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FCC RADIO TEST REPORT

Applicant's company	**Realtek Semiconductor Corp.**
Applicant Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan
FCC ID	**TX2-RTL8723BS**
Manufacturer's company	**Realtek Semiconductor Corp.**
Manufacturer Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan

Product Name	802.11b/g/n RTL8723BS Combo module
Brand Name	REALTEK
Model Name	RTL8723BS
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2402 ~ 2480MHz
Received Date	Mar. 17, 2014
Final Test Date	Apr. 19, 2014
Submission Type	Original Equipment

Statement

Test result included is only for the Bluetooth BR/EDR of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2009** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR431858AB	Rev. 01	Initial issue of report	Apr. 24, 2014

Certificate No.: CB10304102

1. CERTIFICATE OF COMPLIANCE

Product Name	:	802.11b/g/n RTL8723BS Combo module
Brand Name	:	REALTEK
Model No.	:	RTL8723BS
Applicant	:	Realtek Semiconductor Corp.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Mar. 17, 2014 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen
SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	**Rule Section**	**Description of Test**	**Result**	**Under Limit**
4.1	15.207	AC Power Line Conducted Emissions	Complies	12.78 dB
4.2	15.247(b)(1)	Maximum Conducted Output Power	Complies	16.04 dB
4.3	15.247(a)(1)	Hopping Channel Separation	Complies	-
4.4	15.247(b)(1)	Number of Hopping Frequency	Complies	-
4.5	15.247(a)(1)	Dwell Time	Complies	-
4.6	15.247(d)	Radiated Emissions	Complies	3.17 dB
4.7	15.247(d)	Band Edge Emissions	Complies	8.95 dB
4.8	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From host system
Modulation	FHSS (GFSK / π/4-DQPSK / 8DPSK)
Data Rate (Mbps)	GFSK: 1 ; π/4-DQPSK: 2 ; 8DPSK: 3
Frequency Range	2402 ~ 2480MHz
Channel Number	79
Channel Band Width (99%)	BR (GFSK) 1 Mbps: 0.9240 MHz EDR (π/4-DQPSK) 2 Mbps: 1.2000 MHz EDR (8DPSK) 3 Mbps: 1.1800 MHz
Maximum Conducted Output Power	BR (GFSK) 1 Mbps: 4.96 dBm EDR (π/4-DQPSK) 2 Mbps: 4.20 dBm EDR (8DPSK) 3 Mbps: 4.19 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3
Note 1: Bluetooth BR uses a combination of GFSK (1Mbps). Note 2: Bluetooth EDR uses a combination of π/4-DQPSK (2Mbps) and 8DPSK (3Mbps).	

3.2. Accessories

N/A

3.3. Table for Filed Antenna

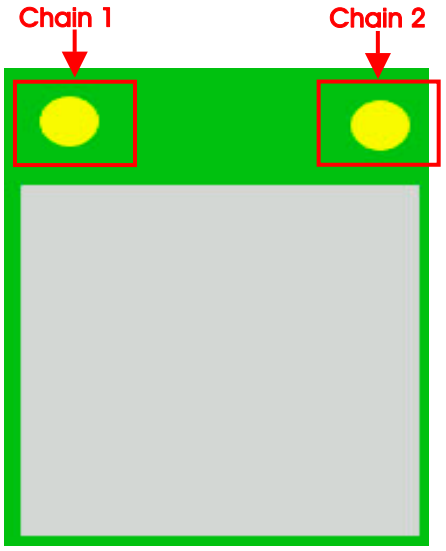
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	LYNwave	ALA110-222050-30001	PIFA Antenna	IPEX MHF4	3.5

Note: There are three configurations for EUT

Configuration	Antenna Chain	Description
Config.1 Diversity	2 chains	The EUT supports the antenna with TX/RX diversity function for WLAN and Bluetooth. (Ex. Assume chain 1 was selected to conduct transmitting function in WLAN, so chain 2 was selected in Bluetooth Mode. Vice versa.) **WLAN-802.11bgn(1TX, 1RX) / Bluetooth (1TX, 1RX)** The EUT supports 1TX/1RX function, and it supports TX/RX diversity function. Both chain 1 and chain 2 could be used as transmitting/receiving antenna, but only one of them could transmit/receive at the same time.
Config.2 Fixed	2 chains	**WLAN-802.11bgn(1TX, 1RX) / Bluetooth (1TX, 1RX)** Chain 1 is designated for WLAN function, Chain 2 is designated for Bluetooth Functions.
Config.3 Single	1 chain	**WLAN-802.11bgn(1TX, 1RX) / Bluetooth (1TX, 1RX)** WLAN and BT share a common chain, but only one of them could transmit/receive at the same time.

After evaluating, configuration 1 has been evaluated to be the worst case, so it was performed for test.

Chain 1 generated the worst case in configuration 1, so it was selected to test and record in the report.



3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5MHz	0	2402 MHz	40	2442 MHz
	1	2403 MHz	:	:
	:	:	77	2479 MHz
	38	2440 MHz	78	2480 MHz
	39	2441 MHz	-	-

3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Chain
AC Power Conducted Emissions	Normal Link	-	-	-
Maximum Conducted Output Power	BR (GFSK)	1 Mbps	0/39/78	1
	EDR (π/4-DQPSK)	2 Mbps	0/39/78	1
	EDR (8DPSK)	3 Mbps	0/39/78	1
Hopping Channel Separation	BR (GFSK)	1 Mbps	0~1 39~40 77~78	1
	EDR (π/4-DQPSK)	2 Mbps	0~1 39~40 77~78	1
	EDR (8DPSK)	3 Mbps	0~1 39~40 77~78	1
Number of Hopping Frequency	BR (GFSK)	1 Mbps	0~78	1
Dwell Time	BR (GFSK) (DH1, DH3, DH5)	1 Mbps	0/39/78	1
Radiated Emissions Below 1GHz	Normal Link	-	-	-
Radiated Emissions Above 1GHz	BR (GFSK)	1 Mbps	0/39/78	1
	EDR (8DPSK)	3 Mbps	0/39/78	1
Band Edge Emissions	BR (GFSK)	1 Mbps	0/39/78	1
	EDR (8DPSK)	3 Mbps	0/39/78	1

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. WiFi function

Mode 2. Bluetooth function

Mode 1 is the worst case, so it was selected to record in this test report.

For Radiated Emission below 1GHz test:

Mode 1. Laying of EUT + WiFi function

Mode 2. Stand of EUT + WiFi function

Mode 1 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode

Mode 3. Laying of EUT + Bluetooth function

Mode 1 has been evaluated to be the worst case among Mode 1~3, so it was selected to record in this test report.

For Radiated Emission above 1GHz test:

There are two modes of EUT, one is stand of EUT, and the other is laying of EUT.

After evaluating, laying of EUT has been evaluated to be the worst case.

Consequently, measurement for Radiated Emission above 1GHz test will follow this same test mode.

Mode 1. Laying of EUT

For Co-location MPE and Radiated Emission Co-location Test:

The EUT could be applied with 2.4GHz WLAN function and Bluetooth function; therefore Co-location Maximum Permissible Exposure (Please refer to Appendix B) and Radiated Emission Co-location (please refer to Appendix C) tests are added for simultaneously transmit between 2.4GHz WLAN function and Bluetooth function.

3.6. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065				
FAX:	886-3-656-9085				
Test Site No.	**Site Category**	**Location**	**FCC Reg. No.**	**IC File No.**	**VCCI Reg. No**
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

3.7. Table for Supporting Units

For Test Site No: 03CH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	M1330	E2K4965AGNM
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Test fixture	Realtek	NGFF Adapter	N/A
AP Router	Planex	GW-AP54SGX	KA220030603014-1

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
Test fixture	Realtek	NGFF Adapter	N/A
AP Router	Planex	GW-AP54SGX	KA220030603014-1

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Test fixture	Realtek	NGFF Adapter	N/A

3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters of Bluetooth

For BR (GFSK) 1 Mbps:

Test Software Version	RTK_BT_MP v3.19.2014.1		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	5/0x11	5/0x11	5/0x11

For EDR (π/4-DQPSK) 2 Mbps:

Test Software Version	RTK_BT_MP v3.19.2014.1		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	5/0x11	5/0x11	5/0x11

For EDR (8DPSK) 3 Mbps:

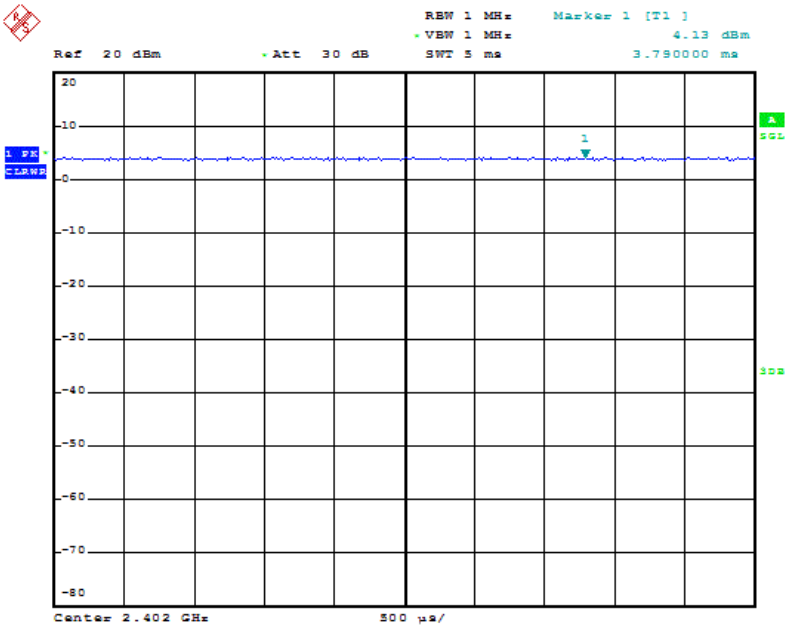
Test Software Version	RTK_BT_MP v3.19.2014.1		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	5/0x11	5/0x11	5/0x11

3.9. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.10. Duty Cycle

BR (GFSK)



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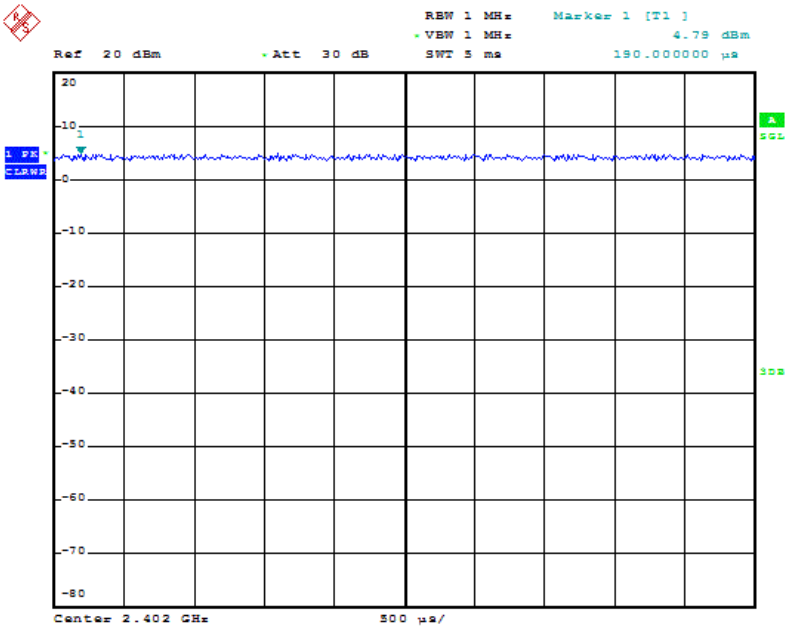
EDR (π/4-DQPSK)



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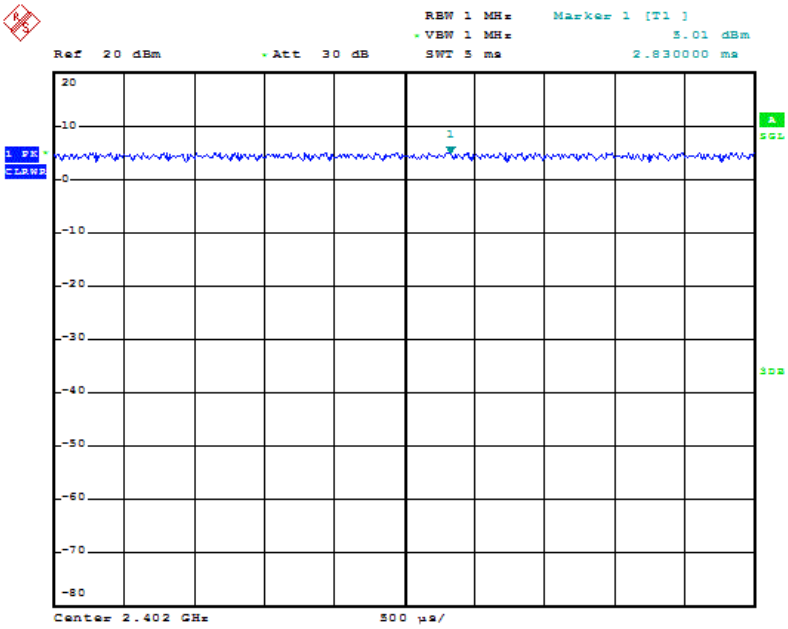
EDR (8DPSK)



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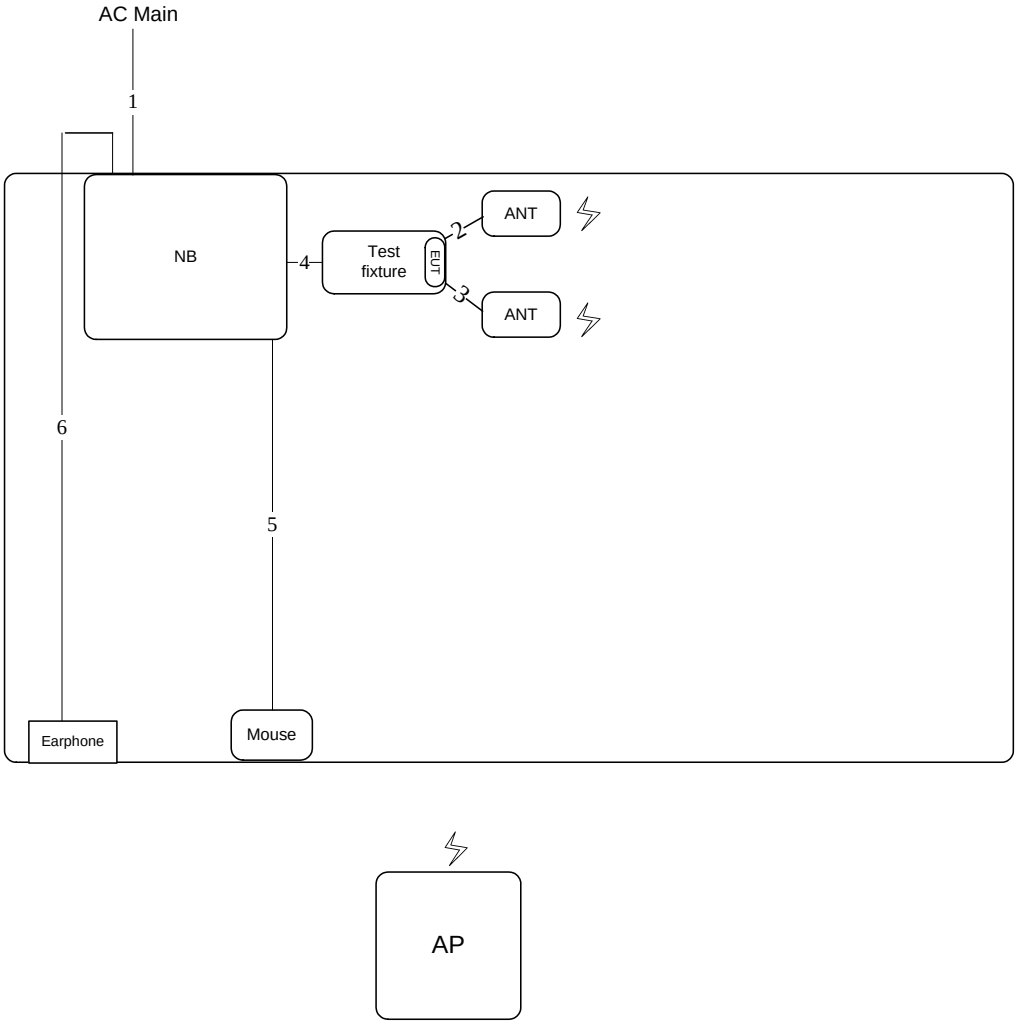
3.11. Test Configurations

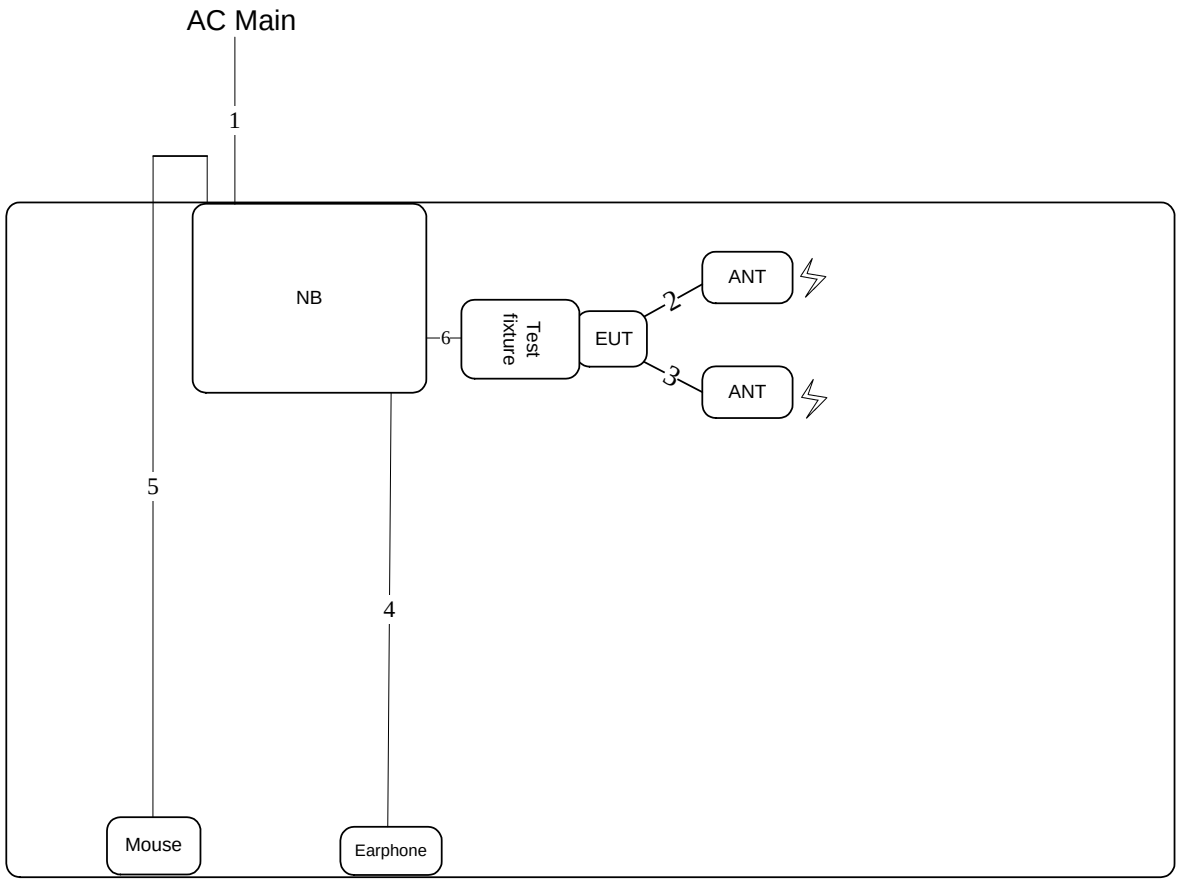
3.11.1. AC Power Line Conduction Emissions Test Configuration

