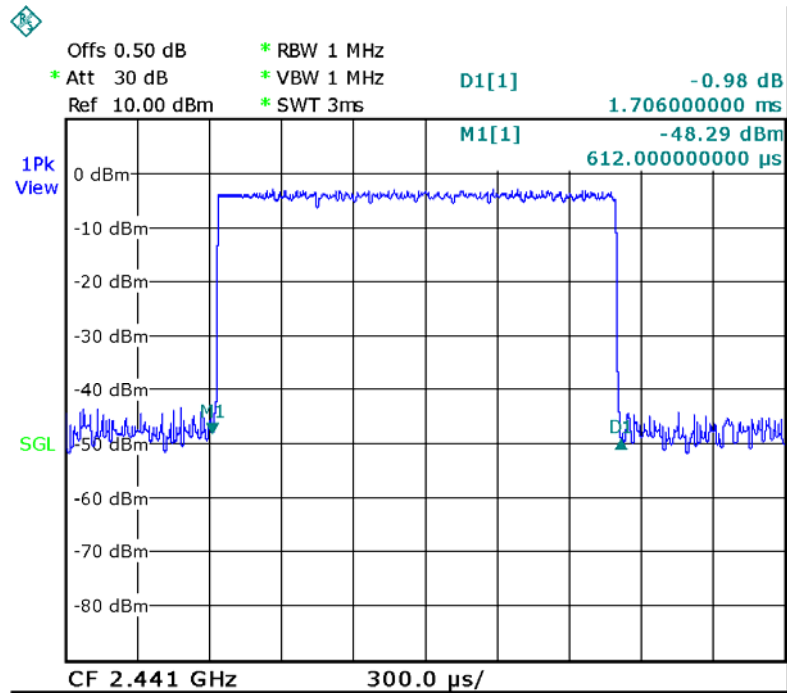
Date: 26.NOV.2013 17:28:55

Data Packet:DH3,Lower channel



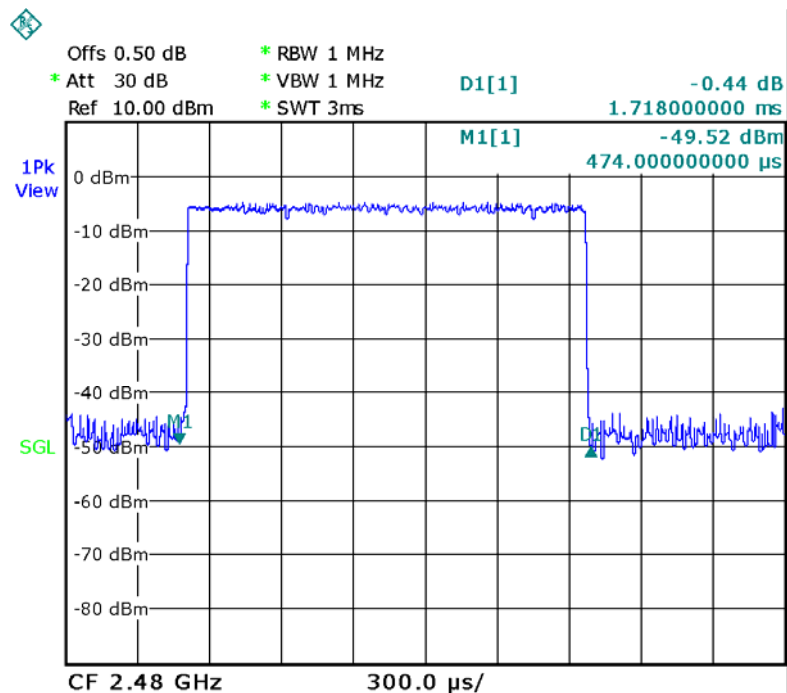
Date: 26.NOV.2013 17:54:12

Data Packet:DH3,Middle channel



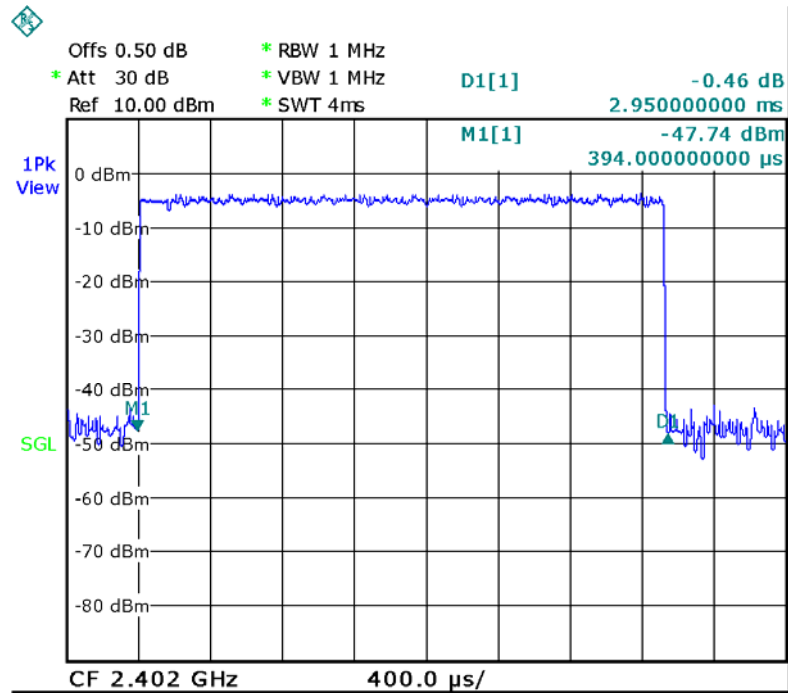
Date: 26.NOV.2013 17:55:40

Data Packet:DH3,Upper channel



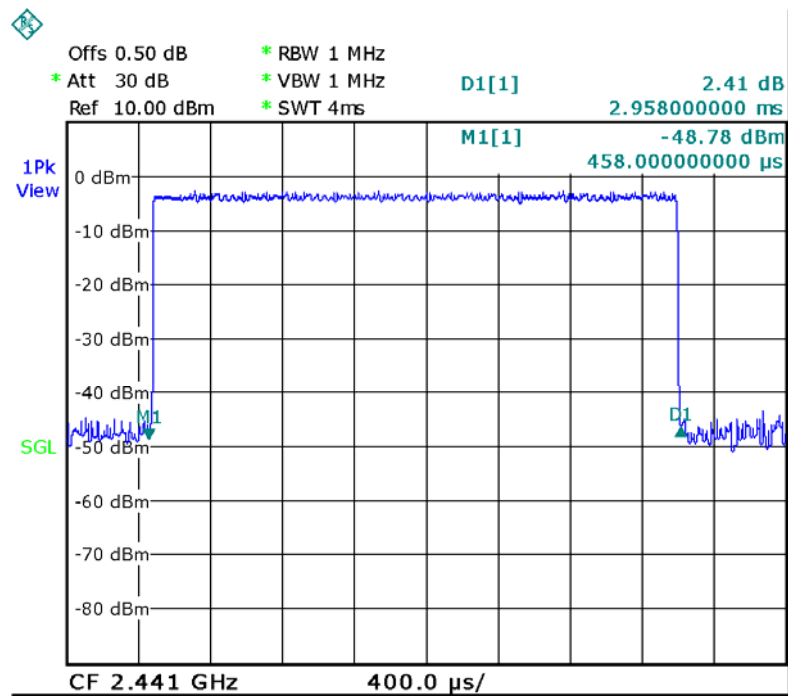
Date: 26.NOV.2013 17:56:55

Data Packet:DH5,Lower channel



