



SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

FCC RADIO TEST REPORT

Applicant's company	Alpha Audiotronics, Inc.
Applicant Address	73 Spring Street, Suite 502, NY, NY 10012, New York, U.S.A.
FCC ID	2AJGJ-SB100-B
Manufacturer's company	Fugang Electronic (Dongguan) Co., Ltd
Manufacturer Address	Industry Street, Dong-Keng, Dong-Guan, Guang-Dong, China

Product Name	SKYBUDS
Brand Name	Alpha
Model Name	SB100
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2402 ~ 2480MHz
Received Date	Aug. 11, 2016
Final Test Date	Sep. 05, 2016
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 C63.10-2013, DA-00705** and

47 CFR FCC Part 15 Subpart C.

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



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History of This Test Report



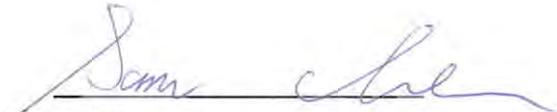
Report No.: FR671803AA

Project No: CB10509056

1. VERIFICATION OF COMPLIANCE

Product Name : SKYBUDS
Brand Name : Alpha
Model No. : SB100
Applicant : Alpha Audiotronics, Inc.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sportun International as requested by the applicant to evaluate the EMC performance of the product sample received on Aug. 11, 2016 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
4.1	15.207	AC Power Line Conducted Emissions	Complies
4.2	15.247(b)(1)	Maximum Conducted Output Power	Complies
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
4.7	15.247(d)	Band Edge Emissions	Complies
4.8	15.203	Antenna Requirements	Complies

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From battery
Modulation	FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK)
Data Rate (Mbps)	GFSK: 1 ; $\pi/4$ -DQPSK: 2 ; 8DPSK: 3
Frequency Range	2402 ~ 2480MHz
Channel Number	79
Channel Bandwidth (99%)	BR (GFSK) 1 Mbps: 0.9595 MHz EDR ($\pi/4$ -DQPSK) 2 Mbps: 1.2370 MHz EDR (8DPSK) 3 Mbps: 1.2420 MHz
Maximum Conducted Peak Output Power	BR (GFSK) 1 Mbps: 8.05 dBm EDR ($\pi/4$ -DQPSK) 2 Mbps: 8.04 dBm EDR (8DPSK) 3 Mbps: 8.03 dBm
Maximum Conducted Average Output Power	BR (GFSK) 1 Mbps: 5.99 dBm EDR ($\pi/4$ -DQPSK) 2 Mbps: 5.98 dBm EDR (8DPSK) 3 Mbps: 5.97 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 $\pi/4$ -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)	Remark
1	FoxLink	DVT	Chip Antenna	N/A	-3.09	TX/RX

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	Antenna
AC Power Conducted Emissions	CTX	-	-	-
Maximum Conducted Output Power	BR (GFSK)	1 Mbps	0/39/78	1
	EDR ($\pi/4$ -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 ($\pi/4$ -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	EDR (8DPSK)	3 Mbps	0~78	1
Dwell Time	BR (GFSK) (DH1, DH3, DH5)	1 Mbps	0/39/78	1
Radiated Emissions Below 1GHz	CTX	-	-	-
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 Radiated Emissions Below 1GHz test:

There are two modes of EUT, one is Y axis, and the other is Z axis for Radiated Emissions Below 1GHz test, and the worst case was found at Z axis. So the measurement will follow this same test configuration.

For Radiated Emissions Above 1GHz test:

The EUT was performed at X axis, Y axis and Z axis position for Radiated Emissions Above 1GHz test, and the worst case was found at Z axis. So the measurement will follow this same test configuration.

3.6. Table for Testing Locations

Test Site Location					
Test Site No.	Site Category	Location	FCC Designation No.	IC File No.	VCCI Reg. No
03CH01-CB	SAC	Hsin Chu	TW0006	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	TW0006	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

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

3.7. Table for Multiple List

The devices in the following table are all refer to the identical product.

Device	Color	Description	Remark
1	Gray	Right	This device has been defined as can only arrange in pairs marketing.
2	Black	Left	

From the above devices, Device 1 was selected as representative model for the test and its data was recorded in this report.

3.8. Table for Supporting Units

For Test Site No: 03CH01-CB and TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Test Fixture (USB to SPI)	Foxlink	N/A	N/A
Test Fixture (USB to SPI/UART)	Foxlink	N/A	N/A

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Test Fixture (USB to SPI)	Foxlink	N/A	N/A
Test Fixture (USB to SPI/UART)	Foxlink	N/A	N/A

3.9. 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	Broadcom BlueTool V1.8.4.8		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	61	49	45

For EDR ($\pi/4$ -DQPSK) 2 Mbps:

Test Software Version	Broadcom BlueTool V1.8.4.8		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	61	61	61

For EDR (8DPSK) 3 Mbps:

Test Software Version	Broadcom BlueTool V1.8.4.8		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	61	61	61

3.10. EUT Operation during Test

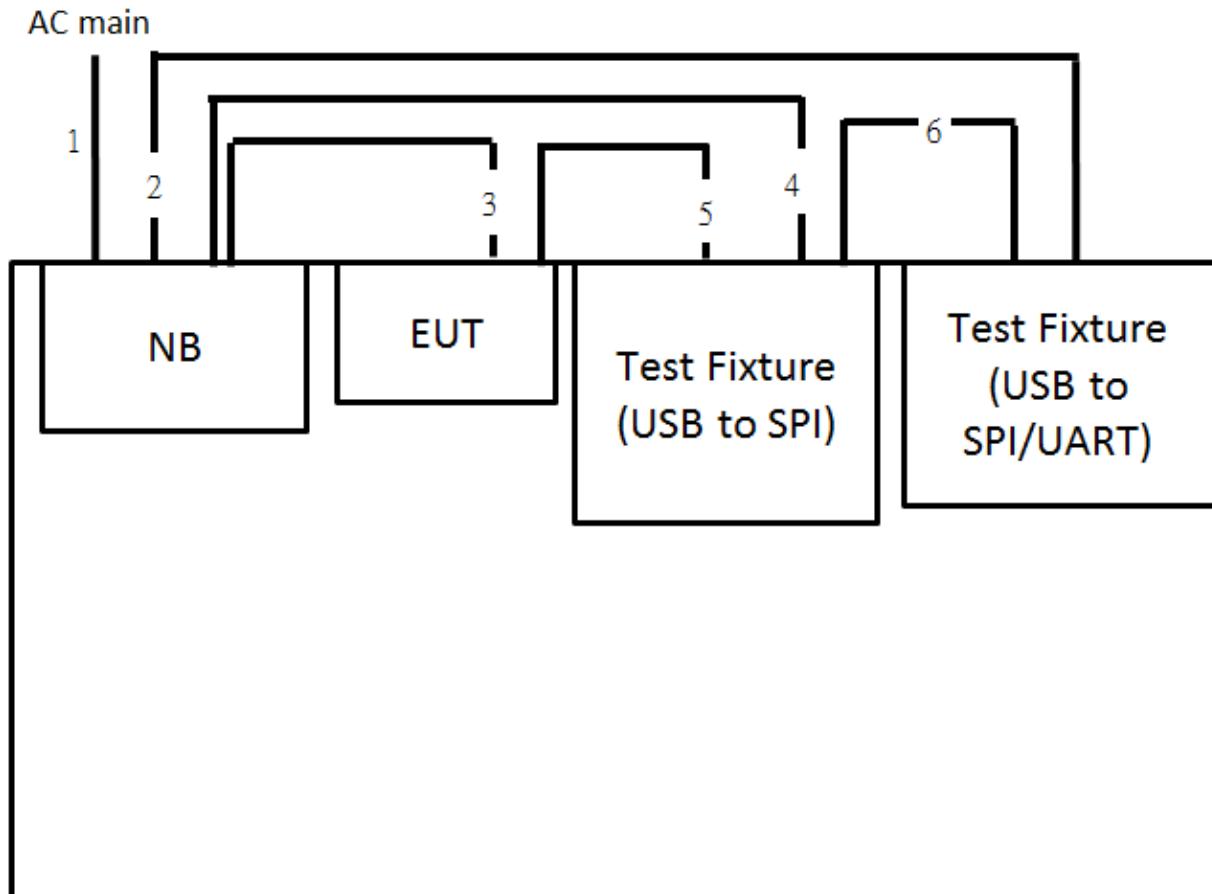
The EUT was programmed to be in continuously transmitting mode.

3.11. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
BR (GFSK)	5.920	100.000	5.92	16.89	0.17
EDR (8DPSK)	5.920	100.000	5.92	12.28	0.17

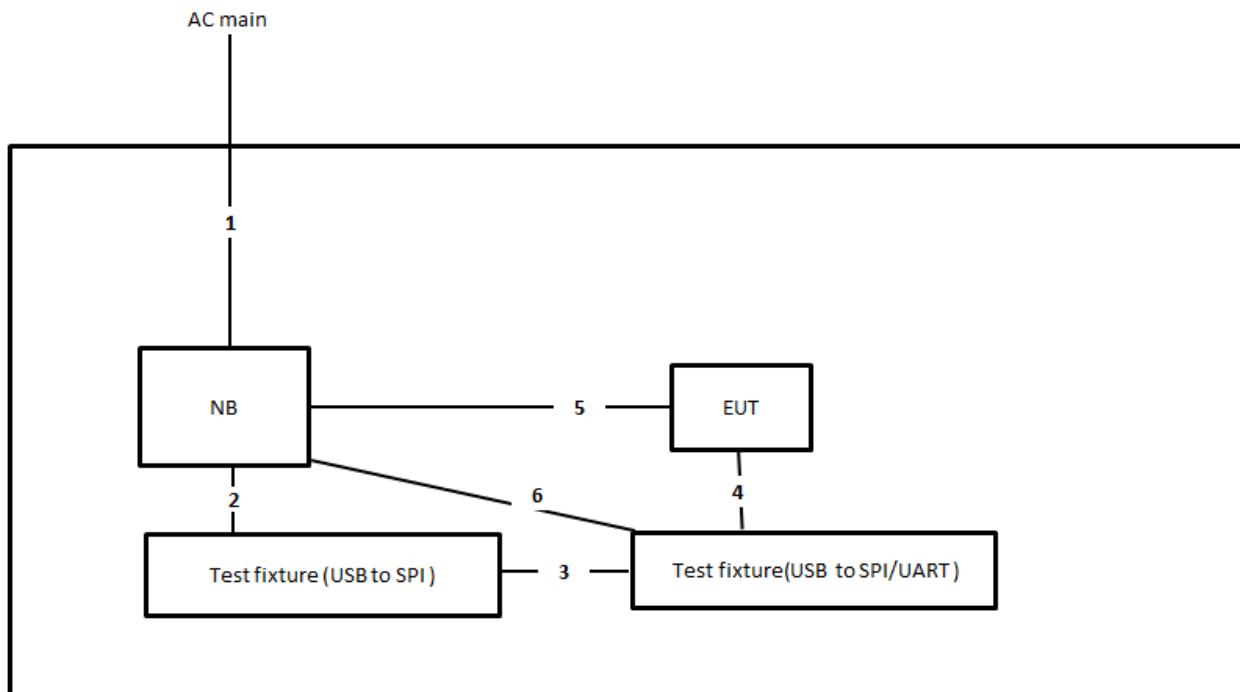
3.12. Test Configurations

3.12.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.8m
3	USB cable	Yes	0.1m
4	USB cable	Yes	1.8m
5	SPI cable	No	0.4m
6	RJ-45 cable	No	1m

3.12.2. Radiation Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.8m
3	RJ-45 cable	No	3m
4	SPI cable	No	0.4m
5	USB cable	Yes	1m
6	USB cable	Yes	1.4m

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

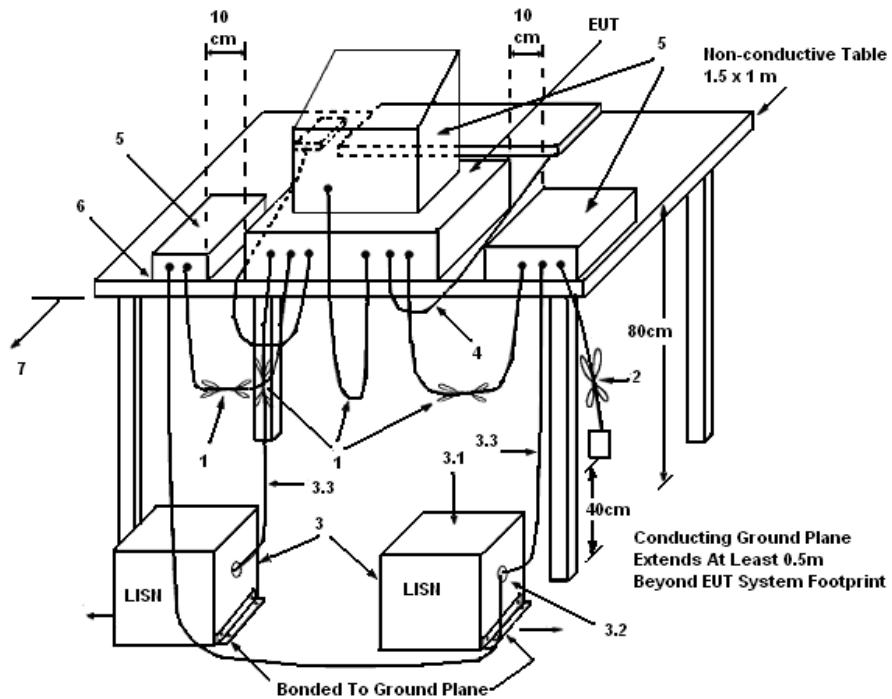
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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 50Ω . 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

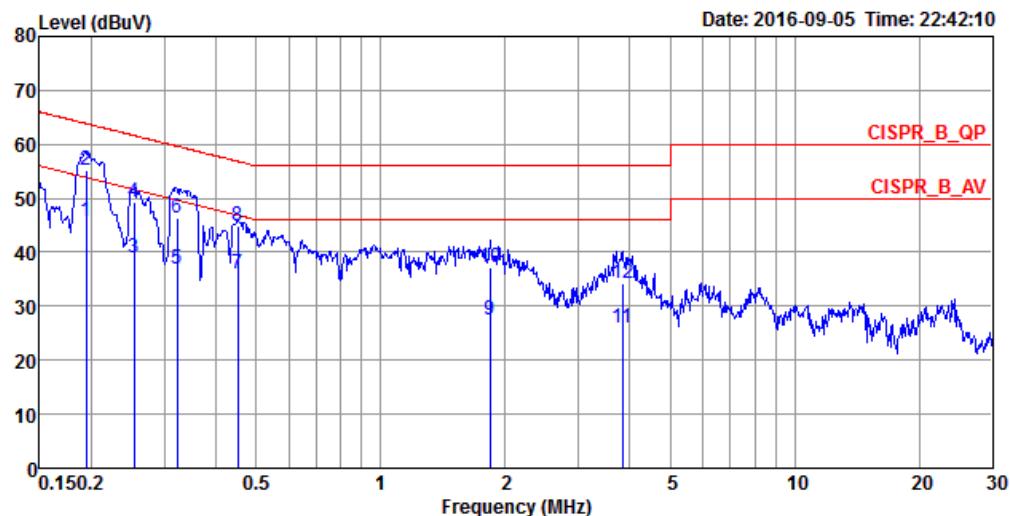
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

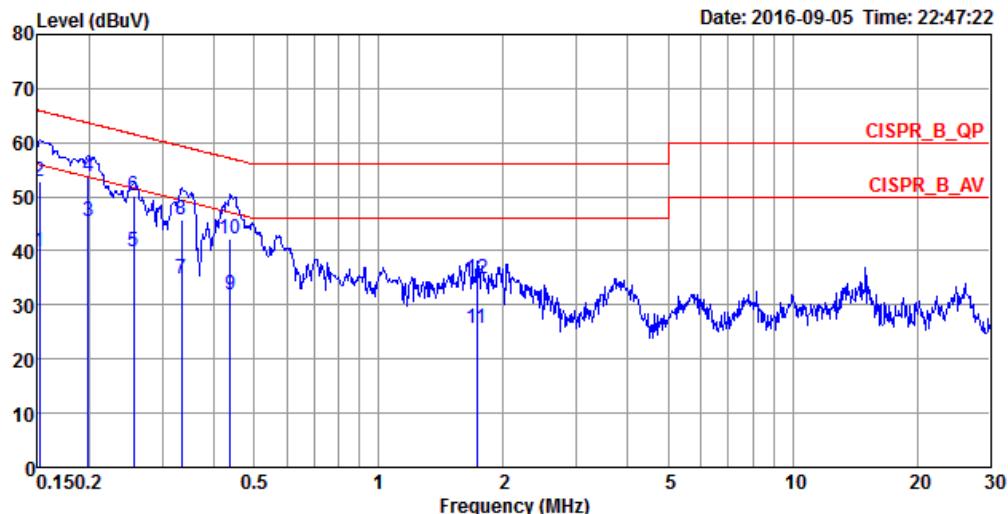
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24°C	Humidity	51%
Test Engineer	Hank Yang	Phase	Line
Configuration	CTX		



Freq	Level	Over	Limit	Read	LISN	Cable	Pol/Phase	Remark
		Line	Level	Factor	Loss			
MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1945	45.70	-8.14	53.84	35.59	9.92	0.19	LINE Average
2	0.1945	55.15	-8.69	63.84	45.04	9.92	0.19	LINE QP
3	0.2535	38.83	-12.81	51.64	28.78	9.92	0.13	LINE Average
4	0.2535	49.30	-12.34	61.64	39.25	9.92	0.13	LINE QP
5	0.3217	36.88	-12.78	49.66	26.89	9.92	0.07	LINE Average
6	0.3217	46.47	-13.19	59.66	36.48	9.92	0.07	LINE QP
7	0.4516	36.00	-10.85	46.85	25.97	9.92	0.11	LINE Average
8	0.4516	44.94	-11.91	56.85	34.91	9.92	0.11	LINE QP
9	1.8386	27.49	-18.51	46.00	17.39	9.96	0.14	LINE Average
10	1.8386	37.33	-18.67	56.00	27.23	9.96	0.14	LINE QP
11	3.8399	25.97	-20.03	46.00	15.89	9.99	0.09	LINE Average
12	3.8399	34.28	-21.72	56.00	24.20	9.99	0.09	LINE QP

Temperature	24°C	Humidity	51%
Test Engineer	Hank Yang	Phase	Neutral
Configuration	CTX		



Freq	Level	Over	Limit	Read	LISN	Cable	Pol/Phase	Remark
		Line	Limit	Level	Factor	Loss		
MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1516	39.90	-16.01	55.91	29.72	10.02	0.16	NEUTRAL
2	0.1516	52.94	-12.97	65.91	42.76	10.02	0.16	NEUTRAL
3	0.1986	45.60	-8.07	53.67	35.49	9.92	0.19	NEUTRAL
4	0.1986	53.80	-9.87	63.67	43.69	9.92	0.19	NEUTRAL
5	0.2562	39.88	-11.68	51.56	29.83	9.92	0.13	NEUTRAL
6	0.2562	50.07	-11.49	61.56	40.02	9.92	0.13	NEUTRAL
7	0.3338	34.85	-14.50	49.35	24.87	9.92	0.06	NEUTRAL
8	0.3338	45.75	-13.60	59.35	35.77	9.92	0.06	NEUTRAL
9	0.4374	31.85	-15.26	47.11	21.85	9.92	0.08	NEUTRAL
10	0.4374	42.10	-15.01	57.11	32.10	9.92	0.08	NEUTRAL
11	1.7253	25.83	-20.17	46.00	15.68	9.95	0.20	NEUTRAL
12	1.7253	34.83	-21.17	56.00	24.68	9.95	0.20	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).