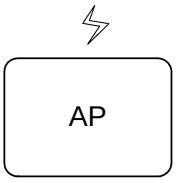


Item	Connection	Shield	Length
1	Power cable	No	1.8m
2	ANT cable	Yes	0.3m
3	ANT cable	Yes	0.3m
4	Mini HDMI cable	Yes	1m
5	USB cable	Yes	1.8m
6	Audio cable	No	1.5m

3.11.2. Radiation Emissions Test Configuration

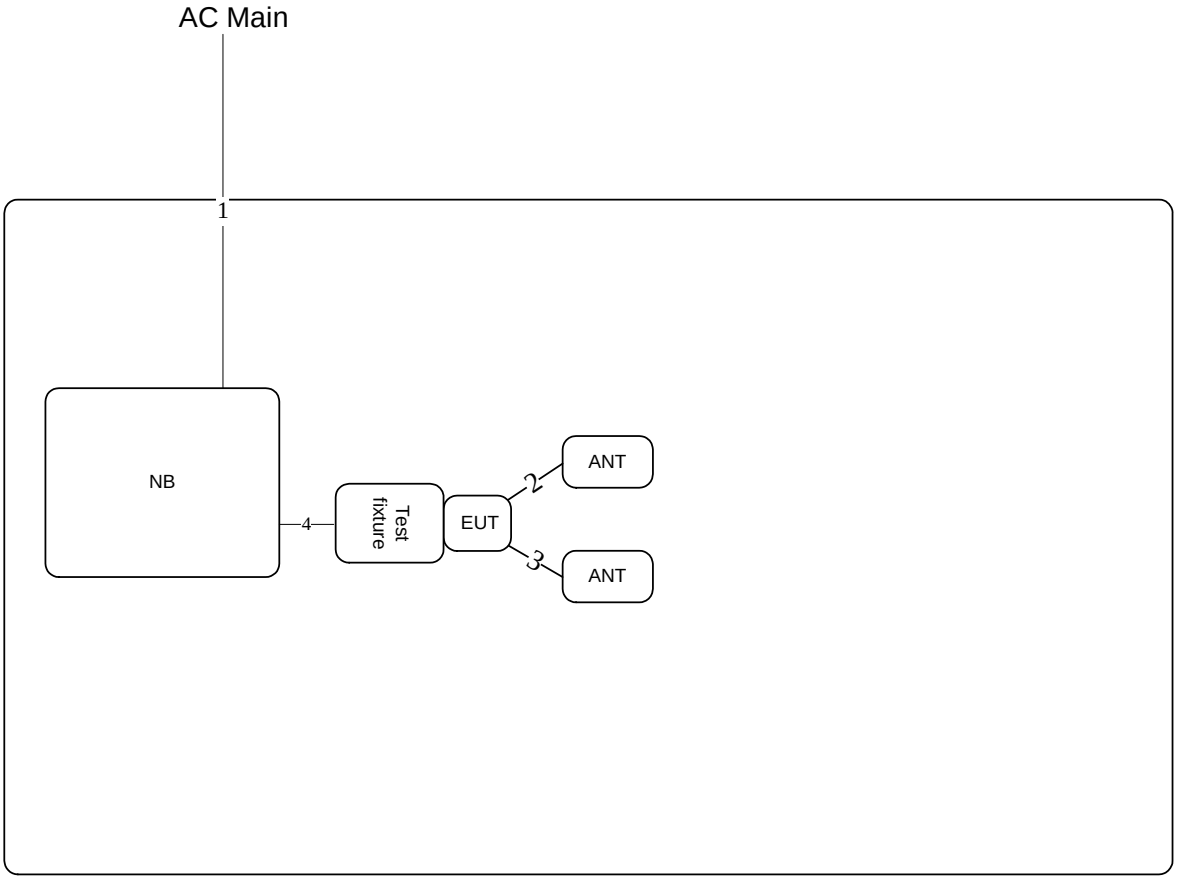
Test Configuration: 30MHz~1GHz





Item	Connection	Shield	Length
1	Power cable	No	1.8m
2	ANT cable	Yes	0.3m
3	ANT cable	Yes	0.3m
4	Audio cable	Yes	1.5m
5	USB cable	Yes	1.8m
6	Mini HDMI cable	Yes	0.5m

Test Configuration: above 1GHz



Item	Connection	Shield	Length
1	Power cable	No	1.8m
2	ANT cable	Yes	0.3m
3	ANT cable	Yes	0.3m
4	Mini HDMI cable	Yes	0.5m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For a Low-power Radio-frequency Device which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

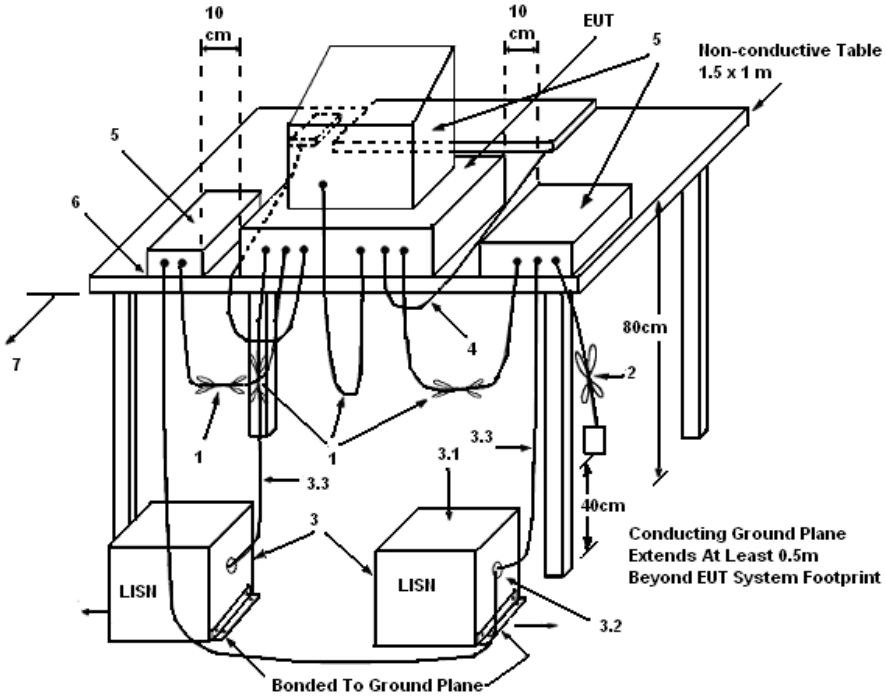
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

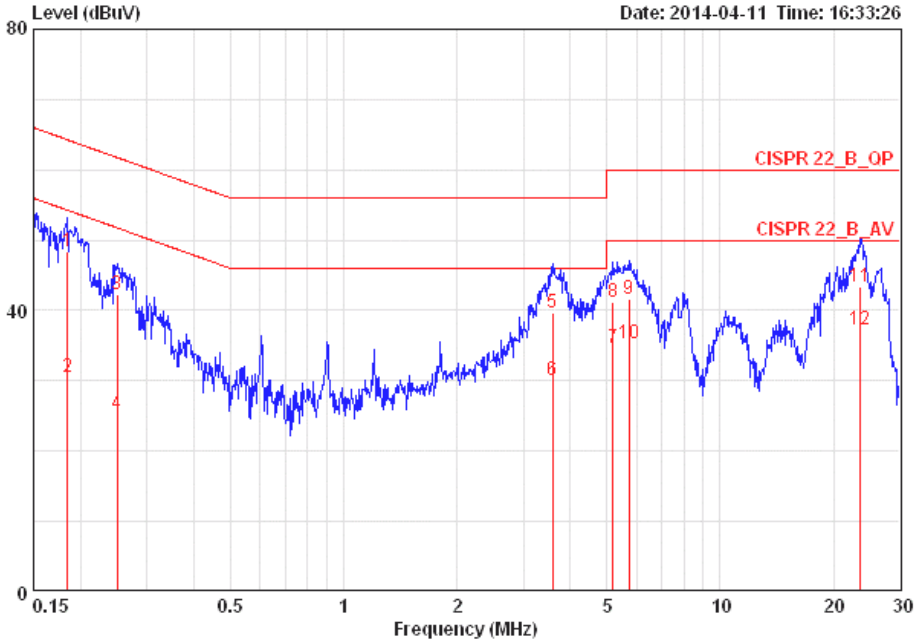
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

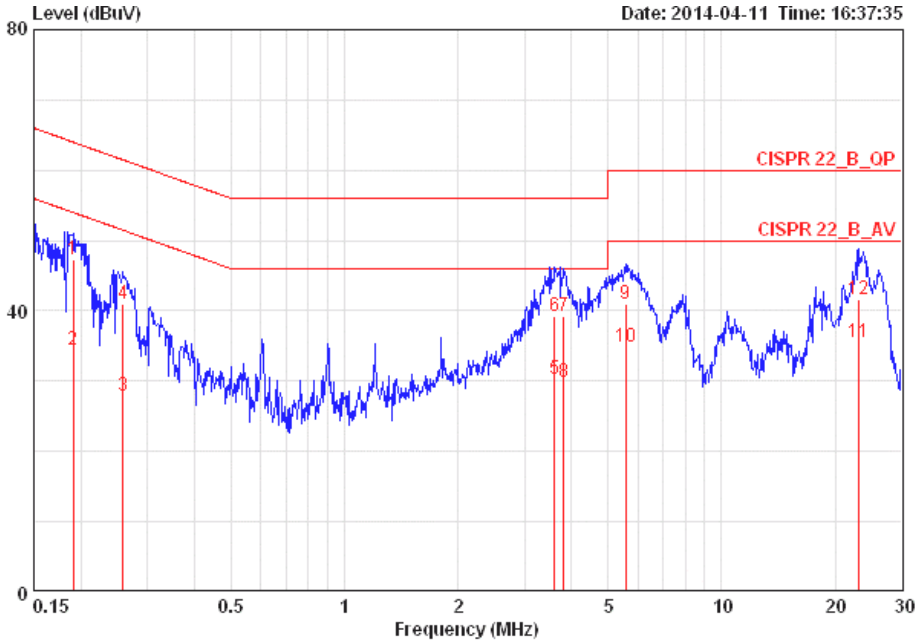
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	52%
Test Engineer	Hank Yang	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.18443	48.48	-15.80	64.28	0.15	48.17	0.16	LINE	QP
2	0.18443	30.55	-23.73	54.28	0.15	30.24	0.16	LINE	AVERAGE
3	0.25078	42.30	-19.43	61.73	0.15	41.98	0.17	LINE	QP
4	0.25078	25.38	-26.35	51.73	0.15	25.06	0.17	LINE	AVERAGE
5	3.584	39.70	-16.30	56.00	0.26	39.15	0.29	LINE	QP
6	3.584	30.02	-15.98	46.00	0.26	29.47	0.29	LINE	AVERAGE
7	5.194	34.59	-15.41	50.00	0.30	33.97	0.32	LINE	AVERAGE
8	5.194	41.26	-18.74	60.00	0.30	40.64	0.32	LINE	QP
9	5.713	41.54	-18.46	60.00	0.31	40.90	0.33	LINE	QP
10	5.713	35.27	-14.73	50.00	0.31	34.63	0.33	LINE	AVERAGE
11	23.636	43.31	-16.69	60.00	0.71	42.04	0.56	LINE	QP
12 @	23.636	37.22	-12.78	50.00	0.71	35.95	0.56	LINE	AVERAGE

Temperature	25°C	Humidity	52%
Test Engineer	Hank Yang	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.19039	47.32	-16.70	64.02	0.07	47.09	0.16	NEUTRAL	QP
2	0.19039	34.43	-19.59	54.02	0.07	34.20	0.16	NEUTRAL	AVERAGE
3	0.25888	27.94	-23.53	51.47	0.07	27.70	0.17	NEUTRAL	AVERAGE
4	0.25888	41.00	-20.47	61.47	0.07	40.76	0.17	NEUTRAL	QP
5	3.603	30.25	-15.75	46.00	0.13	29.83	0.29	NEUTRAL	AVERAGE
6	3.603	39.33	-16.67	56.00	0.13	38.91	0.29	NEUTRAL	QP
7	3.820	39.26	-16.74	56.00	0.13	38.84	0.30	NEUTRAL	QP
8	3.820	29.86	-16.14	46.00	0.13	29.44	0.30	NEUTRAL	AVERAGE
9	5.564	41.00	-19.00	60.00	0.17	40.50	0.33	NEUTRAL	QP
10	5.564	34.81	-15.19	50.00	0.17	34.31	0.33	NEUTRAL	AVERAGE
11	23.018	35.60	-14.40	50.00	0.57	34.48	0.55	NEUTRAL	AVERAGE
12	23.018	41.65	-18.35	60.00	0.57	40.53	0.55	NEUTRAL	QP

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the limit for peak output power is 1Watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21dBm). The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

4.2.2. Measuring Instruments and Setting

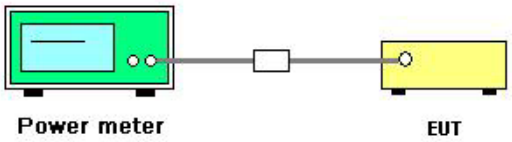
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

4.2.3. Test Procedures

This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

4.2.4. Test Setup Layout



4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Test Result of Maximum Conducted Output Power

Temperature	22°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	GFSK, π/4-DQPSK, 8DPSK
Test Date	Apr. 17, 2014		

For BR (GFSK) 1 Mbps:

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	4.96	21.00	Complies
39	2441 MHz	4.88	21.00	Complies
78	2480 MHz	4.26	21.00	Complies

For EDR (π/4-DQPSK) 2 Mbps:

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	4.20	21.00	Complies
39	2441 MHz	4.06	21.00	Complies
78	2480 MHz	3.39	21.00	Complies

For EDR (8DPSK) 3 Mbps:

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	4.19	21.00	Complies
39	2441 MHz	4.07	21.00	Complies
78	2480 MHz	3.46	21.00	Complies

4.3. Hopping Channel Separation Measurement

4.3.1. Limit

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.

4.3.2. Measuring Instruments and Setting

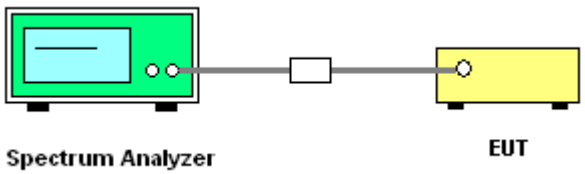
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
VBW	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilized for 20 dB bandwidth measurement.
3. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were utilized for channel separation measurement.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Hopping Channel Separation

Temperature	22°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	GFSK, π/4-DQPSK, 8DPSK

For BR (GFSK) 1 Mbps:

Frequency	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Ch. Separation (MHz)	Two-Thirds of 20dB Bandwidth (MHz)	Result
2402 MHz	1.0440	0.9200	1.00	0.696	Complies
2441 MHz	1.0440	0.9240	1.00	0.696	Complies
2480 MHz	1.0440	0.9240	1.00	0.696	Complies

Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

For EDR (π/4-DQPSK) 2 Mbps:

Frequency	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Ch. Separation (MHz)	Two-Thirds of 20dB Bandwidth (MHz)	Result
2402 MHz	1.3600	1.2000	1.00	0.907	Complies
2441 MHz	1.3560	1.2000	1.00	0.904	Complies
2480 MHz	1.3560	1.2000	1.00	0.904	Complies

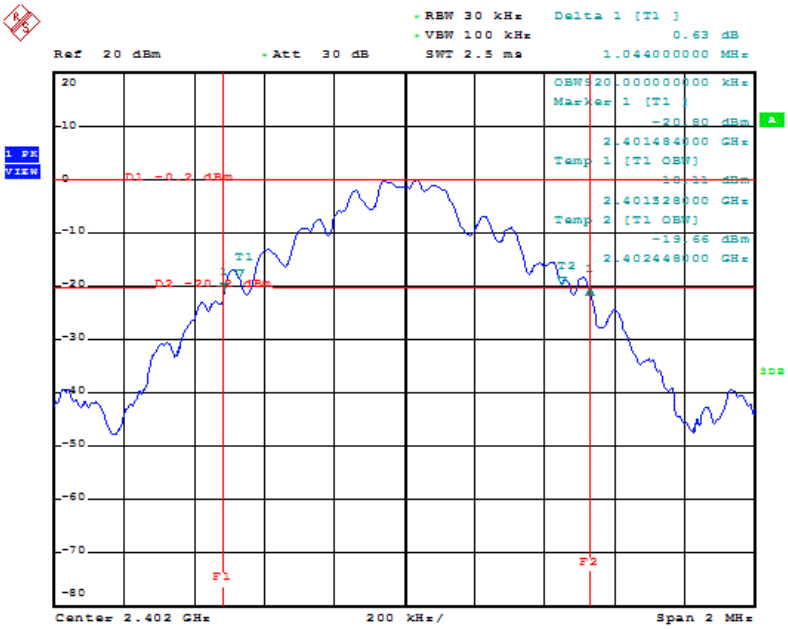
Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

For EDR (8DPSK) 3 Mbps:

Frequency	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Ch. Separation (MHz)	Two-Thirds of 20dB Bandwidth (MHz)	Result
2402 MHz	1.3040	1.1760	1.00	0.869	Complies
2441 MHz	1.3040	1.1800	1.00	0.869	Complies
2480 MHz	1.3040	1.1800	1.00	0.869	Complies

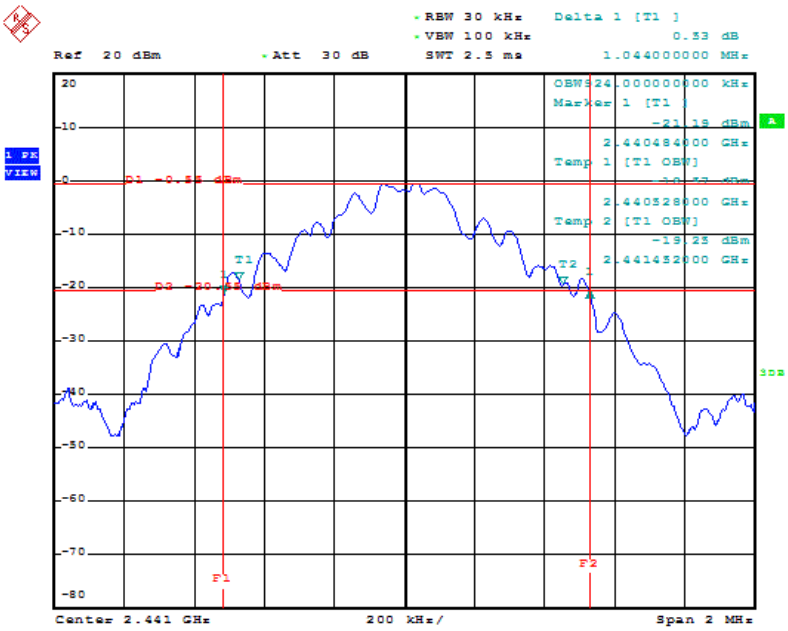
Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 0 / 2402 MHz



