

TEST REPORT

Report No.: SRTC2013-H024-E0005

Product Name: GSM/GPRS/EDGE Digital Mobile Phone
with Bluetooth and WiFi

Product Model: ZTE R239

Applicant: ZTE Corporation

Manufacturer: ZTE Corporation

Specification: FCC Part 15, Subpart C (October 9, 2012 edition)

FCC ID: SRQ-ZTER239

The State Radio_monitoring_center Testing Center (SRTC)

No.80 Beilishi Road Xicheng District Beijing, China

Tel: 86-10-68009202 Fax: 86-10-68009205

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1. General information

1.1 Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio_monitoring_center Testing Center (SRTC).

The test results relate only to individual items of the samples which have been tested.

1.2 Information about the testing laboratory

Company: The State Radio_monitoring_center Testing Center (SRTC)
Address: No.80 Beilishi Road, Xicheng District, Beijing China
City: Beijing
Country or Region: China
Contacted person: Wang Junfeng
Tel: +86 10 68009181 +86 10 68009202
Fax: +86 10 68009195 +86 10 68009205
Email: wangjf@srrc.org.cn / wangjunfeng@srtc.org.cn

1.3 Applicant's details

Company: ZTE Corporation
Address: ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park,
Nanshan District, 518057
City: Shenzhen
Country or Region: P.R.China
Grantee Code: SRQ
Contacted person: Min Zhang
Tel: +86-021-68897541
Fax: +86-021-50801070
Email: zhang.min13@zte.com.cn

1.4 Manufacturer's details

Company: ZTE Corporation
Address: Zhongxing Bldg, Hi-Tech Park, NanShan District, 518057
City: Shenzhen
Country or Region: P.R.China
Contacted person: Li Dezi
Tel: +86-021-68895196
Fax: +86-021-50801070
Email: li.dezi@zte.com.cn

1.5 Application details

Date of reception of test sample: 18th Apr 2013

Date of test: 29th Apr 2013 to 24th May 2013

1.6 Reference specification

FCC Part 15, Subpart C (October 9, 2012 edition)

1.7 Information of EUT

1.7.1 General information

Name of EUT	GSM/GPRS/EDGE Digital Mobile Phone with Bluetooth and WiFi
FCC ID	SRQ-ZTER239
Frequency Range	2.4GHz~2.4835GHz
Number of Channel	79
Modulation Type	GFSK, $\pi/4$ DQPSK, 8DPSK
Duplex Mode	TDD
Channel Spacing	1MHz
Data Rate	1Mbps, 2 Mbps, 3 Mbps
Antenna Type	Fixed Internal
Power Supply	Battery or Charger
Rated Power Supply Voltage	3.8V
HW Version	GMBA
SW Version	ZTE-CN-QS-P150A40V1.0.0

1.7.2 EUT details

Name	Model	IMEI
GSM/GPRS/EDGE Digital Mobile Phone with Bluetooth and WiFi	ZTE R239	355278040000310

1.7.3 Auxiliary equipment details

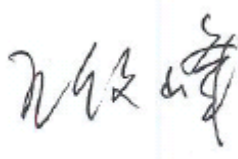
Equipment	Charger
Manufacturer	ZTE CORPORATION
Model Number	STC-A22O50I400M5-C
Input Voltage	100V-240V a.c.
Output Voltage	5.0V d.c.
Frequency	50/60Hz

Equipment	Battery
Manufacturer	ZTE CORPORATION
Model Number	Li3706T42P3h453756
Capacity	670mAh
Rated Voltage	3.7V d.c.

2. Test information

2.1 Summary of the test results

No.	Test case	FCC reference	Verdict
1	Occupied Bandwidth	15.247(a)(1)	Pass
2	Peak Power Output	15.247(a)(1)	Pass
3	Spurious RF Conducted Emissions	15.247(d)	Pass
4	Spurious Radiated Emissions	15.247(d)/15.35(b)/15.209	Pass
5	Band Edge Compliance	15.247(d)	Pass
6	Dwell time	15.247(a)(1)(iii)	Pass
7	Channel separation	15.247(a)(1)	Pass
8	Number of Hopping Frequencies	15.247(a)(1)(iii)	Pass

This Test Report Is Issued by: Mr. Song Qizhu Director of the test lab 	Checked by: Mr. Wang Junfeng Deputy director of the test lab 
Tested by: Mr. Li Bin Test engineer 	Issued date: 2013.07.11

2.2 Test result

2.2.1 Occupied Bandwidth

2.2.1.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.1.2 Test Description

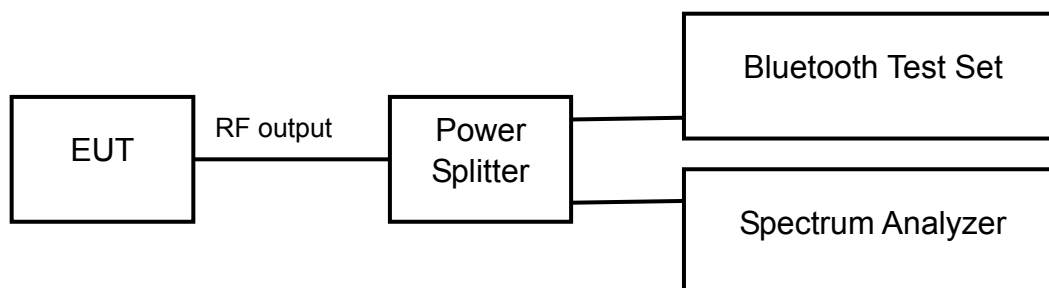
The measurement is made according to Public notice DA 00-705 and ANSI C63.4.