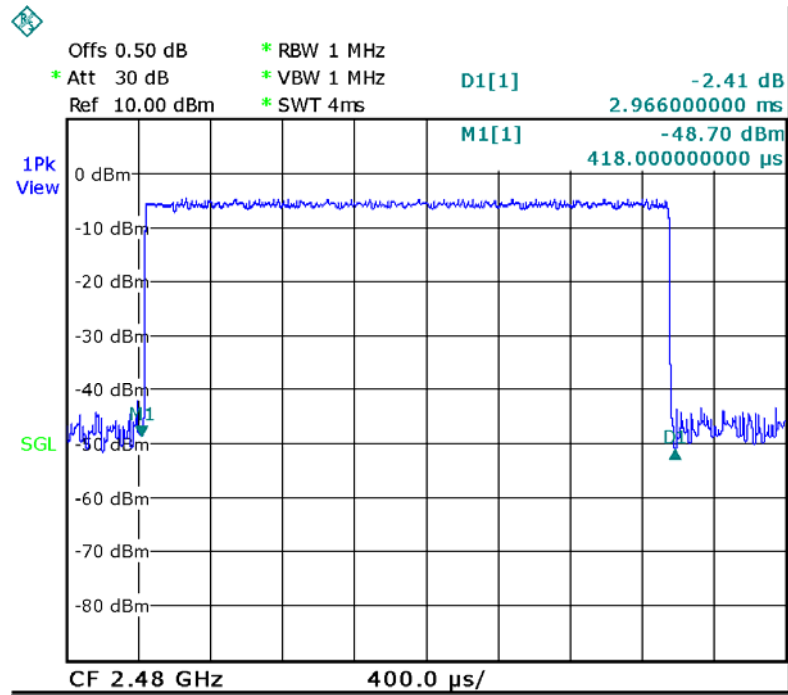
Date: 26.NOV.2013 19:00:47

Data Packet:DH5,Middle channel



Date: 26.NOV.2013 19:01:56

Data Packet:DH5,Upper channel



Date: 26.NOV.2013 19:03:19

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 ²)	Averaging Time E ² , H ² 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 ²)	Averaging Time E ² , H ² 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)