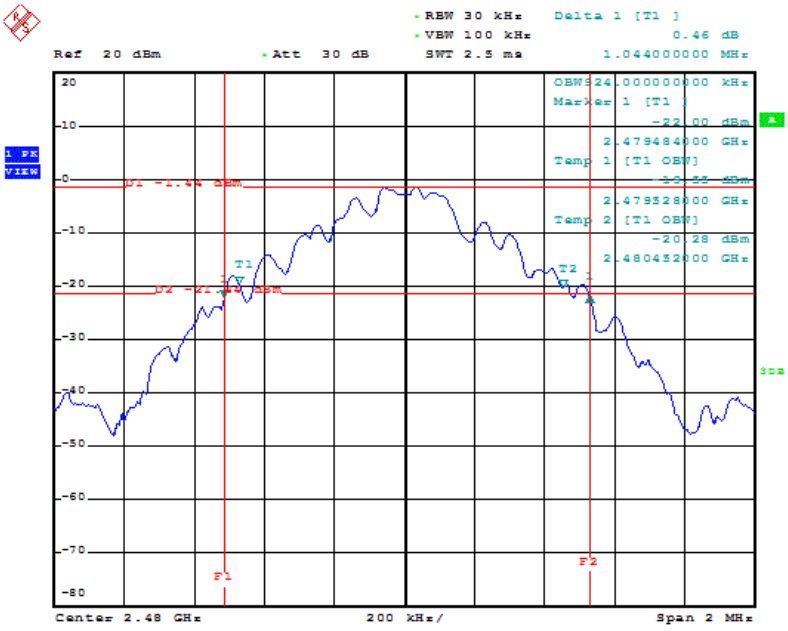
Date: 17.APR.2014 21:24:24

20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 39 / 2441 MHz



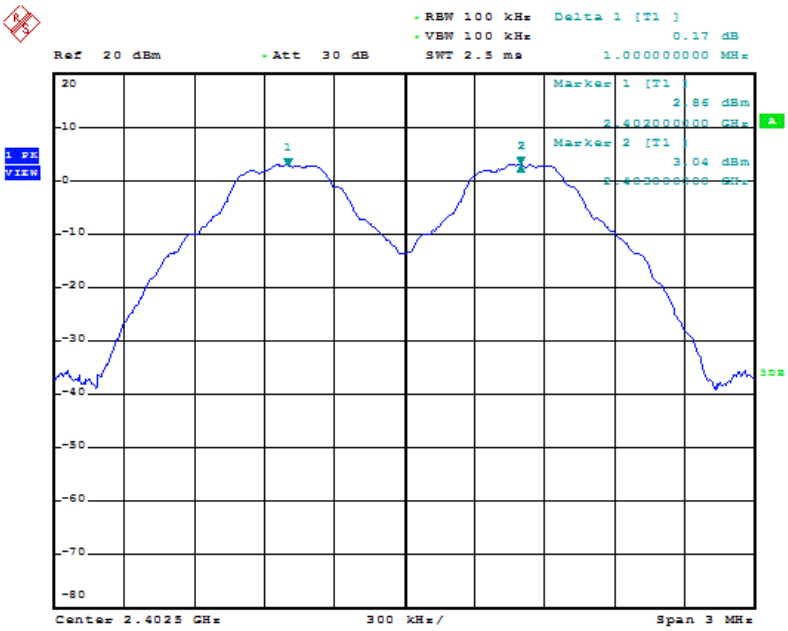
Date: 17.APR.2014 21:25:46

20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 78 / 2480 MHz



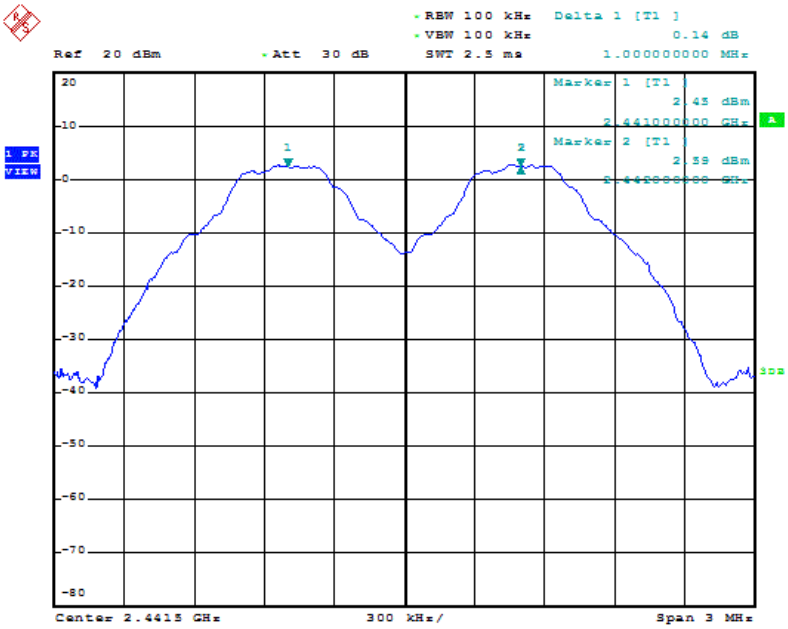
Date: 17.APR.2014 21:26:53

Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



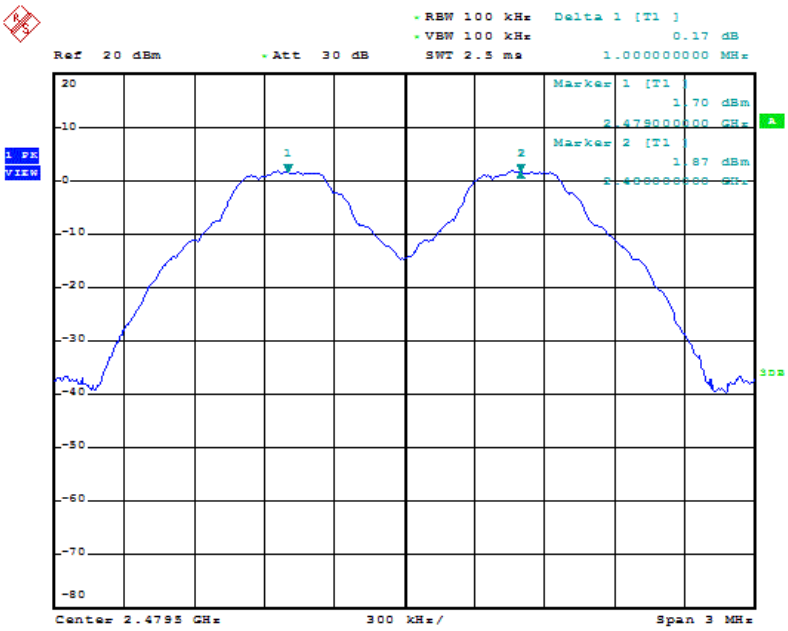
Date: 17.APR.2014 21:31:13

Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



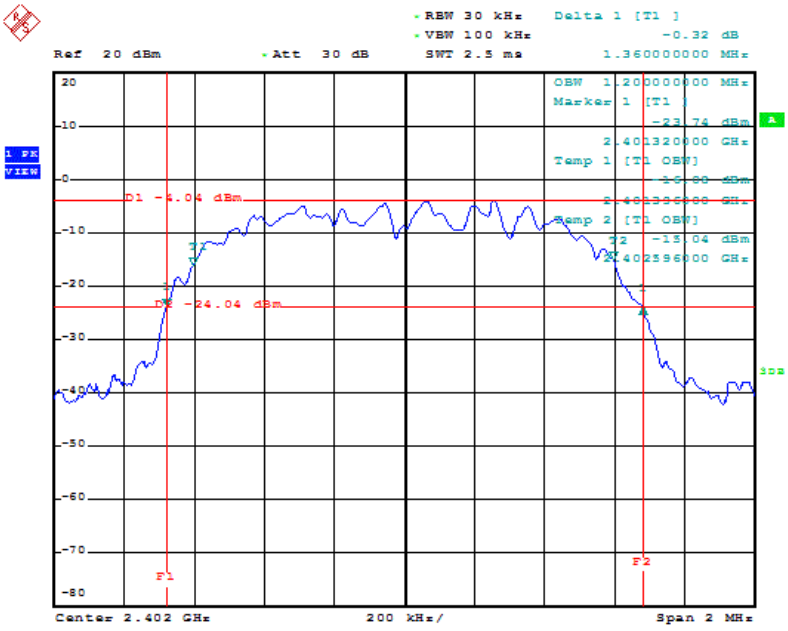
Date: 17.APR.2014 21:32:31

Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



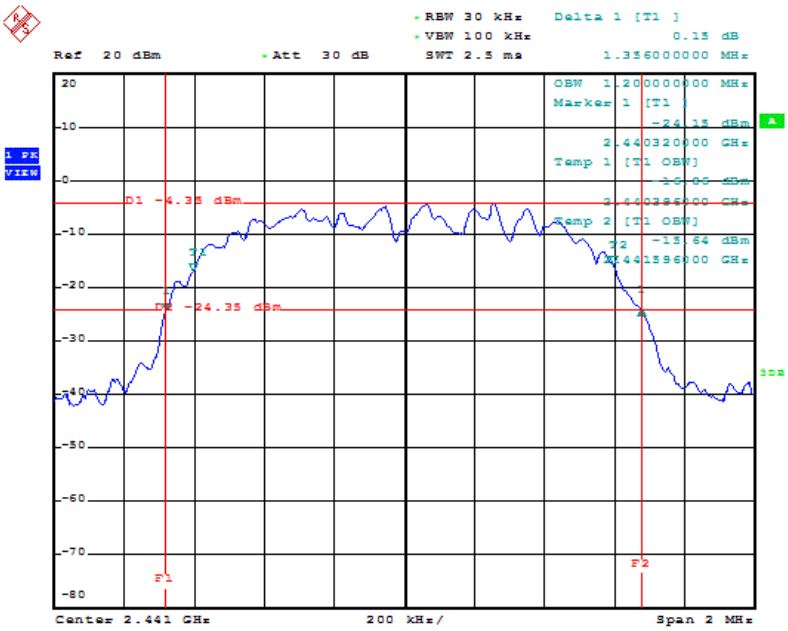
Date: 17.APR.2014 21:33:30

20 dB Bandwidth Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 0 / 2402 MHz



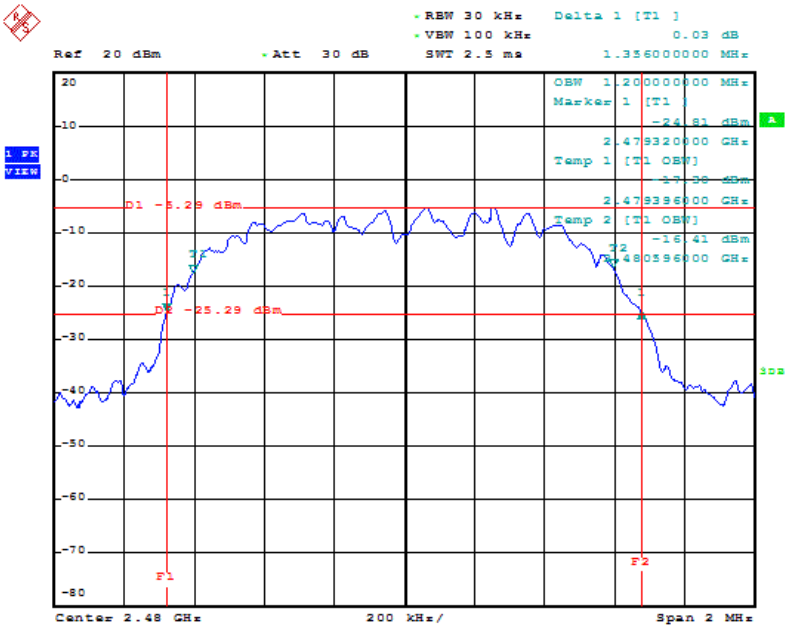
Date: 17.APR.2014 21:22:54

20 dB Bandwidth Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 39 / 2441 MHz



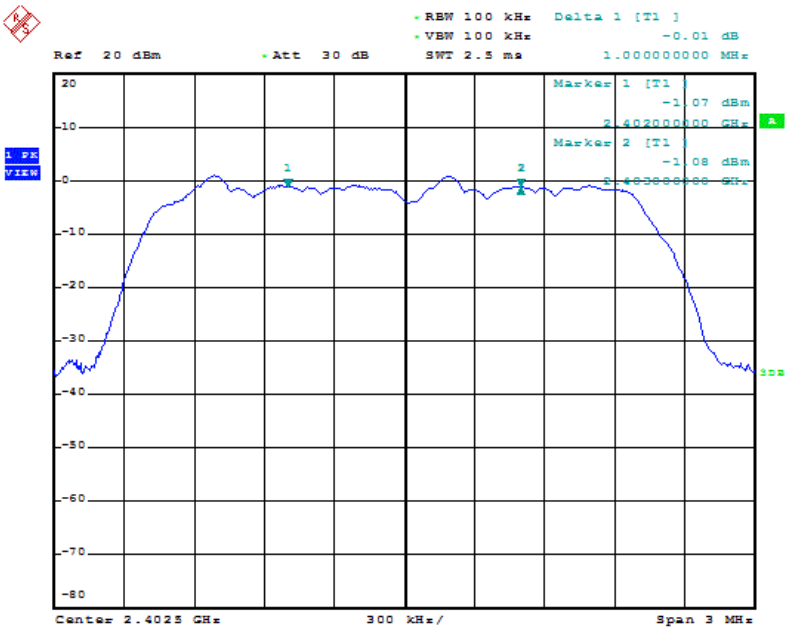
Date: 17.APR.2014 21:21:39

20 dB Bandwidth Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 78 / 2480 MHz



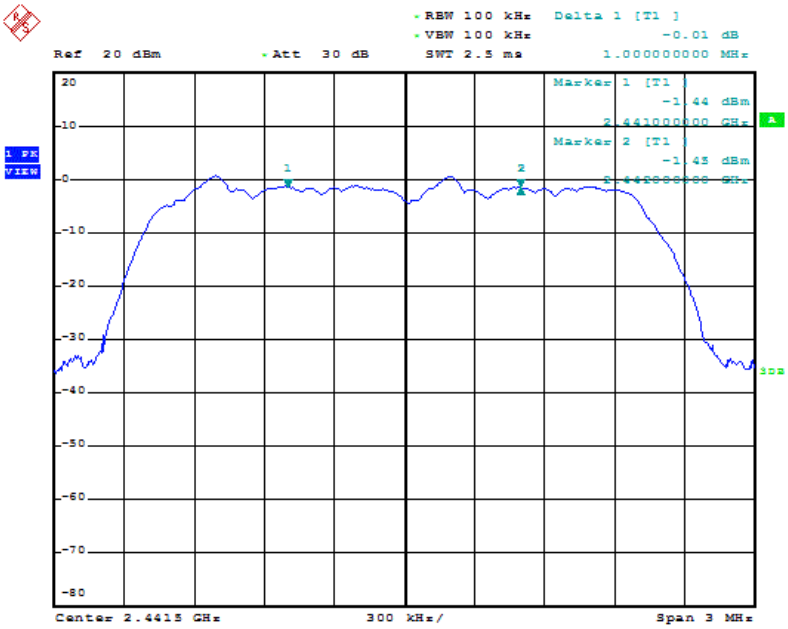
Date: 17.APR.2014 21:19:27

Channel Separation Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



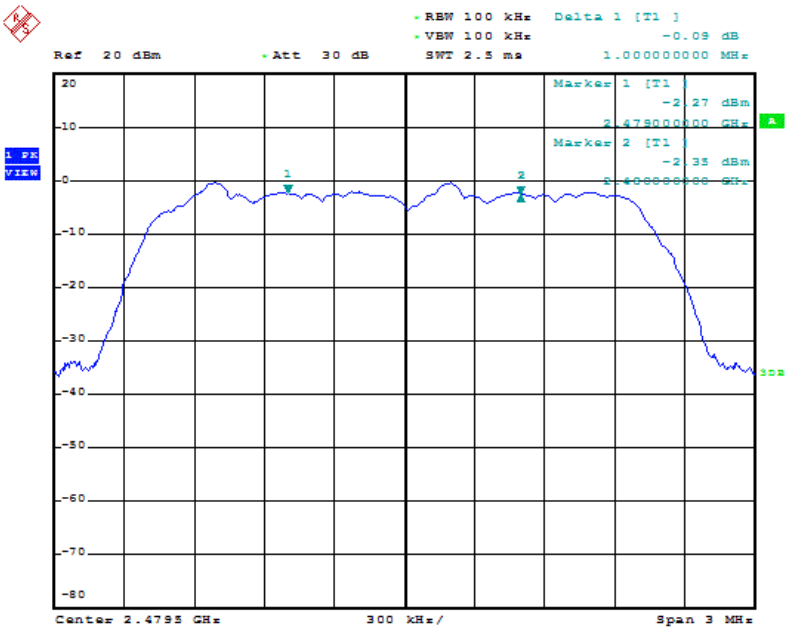
Date: 17.APR.2014 21:37:11

Channel Separation Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



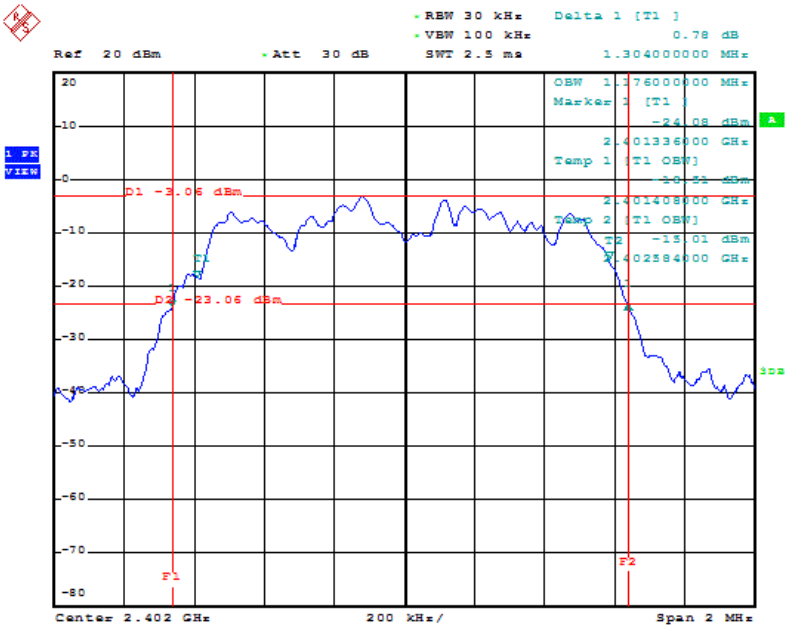
Date: 17.APR.2014 21:36:17

Channel Separation Plot on EDR (π/4-DQPSK) 2 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