4.2.2. Measuring Instruments and Setting

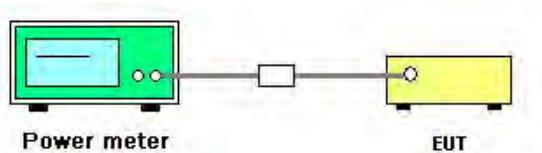
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak and 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	24°C	Humidity	58%
Test Engineer	Eddie Weng	Configurations	GFSK, $\pi/4$ -DQPSK, 8DPSK
Test Date	Aug. 18, 2016~Aug. 25, 2016		

For BR (GFSK) 1 Mbps:

Channel	Frequency	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	8.02	5.96	21.00	Complies
39	2441 MHz	8.03	5.97	21.00	Complies
78	2480 MHz	8.05	5.99	21.00	Complies

For EDR ($\pi/4$ -DQPSK) 2 Mbps:

Channel	Frequency	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	8.04	5.98	21.00	Complies
39	2441 MHz	8.01	5.95	21.00	Complies
78	2480 MHz	8.04	5.98	21.00	Complies

For EDR (8DPSK) 3 Mbps:

Channel	Frequency	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	7.96	5.90	21.00	Complies
39	2441 MHz	8.00	5.94	21.00	Complies
78	2480 MHz	8.03	5.97	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

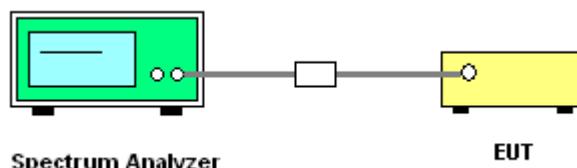
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

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	24°C	Humidity	58%
Test Engineer	Eddie Weng	Configurations	GFSK, $\pi/4$ -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	0.9609	0.9030	1.00	0.641	Complies
2441 MHz	1.0350	0.9595	1.00	0.690	Complies
2480 MHz	0.9391	0.9161	1.00	0.626	Complies

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

For EDR ($\pi/4$ -DQPSK) 2 Mbps:

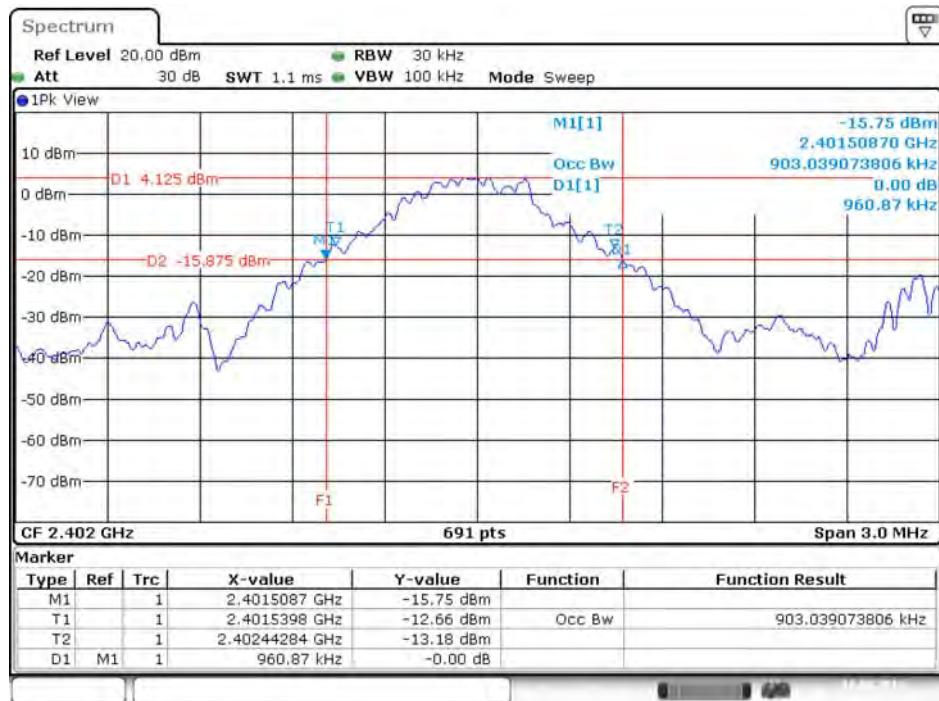
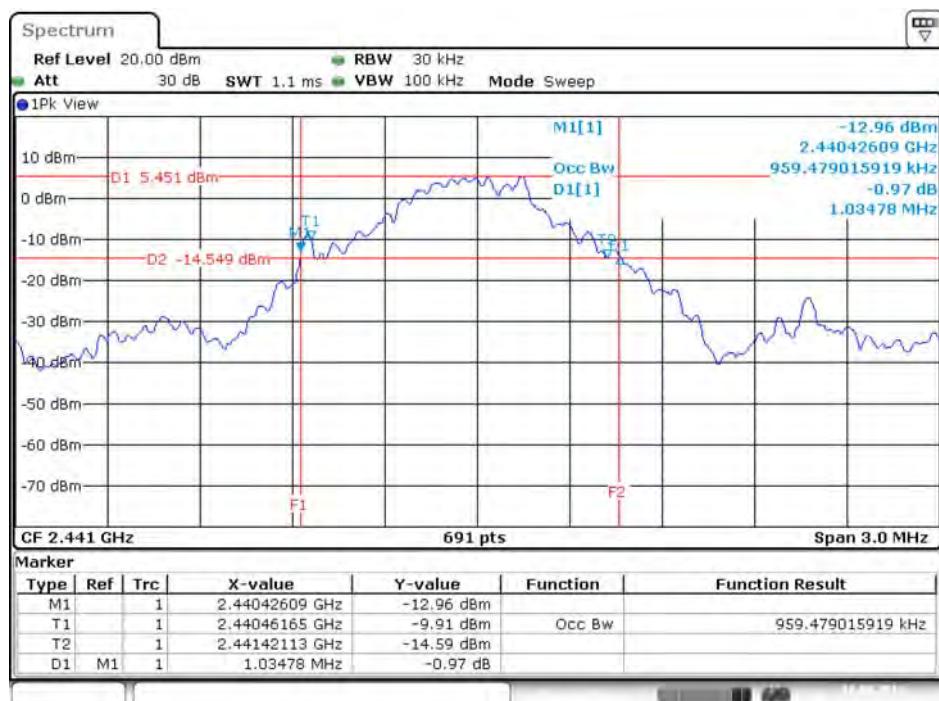
Frequency	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Ch. Separation (MHz)	Two-Thirds of 20dB Bandwidth (MHz)	Result
2402 MHz	1.2480	1.1980	1.00	0.832	Complies
2441 MHz	1.2830	1.2290	1.00	0.855	Complies
2480 MHz	1.2780	1.2370	1.00	0.852	Complies

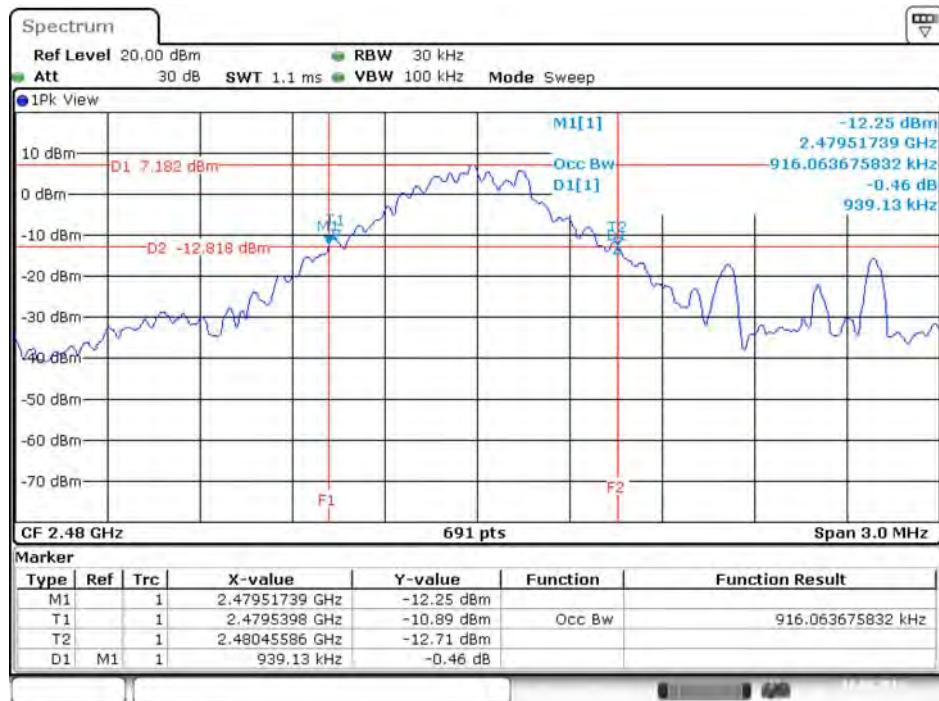
Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

For EDR (8DPSK) 3 Mbps:

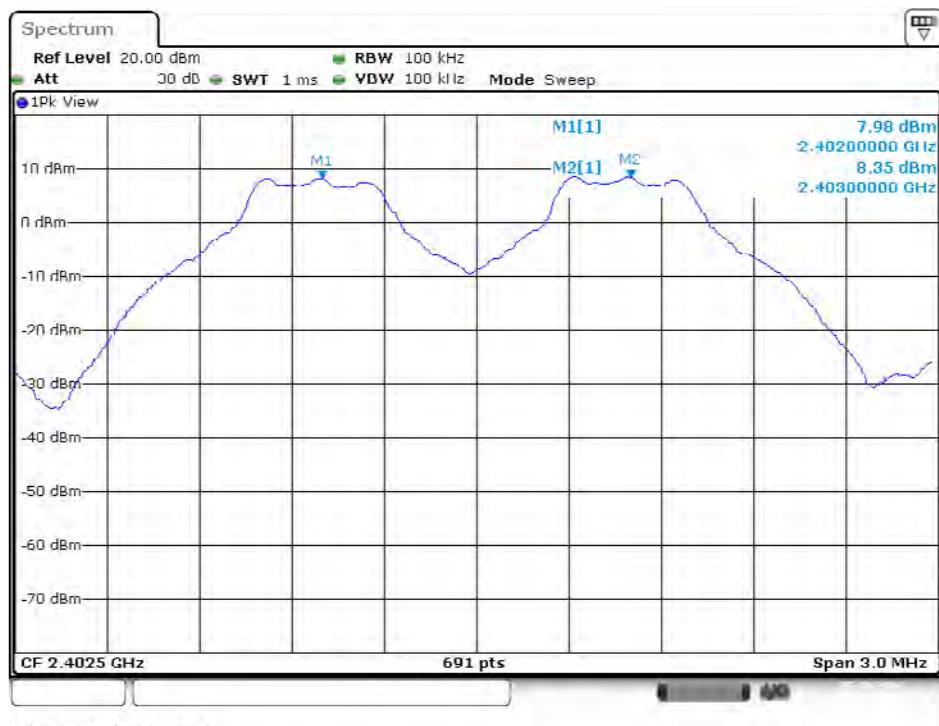
Frequency	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Ch. Separation (MHz)	Two-Thirds of 20dB Bandwidth (MHz)	Result
2402 MHz	1.2570	1.1770	1.00	0.838	Complies
2441 MHz	1.2610	1.2240	1.00	0.841	Complies
2480 MHz	1.2650	1.2420	1.00	0.843	Complies

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

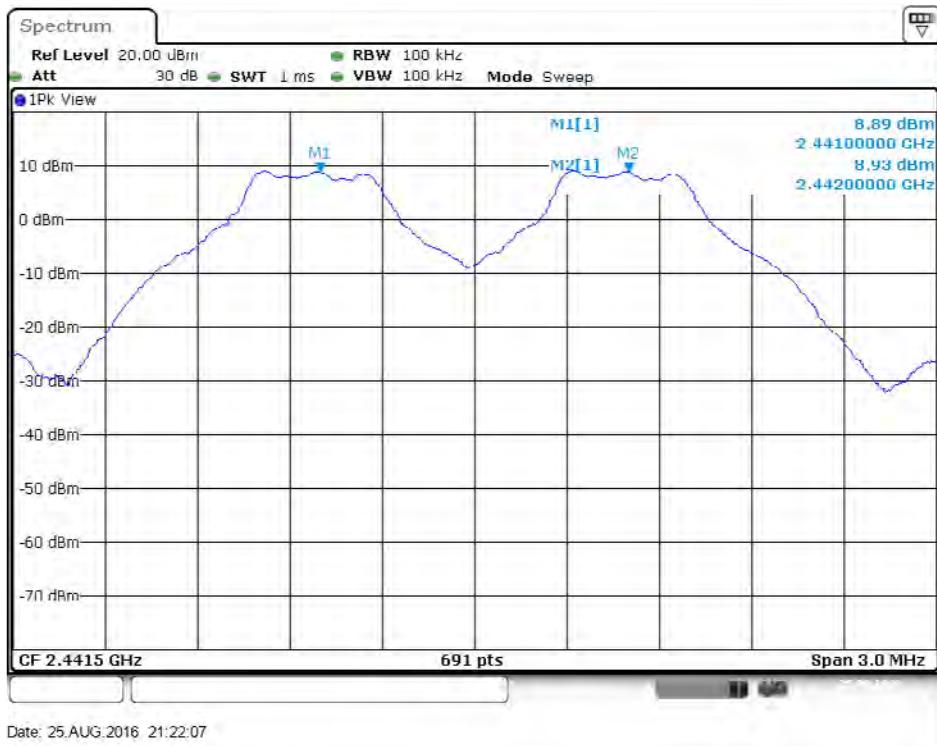
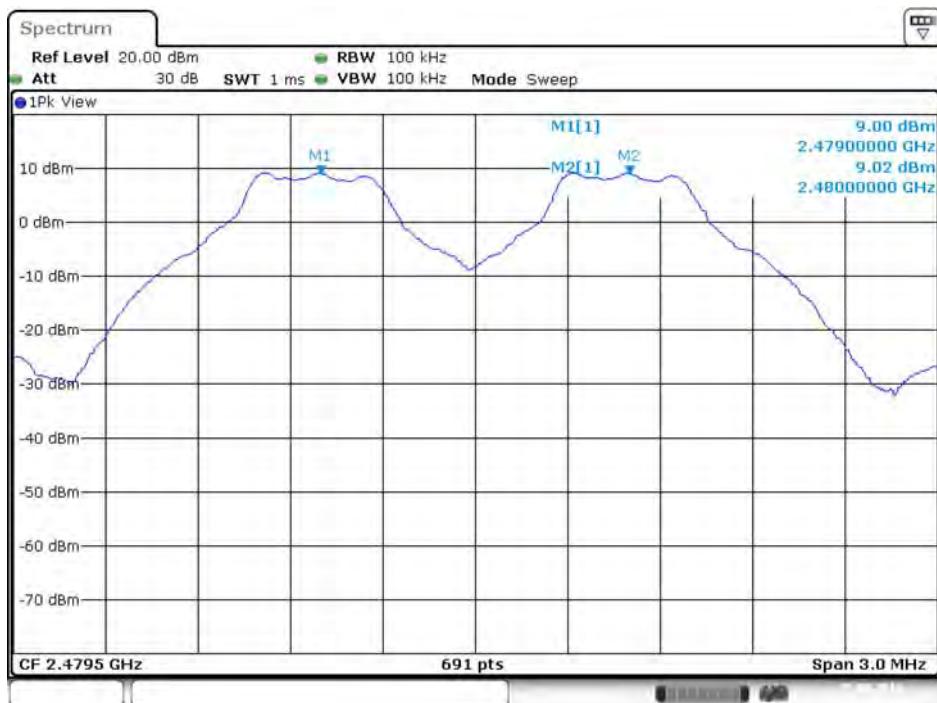
20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 0 / 2402 MHz