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

The formula can be changed to

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

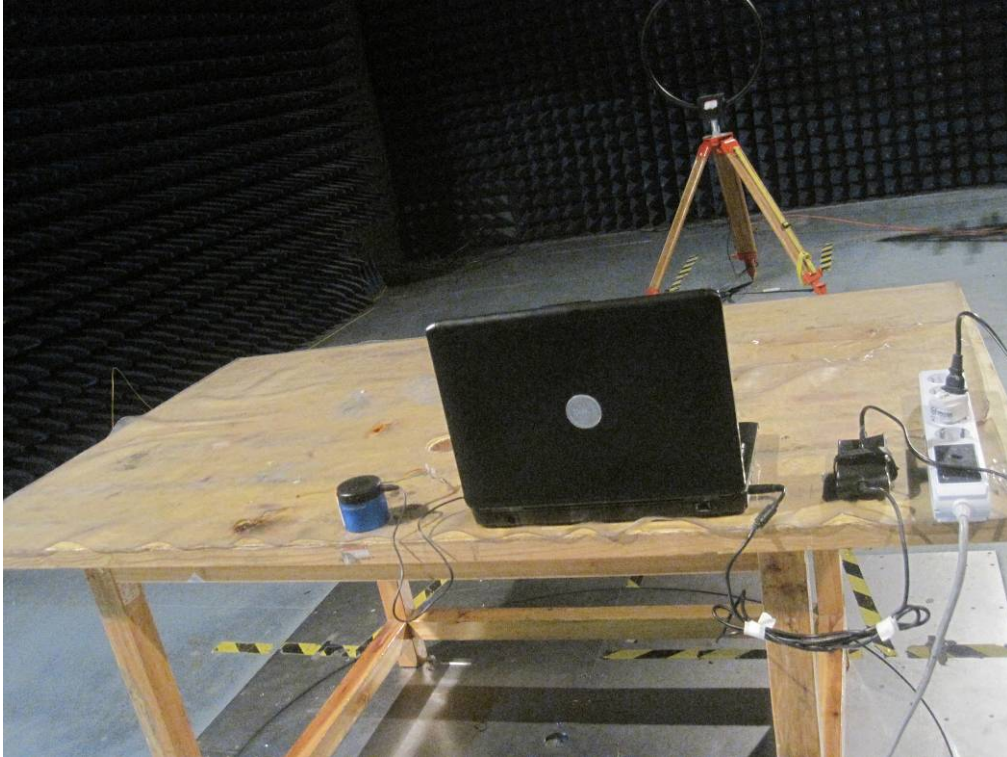
From the peak EUT RF output power, the minimum mobile separation distance, $d=0.2\text{m}$, as well as the gain of the used antenna, the RF power density can be obtained

Modulation	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
GFSK	1.585	-0.33	0.927	0.000292	1
Pi/4DQPSK	1.585	-1.42	0.721	0.000227	1
8DPSK	1.585	-0.29	0.935	0.000295	1