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produces the worst-case (widest) occupied bandwidth. The resolution bandwidth for measuring the reference level and the occupied bandwidth was 10 kHz.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.



2.2.1.3 Test limit

FCC Part15.247(a)(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

2.2.1.4 Test result

Modulation type: GFSK

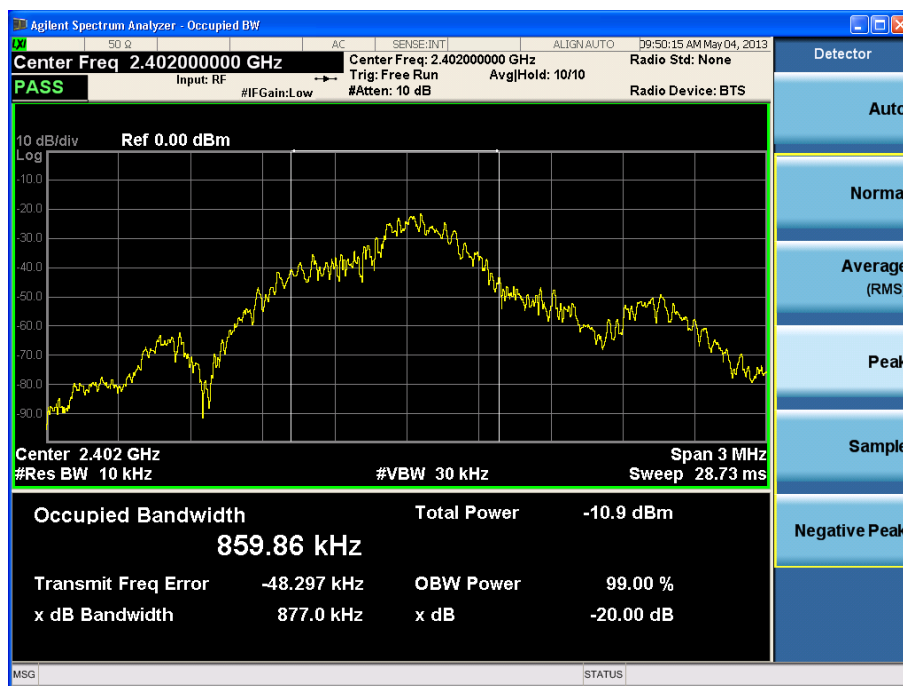
Carrier frequency (MHz)	Channel No.	20 dB bandwidth(KHz)
2402	0	877.00
2441	39	875.90
2480	79	843.60

Modulation type: $\pi/4$ DQPSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(KHz)
2402	0	1323.00
2441	39	1312.00
2480	79	1510.00

Modulation type: 8DPSK

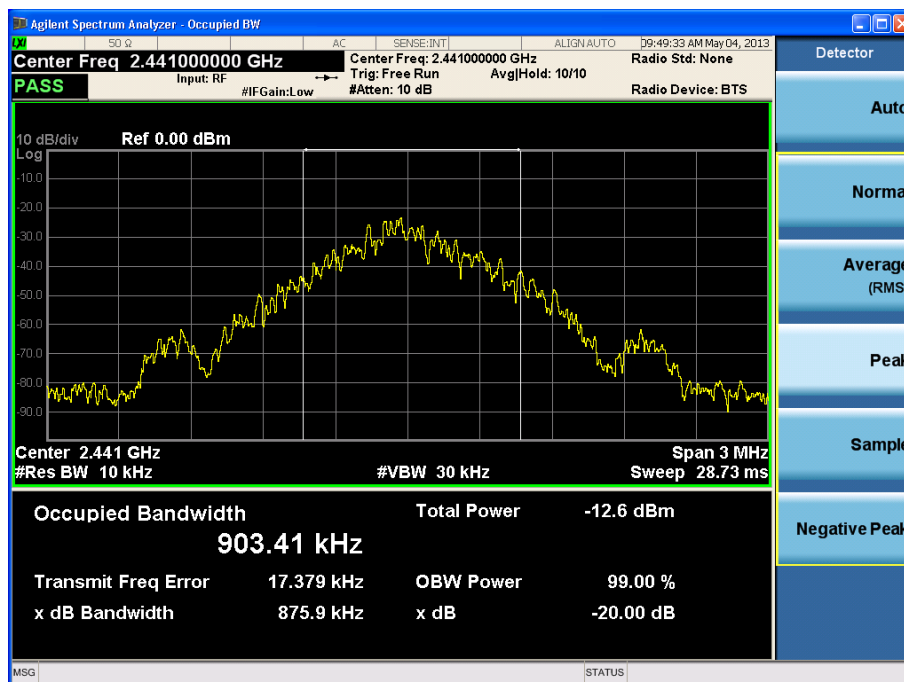
Carrier frequency (MHz)	Channel No.	20 dB bandwidth(KHz)
2402	0	1305.00
2441	39	1291.00
2480	79	1309.00