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


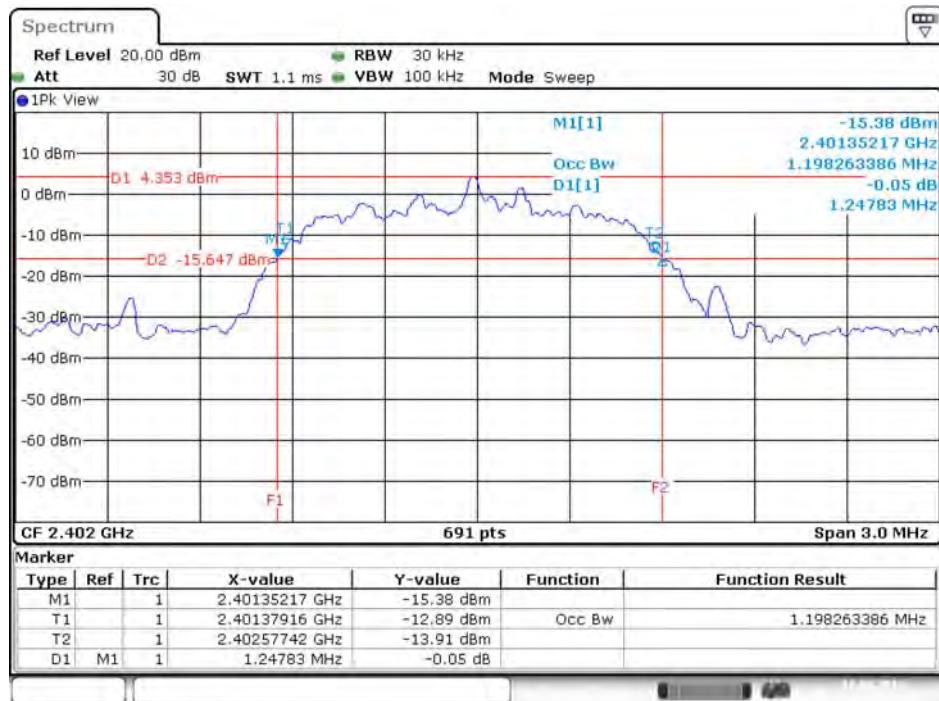
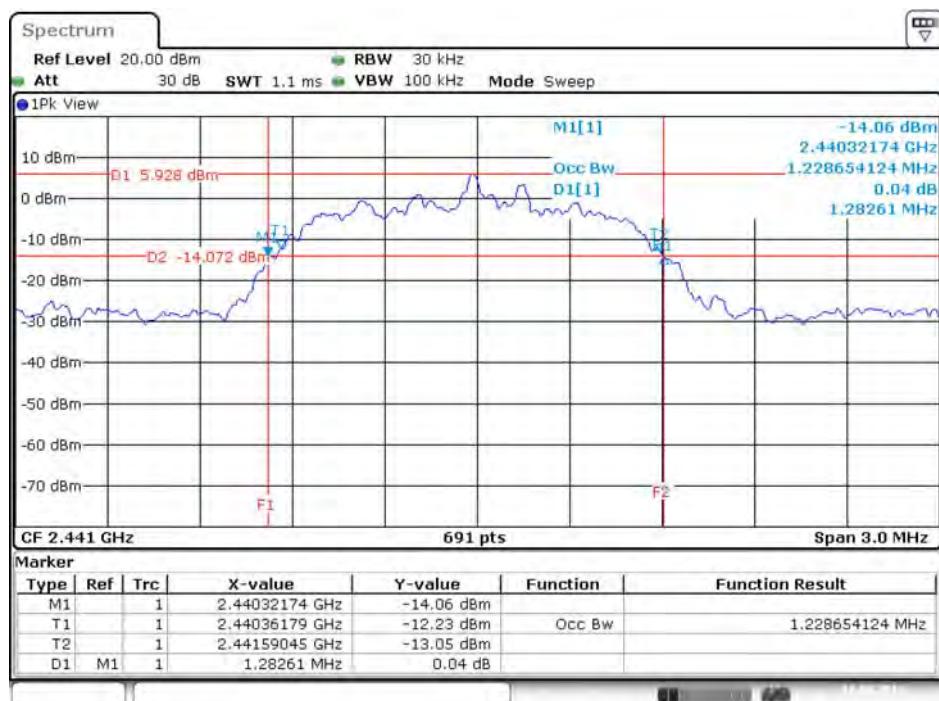
20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 78 / 2480 MHz


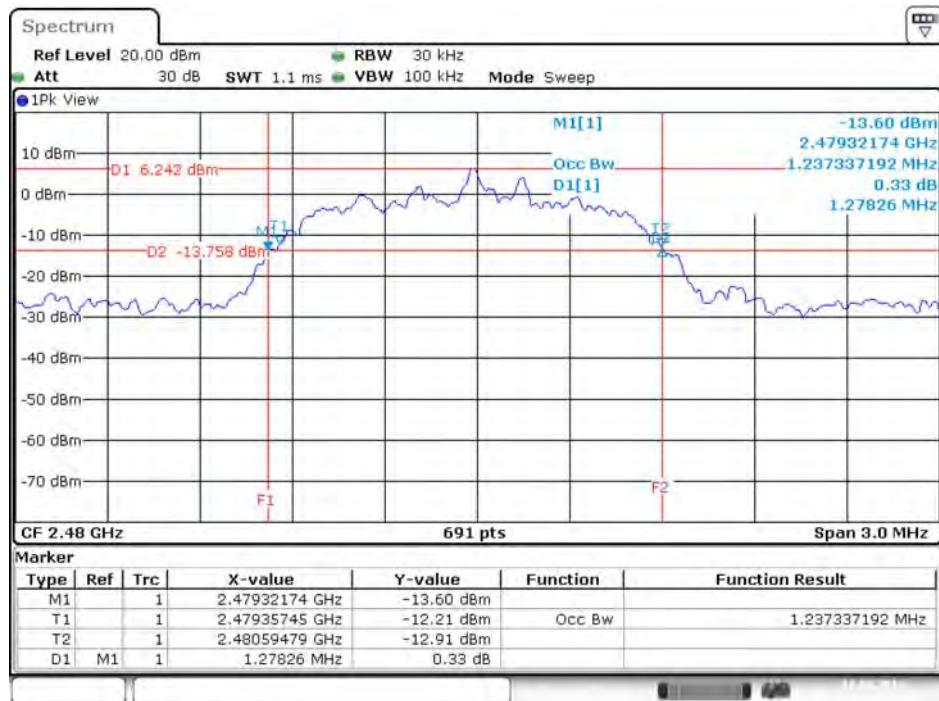
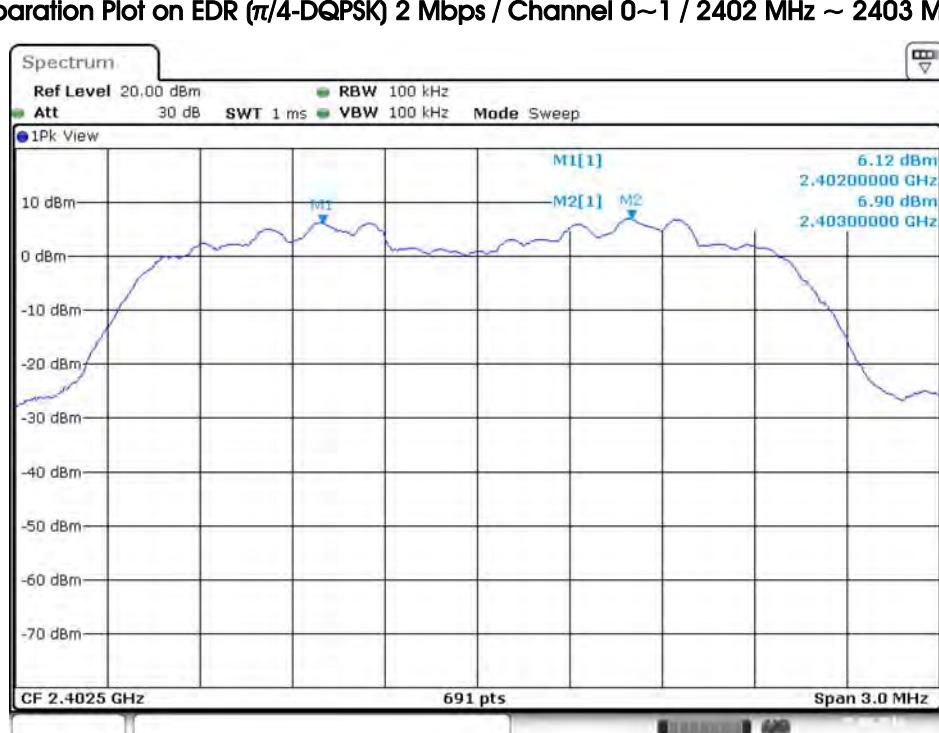
Date: 18.AUG.2016 17:24:08

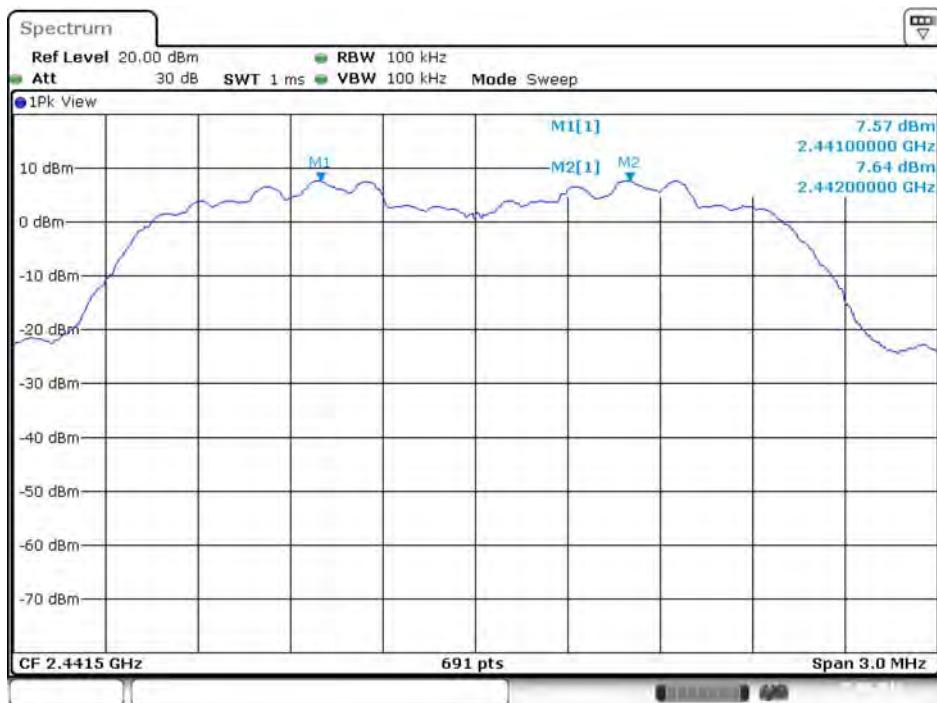
Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz


Date: 25.AUG.2016 21:20:00

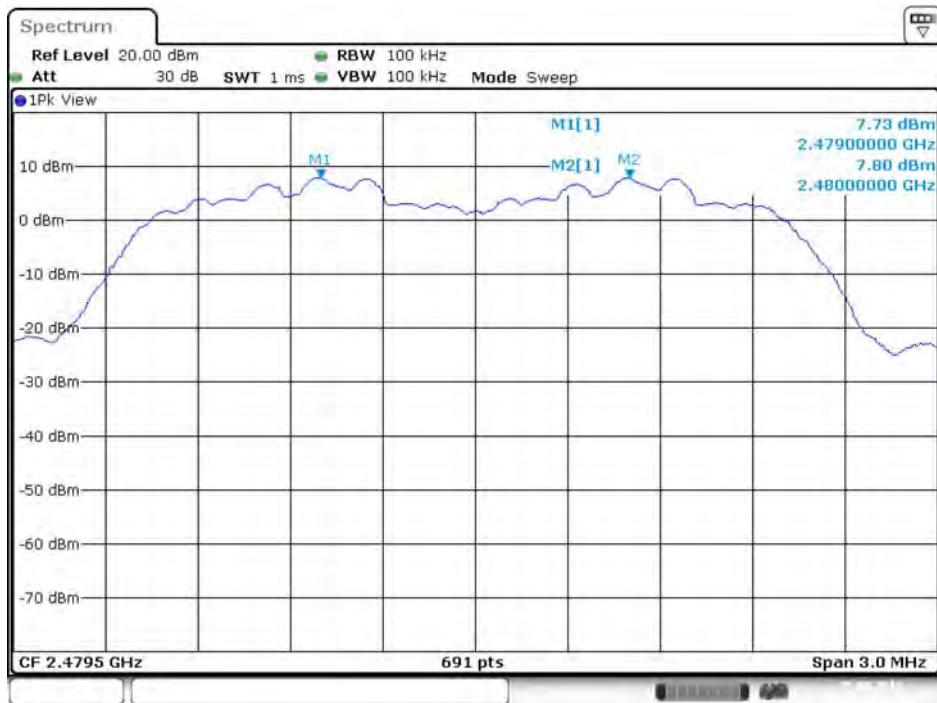
Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz

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


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

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


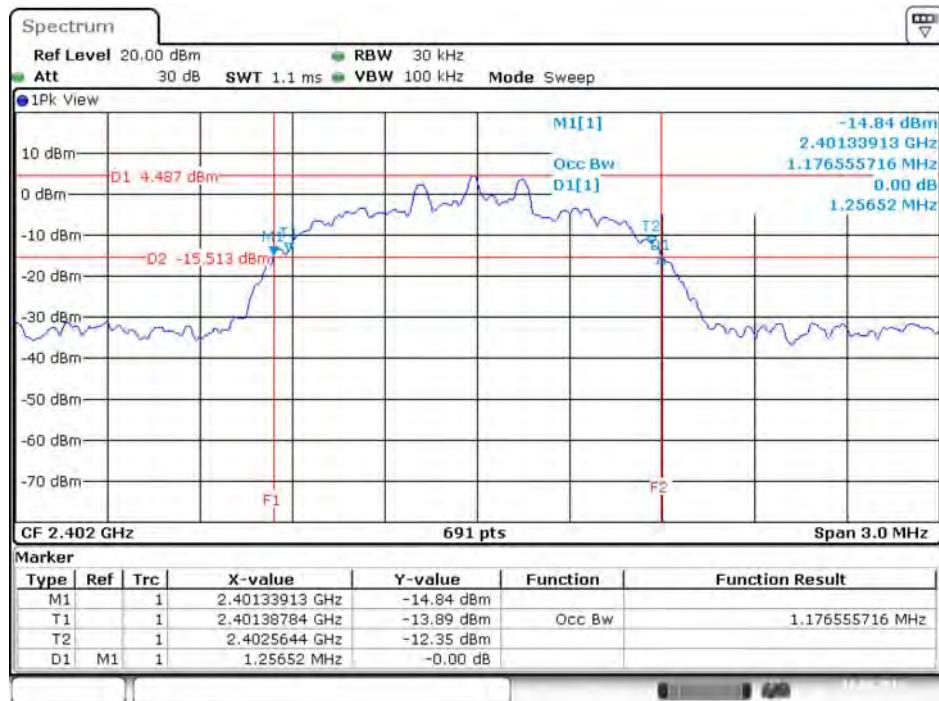
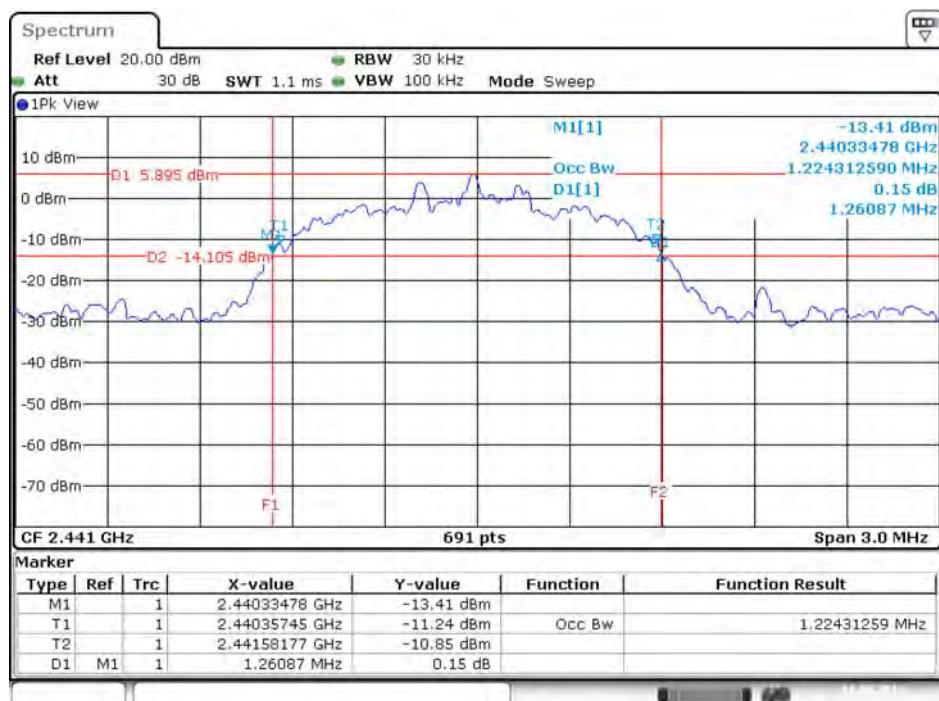
20 dB Bandwidth Plot on EDR ($\pi/4$ -DQPSK) 2 Mbps / Channel 78 / 2480 MHz

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


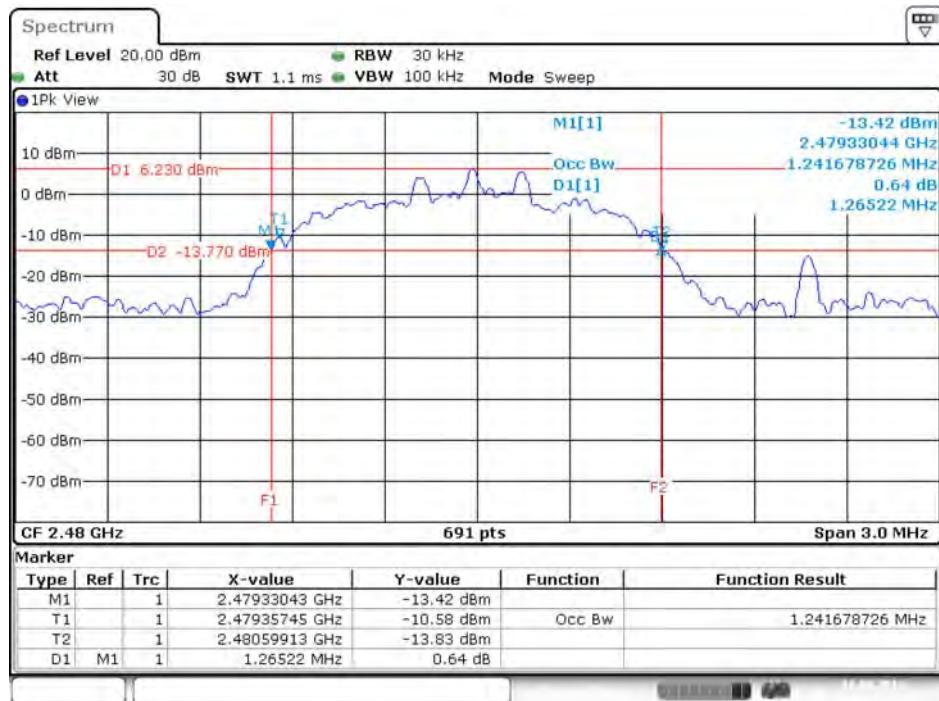
Channel Separation Plot on EDR ($\pi/4$ -DQPSK) 2 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz