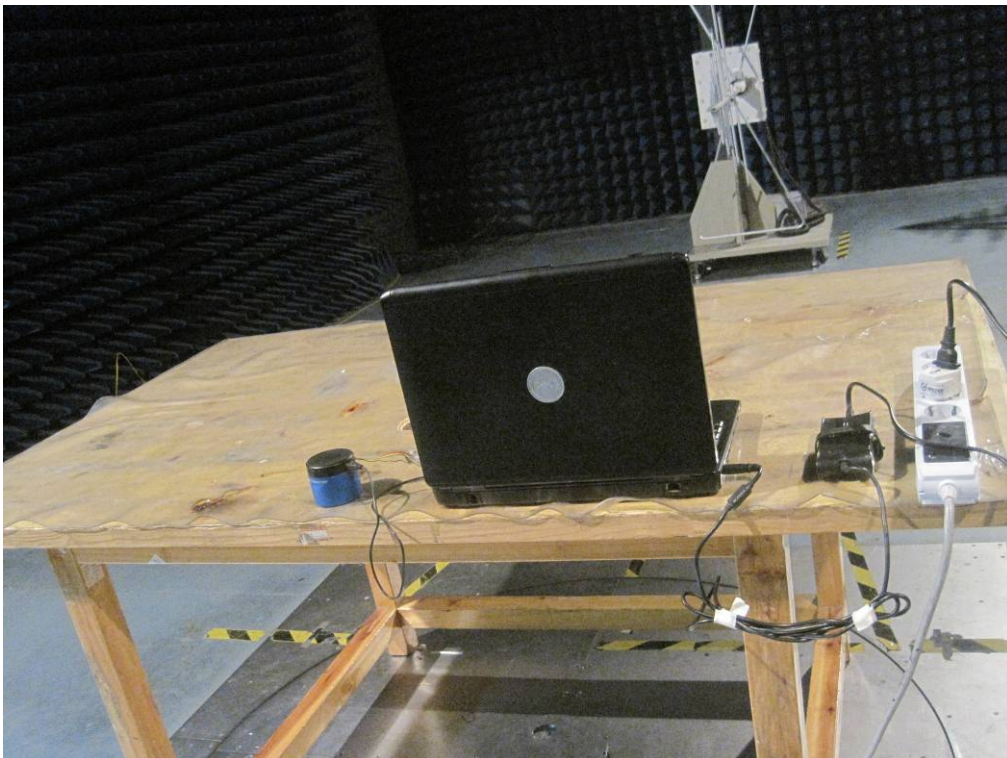
17 Photographs – Test Setup

17.1 Radiated Emissions

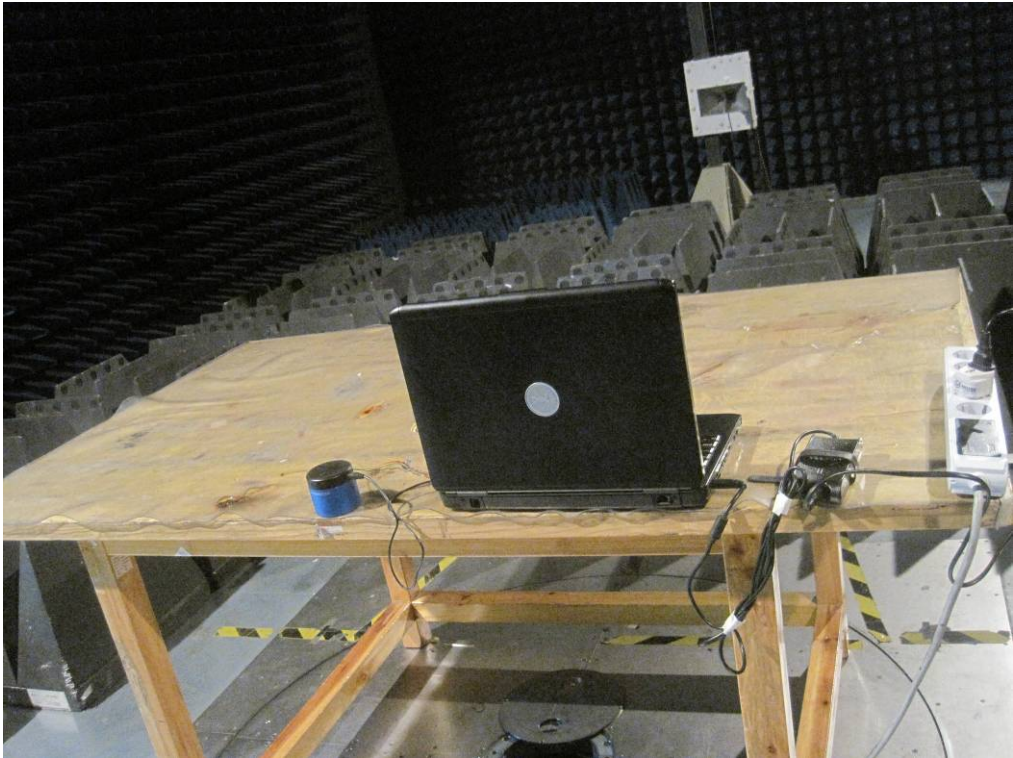