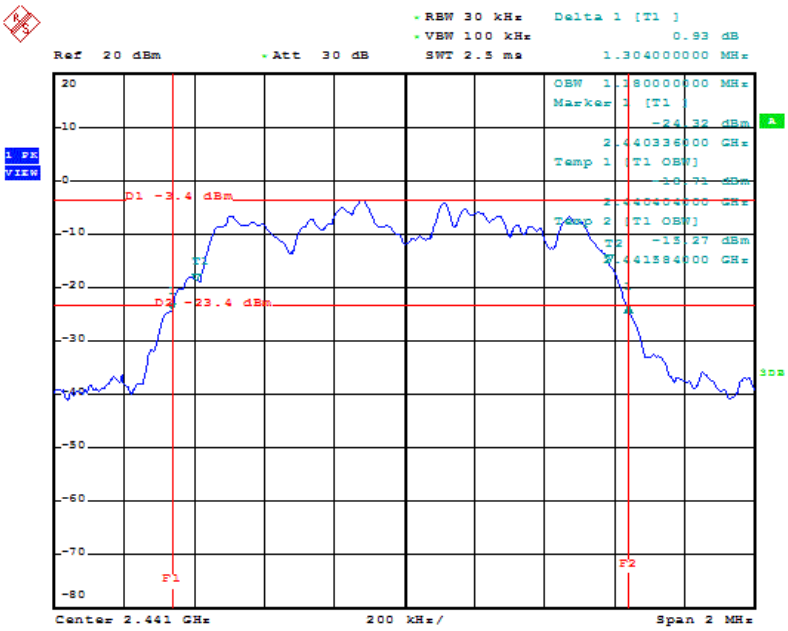
Date: 17.APR.2014 21:35:23

20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 0 / 2402 MHz



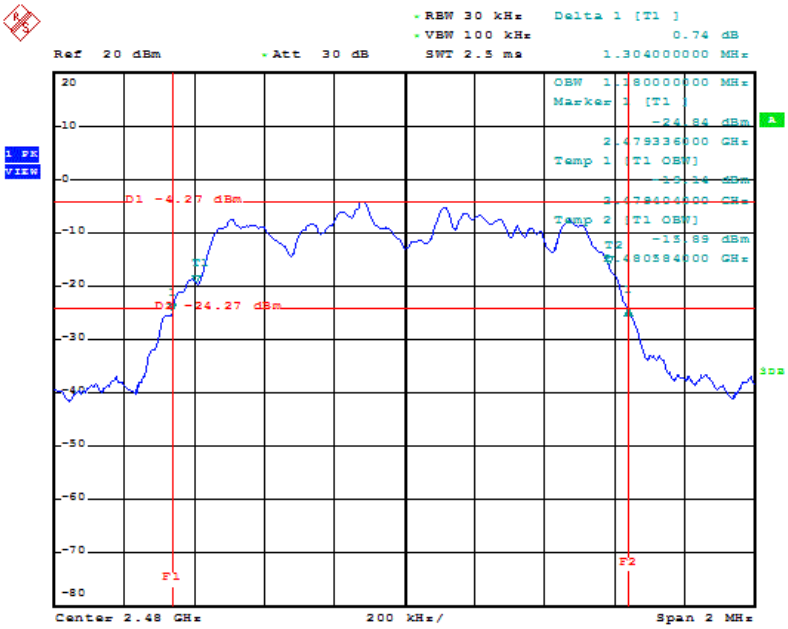
Date: 17.APR.2014 21:14:42

20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 39 / 2441 MHz



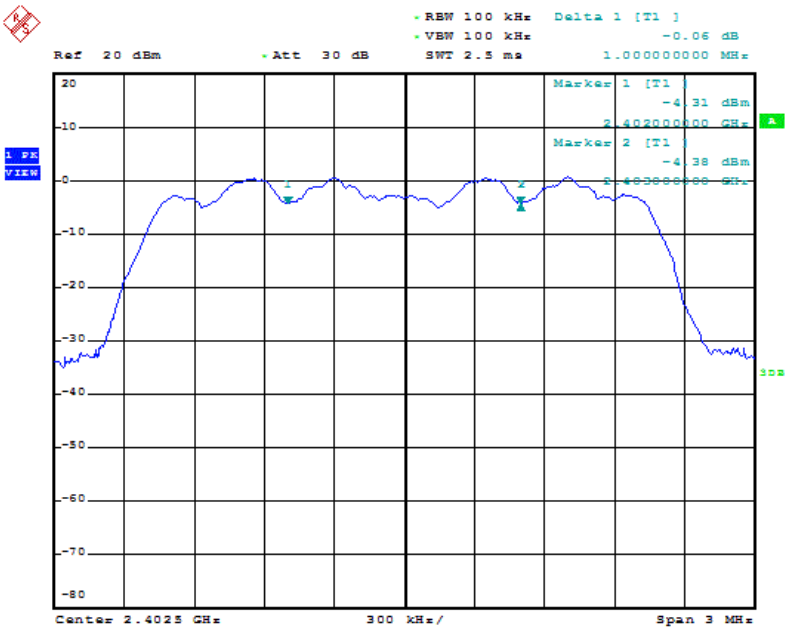
Date: 17.APR.2014 21:16:38

20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 78 / 2480 MHz



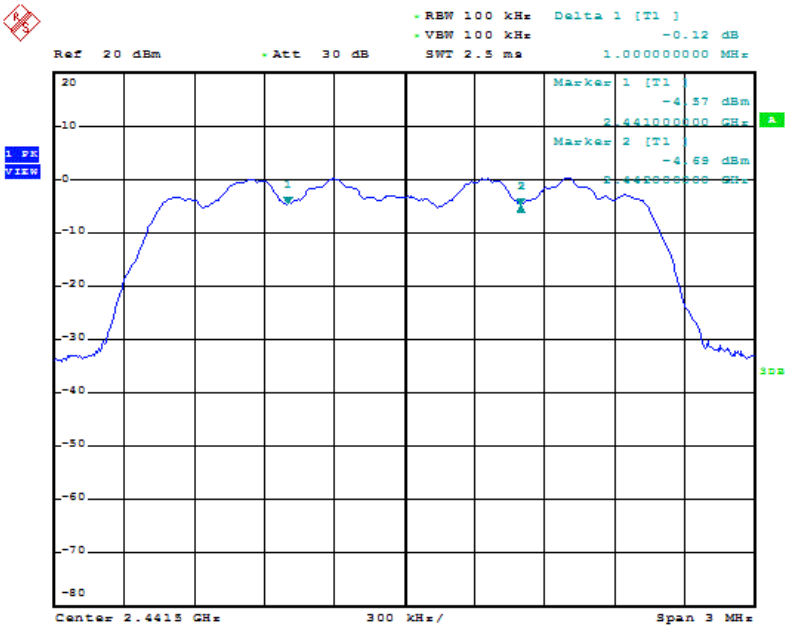
Date: 17.APR.2014 21:17:53

Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



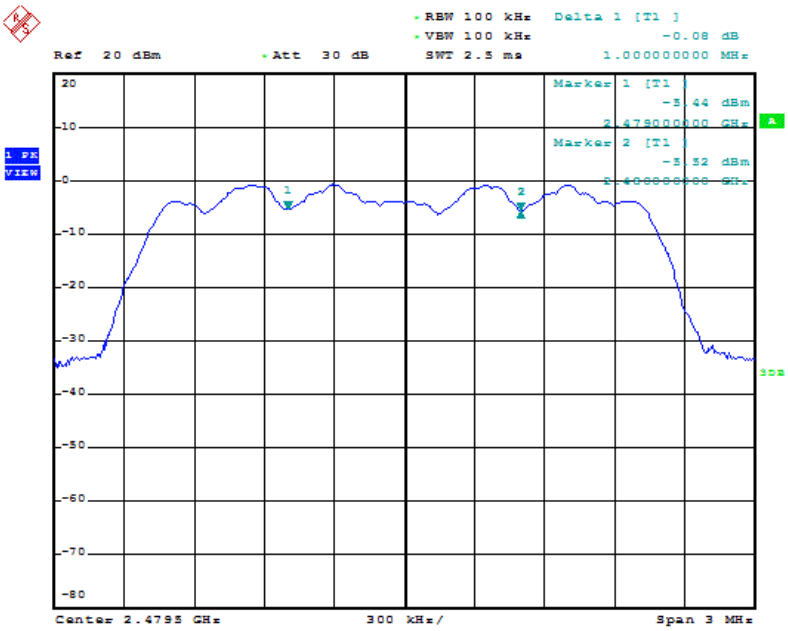
Date: 17.APR.2014 21:38:06

Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



Date: 17.APR.2014 21:38:47

Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



Date: 17.APR.2014 21:39:49

4.4. Number of Hopping Frequency Measurement

4.4.1. Limit

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

4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RBW	1000 kHz
VBW	1000 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 1000 kHz and the video bandwidth of 1000 kHz were utilized.
3. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.

4.4.4. Test Setup Layout

4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

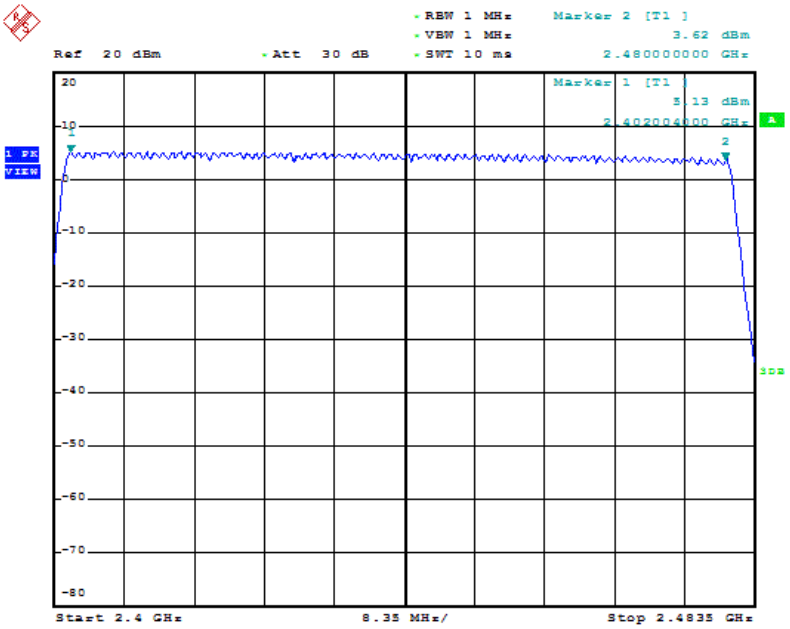
The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Number of Hopping Frequency

Temperature	22°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	BR (GFSK)

Modulation Type	Channel No.	Frequency (MHz)	Hopping Ch. (Channels)	Min. Limit (Channels)	Test Result
BR (GFSK)	0 ~ 78	2402 ~ 2480MHz	79	15	Complies

Number of Hopping Channel Plot on BR (GFSK) / Channel 0~78 / 2402 MHz ~ 2480 MHz



4.5. Dwell Time Measurement

4.5.1. Limit

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.

4.5.2. Measuring Instruments and Setting

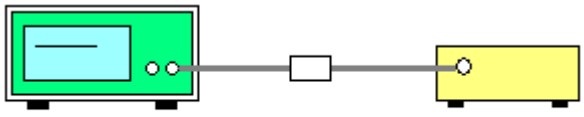
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	0 MHz
RBW	1000 kHz
VBW	1000 kHz
Detector	Peak
Trace	Single Trigger

4.5.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer
2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.
3. Use a video trigger with the trigger level set to enable triggering only on full pulses.
4. Sweep Time is more than once pulse time.
5. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
6. Measure the maximum time duration of one single pulse.
7. Set the EUT for DH1, DH3, DH5 packet transmitting.
8. Measure the maximum time duration of one single pulse.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Dwell Time

Temperature	22°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	BR (GFSK) / DH1, DH3, DH5

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402 MHz	2.8900	0.3083	0.4000	Complies
DH3	2402 MHz	1.6400	0.2624	0.4000	Complies
DH1	2402 MHz	0.3900	0.1248	0.4000	Complies
DH5	2441 MHz	2.8900	0.3083	0.4000	Complies
DH3	2441 MHz	1.6400	0.2624	0.4000	Complies
DH1	2441 MHz	0.3900	0.1248	0.4000	Complies
DH5	2480 MHz	2.8900	0.3083	0.4000	Complies
DH3	2480 MHz	1.6400	0.2624	0.4000	Complies
DH1	2480 MHz	0.3900	0.1248	0.4000	Complies

Note: Pulse Duration * Number of Pulses*(Dwell time / measure time)

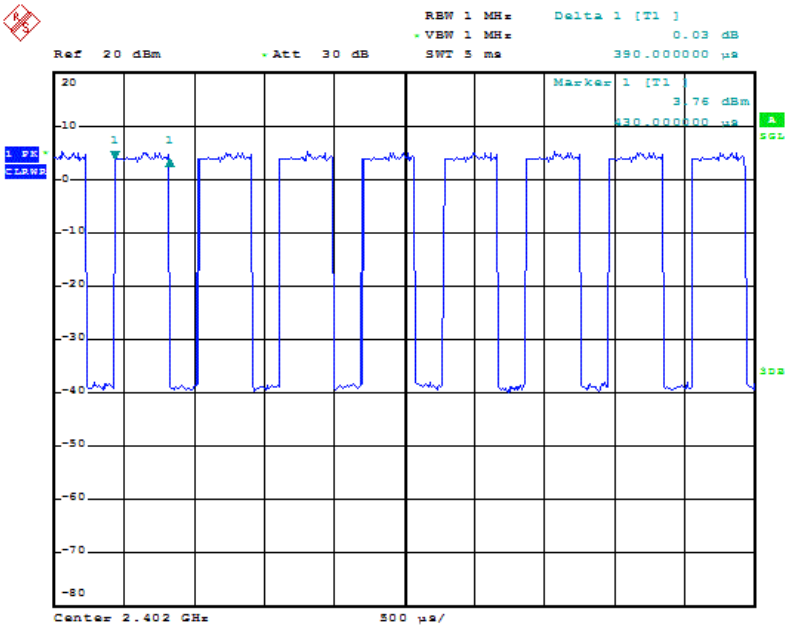
Remark:

Dwell Time=79(channels) x 0.4(s) x average hopping channel x package transfer time (us)

79 channels come from the Hopping Channel number.

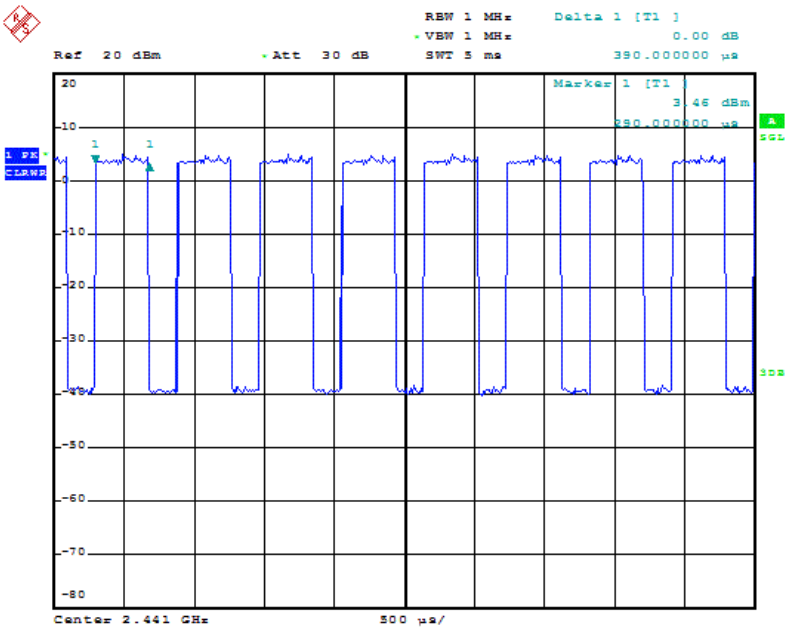
Average Hopping Channel = hops / sweep time