Date: 25.AUG.2016 21:37:28

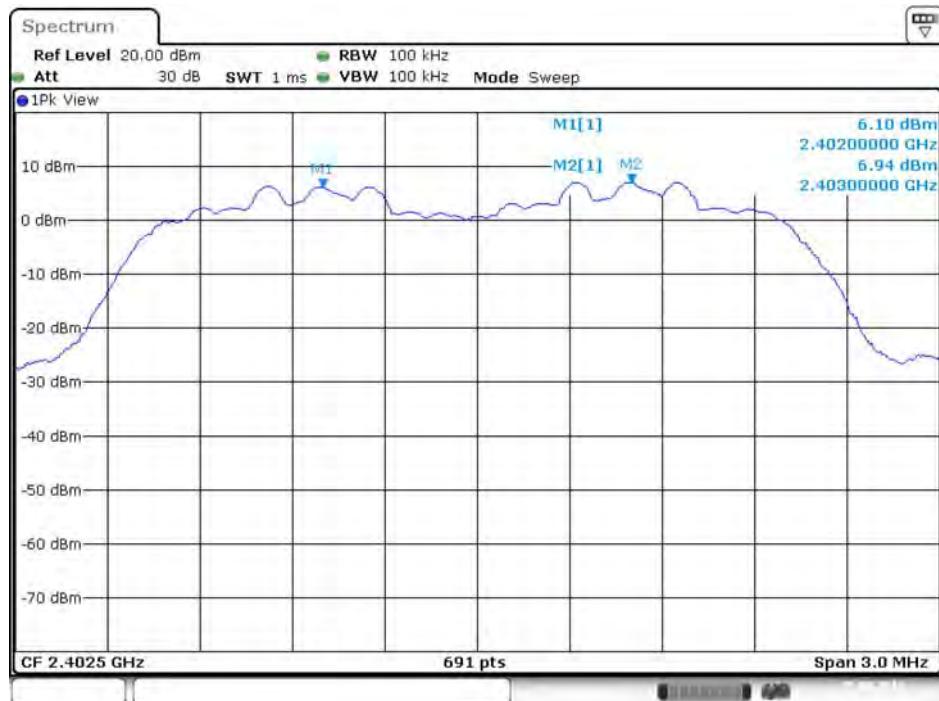
Channel Separation Plot on EDR ($\pi/4$ -DQPSK) 2 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz


Date: 25.AUG.2016 21:39:44

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

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


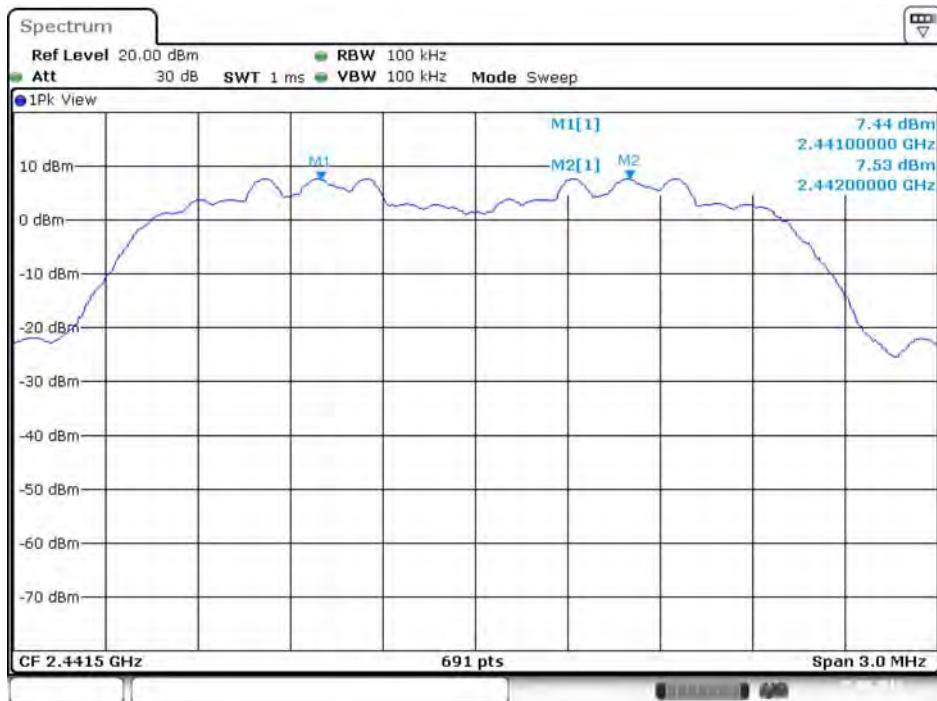
20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 78 / 2480 MHz


Date: 18.AUG.2016 17:32:06

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


Date: 25.AUG.2016 21:43:04

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



Date: 25.AUG.2016 21:45:15

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



Date: 25.AUG.2016 21:47:26

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

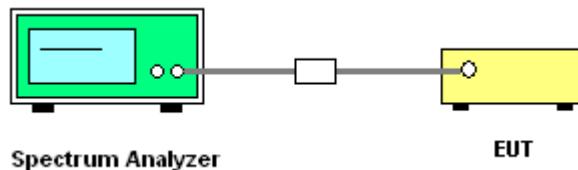
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

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

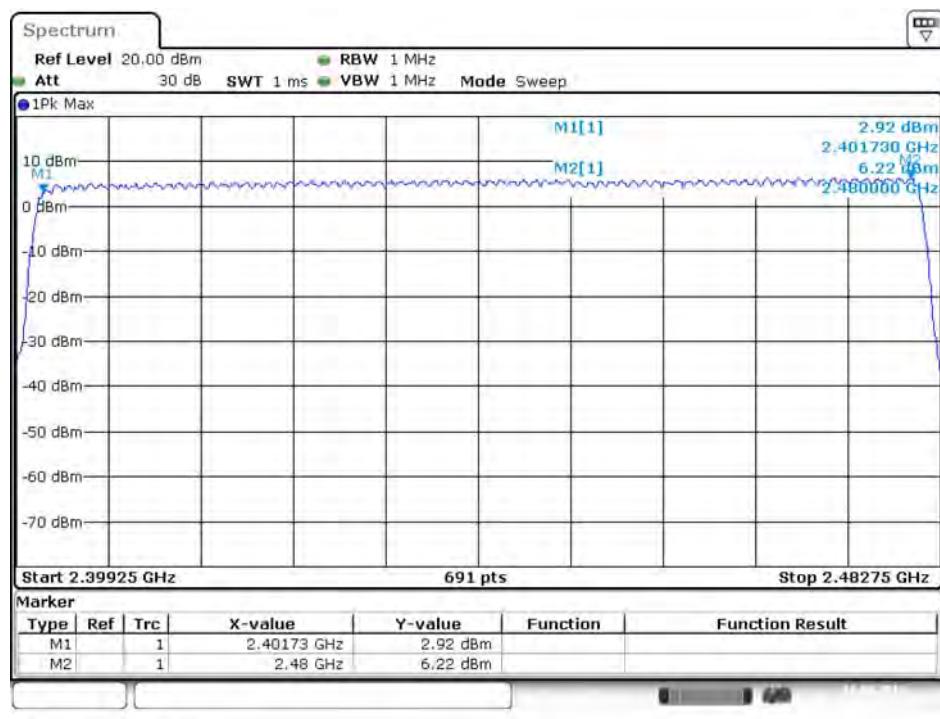
The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Number of Hopping Frequency

Temperature	24°C	Humidity	58%
Test Engineer	Eddie Weng	Configurations	EDR (8DPSK)

Modulation Type	Channel No.	Frequency (MHz)	Hopping Ch. (Channels)	Min. Limit (Channels)	Test Result
EDR (8DPSK)	0 ~ 78	2402 ~ 2480MHz	79	15	Complies

Number of Hopping Channel Plot on EDR (8DPSK) / 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

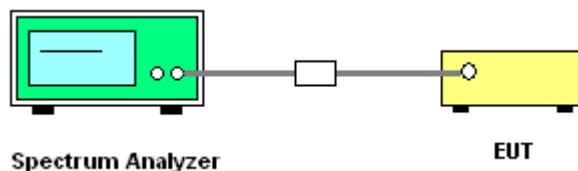
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

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	24°C	Humidity	58%
Test Engineer	Eddie Weng	Configurations	BR (GFSK) / DH1, DH3, DH5

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH1	2402 MHz	0.4029	0.1289	0.4000	Complies
DH3	2402 MHz	1.6522	0.2644	0.4000	Complies
DH5	2402 MHz	2.9130	0.3107	0.4000	Complies
DH1	2441 MHz	0.3971	0.1271	0.4000	Complies
DH3	2441 MHz	1.6522	0.2644	0.4000	Complies
DH5	2441 MHz	2.9130	0.3107	0.4000	Complies
DH1	2480 MHz	0.3971	0.1271	0.4000	Complies
DH3	2480 MHz	1.6522	0.2644	0.4000	Complies
DH5	2480 MHz	2.9130	0.3107	0.4000	Complies

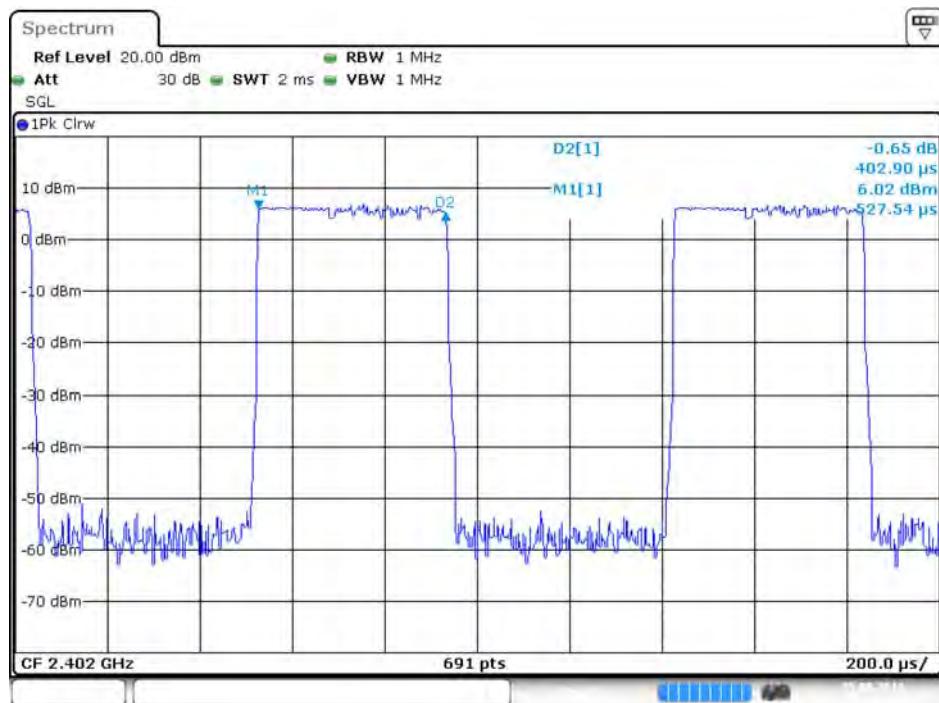
Note: Pulse Duration * Number of Pulses*(Dwell time / measure time)

Remark:

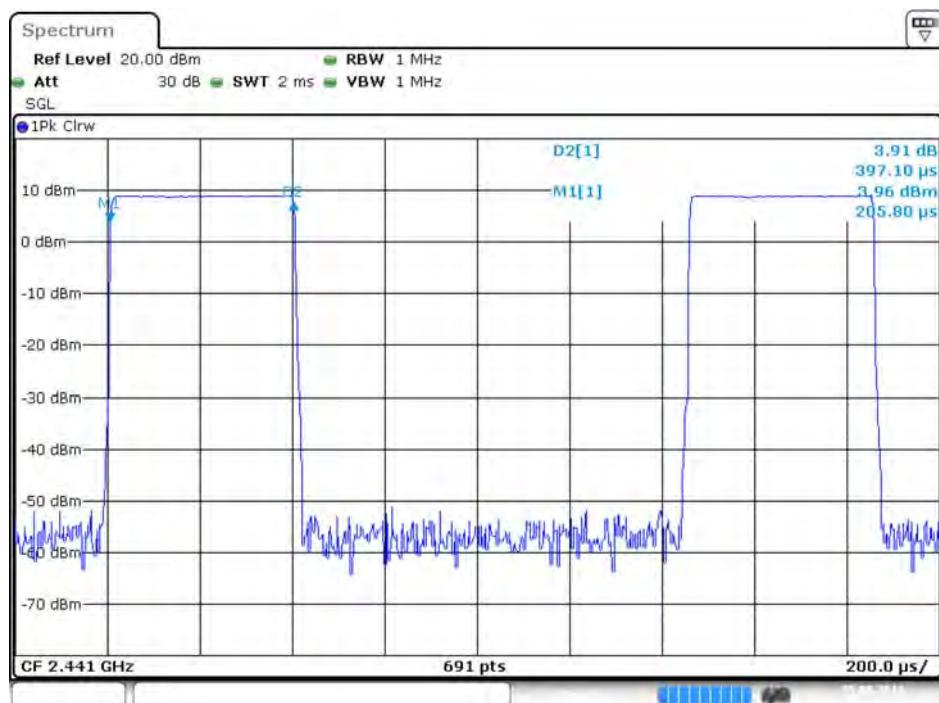
Dwell Time = 79(channels) x 0.4(s) x average hopping channel x package transfer time (us)

79 channels come from the Hopping Channel number.

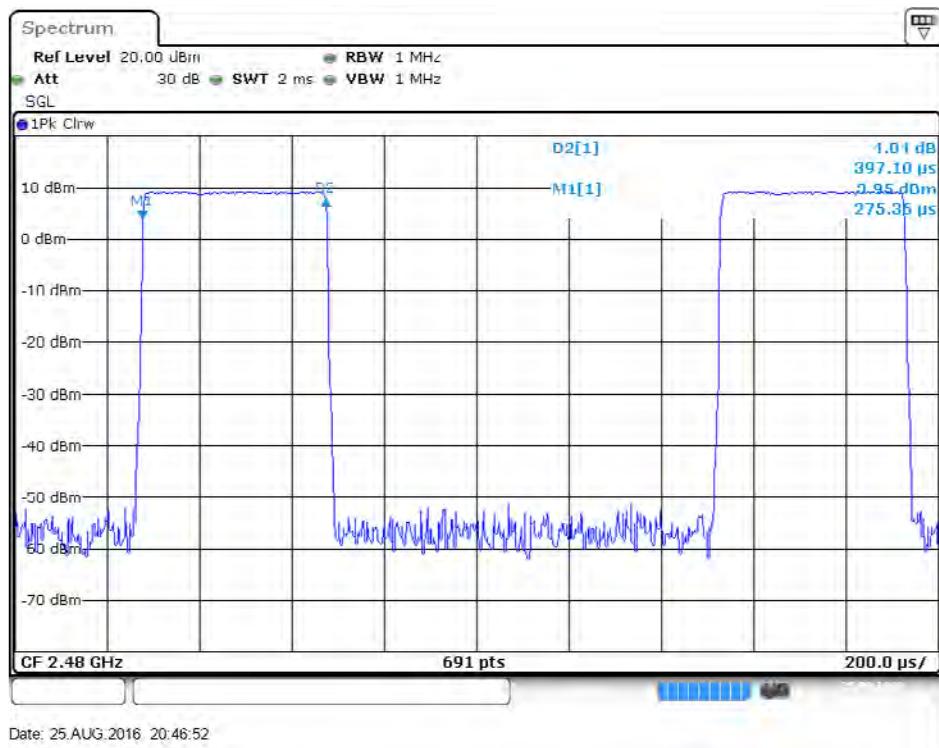
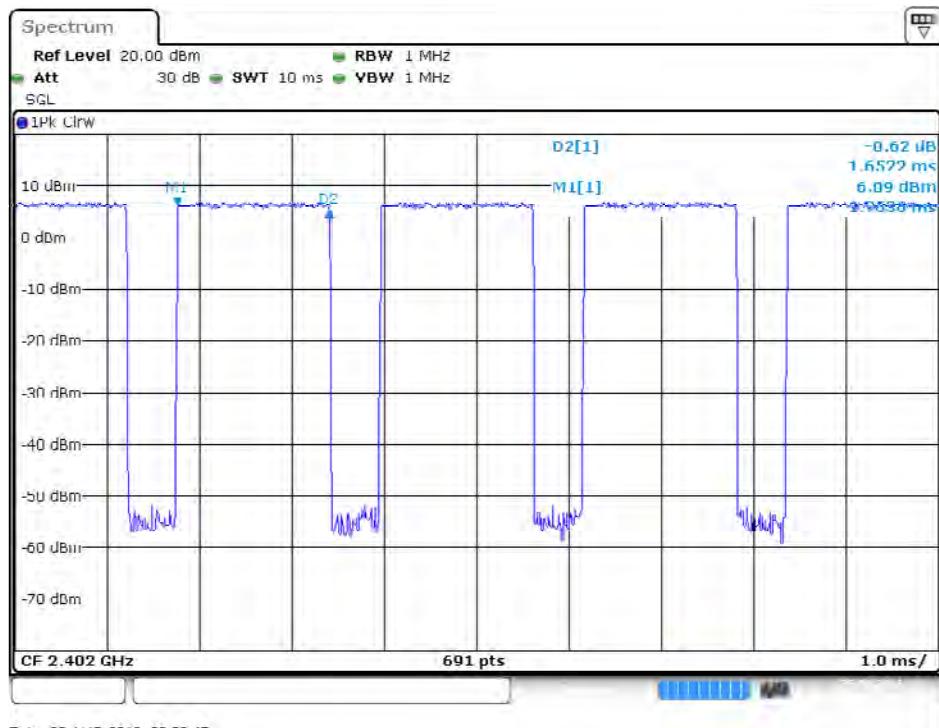
Average Hopping Channel = hops / sweep time