Below 30MHz



From 30-1000MHz



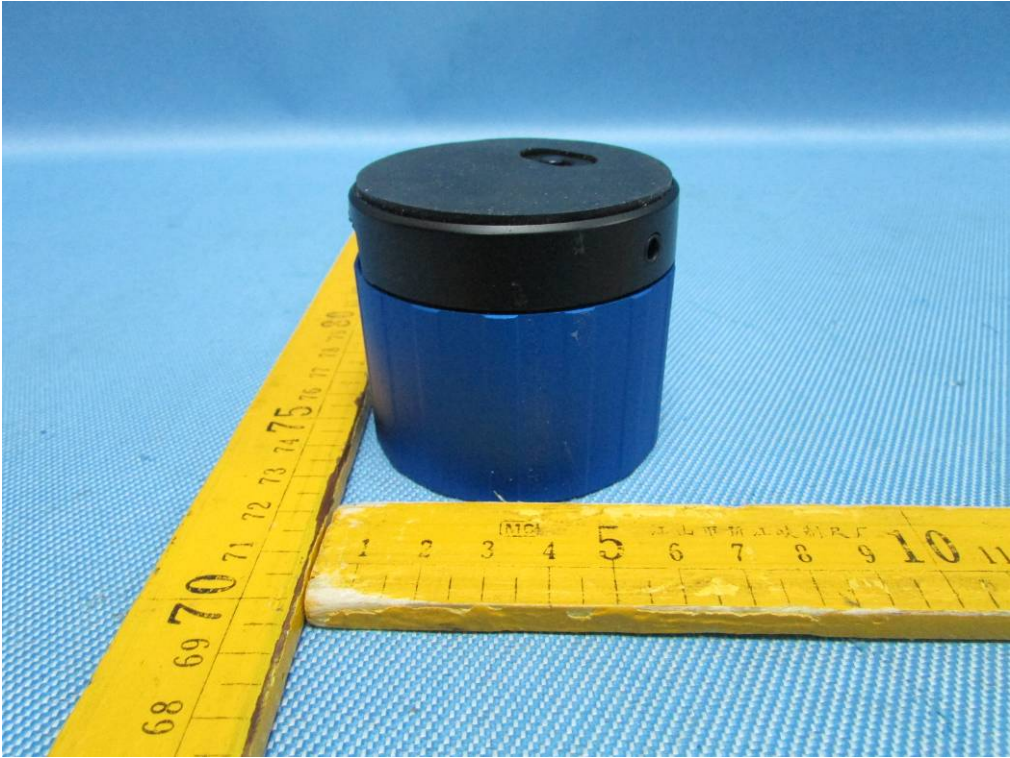
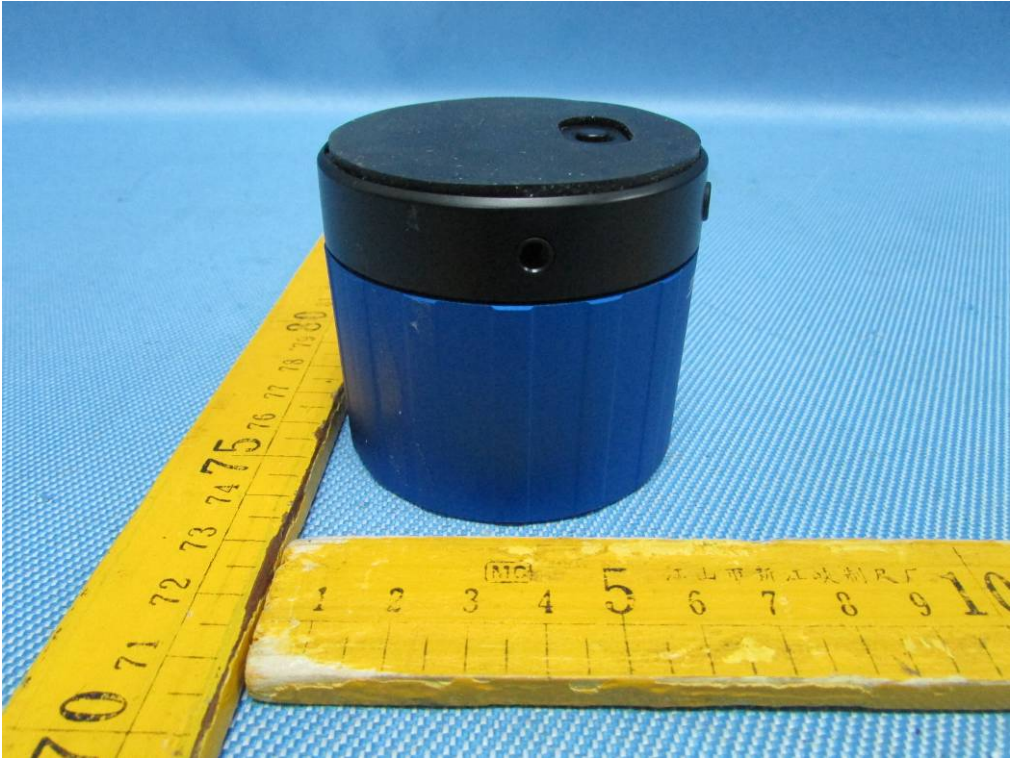
Above 1GHz