Dwell Time Plot on BR (GFSK) / Channel 0 / DH1 / 2402 MHz



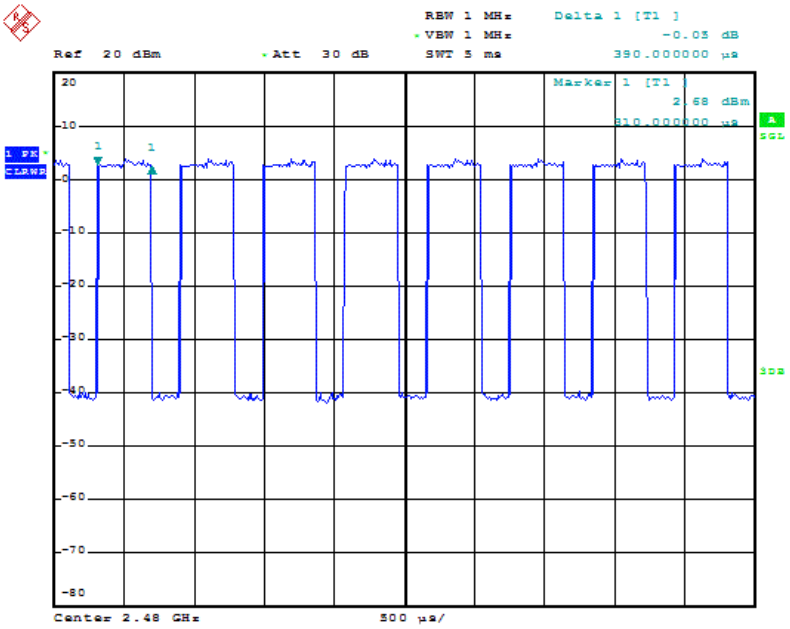
Date: 17.APR.2014 21:46:04

Dwell Time Plot on BR (GFSK) / Channel 39 / DH1 / 2441 MHz



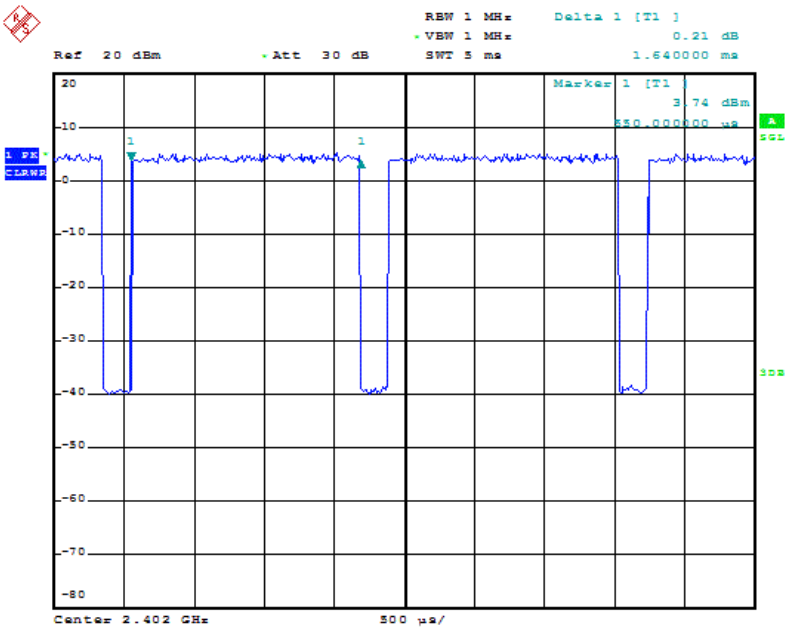
Date: 17.APR.2014 21:46:49

Dwell Time Plot on BR (GFSK) / Channel 78 / DH1 / 2480 MHz



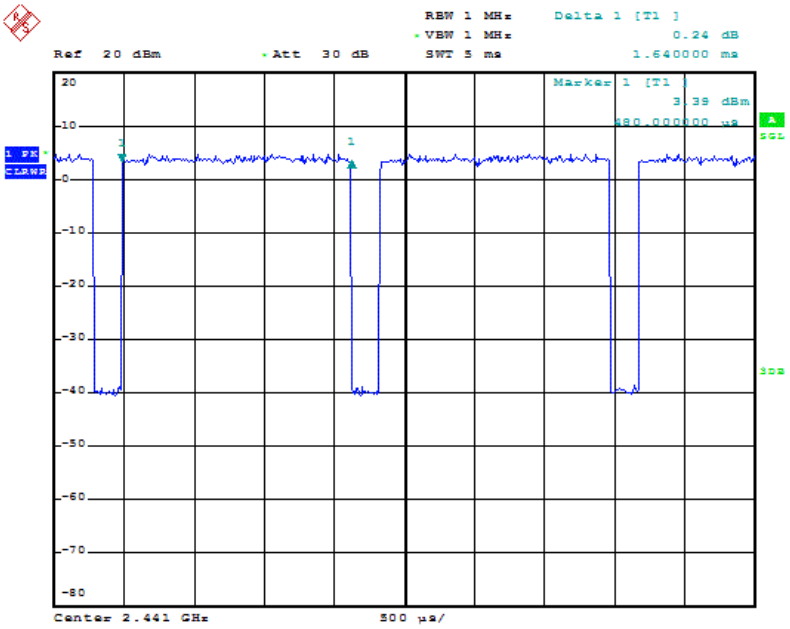
Date: 17.APR.2014 21:52:10

Dwell Time Plot on BR (GFSK) / Channel 0 / DH3 / 2402 MHz



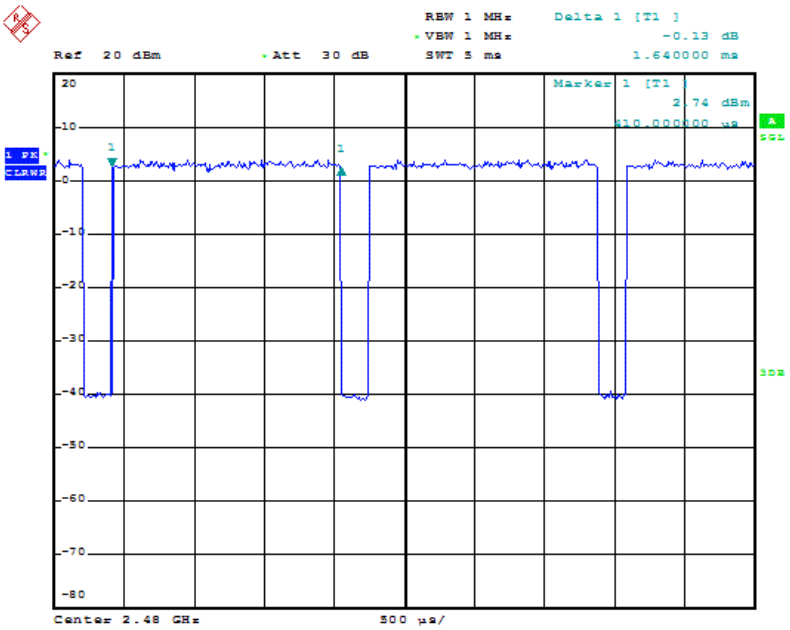
Date: 17.APR.2014 21:45:14

Dwell Time Plot on BR (GFSK) / Channel 39 / DH3 / 2441 MHz



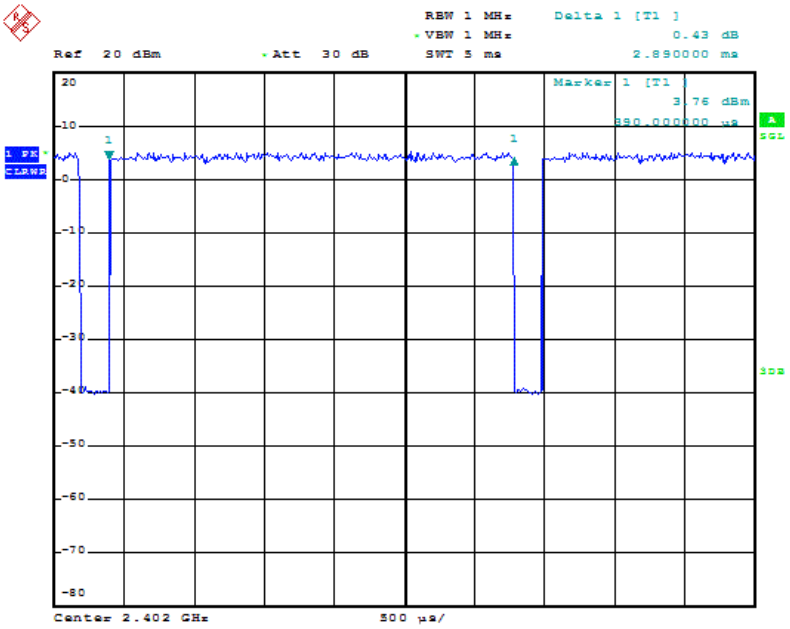
Date: 17.APR.2014 21:47:44

Dwell Time Plot on BR (GFSK) / Channel 78 / DH3 / 2480 MHz



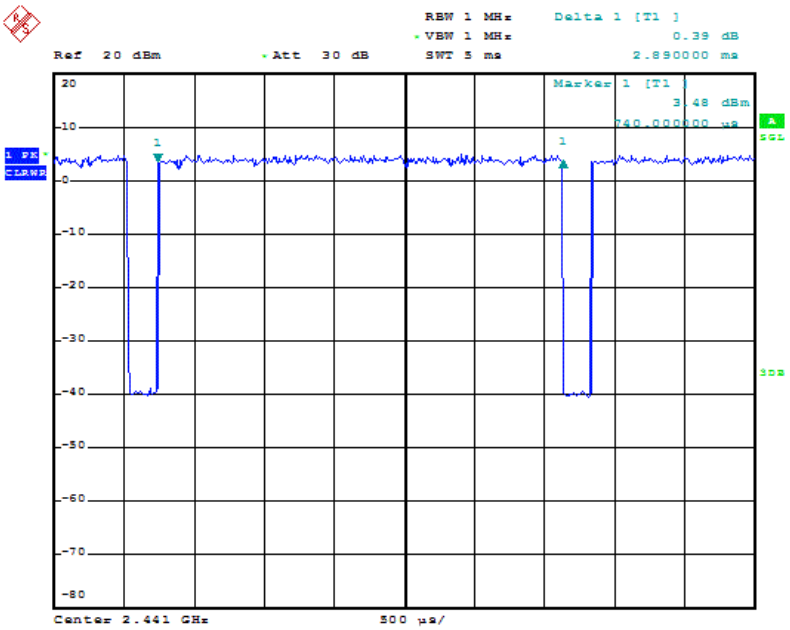
Date: 17.APR.2014 21:51:26

Dwell Time Plot on BR (GFSK) / Channel 0 / DH5 / 2402 MHz



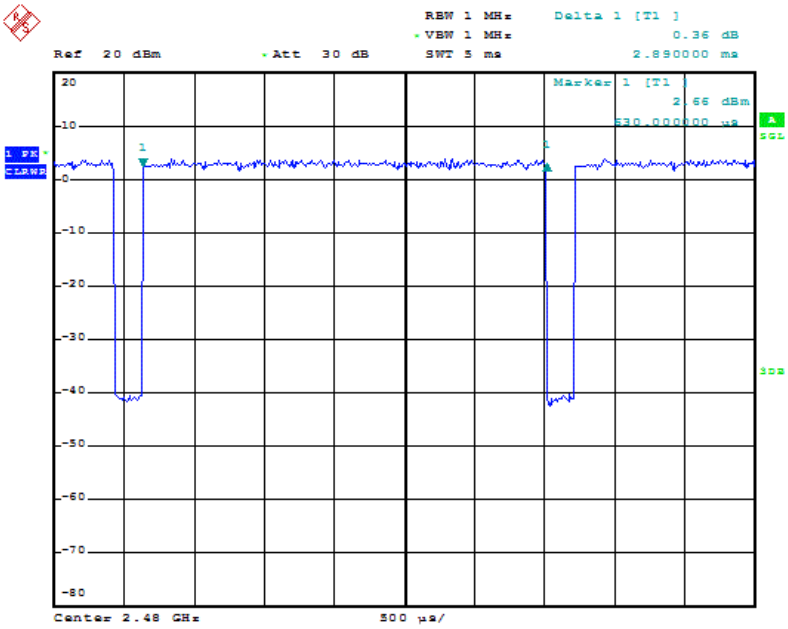
Date: 17.APR.2014 21:44:18

Dwell Time Plot on BR (GFSK) / Channel 39 / DH5 / 2441 MHz



Date: 17.APR.2014 21:50:10

Dwell Time Plot on BR (GFSK) / Channel 78 / DH5 / 2480 MHz



Date: 17.APR.2014 21:51:00

4.6. Radiated Emissions Measurement

4.6.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

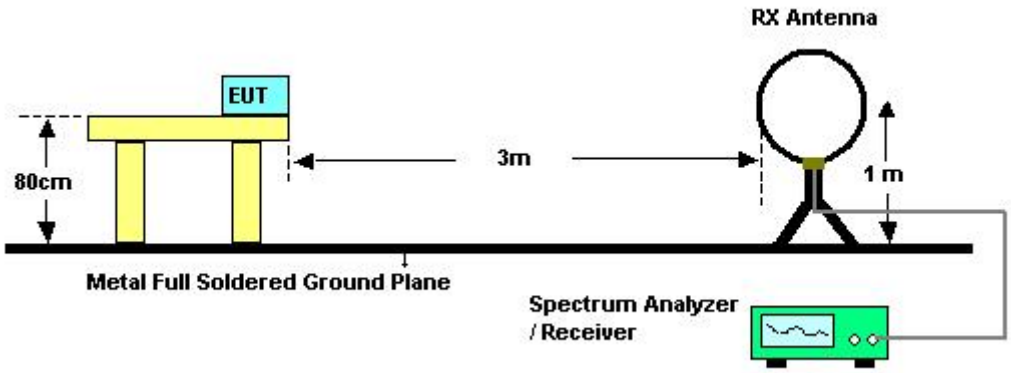
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.6.3. Test Procedures

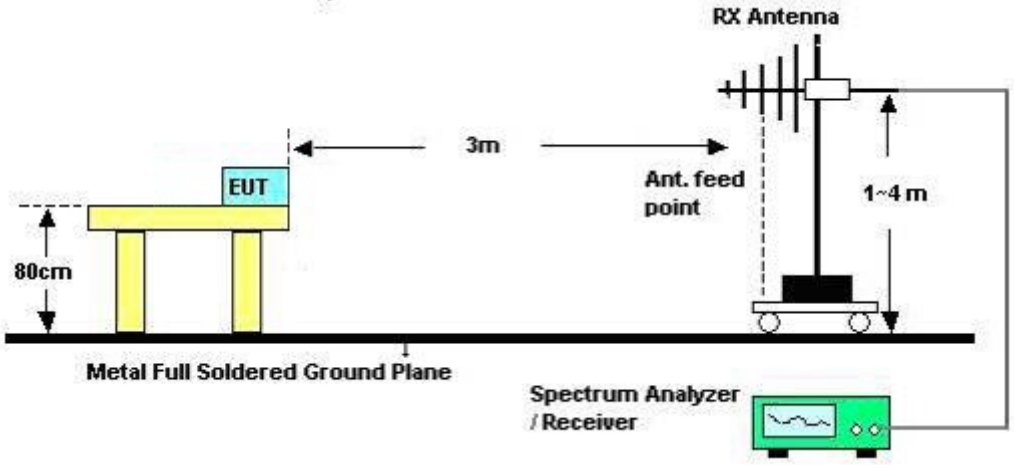
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.6.4. Test Setup Layout

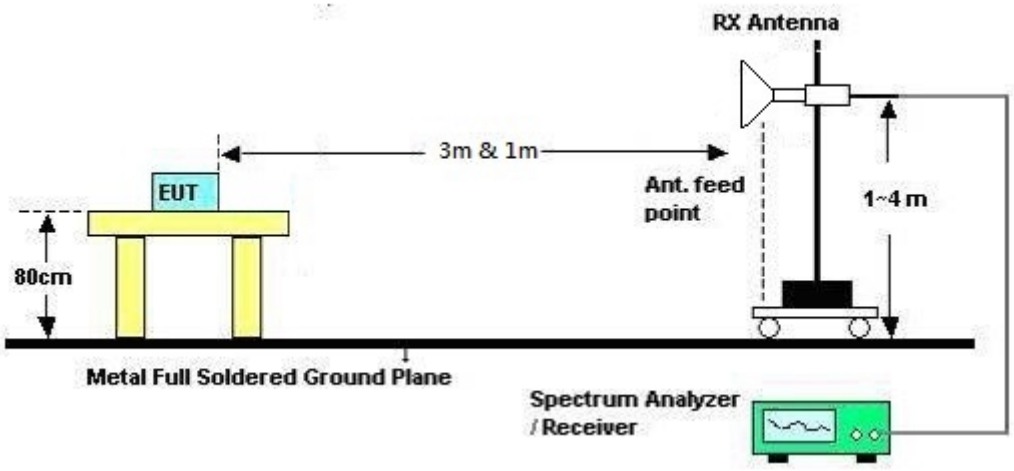
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.6.7. Results of Radiated Emissions (9kHz~30MHz)

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	Normal Link
Test Date	Apr. 19, 2014	Test Mode	Mode 1

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

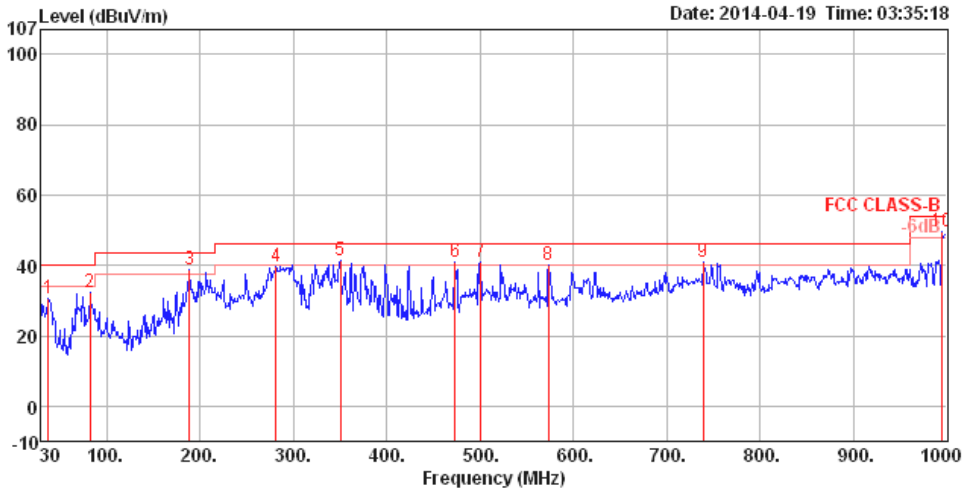
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

4.6.8. Results of Radiated Emissions (30MHz~1GHz)

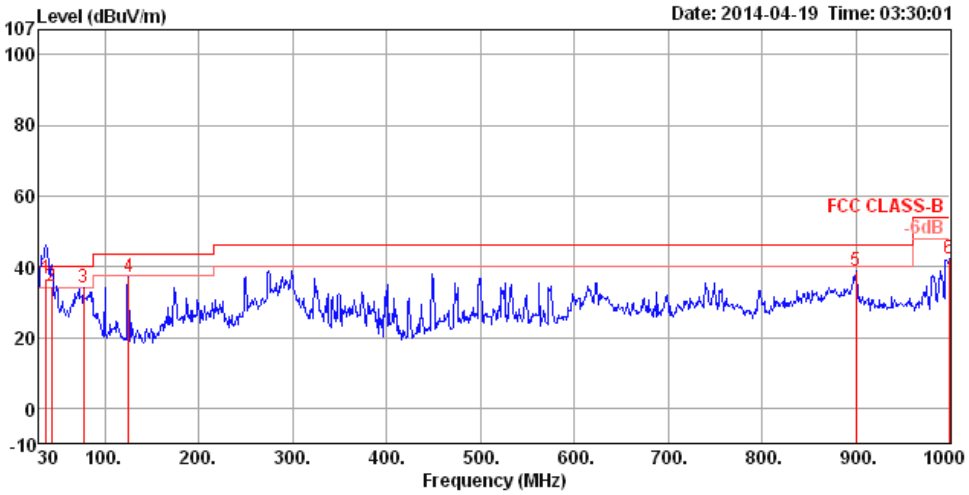
Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	37.76	30.69	40.00	-9.31	48.07	0.72	13.78	31.88	100	28	HORIZONTAL	Peak
2	82.38	32.23	40.00	-7.77	55.74	1.06	7.13	31.70	300	194	HORIZONTAL	Peak
3	189.08	38.64	43.50	-4.86	60.07	1.65	8.42	31.50	150	36	HORIZONTAL	Peak
4	281.23	39.76	46.00	-6.24	56.72	2.03	12.56	31.55	150	352	HORIZONTAL	Peak
5	350.10	41.51	46.00	-4.49	56.21	2.31	14.33	31.34	100	124	HORIZONTAL	Peak
6	473.29	40.94	46.00	-5.06	52.73	2.71	16.73	31.23	200	168	HORIZONTAL	Peak
7	500.45	40.75	46.00	-5.25	52.42	2.82	16.92	31.41	200	258	HORIZONTAL	Peak
8	573.20	40.30	46.00	-5.70	50.10	3.02	18.38	31.20	200	213	HORIZONTAL	Peak
9	739.07	40.80	46.00	-5.20	49.01	3.48	19.66	31.35	125	132	HORIZONTAL	Peak
10	995.15	49.45	54.00	-4.55	55.03	4.20	21.38	31.16	100	170	HORIZONTAL	Peak

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	37.76	36.83	40.00	-3.17	54.21	0.72	13.78	31.88	100	167	VERTICAL	QP
2	43.58	34.56	40.00	-5.44	55.37	0.78	10.25	31.84	100	224	VERTICAL	QP
3	77.53	34.13	40.00	-5.87	58.27	1.03	6.53	31.70	125	256	VERTICAL	Peak
4	125.06	37.02	43.50	-6.48	55.53	1.33	11.73	31.57	100	304	VERTICAL	Peak
5	900.09	38.84	46.00	-7.16	45.44	3.97	20.64	31.21	150	184	VERTICAL	Peak
6	999.03	42.39	54.00	-11.61	47.93	4.21	21.43	31.18	150	253	VERTICAL	Peak

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.6.9. Results for Radiated Emissions (1GHz~10th Harmonic)

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	BR (GFSK) / Channel 0
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4803.68	32.14	54.00	-21.86	29.03	5.66	32.74	35.29	100	212	HORIZONTAL	Average
2	4803.95	44.75	74.00	-29.25	41.64	5.66	32.74	35.29	100	212	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4803.27	32.28	54.00	-21.72	29.17	5.66	32.74	35.29	100	223	VERTICAL	Average
2	4803.93	45.85	74.00	-28.15	42.74	5.66	32.74	35.29	100	223	VERTICAL	Peak