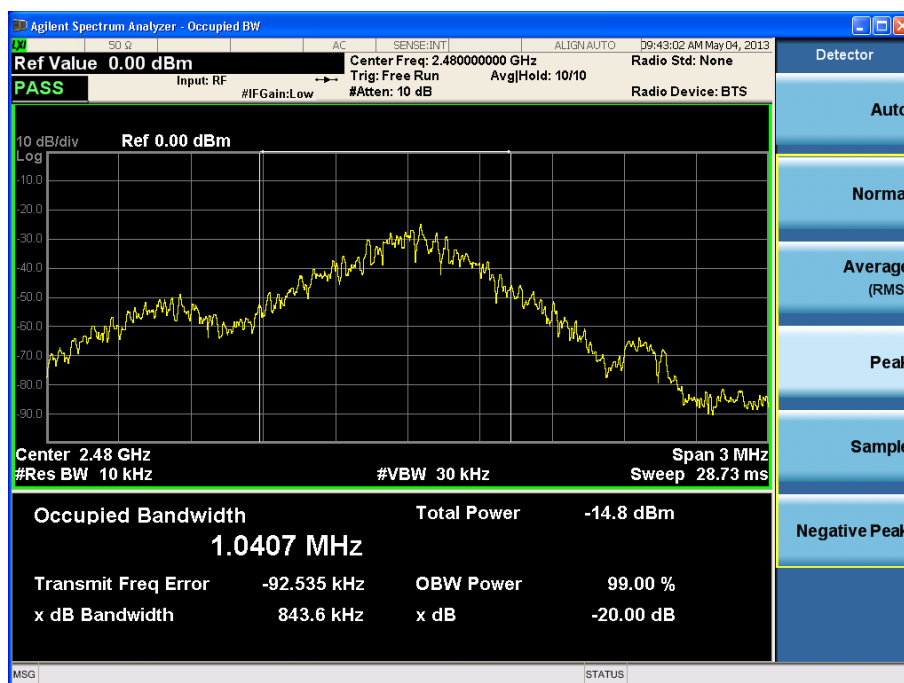
Carrier frequency (MHz): 2402

Channel No.:0

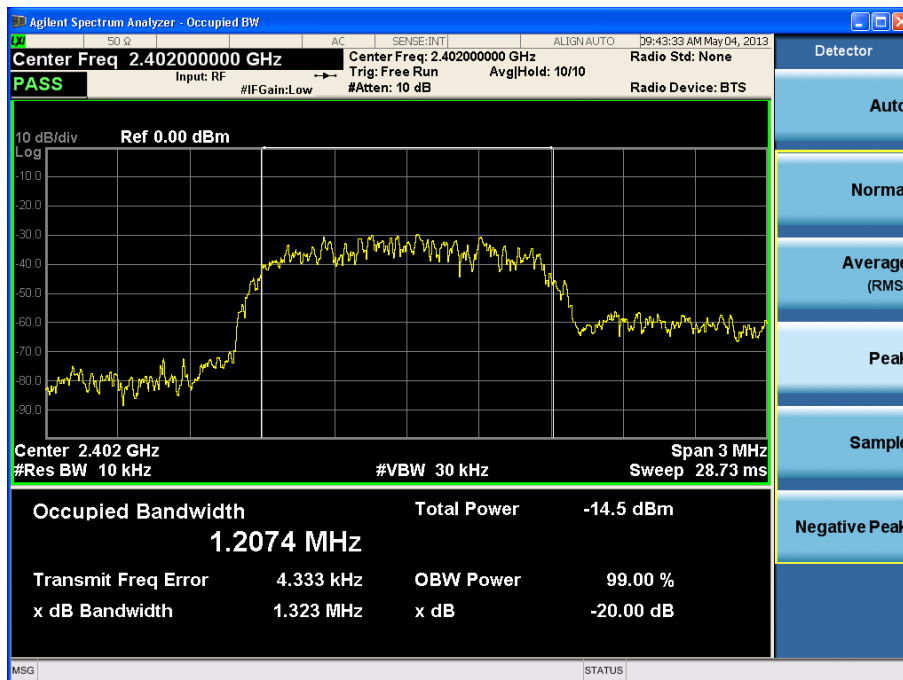
Modulation type: GFSK



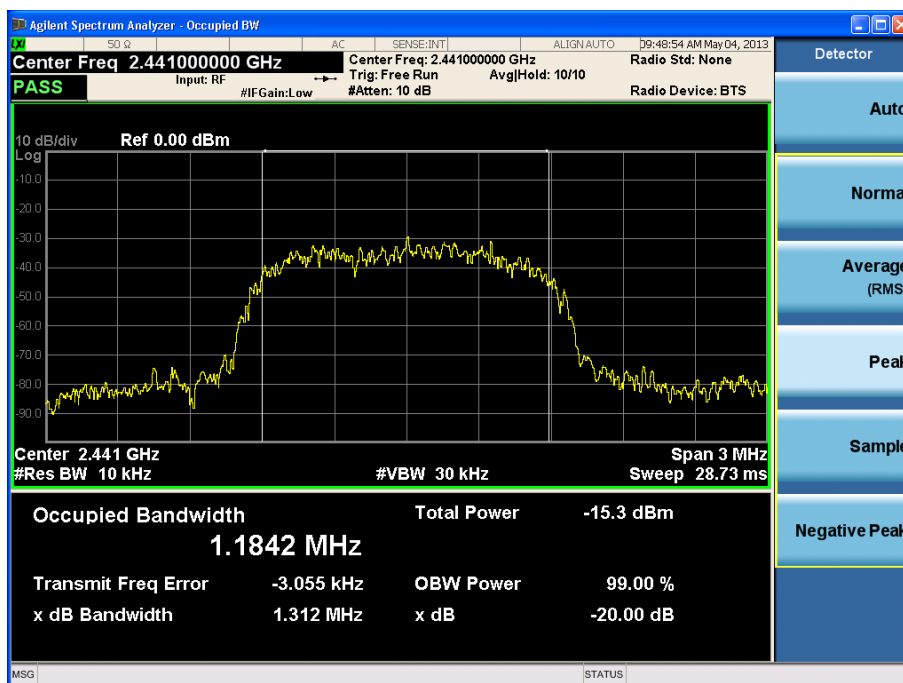
Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: GFSK