18 Photographs - Constructional Details

18.1 EUT – External View1.

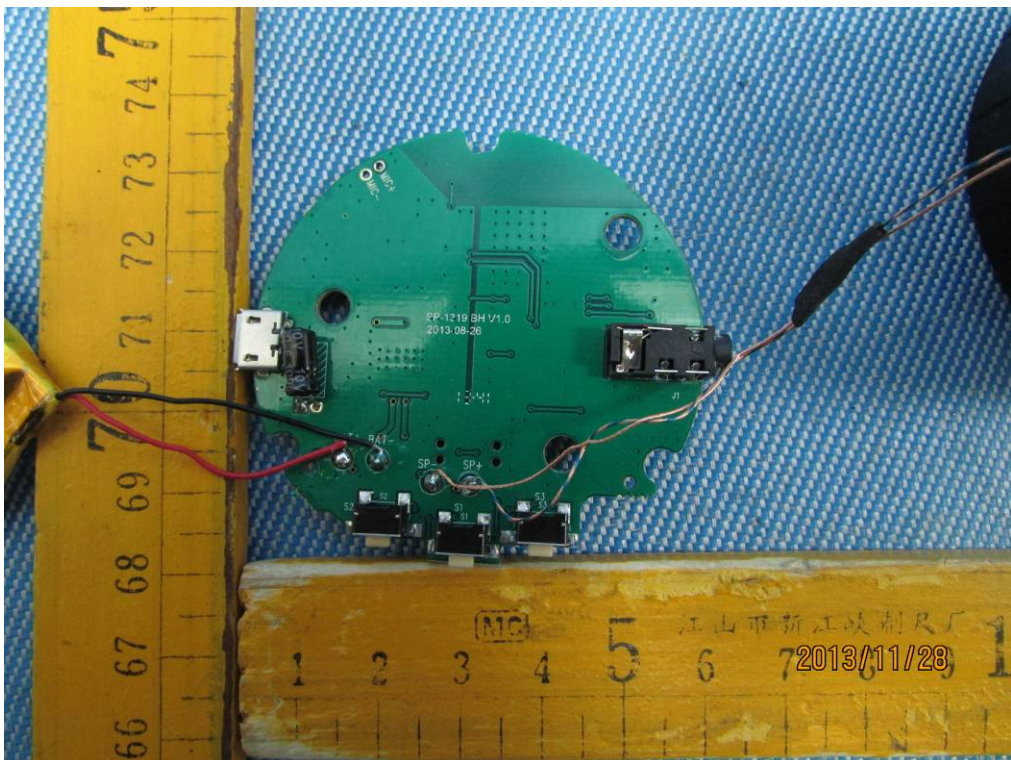
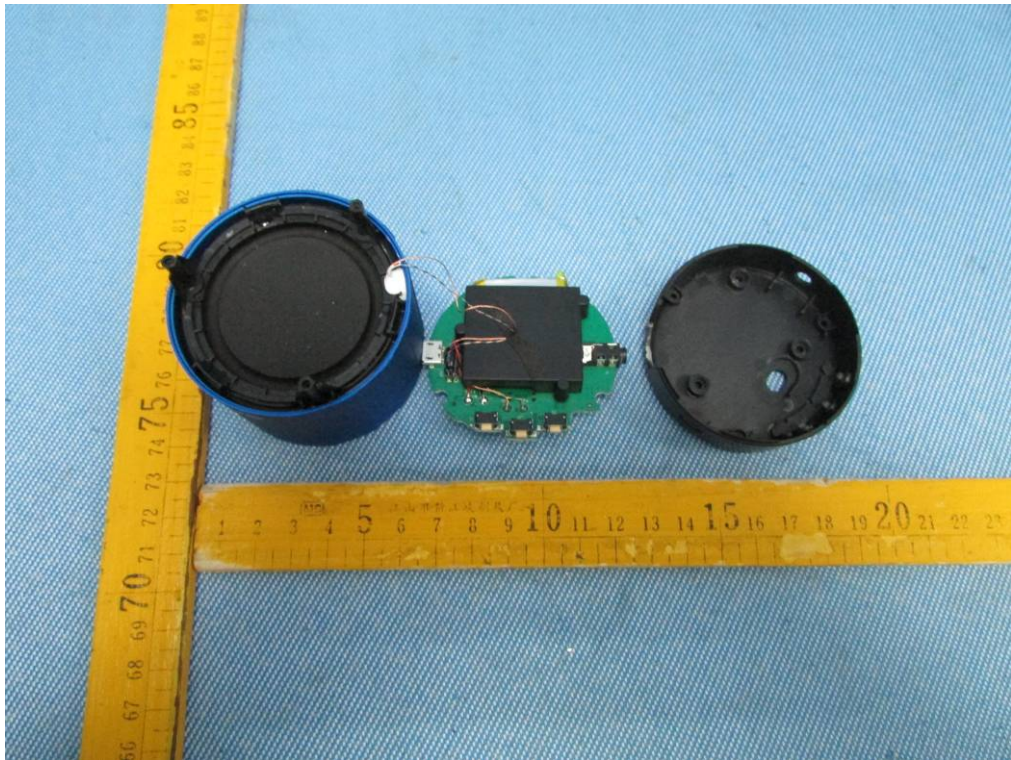