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	BR (GFSK) / Channel 39
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4882.40	44.36	74.00	-29.64	41.11	5.76	32.81	35.32	100	22	HORIZONTAL	Peak
2	4882.55	32.34	54.00	-21.66	29.09	5.76	32.81	35.32	100	22	HORIZONTAL	Average
3	7324.98	38.44	54.00	-15.56	29.60	7.06	37.13	35.35	100	164	HORIZONTAL	Average
4	7325.26	50.01	74.00	-23.99	41.17	7.06	37.13	35.35	100	164	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.95	32.32	54.00	-21.68	29.09	5.75	32.80	35.32	100	182	VERTICAL	Average
2	4881.37	44.38	74.00	-29.62	41.13	5.76	32.81	35.32	100	182	VERTICAL	Peak
3	7322.41	50.90	74.00	-23.10	42.06	7.06	37.13	35.35	100	307	VERTICAL	Peak
4	7325.34	38.62	54.00	-15.38	29.78	7.06	37.13	35.35	100	307	VERTICAL	Average

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	BR (GFSK) / Channel 78
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4961.19	45.54	74.00	-28.46	42.17	5.85	32.87	35.35	100	307	HORIZONTAL	Peak
2	4961.56	32.23	54.00	-21.77	28.86	5.85	32.87	35.35	100	307	HORIZONTAL	Average
3	7437.96	52.00	74.00	-22.00	43.01	7.11	37.17	35.29	100	265	HORIZONTAL	Peak
4	7440.14	38.70	54.00	-15.30	29.70	7.11	37.17	35.28	100	265	HORIZONTAL	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4960.55	44.48	74.00	-29.52	41.11	5.85	32.87	35.35	100	167	VERTICAL	Peak
2	4962.47	32.33	54.00	-21.67	28.96	5.85	32.87	35.35	100	167	VERTICAL	Average
3	7440.12	38.53	54.00	-15.47	29.53	7.11	37.17	35.28	100	214	VERTICAL	Average
4	7441.59	51.63	74.00	-22.37	42.63	7.11	37.17	35.28	100	214	VERTICAL	Peak

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	EDR (8DPSK) / Channel 0
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4802.36	44.63	74.00	-29.37	41.52	5.66	32.74	35.29	100	278	HORIZONTAL	Peak
2	4805.99	31.72	54.00	-22.28	28.61	5.66	32.74	35.29	100	278	HORIZONTAL	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4801.53	32.20	54.00	-21.80	29.09	5.66	32.74	35.29	100	343	VERTICAL	Average
2	4806.08	44.68	74.00	-29.32	41.57	5.66	32.74	35.29	100	343	VERTICAL	Peak

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	EDR (8DPSK) / Channel 39
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.86	32.17	54.00	-21.83	28.94	5.75	32.80	35.32	100	206	HORIZONTAL	Average
2	4880.49	44.46	74.00	-29.54	41.22	5.76	32.80	35.32	100	206	HORIZONTAL	Peak
3	7322.68	50.43	74.00	-23.57	41.59	7.06	37.13	35.35	100	206	HORIZONTAL	Peak
4	7324.75	38.02	54.00	-15.98	29.18	7.06	37.13	35.35	100	206	HORIZONTAL	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4880.75	32.00	54.00	-22.00	28.76	5.76	32.80	35.32	100	172	VERTICAL	Average
2	4882.33	44.27	74.00	-29.73	41.02	5.76	32.81	35.32	100	172	VERTICAL	Peak
3	7323.78	50.19	74.00	-23.81	41.35	7.06	37.13	35.35	100	172	VERTICAL	Peak
4	7325.37	38.24	54.00	-15.76	29.40	7.06	37.13	35.35	100	172	VERTICAL	Average

Temperature	24°C	Humidity	54%
Test Engineer	Nick Peng	Configurations	EDR (8DPSK) / Channel 78
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4961.84	32.40	54.00	-21.60	29.03	5.85	32.87	35.35	100	82	HORIZONTAL	Average
2	4962.23	44.29	74.00	-29.71	40.92	5.85	32.87	35.35	100	82	HORIZONTAL	Peak
3	7439.51	38.73	54.00	-15.27	29.74	7.11	37.17	35.29	100	123	HORIZONTAL	Average
4	7440.63	50.56	74.00	-23.44	41.56	7.11	37.17	35.28	100	123	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4958.39	44.61	74.00	-29.39	41.24	5.85	32.87	35.35	100	234	VERTICAL	Peak
2	4959.88	32.12	54.00	-21.88	28.75	5.85	32.87	35.35	100	234	VERTICAL	Average
3	7437.92	50.40	74.00	-23.60	41.41	7.11	37.17	35.29	100	185	VERTICAL	Peak
4	7439.01	38.47	54.00	-15.53	29.48	7.11	37.17	35.29	100	185	VERTICAL	Average

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.7. Emissions Measurement

4.7.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

4.7.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100 kHz /100 kHz for Peak

4.7.3. Test Procedures

For Radiated band edges Measurement:

1. The test procedure is the same as section 4.6.3, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

1. The radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
   Only worst data of each operating mode is presented.

4.7.4. Test Setup Layout

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.6.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.6.4.

4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.7.7. Test Result of Band Edge and Fundamental Emissions

Temperature	24℃	Humidity	54%
Test Engineer	Nick Peng	Configurations	BR (GFSK) / Channel 0, 39, 78
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2362.00	45.05	54.00	-8.95	13.49	3.66	27.90	0.00	146	87	HORIZONTAL	Average
2	2362.00	57.55	74.00	-16.45	25.99	3.66	27.90	0.00	146	87	HORIZONTAL	Peak
3	2401.90	104.59			73.00	3.69	27.90	0.00	146	87	HORIZONTAL	Peak
4	2402.00	103.80			72.21	3.69	27.90	0.00	146	87	HORIZONTAL	Average

Item 3, 4 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2360.80	42.48	54.00	-11.52	10.92	3.66	27.90	0.00	173	80	HORIZONTAL	Average
2	2360.80	58.37	74.00	-15.63	26.81	3.66	27.90	0.00	173	80	HORIZONTAL	Peak
3	2441.00	105.03			73.42	3.71	27.90	0.00	173	80	HORIZONTAL	Average
4	2441.00	105.88			74.27	3.71	27.90	0.00	173	80	HORIZONTAL	Peak
5	2492.90	41.37	54.00	-12.63	9.73	3.74	27.90	0.00	173	80	HORIZONTAL	Average
6	2492.90	57.56	74.00	-16.44	25.92	3.74	27.90	0.00	173	80	HORIZONTAL	Peak

Item 3, 4 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2480.00	103.45			71.82	3.73	27.90	0.00	136	84	HORIZONTAL	Average
2	2480.00	104.17			72.54	3.73	27.90	0.00	136	84	HORIZONTAL	Peak
3	2483.50	39.84	54.00	-14.16	8.21	3.73	27.90	0.00	136	84	HORIZONTAL	Average
4	2484.70	57.04	74.00	-16.96	25.41	3.73	27.90	0.00	136	84	HORIZONTAL	Peak

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Temperature	24℃	Humidity	54%
Test Engineer	Nick Peng	Configurations	EDR (8DPSK) / Channel 0, 39, 78
Test Date	Apr. 08, 2014	Test Mode	Mode 1

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2361.90	58.24	74.00	-15.76	26.68	3.66	27.90	0.00	143	87	HORIZONTAL	Peak
2	2362.00	43.01	54.00	-10.99	11.45	3.66	27.90	0.00	143	87	HORIZONTAL	Average
3	2402.00	101.65			70.06	3.69	27.90	0.00	143	87	HORIZONTAL	Average
4	2402.00	105.48			73.89	3.69	27.90	0.00	143	87	HORIZONTAL	Peak

Item 3, 4 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2361.00	44.00	54.00	-10.00	12.44	3.66	27.90	0.00	146	273	HORIZONTAL	Average
2	2361.00	56.44	74.00	-17.56	24.88	3.66	27.90	0.00	146	273	HORIZONTAL	Peak
3	2441.00	100.27			68.66	3.71	27.90	0.00	146	273	HORIZONTAL	Average
4	2441.00	104.13			72.52	3.71	27.90	0.00	146	273	HORIZONTAL	Peak
5	2492.90	38.92	54.00	-15.08	7.28	3.74	27.90	0.00	146	273	HORIZONTAL	Average
6	2492.90	56.48	74.00	-17.52	24.84	3.74	27.90	0.00	146	273	HORIZONTAL	Peak

Item 3, 4 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2480.00	99.86			68.23	3.73	27.90	0.00	173	68	HORIZONTAL	Average
2	2480.10	103.65			72.02	3.73	27.90	0.00	173	68	HORIZONTAL	Peak
3	2483.50	39.85	54.00	-14.15	8.22	3.73	27.90	0.00	173	68	HORIZONTAL	Average
4	2484.70	57.69	74.00	-16.31	26.06	3.73	27.90	0.00	173	68	HORIZONTAL	Peak

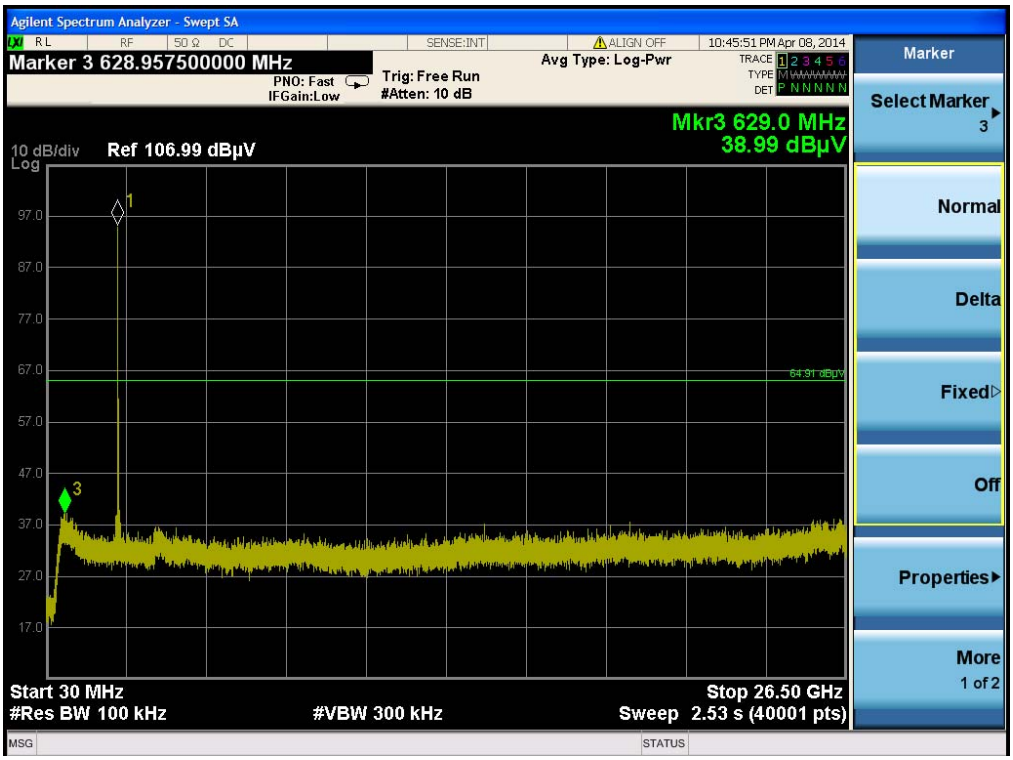
Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

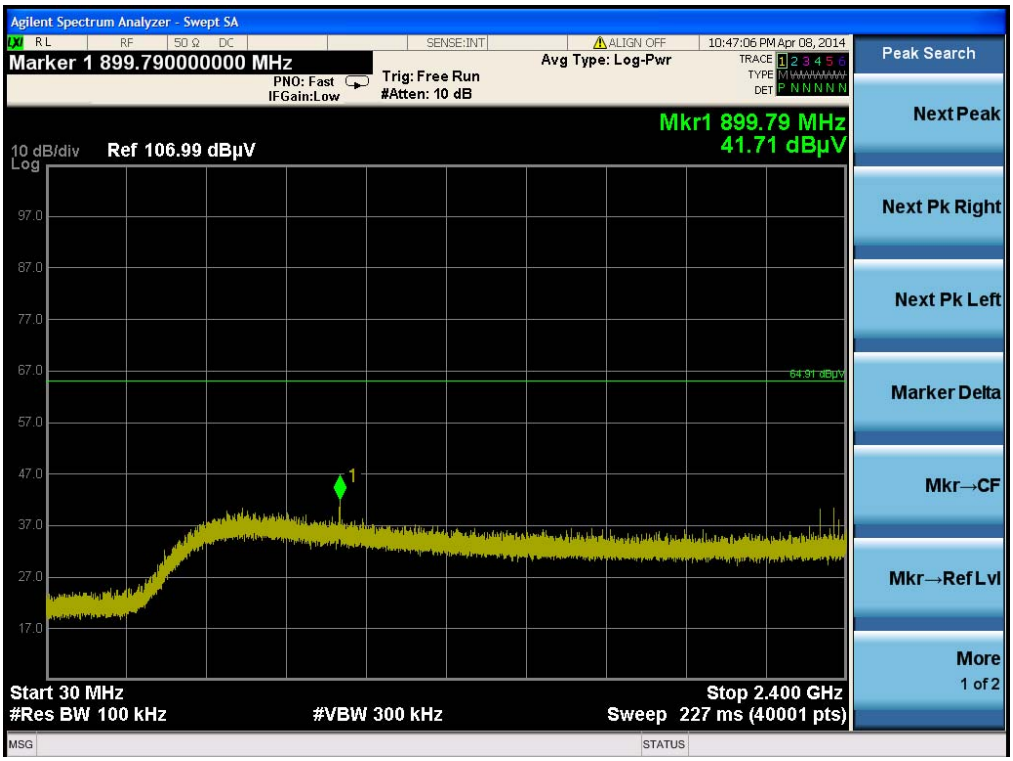
Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

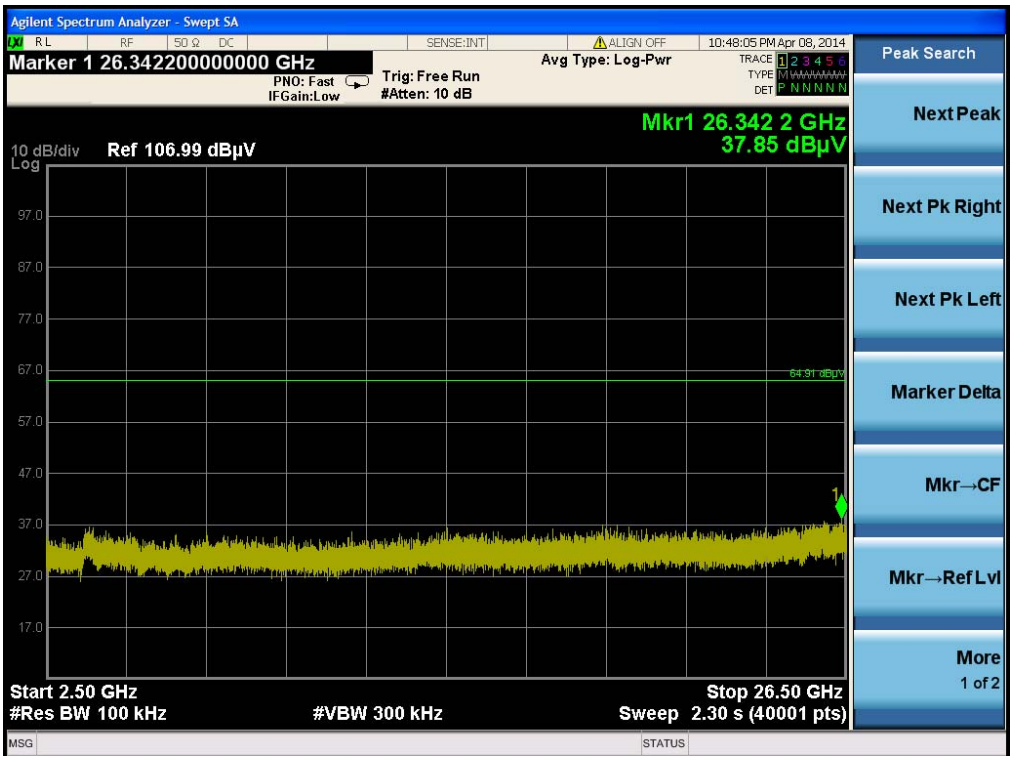
Plot on Configuration For BR (GFSK) / Channel 0 / Reference Level



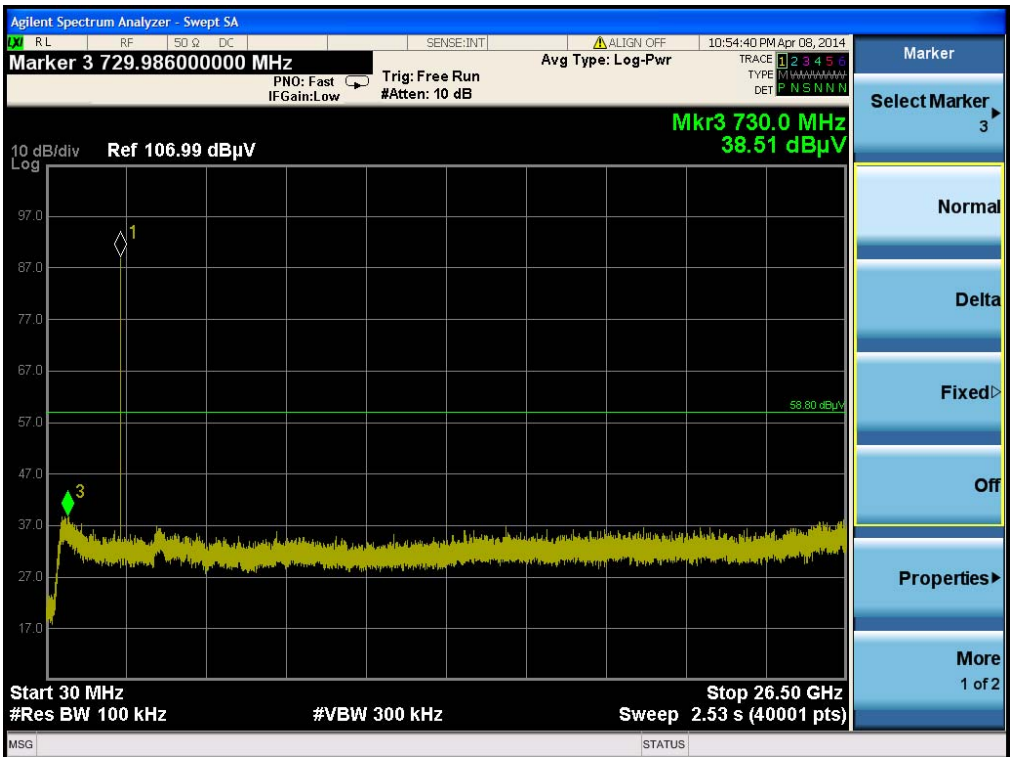
Plot on Configuration For BR (GFSK) / Channel 0 / 30MHz~2400MHz (down 30dBc)