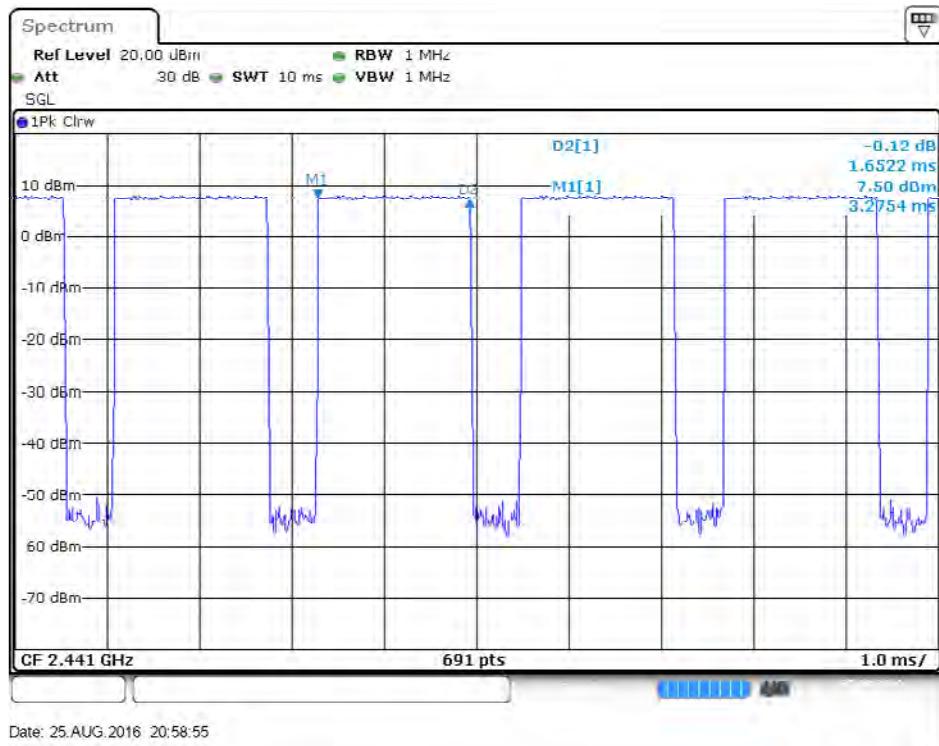
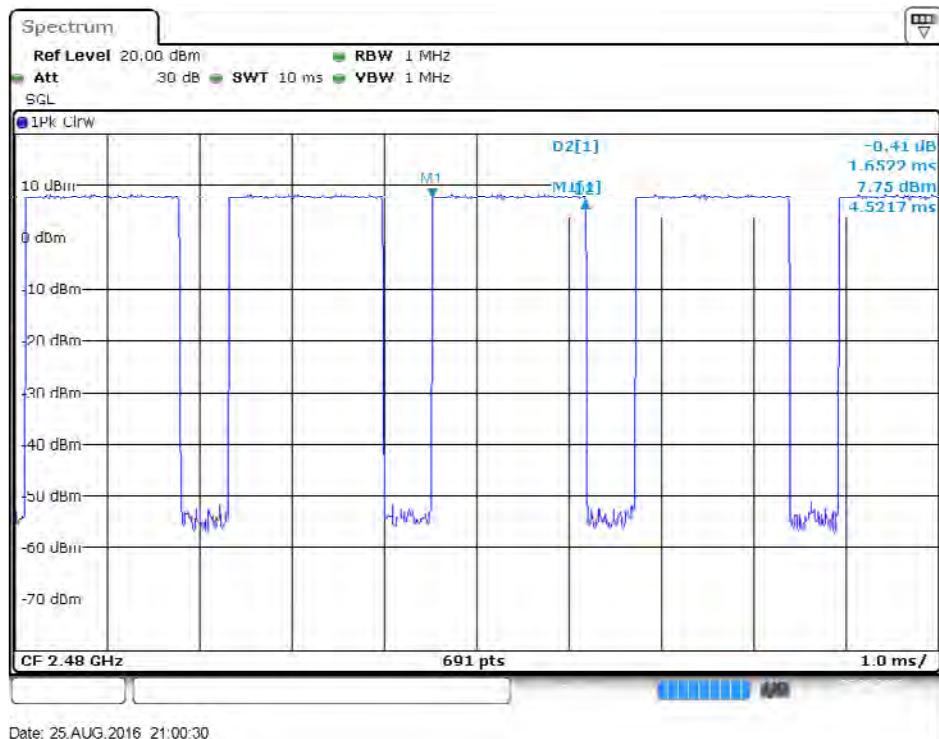
Dwell Time Plot on BR (GFSK) / Channel 0 / DH1 / 2402 MHz


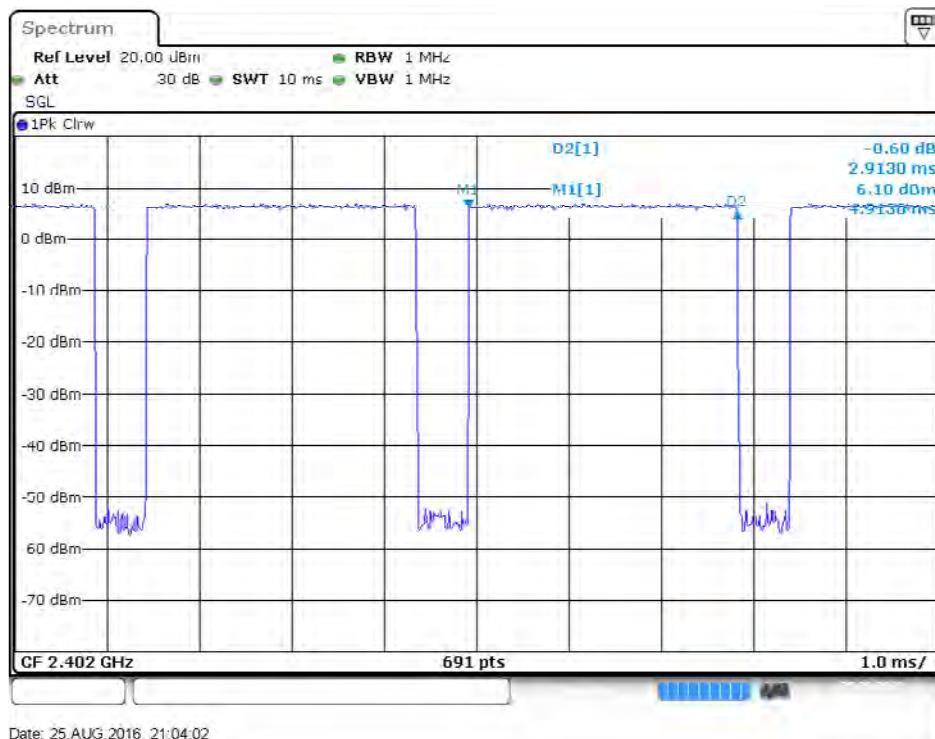
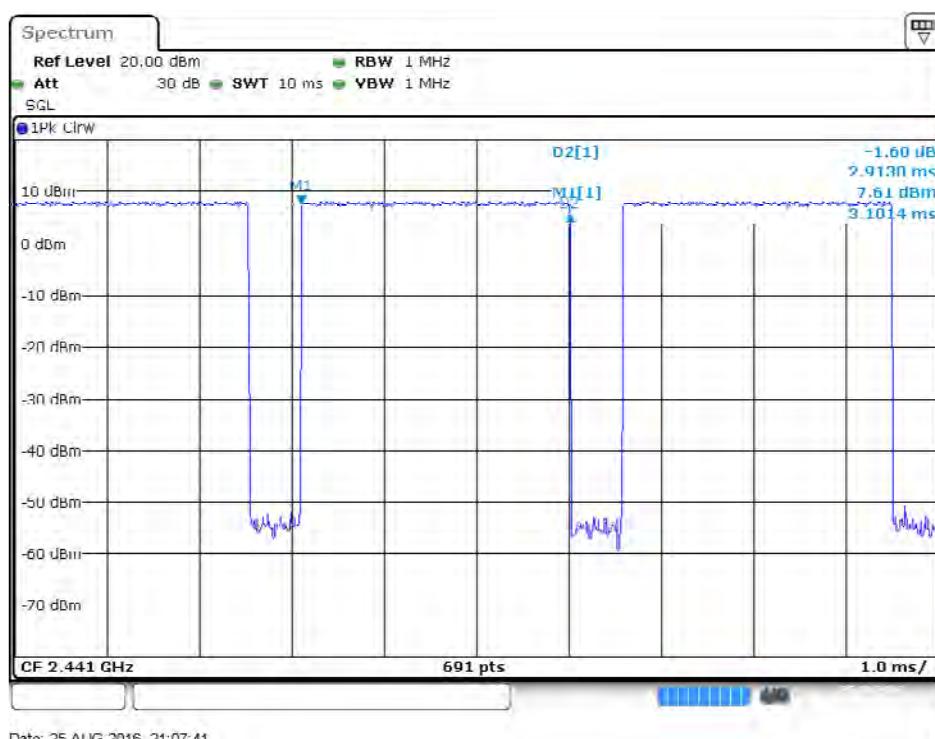
Date: 25.AUG.2016 20:40:34

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


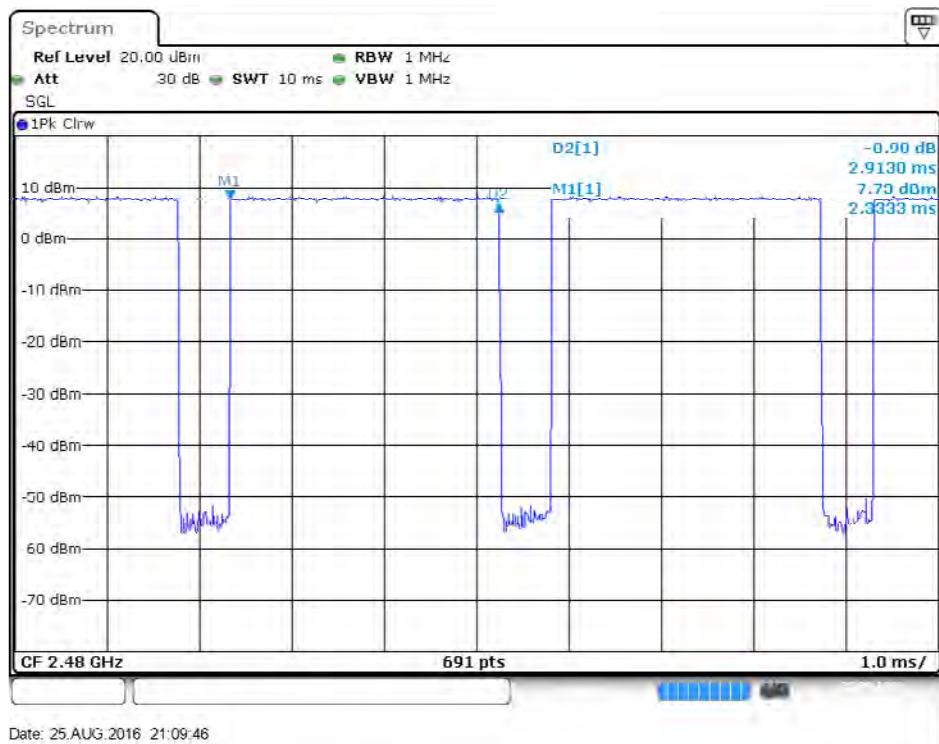
Date: 25.AUG.2016 20:44:21

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

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


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

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


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

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


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



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 / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz, 300kHz for peak

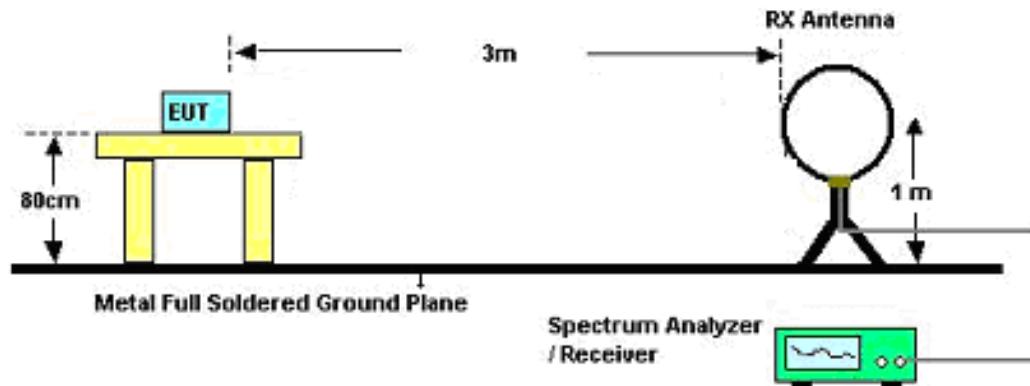
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz, RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz, RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz, RBW 120kHz for QP

4.6.3. Test Procedures

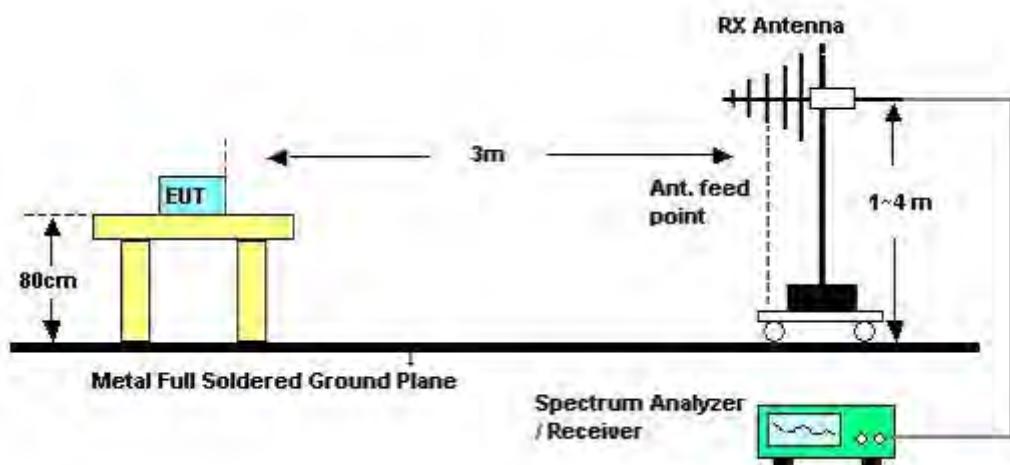
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting 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 1/T 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

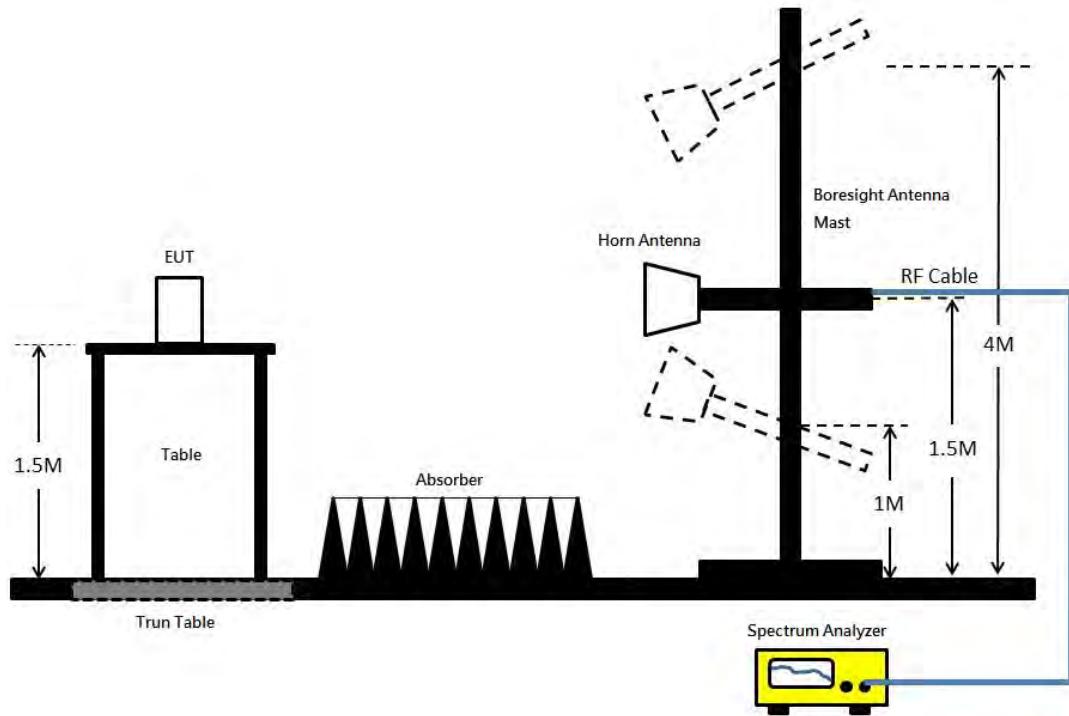
For Radiated Emissions: 9kHz ~30MHz



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	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	CTX
Test Date	Aug. 19, 2016		

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.