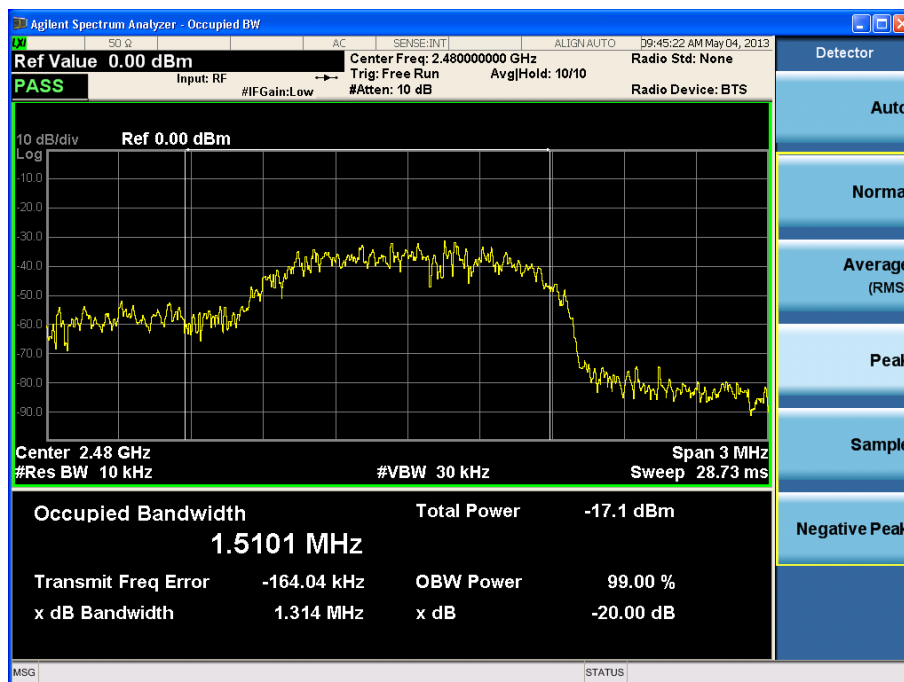
Carrier frequency (MHz): 2480
Channel No.:79
Modulation type: GFSK



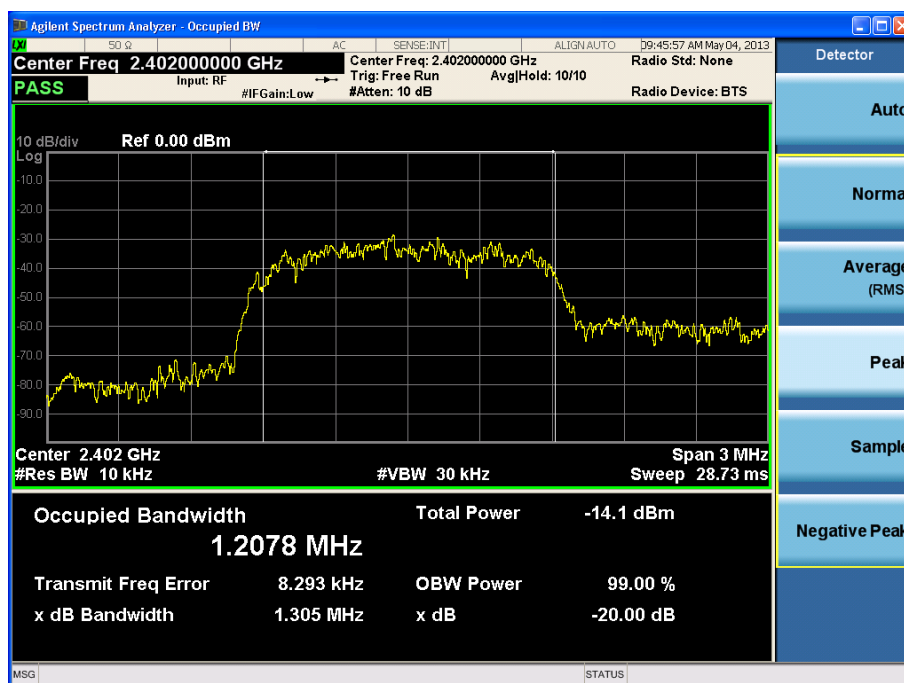
Carrier frequency (MHz): 2402
Channel No.:0
Modulation type: $\pi/4$ DQPSK