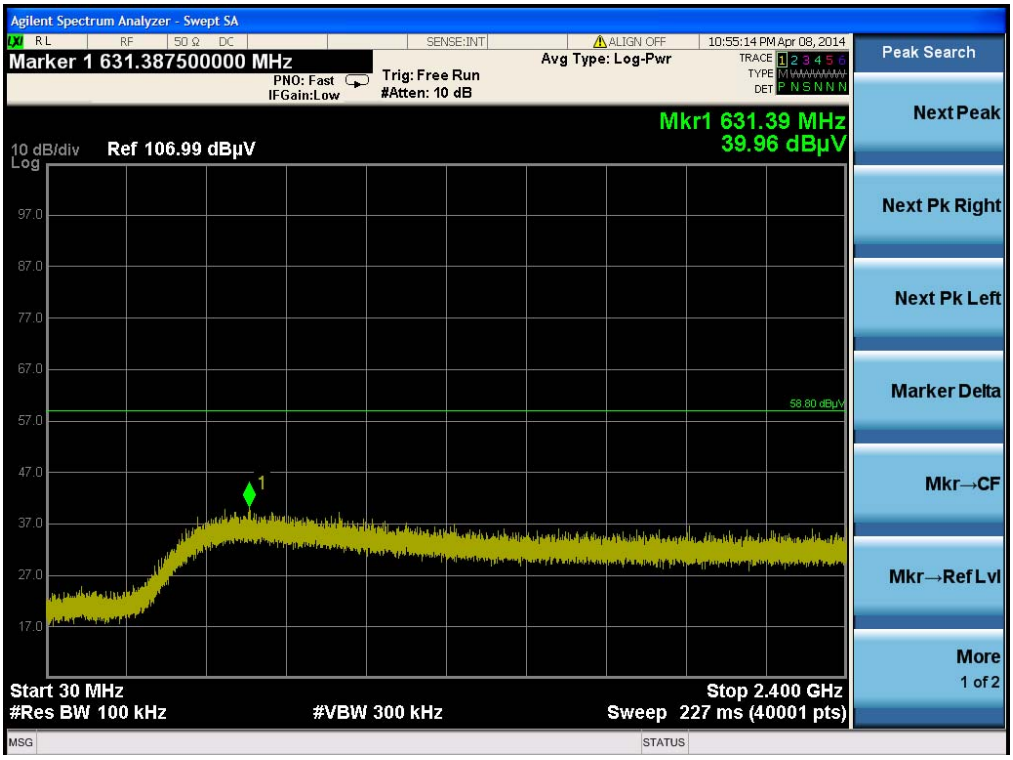
Plot on Configuration For BR (GFSK) / Channel 0 / 2500MHz~26500MHz (down 30dBc)



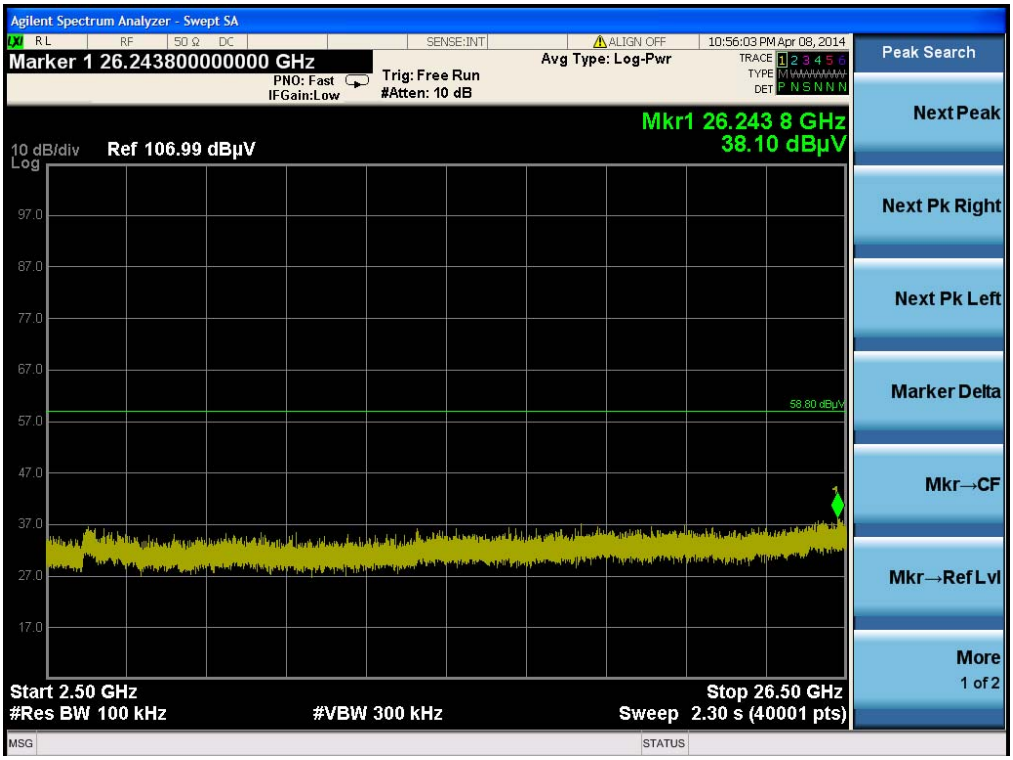
Plot on Configuration For BR (GFSK) / Channel 78 / Reference Level



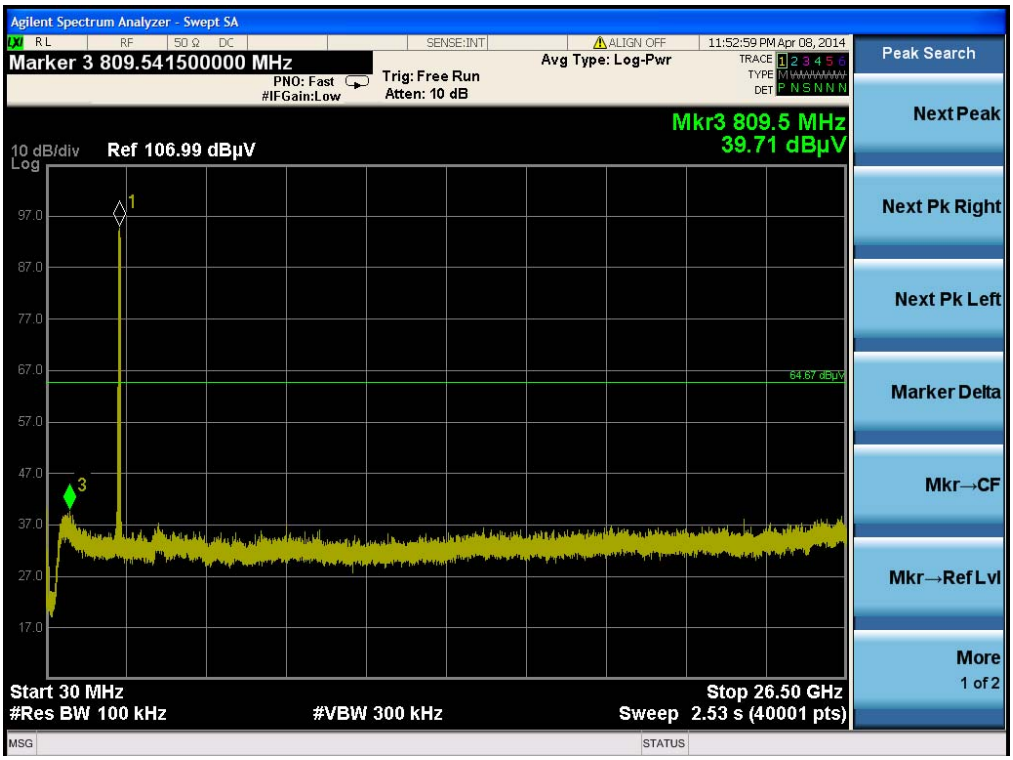
Plot on Configuration For BR (GFSK) / Channel 78 / 30MHz~2400MHz (down 30dBc)



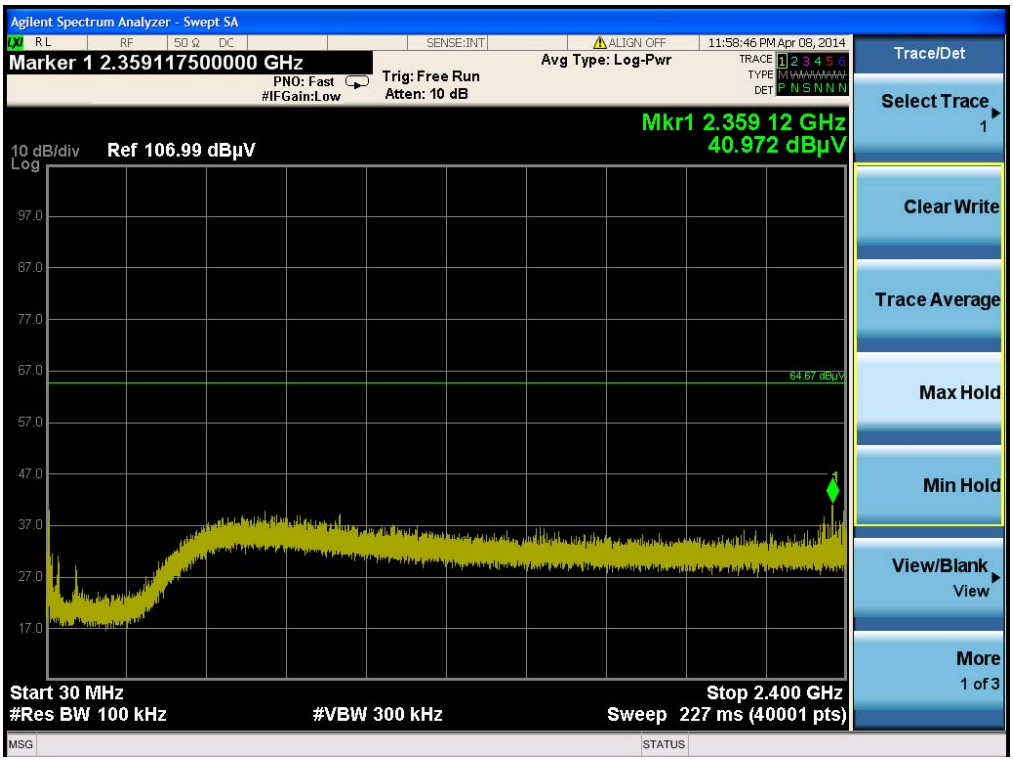
Plot on Configuration For BR (GFSK) / Channel 78 / 2500MHz~26500MHz (down 30dBc)



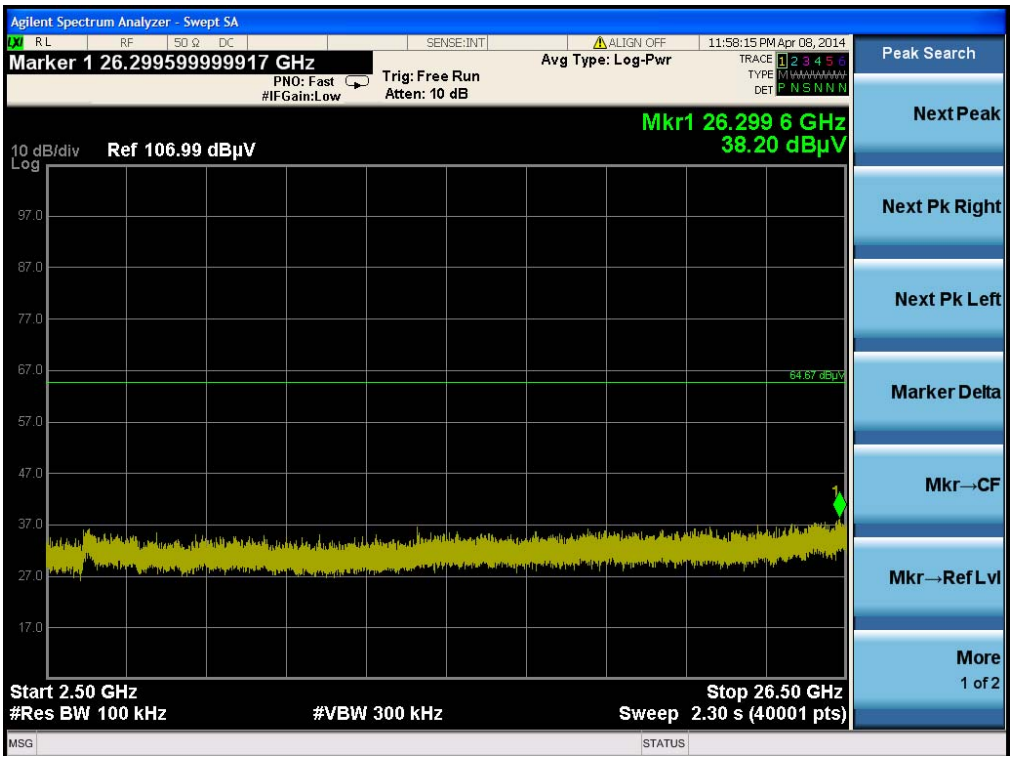
Plot on Configuration For BR (GFSK) / Hopping / Reference Level



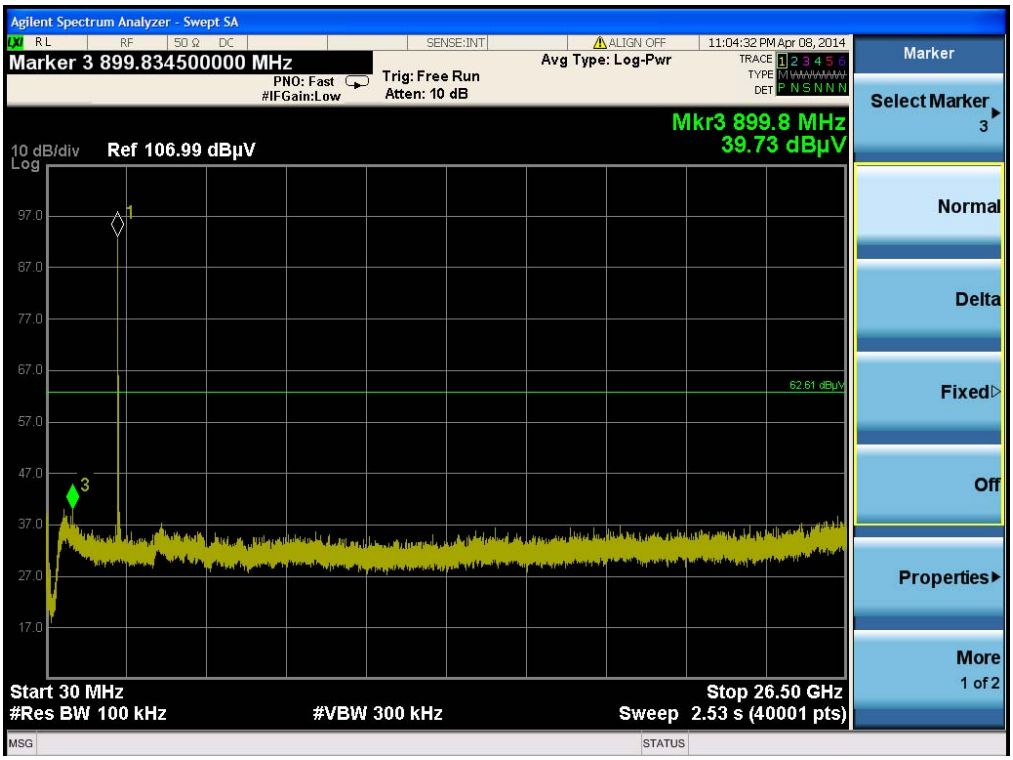
Plot on Configuration For BR (GFSK) / Hopping / 30MHz~2400MHz (down 30dBc)



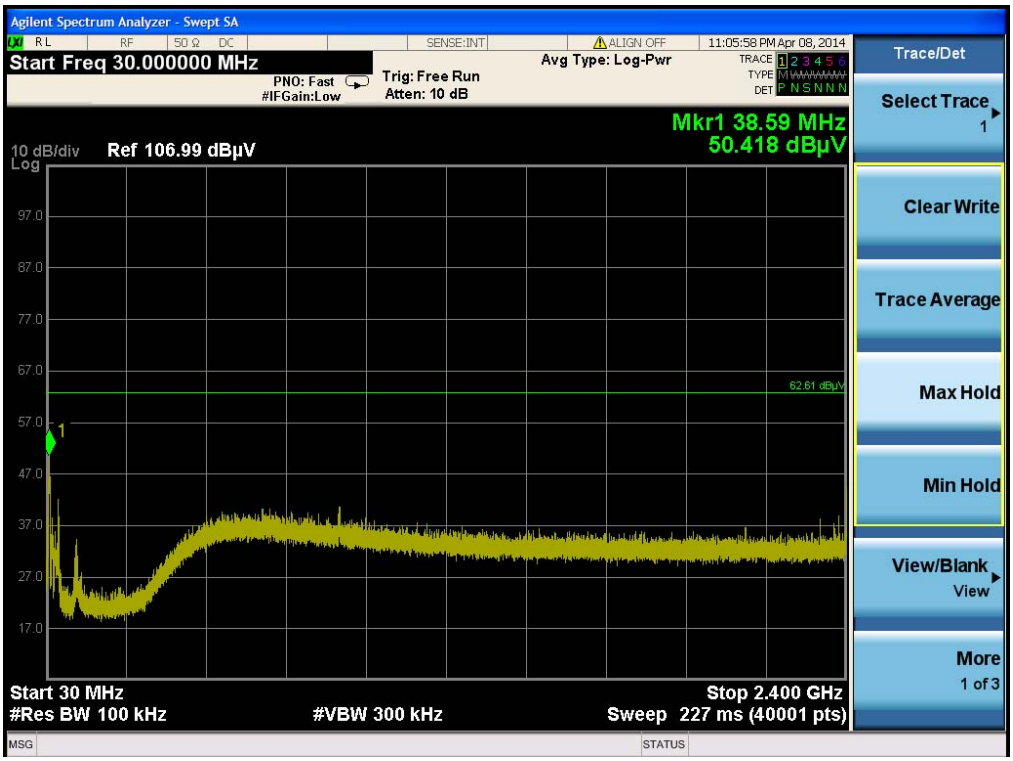
Plot on Configuration For BR (GFSK) / Hopping / 2500MHz~26500MHz (down 30dBc)