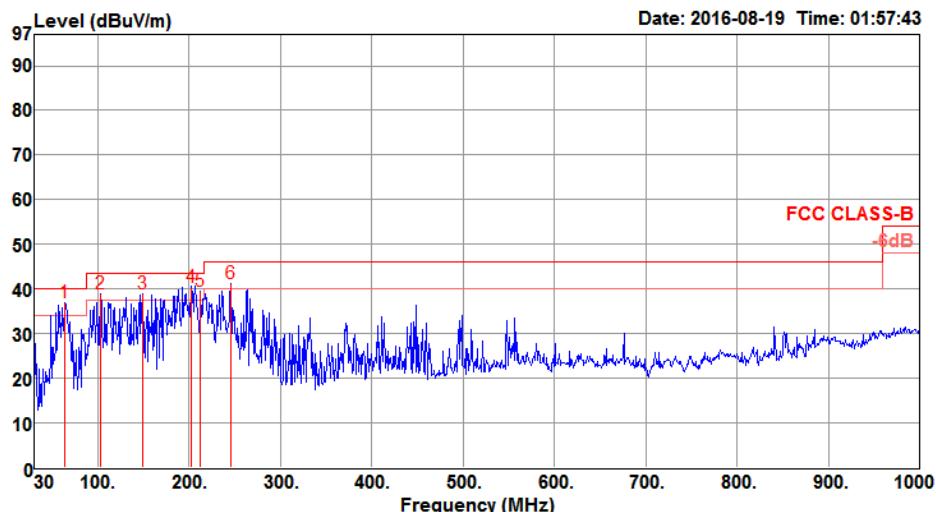
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

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

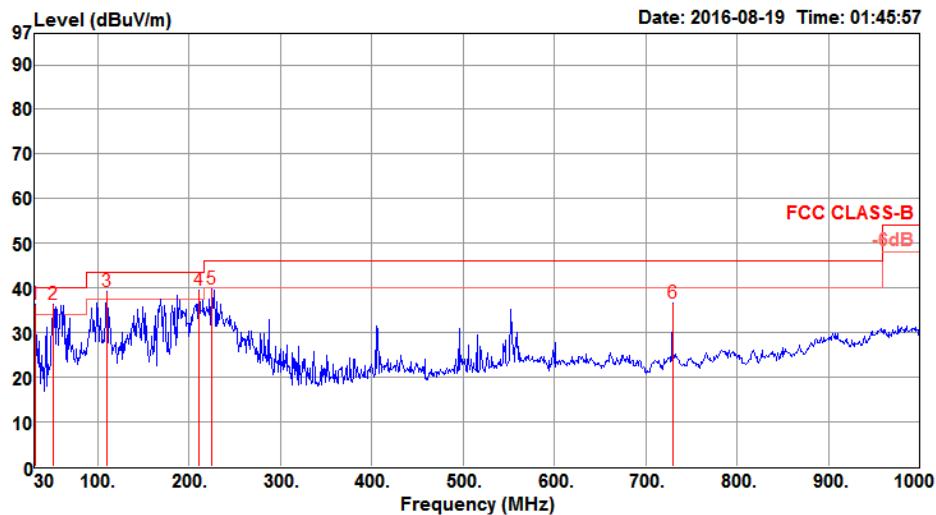
4.6.8. Results of Radiated Emissions (30MHz~1GHz)

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	CTX

Horizontal



Freq	Limit		Over Limit	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	Level	Line			Loss	dBuV			dB	cm	deg	
	MHz	dBuV/m	dBuV/m		dB		dB	dB/m	dB			
1	63.95	36.89	40.00	-3.11	52.41	1.42	12.52	28.40	100	0	Peak	HORIZONTAL
2	102.75	39.01	43.50	-4.49	52.18	1.59	17.21	28.26	100	0	Peak	HORIZONTAL
3	149.31	39.02	43.50	-4.48	52.49	1.68	16.93	27.98	100	0	Peak	HORIZONTAL
4	202.66	40.49	43.50	-3.01	52.67	1.87	16.14	27.76	100	0	Peak	HORIZONTAL
5	212.36	39.45	43.50	-4.05	48.93	1.89	16.43	27.73	100	0	Peak	HORIZONTAL
6	245.34	41.19	46.00	-4.81	51.43	1.96	18.45	27.65	100	0	Peak	HORIZONTAL

Vertical


Freq	Limit		Over Limit	Read Level	Cable Antenna			Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	Level	Line			Loss	Factor	Factor					
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	30.97	36.32	40.00	-3.68	55.07	1.22	24.93	28.49	400	0	Peak	VERTICAL
2	50.37	36.36	40.00	-3.64	51.31	1.32	14.91	28.46	400	0	Peak	VERTICAL
3	109.54	39.17	43.50	-4.33	51.14	1.61	17.92	28.21	400	0	Peak	VERTICAL
4	210.42	39.46	43.50	-4.04	49.19	1.89	16.48	27.74	400	0	Peak	VERTICAL
5	224.00	39.82	46.00	-6.18	50.17	1.91	16.51	27.70	400	0	Peak	VERTICAL
6	729.37	36.61	46.00	-9.39	44.13	3.20	25.84	28.56	400	0	Peak	VERTICAL

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	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	BR (GFSK) / Channel 0
Test Date	Aug. 18, 2016		

Horizontal

Freq	Level	Limit		Over Line	Read Limit	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	Factor	Factor	cm	deg		
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4803.70	35.86	54.00	-18.14	29.62	7.01	34.13	34.90	117	125	Average	HORIZONTAL
2	4803.70	60.41	74.00	-13.59	54.17	7.01	34.13	34.90	117	125	Peak	HORIZONTAL

Vertical

Freq	Level	Limit		Over Line	Read Limit	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	Factor	Factor	cm	deg		
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4803.65	36.66	54.00	-17.34	30.42	7.01	34.13	34.90	118	322	Average	VERTICAL
2	4803.65	61.21	74.00	-12.79	54.97	7.01	34.13	34.90	118	322	Peak	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	BR (GFSK) / Channel 39
Test Date	Aug. 18, 2016		

Horizontal

Freq	Level	Limit		Over	Read	Cable			A/Pos	T/Pos	Remark	Pol/Phase
		Line	Limit			Loss	Antenna	Preamp				
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4881.56	32.06	54.00	-21.94	25.37	7.21	34.38	34.90	117	126	Average	HORIZONTAL
2	4881.56	56.61	74.00	-17.39	49.92	7.21	34.38	34.90	117	126	Peak	HORIZONTAL

Vertical

Freq	Level	Limit		Over	Read	Cable			A/Pos	T/Pos	Remark	Pol/Phase
		Line	Limit			Loss	Antenna	Preamp				
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4882.02	33.46	54.00	-20.54	26.77	7.21	34.38	34.90	121	349	Average	VERTICAL
2	4882.02	58.01	74.00	-15.99	51.32	7.21	34.38	34.90	121	349	Peak	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	BR (GFSK) / Channel 78
Test Date	Aug. 18, 2016		

Horizontal

	Freq	Limit		Over Limit	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	dB/m						
	1	4960.14	31.75	54.00	-22.25	24.69	7.38	34.58	34.90	119	123	Average	HORIZONTAL
	2	4960.14	56.30	74.00	-17.70	49.24	7.38	34.58	34.90	119	123	Peak	HORIZONTAL

Vertical

	Freq	Limit		Over Limit	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	dB/m						
	1	4960.31	34.52	54.00	-19.48	27.46	7.38	34.58	34.90	121	322	Average	VERTICAL
	2	4960.31	59.07	74.00	-14.93	52.01	7.38	34.58	34.90	121	322	Peak	VERTICAL

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	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	EDR (8DPSK) / Channel 0
Test Date	Aug. 18, 2016		

Horizontal

	Freq	Limit		Over Line	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	dB						
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4803.60	33.77	54.00	-20.23	27.53	7.01	34.13	34.90	114	125	Average	HORIZONTAL	
2	4803.60	58.32	74.00	-15.68	52.08	7.01	34.13	34.90	114	125	Peak	HORIZONTAL	

Vertical

	Freq	Limit		Over Line	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Level	Line			Loss	dB						
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg			
1	4803.97	34.13	54.00	-19.87	27.89	7.01	34.13	34.90	110	322	Average	VERTICAL	
2	4803.97	58.68	74.00	-15.32	52.44	7.01	34.13	34.90	110	322	Peak	VERTICAL	

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	EDR (8DPSK) / Channel 39
Test Date	Aug. 18, 2016		

Horizontal

	Freq	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	Freq	Level	Line	Limit	Level	Loss	Factor	Factor			
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4882.54	30.86	54.00	-23.14	24.17	7.21	34.38	34.90	109	129	Average HORIZONTAL
2	4882.54	55.41	74.00	-18.59	48.72	7.21	34.38	34.90	109	129	Peak HORIZONTAL

Vertical

	Freq	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	Freq	Level	Line	Limit	Level	Loss	Factor	Factor			
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4881.55	33.55	54.00	-20.45	26.86	7.21	34.38	34.90	109	322	Average VERTICAL
2	4881.55	58.10	74.00	-15.90	51.41	7.21	34.38	34.90	109	322	Peak VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	EDR (8DPSK) / Channel 78
Test Date	Aug. 18, 2016		

Horizontal

	Freq	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	Freq	Level	Line	Limit	Level	Loss	Factor	Factor			
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4959.00	32.19	54.00	-21.81	25.13	7.38	34.58	34.90	108	126	Average HORIZONTAL
2	4959.00	56.74	74.00	-17.26	49.68	7.38	34.58	34.90	108	126	Peak HORIZONTAL

Vertical

	Freq	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	Freq	Level	Line	Limit	Level	Loss	Factor	Factor			
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4960.23	34.64	54.00	-19.36	27.58	7.38	34.58	34.90	122	322	Average VERTICAL
2	4960.23	59.19	74.00	-14.81	52.13	7.38	34.58	34.90	122	322	Peak VERTICAL

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 (microvolt/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 / 1/T for Average
RBW / VBW (20dBc in any 100 kHz bandwidth emission)	100 kHz /100 kHz for Peak

4.7.3. Test Procedures

For Radiated band edges Measurement:

The test procedure is the same as section 4.6.3.

For Radiated Out of Band Emission Measurement:

The test procedure is follow 15.247(d).

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.

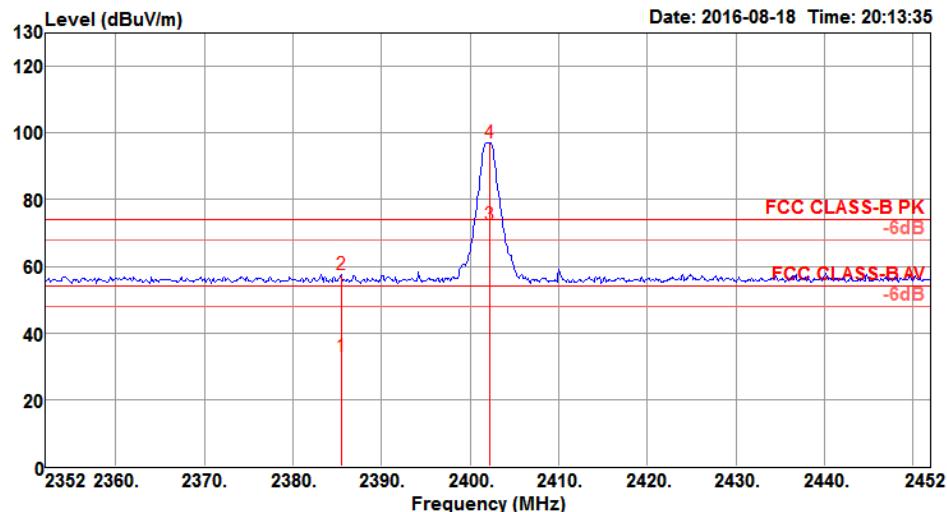
4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.7.7. Test Result of Band Edge and Fundamental Emissions

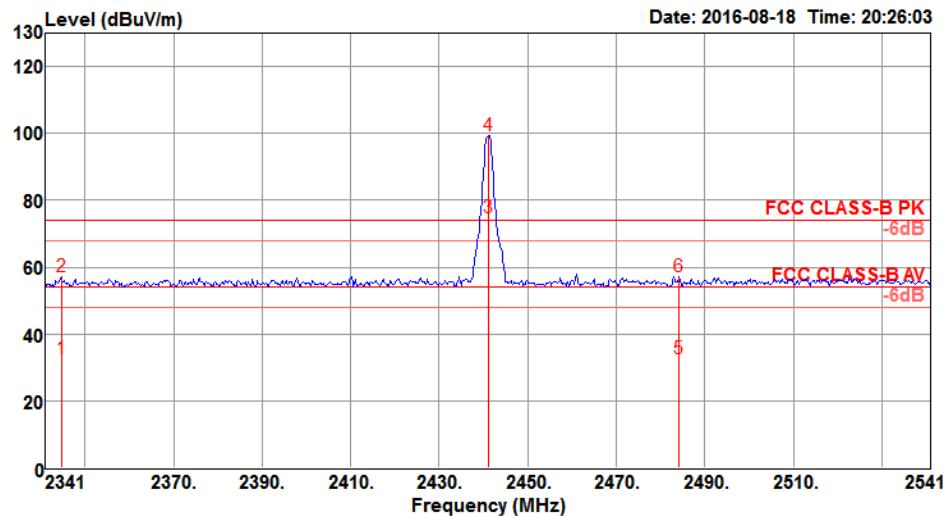
Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	BR (GFSK) / Channel 0, 39, 78

Channel 0



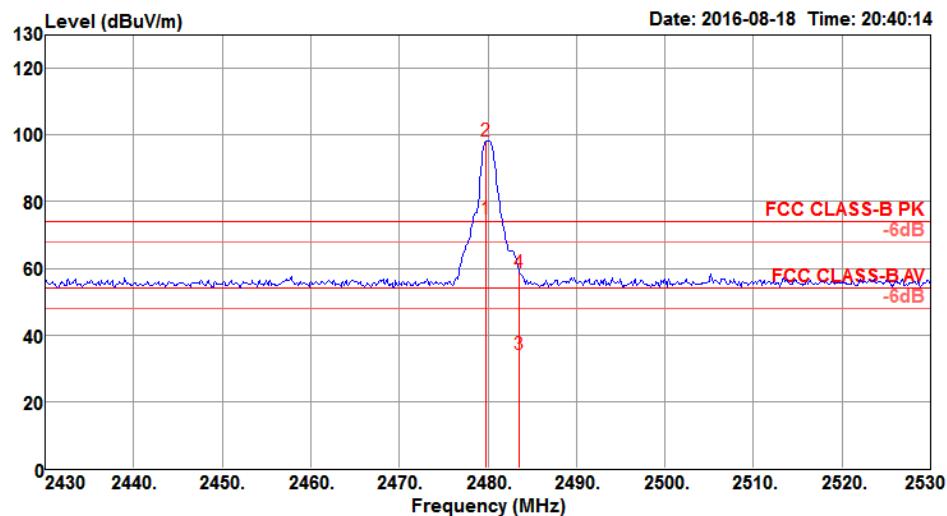
Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
		Line	Limit	Level	Loss	Factor	Factor	cm	deg		
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2385.40	32.93	54.00	-21.07	-0.49	4.85	28.57	0.00	117	228	Average
2	2385.40	57.48	74.00	-16.52	24.06	4.85	28.57	0.00	117	228	Peak
3	2402.20	72.63			39.17	4.86	28.60	0.00	117	228	Average
4	2402.20	97.18			63.72	4.86	28.60	0.00	117	228	Peak

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

Channel 39


Freq	Level	Limit		Over Limit	Read Level	Cable		Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Line	dBuV/m			dB	dBuV			dB	cm	deg	
	MHz												
1	2344.60	32.69	54.00	-21.31	-0.61	4.81	28.49	0.00	124	230	Average	VERTICAL	
2	2344.60	57.24	74.00	-16.76	23.94	4.81	28.49	0.00	124	230	Peak	VERTICAL	
3	2441.00	74.75			41.15	4.91	28.69	0.00	124	230	Average	VERTICAL	
4	2441.00	99.30			65.70	4.91	28.69	0.00	124	230	Peak	VERTICAL	

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

Channel 78


Freq	Level	Limit		Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
		Line	dBuV/m									
MHz	dBuV/m	dBuV/m	dB	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2479.80	74.65			40.94	4.95	28.76	0.00	140	133	Average	HORIZONTAL
2	2479.80	98.20			64.49	4.95	28.76	0.00	140	133	Peak	HORIZONTAL
3	2483.50	34.22	54.00	-19.78	0.50	4.95	28.77	0.00	140	133	Average	HORIZONTAL
4	2483.50	58.77	74.00	-15.23	25.05	4.95	28.77	0.00	140	133	Peak	HORIZONTAL

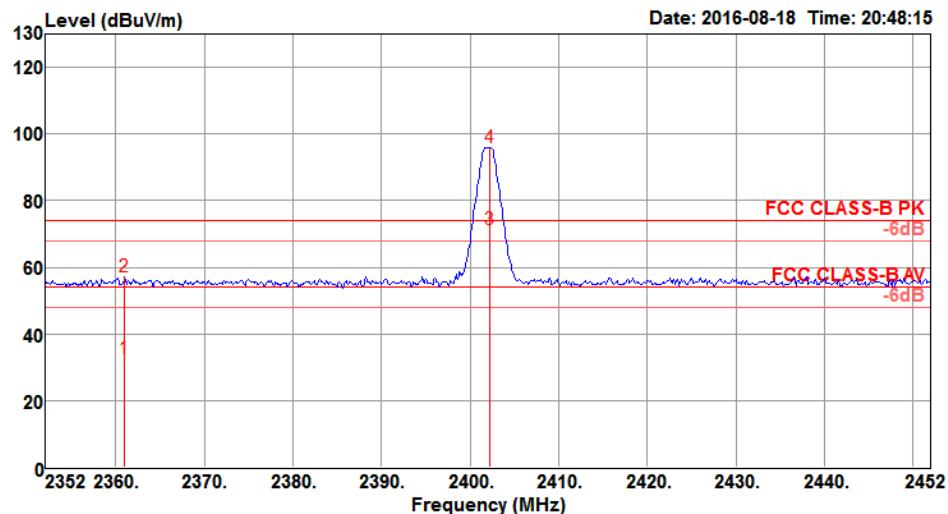
Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