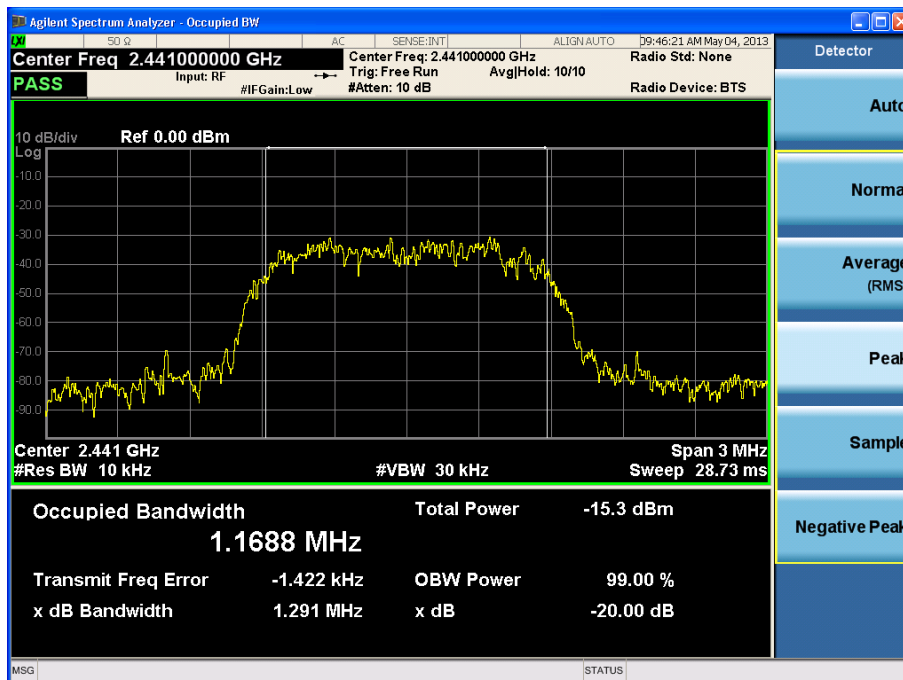
Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: $\pi/4$ DQPSK



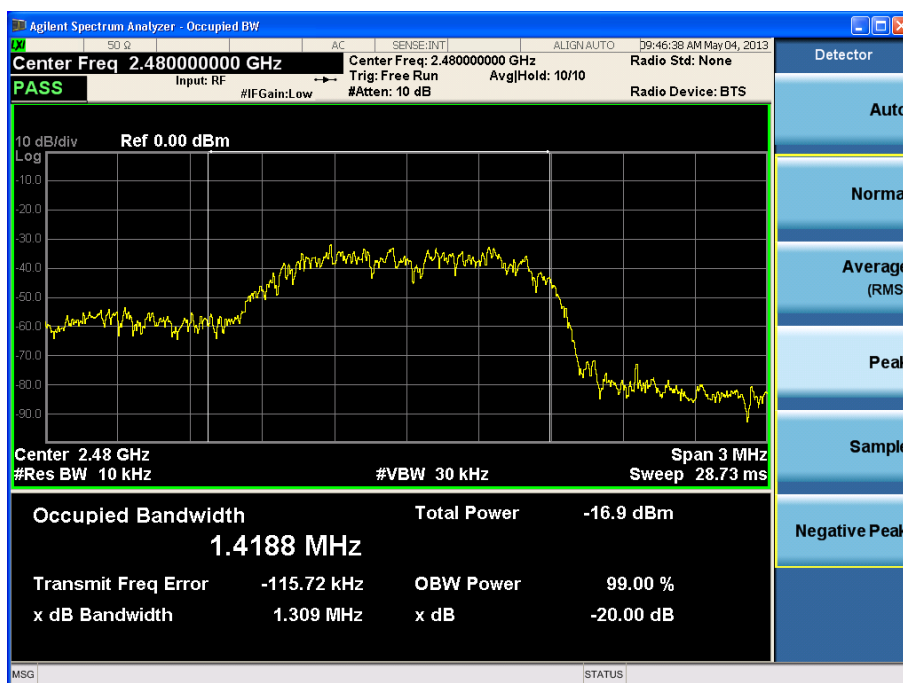
Carrier frequency (MHz): 2480
 Channel No.:79
 Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2402
 Channel No.:0
 Modulation type: 8DPSK



Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: 8DPSK



Carrier frequency (MHz): 2480
Channel No.:79
Modulation type: 8DPSK

2.2.2 Peak Power Output

2.2.2.1 Ambient condition:

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.2.2 Test Description

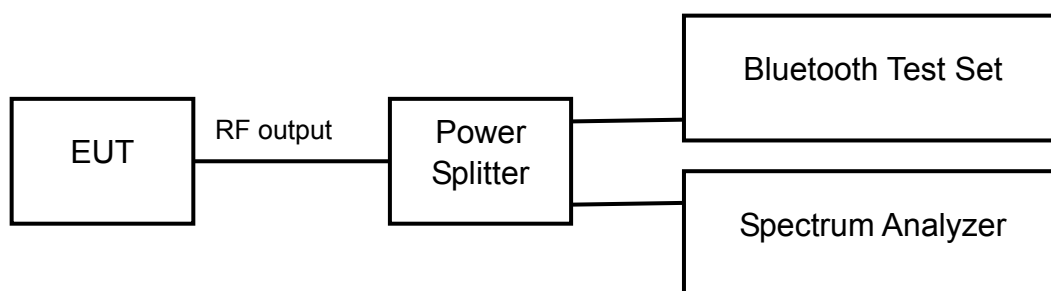
The Equipment Under Test (EUT) was set up in a shielded room to perform the output power measurements.