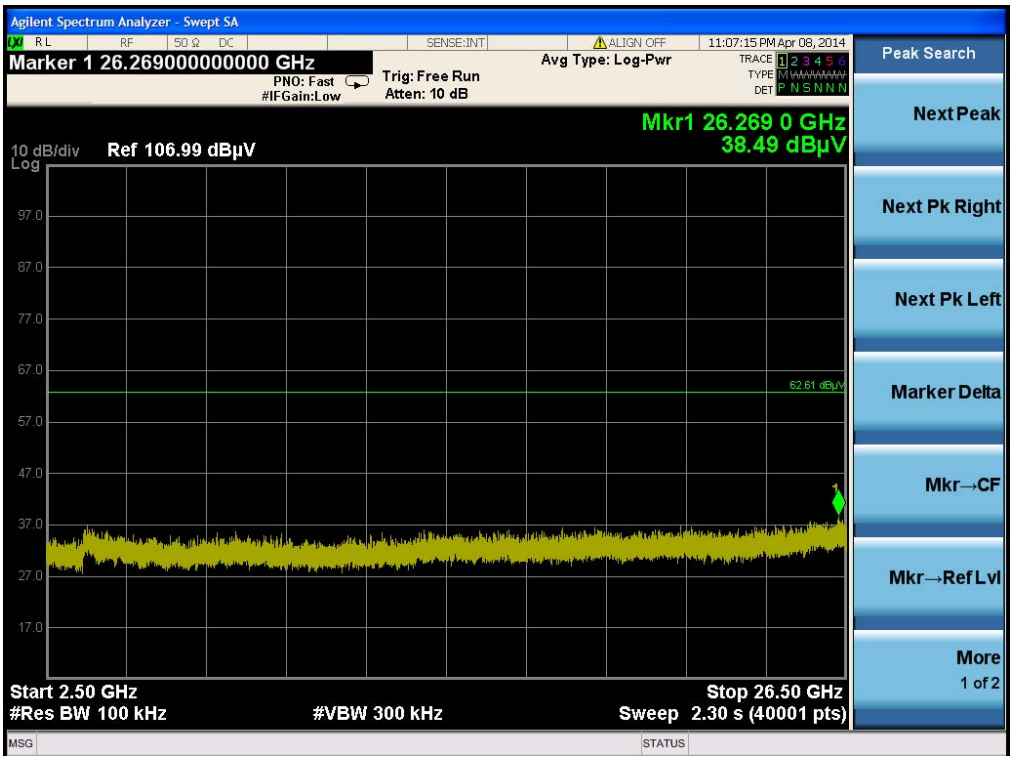
Plot on Configuration For EDR (8DPSK) / Channel 0 / Reference Level



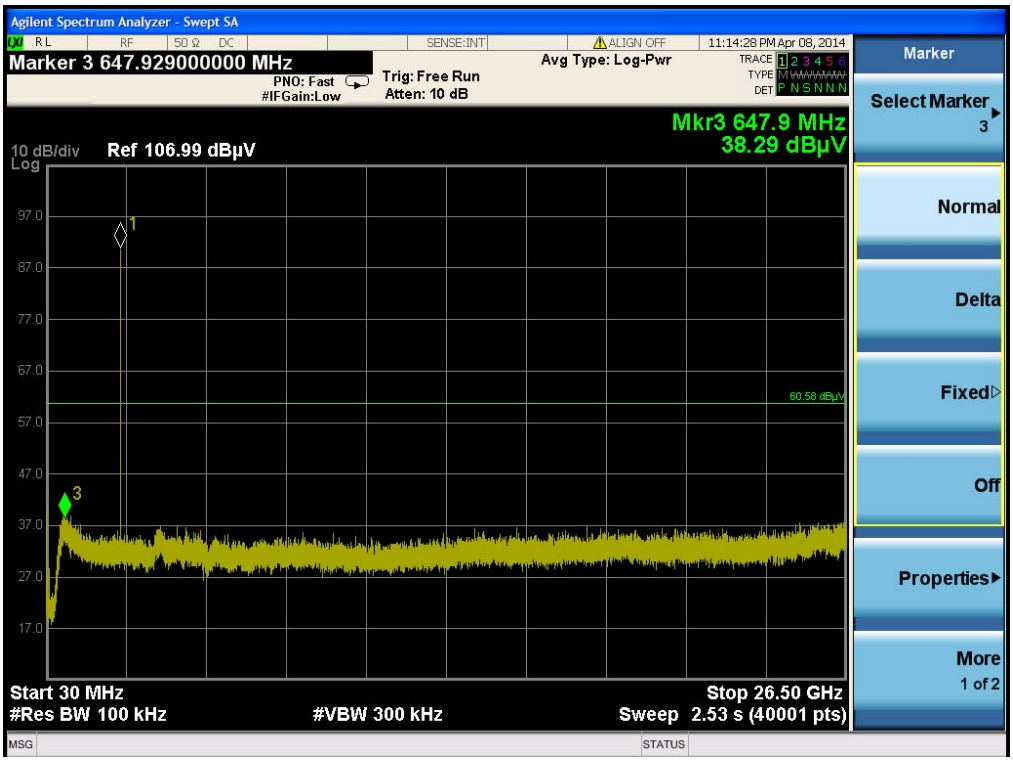
Plot on Configuration For EDR (8DPSK) / Channel 0 / 30MHz~2400MHz (down 30dBc)



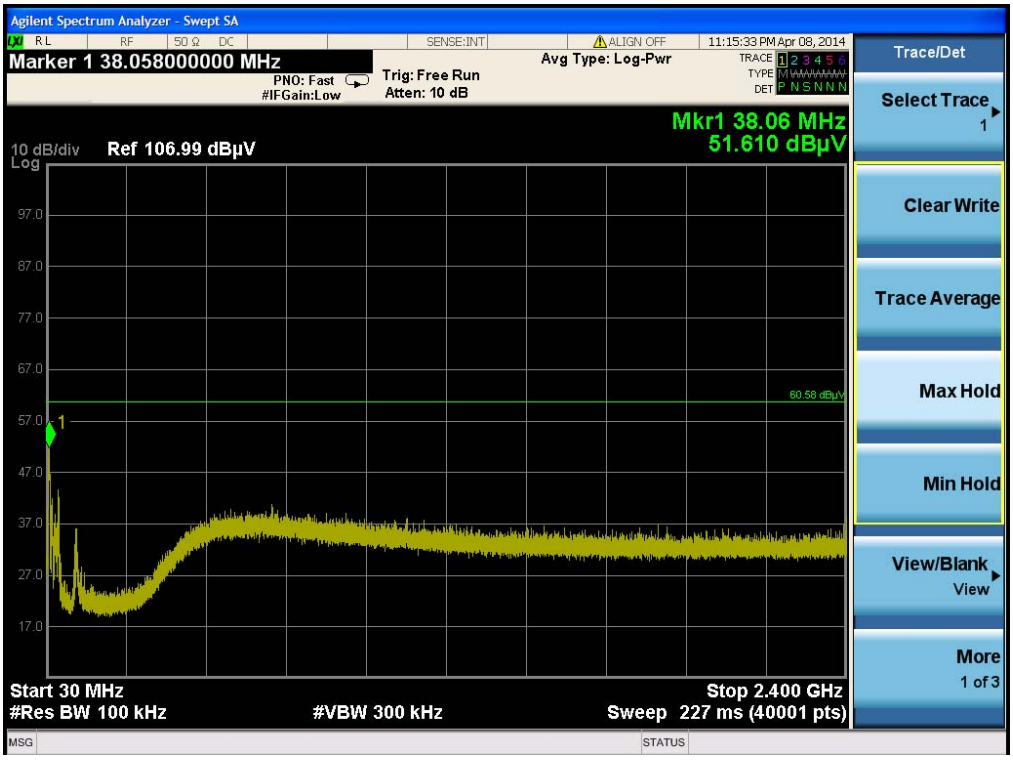
Plot on Configuration For EDR (8DPSK) / Channel 0 / 2500MHz~26500MHz (down 30dBc)



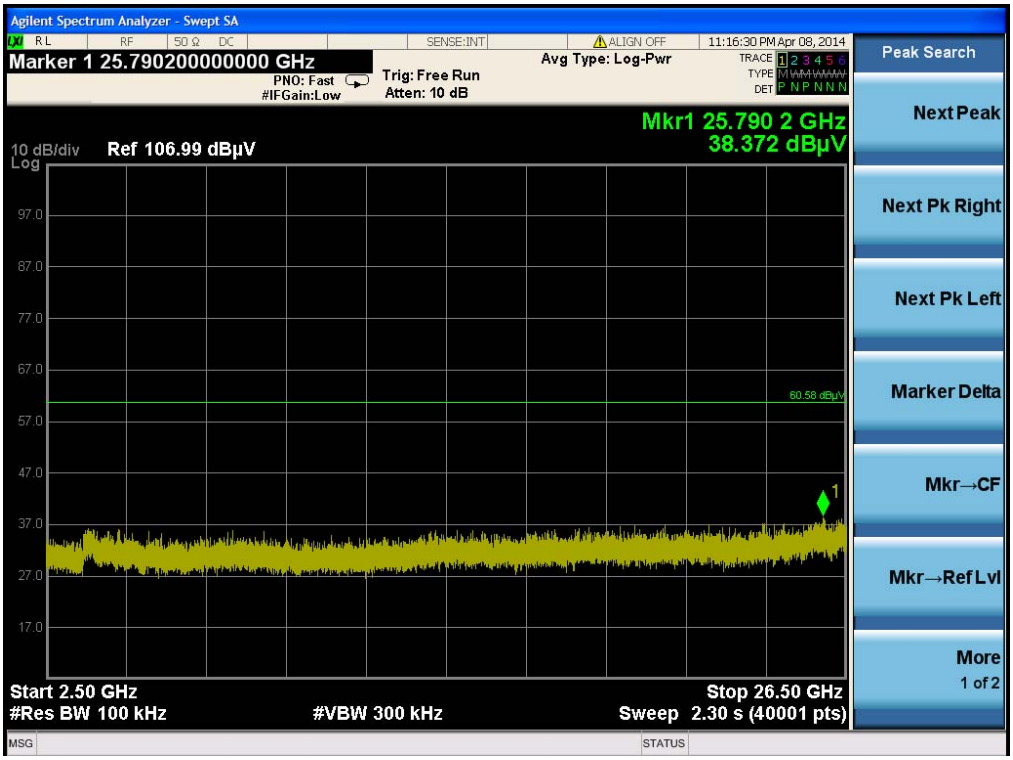
Plot on Configuration For EDR (8DPSK) / Channel 78 / Reference Level



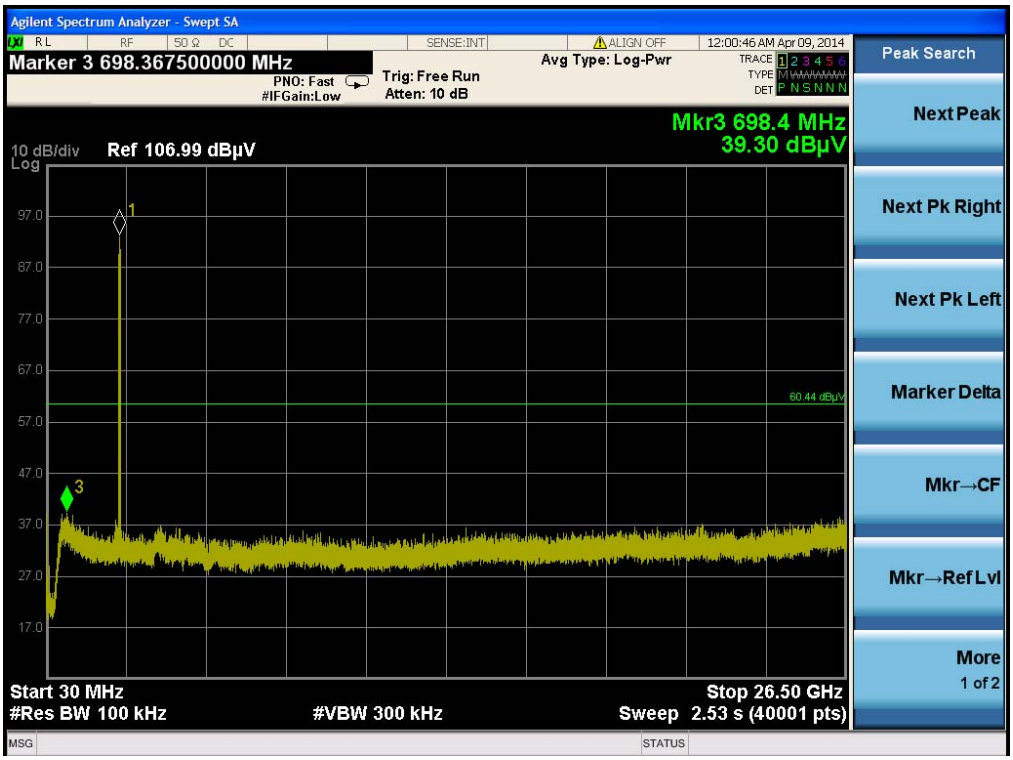
Plot on Configuration For EDR (8DPSK) / Channel 78 / 30MHz~2400MHz (down 30dBc)



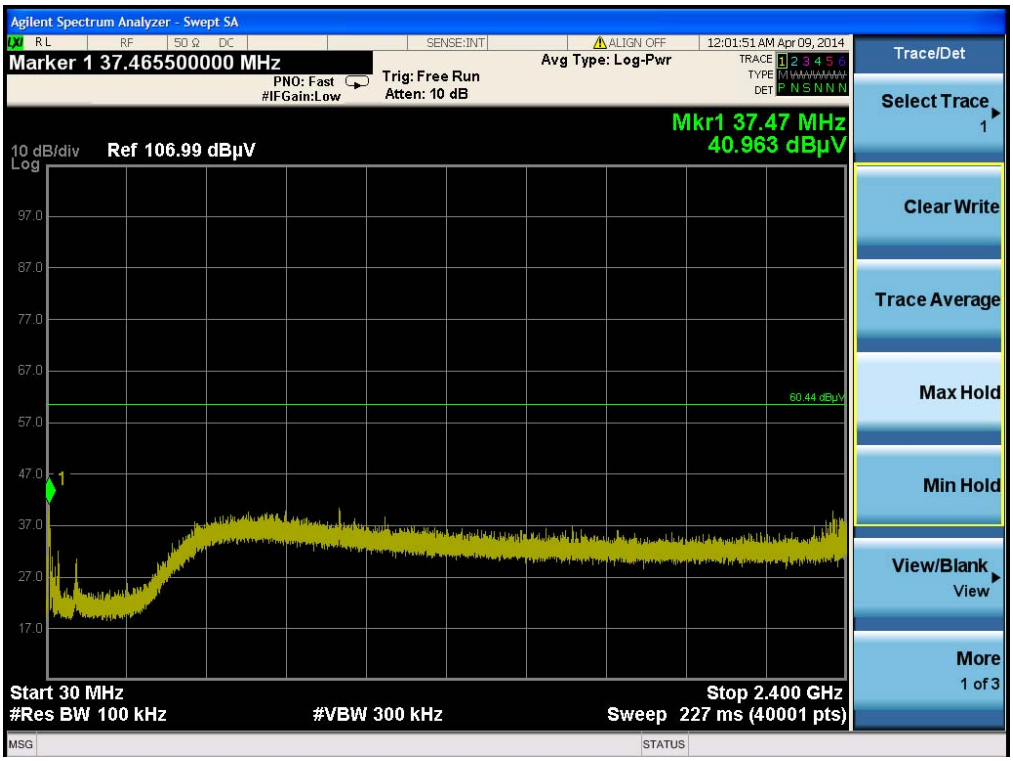
Plot on Configuration For EDR (8DPSK) / Channel 78 / 2500MHz~26500MHz (down 30dBc)



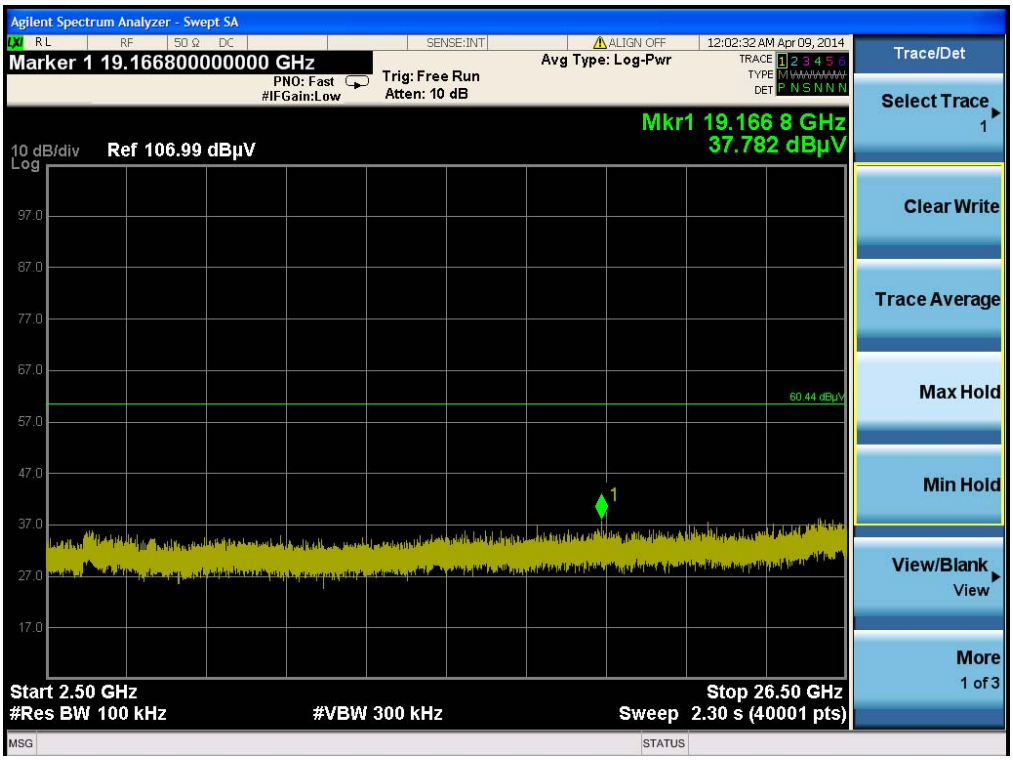
Plot on Configuration For EDR (8DPSK) / Hopping / Reference Level



Plot on Configuration For EDR (8DPSK) / Hopping / 30MHz~2400MHz (down 30dBc)



Plot on Configuration For EDR (8DPSK) / Hopping / 2500MHz~26500MHz (down 30dBc)



4.8. Antenna Requirements

4.8.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

4.8.2. Antenna Connector Construction

Please refer to section 3.3 in this test report, antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75 GHz	Apr. 12, 2013	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100 MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Nov. 23, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30 MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112B	2928	30MHz ~ 2GHz	Dec. 27, 2013	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 01, 2013	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Dec. 17, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO 2000	N/A	1 m - 4 m	N.C.R.	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-1	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-2	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

"*" Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	0.026	dB	normal(k=2)	0.013
Cable loss	0.002	dB	normal(k=2)	0.001
AMN/LISN specification	1.200	dB	normal(k=2)	0.600
Mismatch Receiver VSWR 1= AMN/LISN VSWR 2=	-0.080	dB	U-shaped	0.060
Combined standard uncertainty Uc(y)				1.2
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				2.4

Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	±0.173	dB	k=1	0.086
Cable loss	±0.174	dB	k=2	0.087
Antenna gain	±0.169	dB	k=2	0.084
Site imperfection	±0.433	dB	Triangular	0.214
Pre-amplifier gain	±0.366	dB	k=2	0.183
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.778
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.555

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	±0.191	dB	k=1	0.095
Cable loss	±0.169	dB	k=2	0.084
Antenna gain	±0.191	dB	k=2	0.096
Site imperfection	±0.582	dB	Triangular	0.291
Pre-amplifier gain	±0.304	dB	k=2	0.152
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.839
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.678

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	±0.186	dB	k=1	0.093
Cable loss	±0.167	dB	k=2	0.083
Antenna gain	±0.190	dB	k=2	0.095
Site imperfection	±0.488	dB	Triangular	0.244
Pre-amplifier gain	±0.269	dB	k=2	0.134
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.771
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.541

Uncertainty of Conducted Emission Measurement

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Cable loss	±0.038	dB	k=2	0.019
Attenuator	±0.047	dB	k=2	0.024
Power Meter specification	±0.300	dB	Triangular	0.150
Power Sensor specification	±0.300	dB	Rectangular	0.150
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				0.863
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				1.726