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

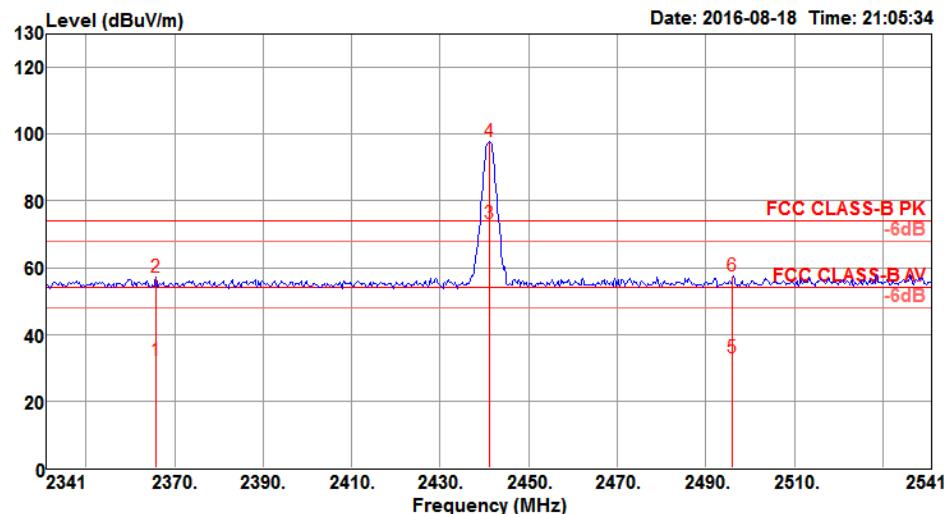
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	EDR (8DPSK) / Channel 0, 39, 78

Channel 0


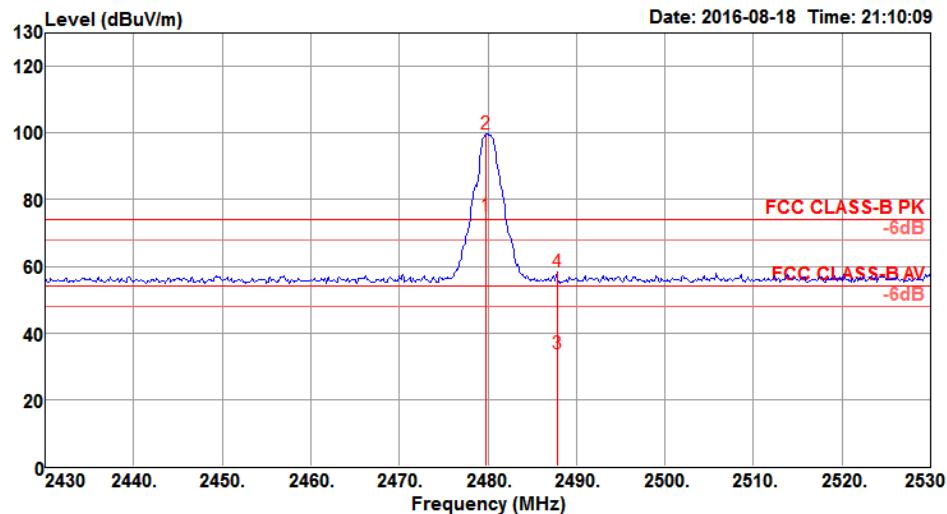
Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
		Line	Limit	Level	Loss	Factor	Factor	cm	deg		
1	2361.00	32.67	54.00	-21.33	-0.66	4.82	28.51	0.00	103	228	Average
2	2361.00	57.22	74.00	-16.78	23.89	4.82	28.51	0.00	103	228	Peak
3	2402.20	71.43			37.97	4.86	28.60	0.00	103	228	Average
4	2402.20	95.98			62.52	4.86	28.60	0.00	103	228	Peak

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

Channel 39


Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
		Line	Limit	Level	Loss	Factor	Factor	dB	cm		
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2365.80	32.29	54.00	-21.71	-1.07	4.83	28.53	0.00	167	134	Average
2	2365.80	57.14	74.00	-16.86	23.78	4.83	28.53	0.00	167	134	Peak
3	2441.00	73.19			39.59	4.91	28.69	0.00	167	134	Average
4	2441.00	97.74			64.14	4.91	28.69	0.00	167	134	Peak
5	2496.00	32.94	54.00	-21.06	-0.81	4.96	28.79	0.00	167	134	Average
6	2496.00	57.49	74.00	-16.51	23.74	4.96	28.79	0.00	167	134	Peak

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

Channel 78


Freq	Level	Limit	Over	Read	Cable		Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
					Line	Limit						
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	dB	cm	deg		
1	2479.80	75.03			41.32	4.95	28.76	0.00	135	126	Average	VERTICAL
2	2479.80	99.58			65.87	4.95	28.76	0.00	135	126	Peak	VERTICAL
3	2487.80	33.85	54.00	-20.15	0.13	4.95	28.77	0.00	135	126	Average	VERTICAL
4	2487.80	58.40	74.00	-15.60	24.68	4.95	28.77	0.00	135	126	Peak	VERTICAL

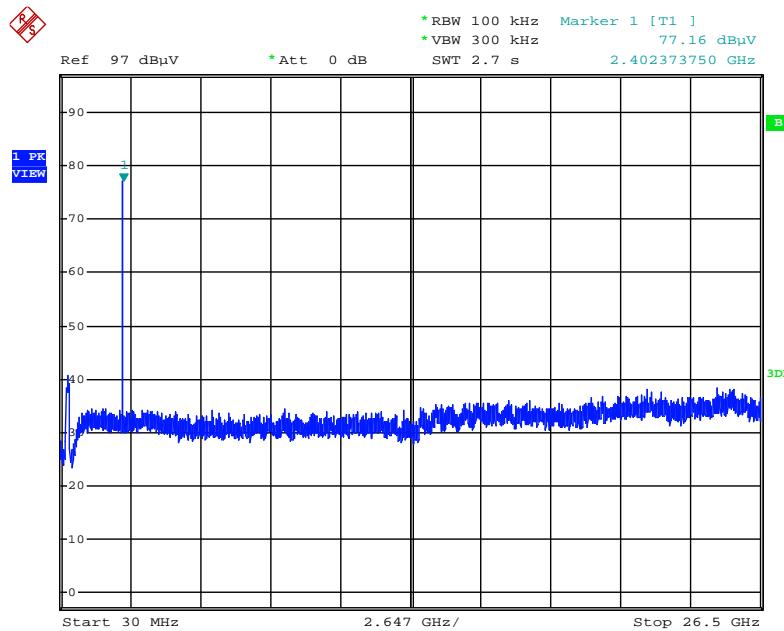
Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

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

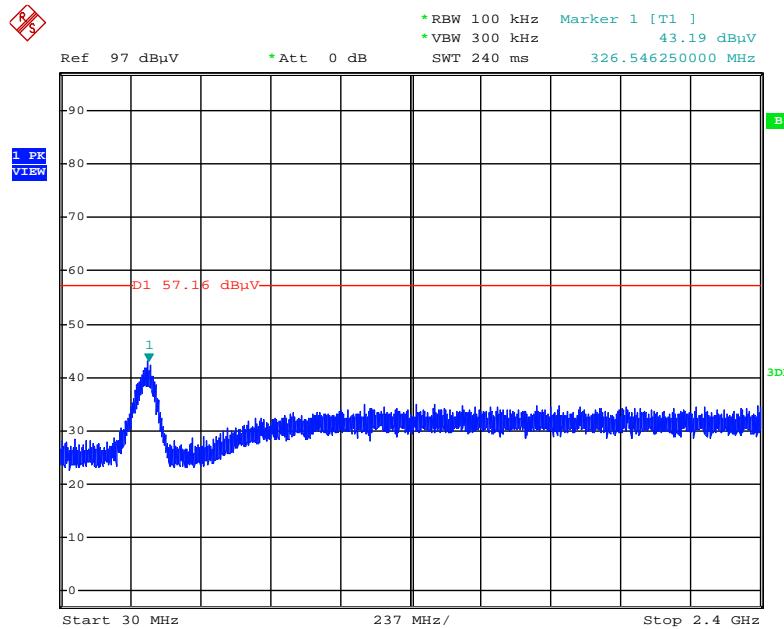
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

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



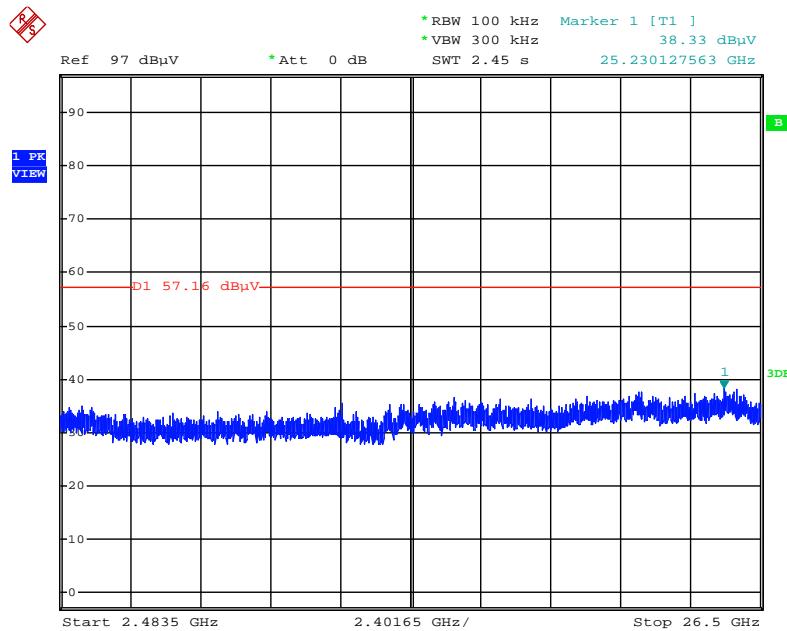
Date: 18.AUG.2016 22:38:15

Plot on Configuration For BR (GFSK) / Channel 0 / 30MHz~2400MHz (down 20dBc)



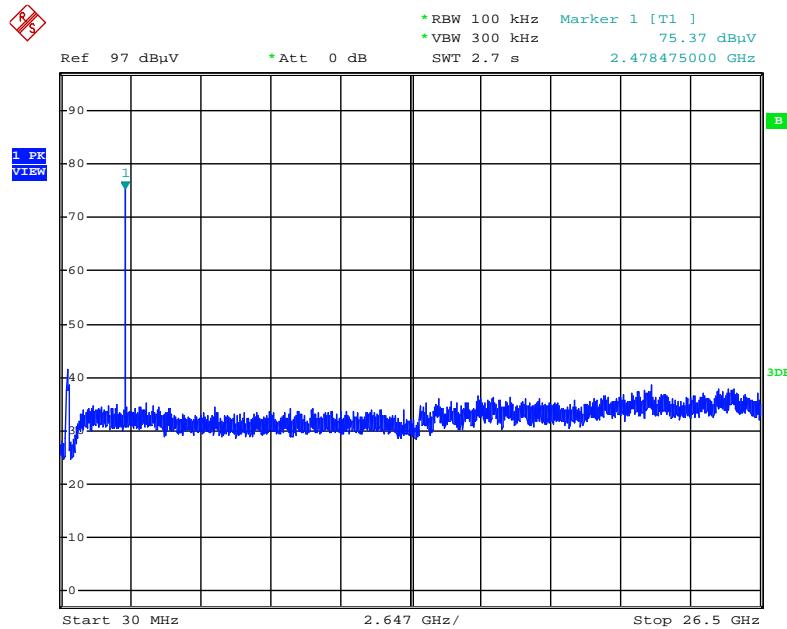
Date: 18.AUG.2016 22:38:55

Plot on Configuration For BR (GFSK) / Channel 0 / 2483.5MHz~26500MHz (down 20dBc)



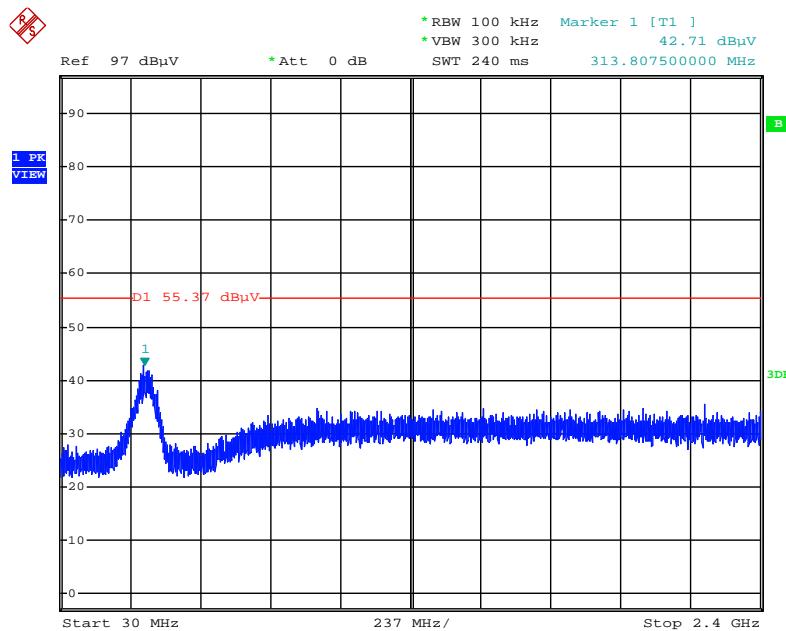
Date: 18.AUG.2016 22:39:26

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



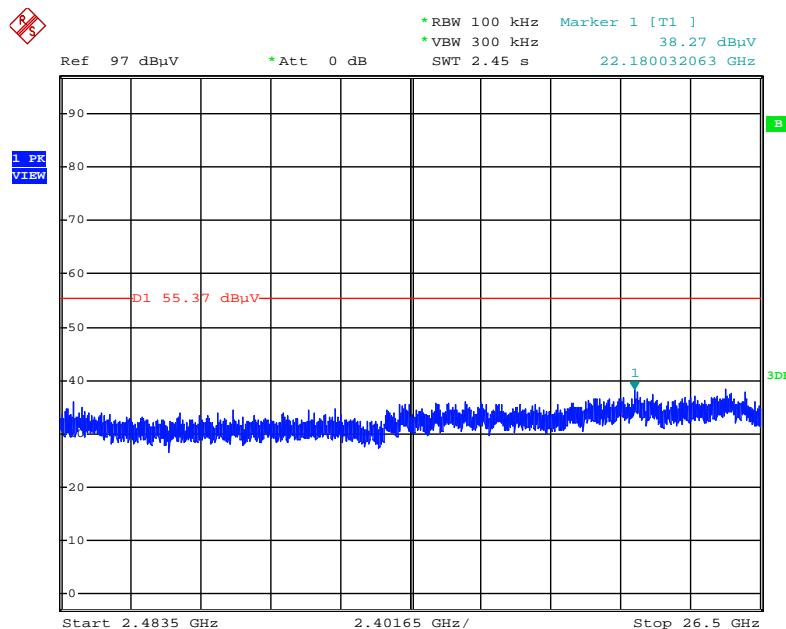
Date: 18.AUG.2016 22:33:24

Plot on Configuration For BR (GFSK) / Channel 78 / 30MHz~2400MHz (down 20dBc)



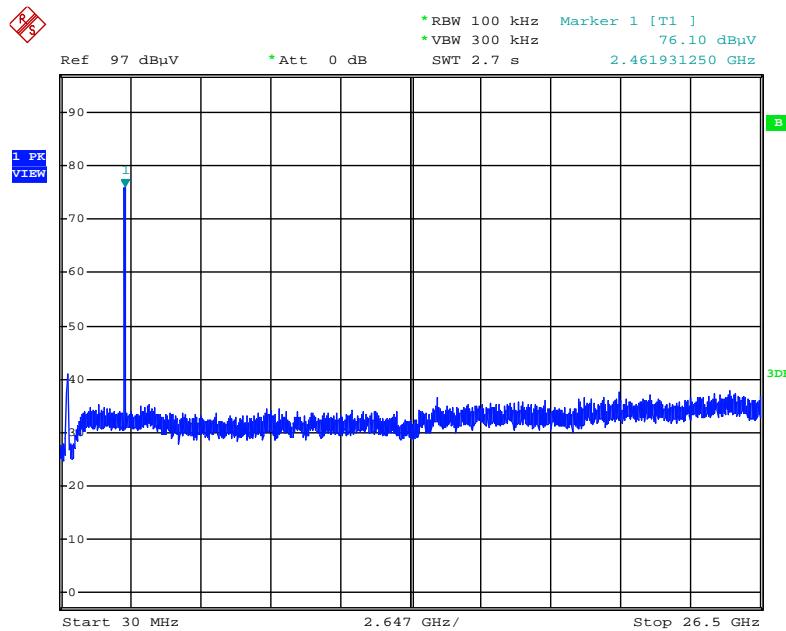
Date: 18.AUG.2016 22:34:08

Plot on Configuration For BR (GFSK) / Channel 78 / 2483.5MHz~26500MHz (down 20dBc)