The results recorded were measured with the modulation which produces the worst-case (highest) output power.

The resolution bandwidth for measuring the output power was 2 MHz.

The reference level of the spectrum analyzer was set higher than the output power of the EUT.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.



2.2.2.3 Test limit

FCC Part15.247(a)(1):

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

Used conversion factor: $\text{Limit (dBm)} = 10 \log (\text{Limit (W)}/1\text{mW})$

==> Maximum Output Power: 30 dBm

2.2.2.4 Test result:

Offset= the insertion loss of the power splitter+ cable loss
=7.00+0.50=7.50dB

Modulation type: GFSK

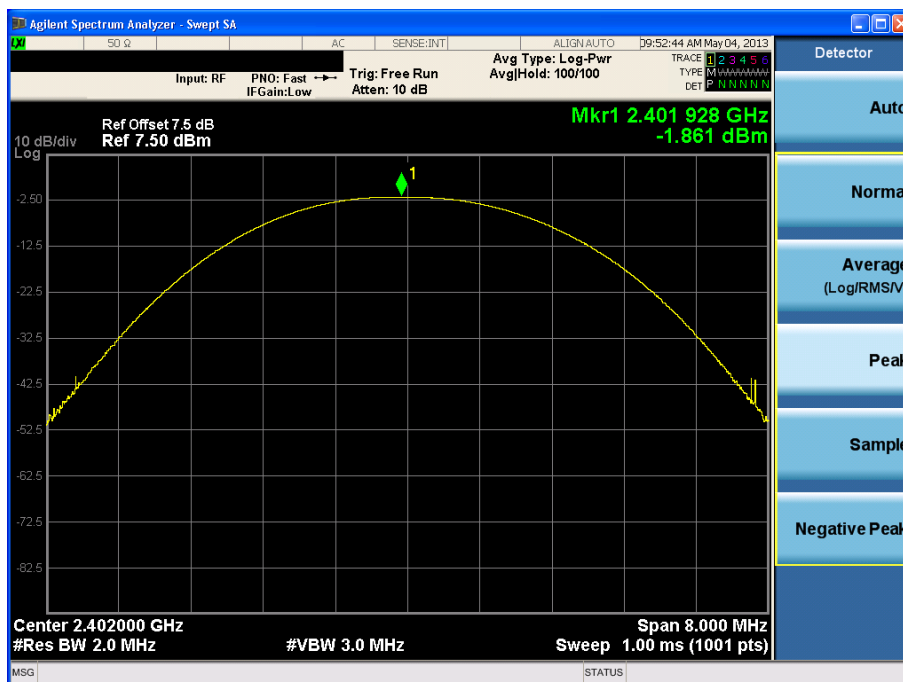
Carrier frequency (MHz)	Channel No.	Peak Conducted Output Power (dBm)
2402	0	-1.86
2441	39	-3.11
2480	79	-5.05

Modulation type: $\pi/4$ DQPSK

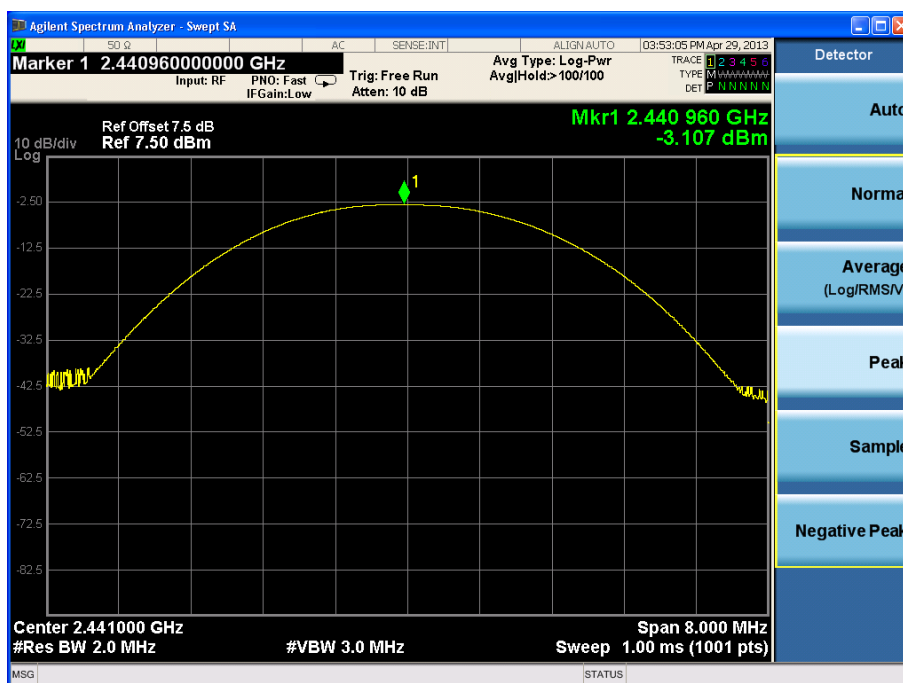
Carrier frequency (MHz)	Channel No.	Peak Conducted Output Power (dBm)
2402	0	-2.36
2441	39	-3.39
2480	79	-5.32