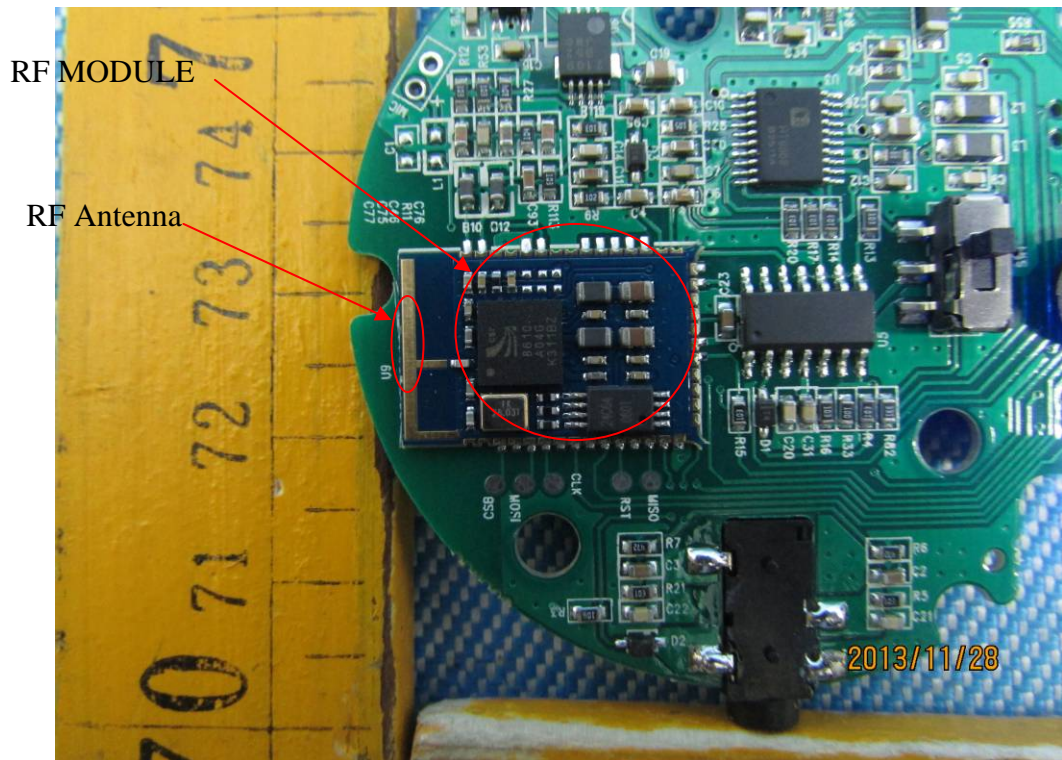
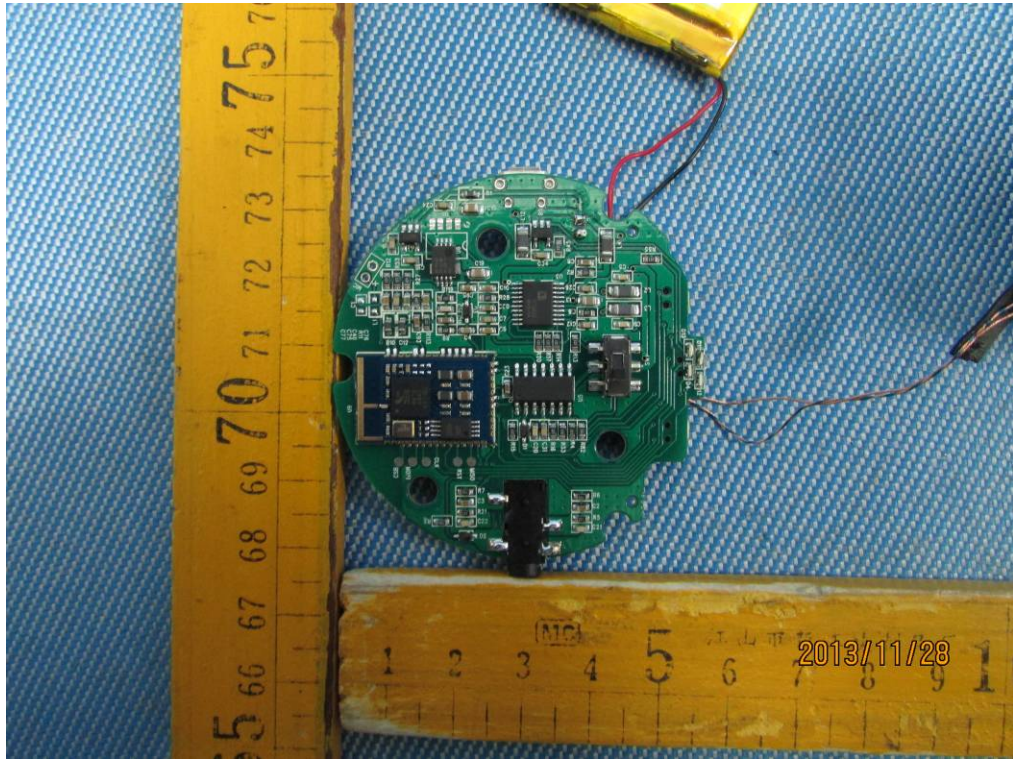