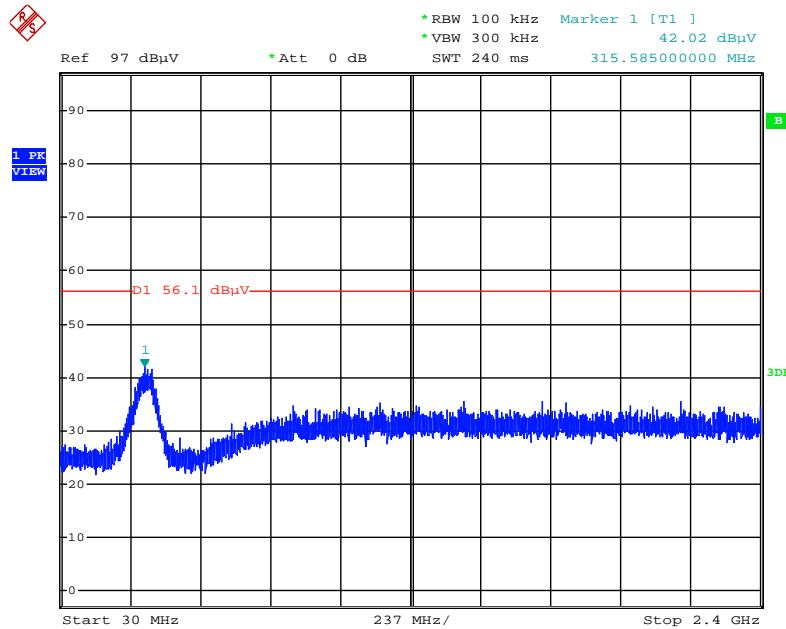
Date: 18.AUG.2016 22:34:50

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



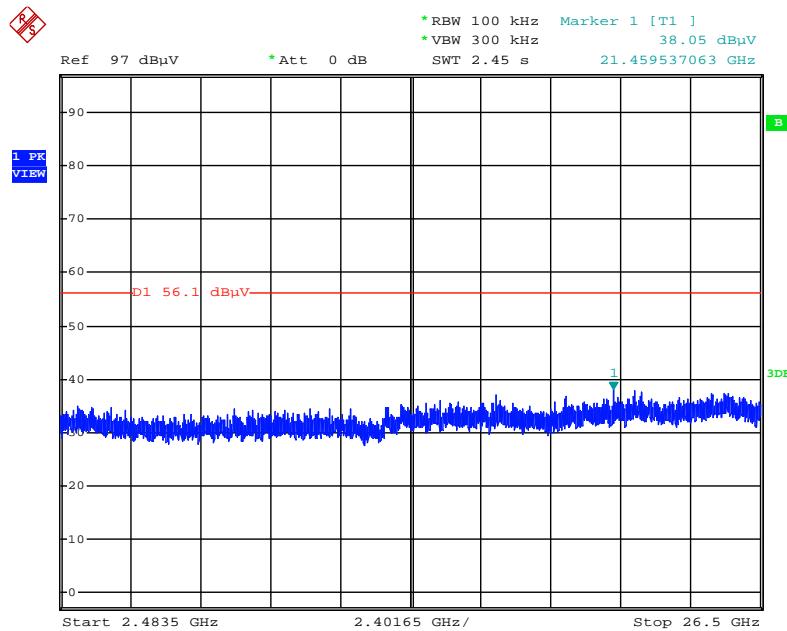
Date: 18.AUG.2016 22:55:37

Plot on Configuration For BR (GFSK) / Hopping / 30MHz~2400MHz (down 20dBc)



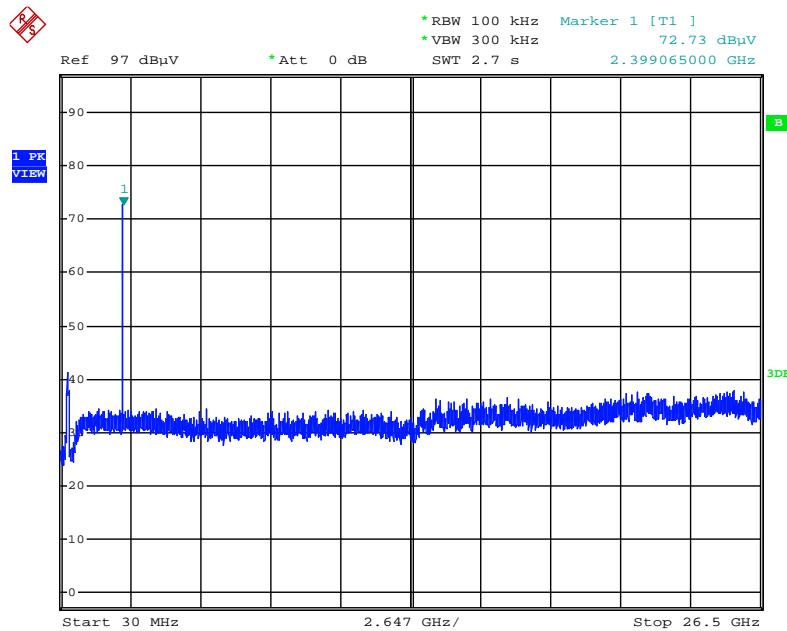
Date: 18.AUG.2016 22:56:11

Plot on Configuration For BR (GFSK) / Hopping / 2483.5MHz~26500MHz (down 20dBc)



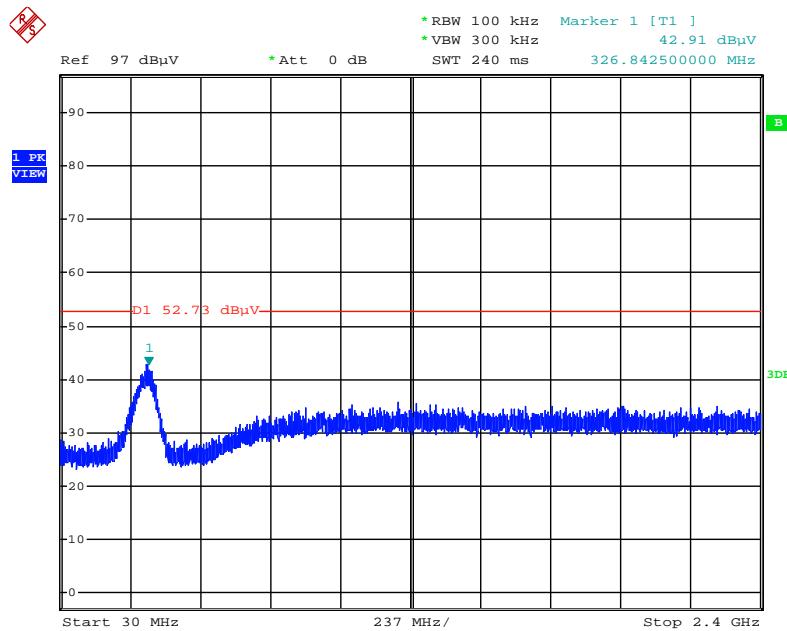
Date: 18.AUG.2016 22:56:47

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



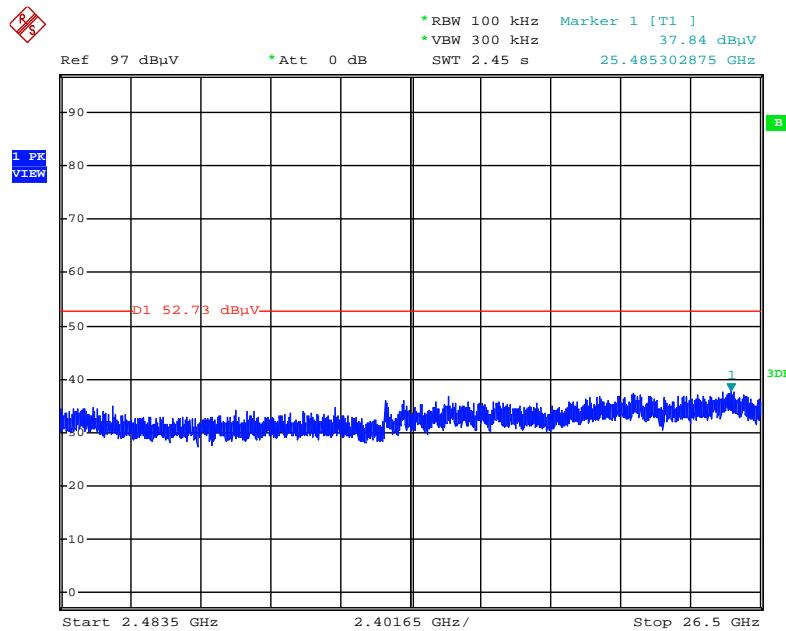
Date: 18.AUG.2016 22:42:03

Plot on Configuration For EDR (8DPSK) / Channel 0 / 30MHz~2400MHz (down 20dBc)



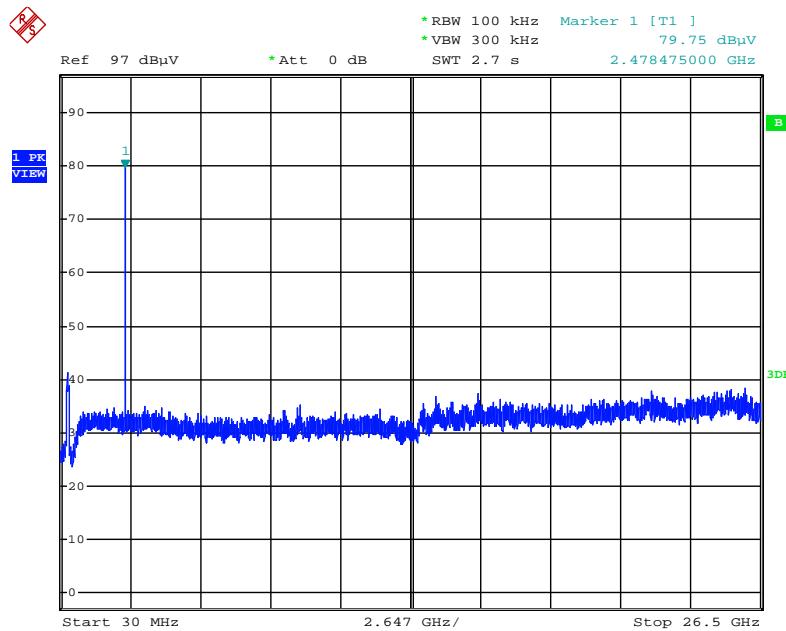
Date: 18.AUG.2016 22:42:51

Plot on Configuration For EDR (8DPSK) / Channel 0 / 2483.5MHz~26500MHz (down 20dBc)



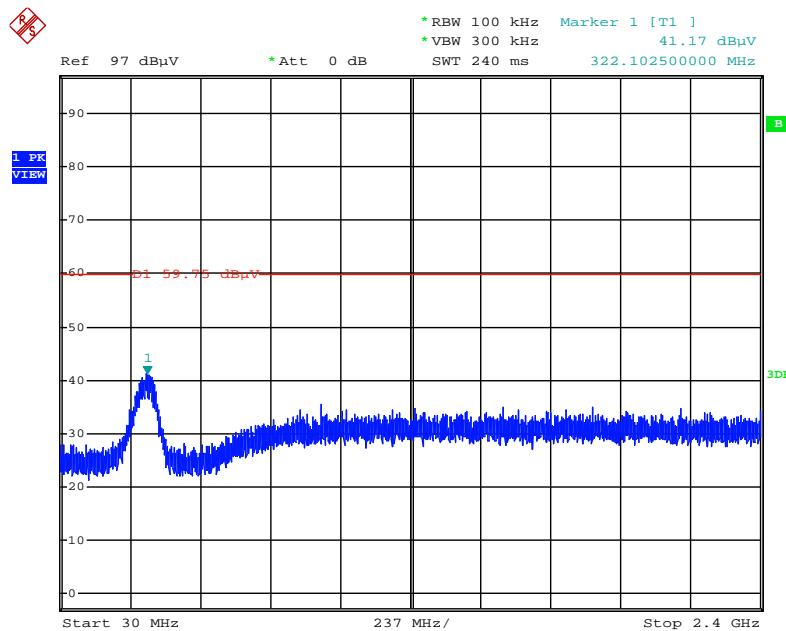
Date: 18.AUG.2016 22:43:30

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



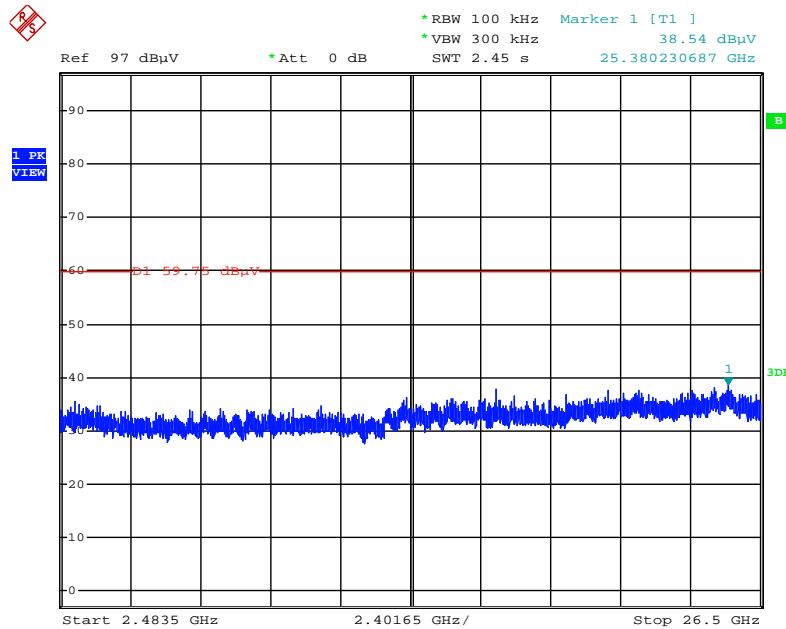
Date: 18.AUG.2016 22:44:48

Plot on Configuration For EDR (8DPSK) / Channel 78 / 30MHz~2400MHz (down 20dBc)



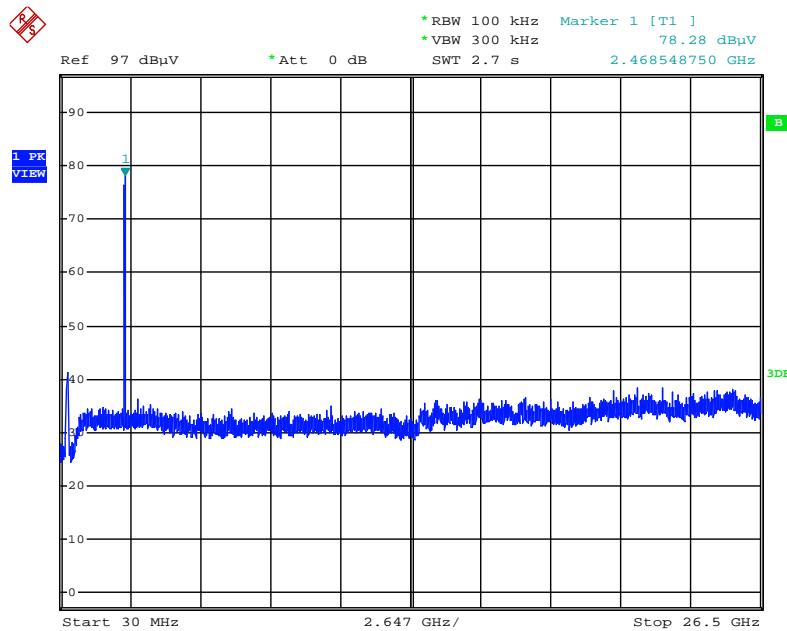
Date: 18.AUG.2016 22:45:21

Plot on Configuration For EDR (8DPSK) / Channel 78 / 2483.5MHz~26500MHz (down 20dBc)



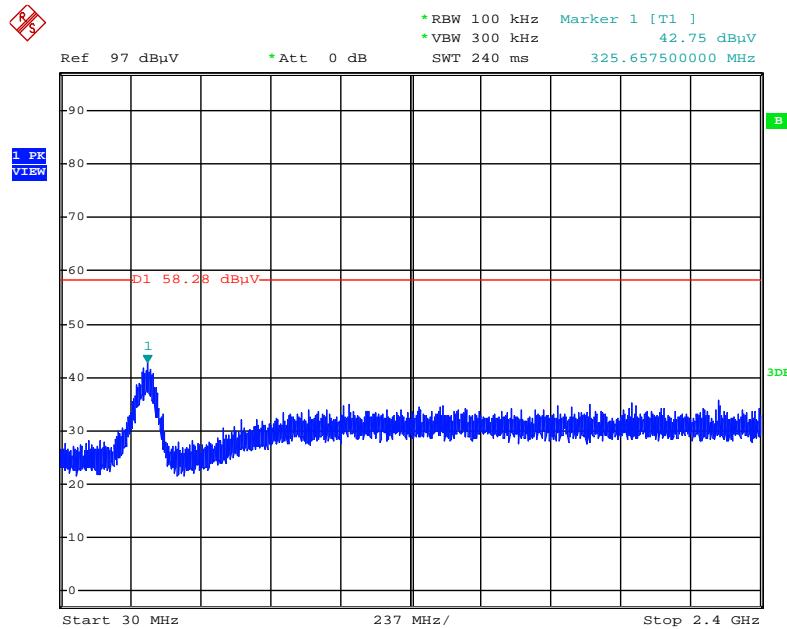
Date: 18.AUG.2016 22:46:00

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



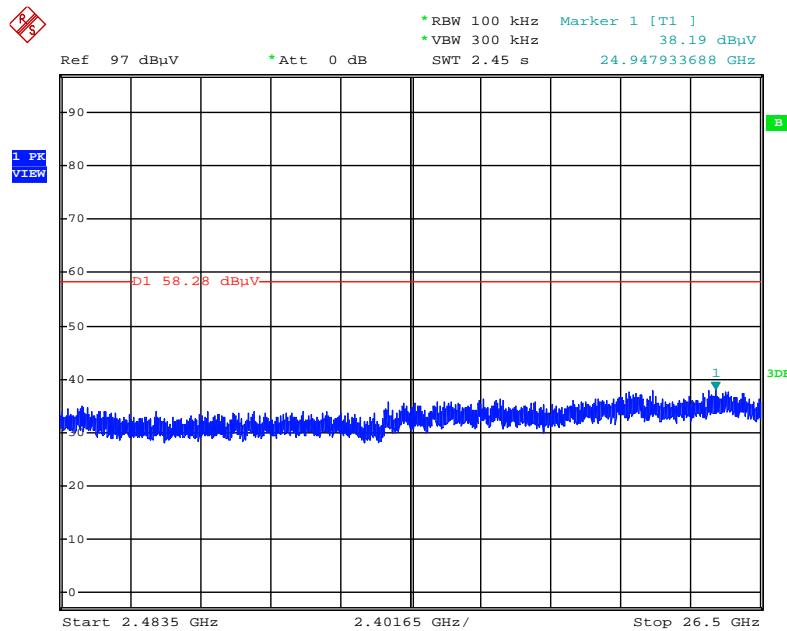
Date: 18.AUG.2016 22:49:23

Plot on Configuration For EDR (8DPSK) / Hopping / 30MHz~2400MHz (down 20dBc)



Date: 18.AUG.2016 22:50:26

Plot on Configuration For EDR (8DPSK) / Hopping / 2483.5MHz~26500MHz (down 20dBc)



Date: 18.AUG.2016 22:51:19

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 Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 27, 2016	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 08, 2015	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 23, 2015	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
Bilog Antenna	SCHAFFNER	CBL 6112B	2888	30MHz ~ 1GHz	Nov. 17, 2015	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Mar. 15, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 13, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 16, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-I0-7	N/A	N/A	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2016*	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 09, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz - 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz - 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz - 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz - 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz - 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	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

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%



Appendix A. Test Photos