Modulation type: 8DPSK

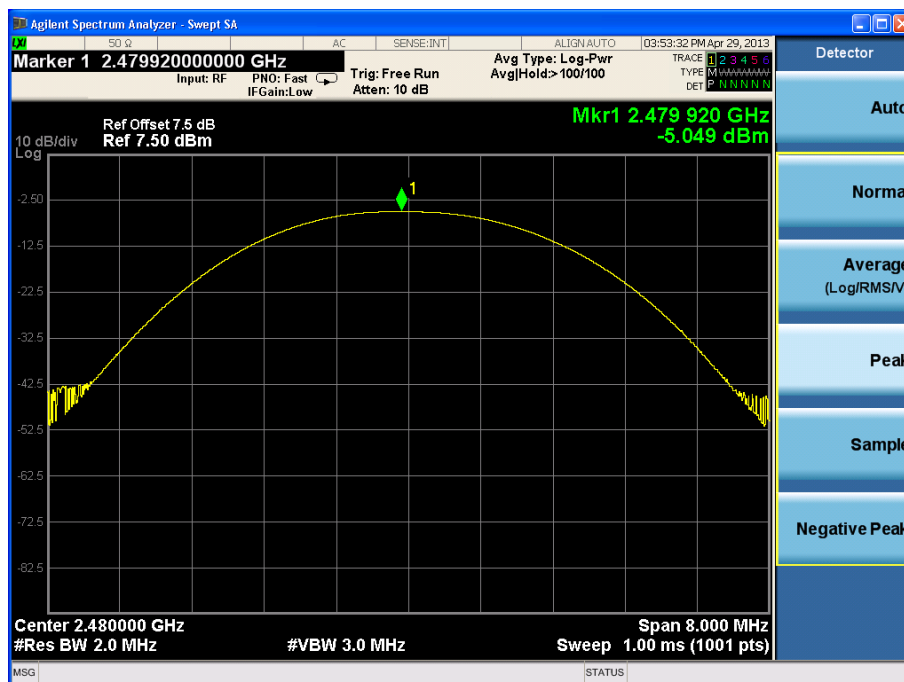
Carrier frequency (MHz)	Channel No.	Peak Conducted Output Power (dBm)
2402	0	-2.15
2441	39	-3.21
2480	79	-5.15



Carrier frequency (MHz): 2402
Channel No.:0
Modulation type: GFSK



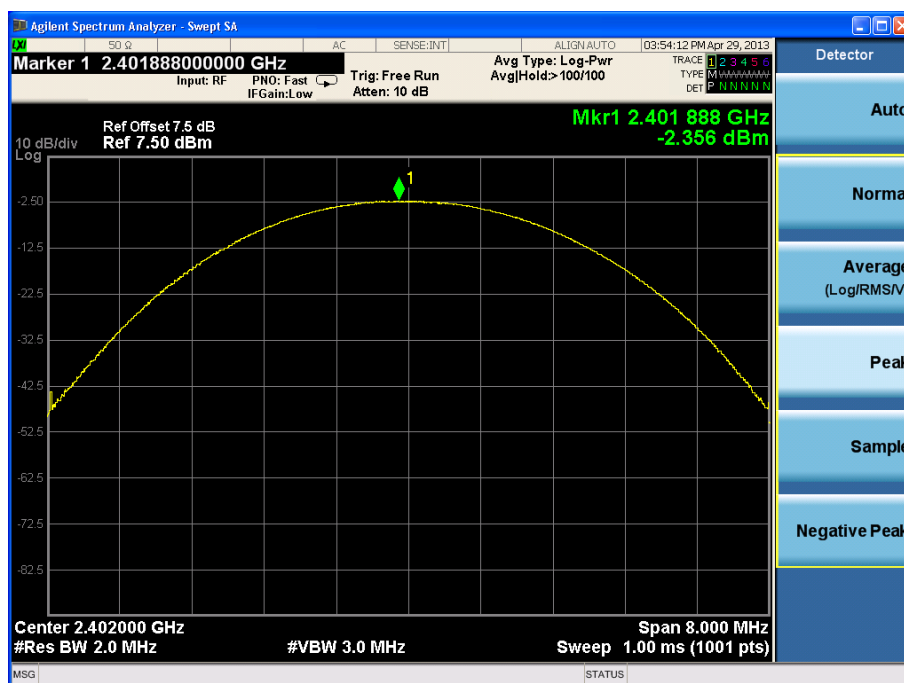
Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: GFSK