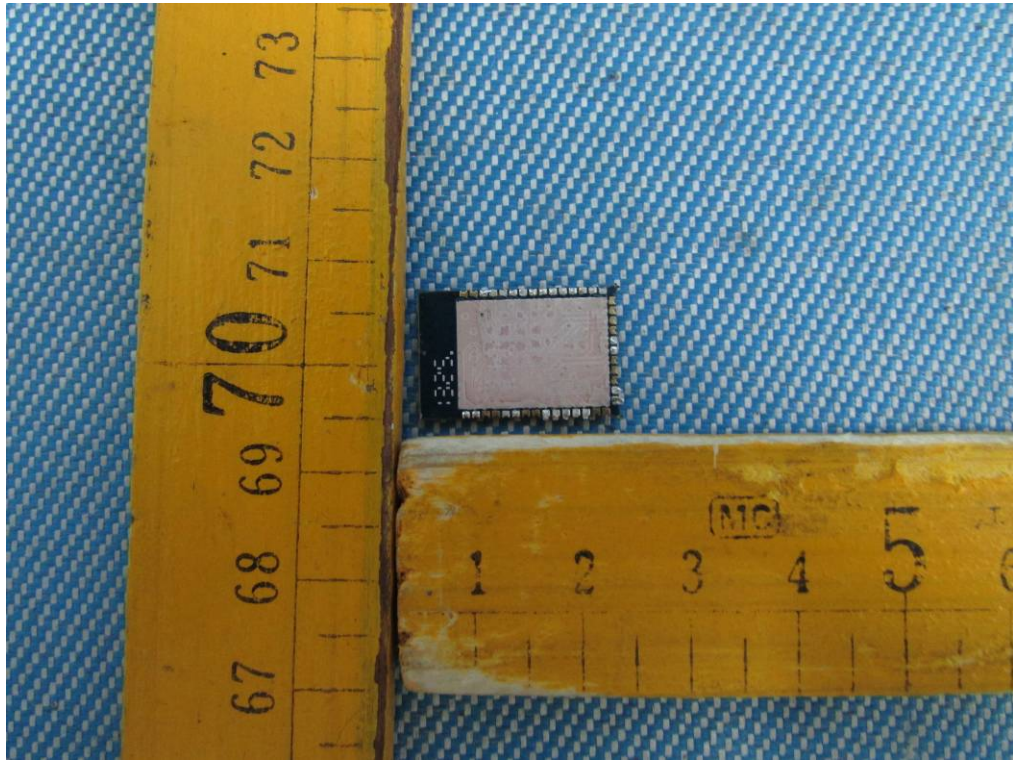
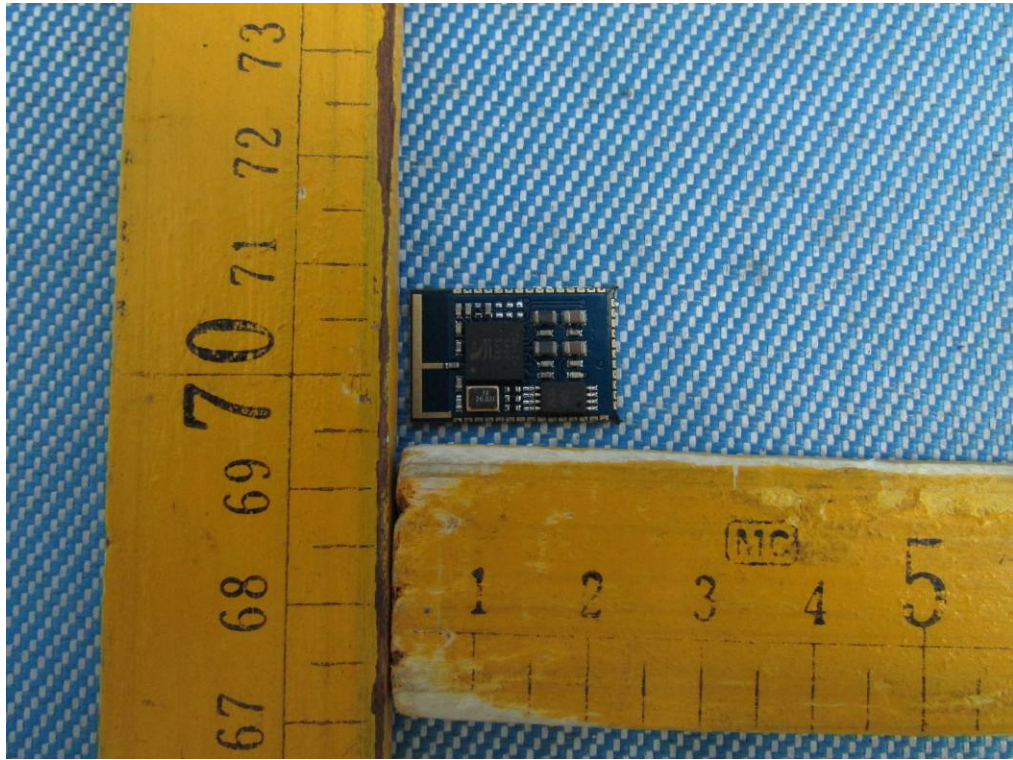




18.2 EUT – Internal View







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