Carrier frequency (MHz): 2480

Channel No.:79

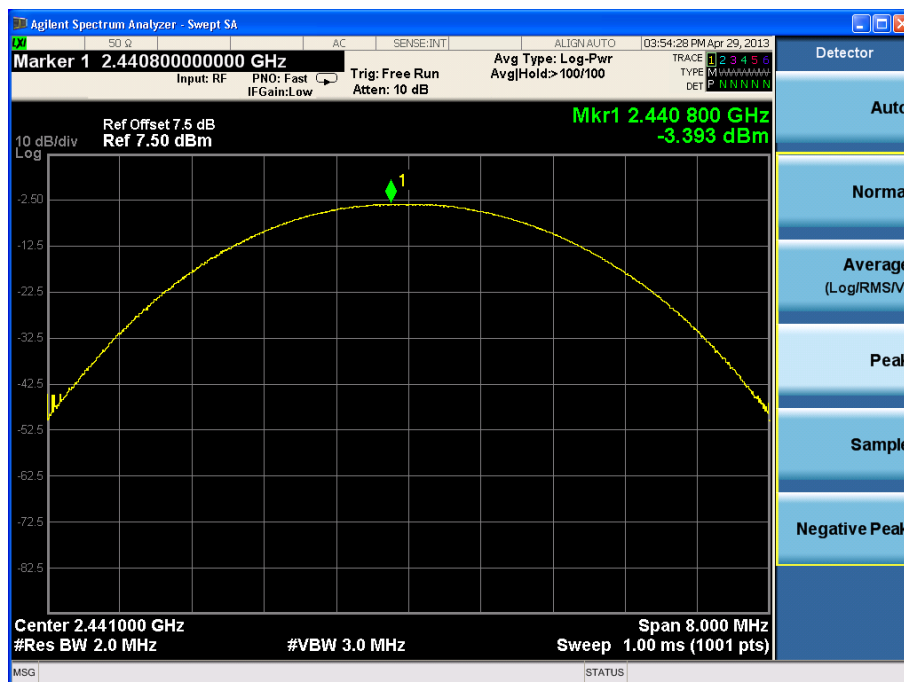
Modulation type: GFSK



Carrier frequency (MHz): 2402

Channel No.:0

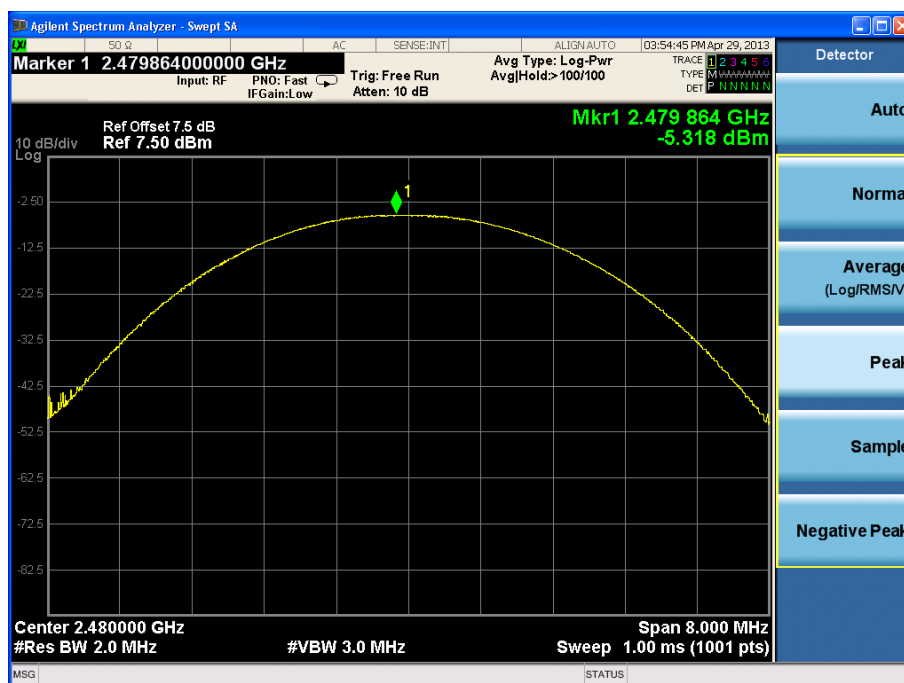
Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2441

Channel No.:39

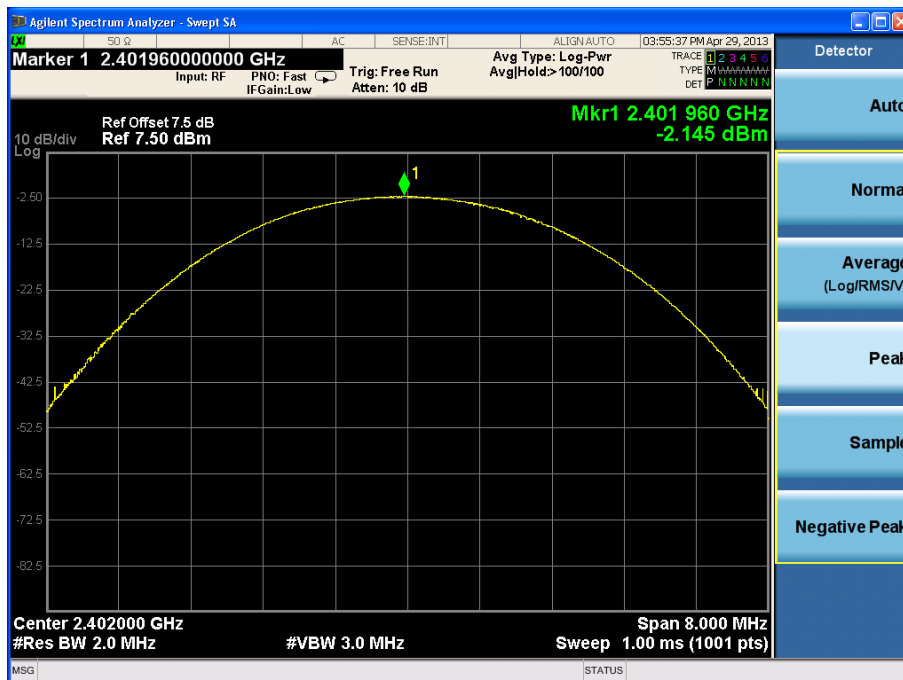
Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2480

Channel No.:79

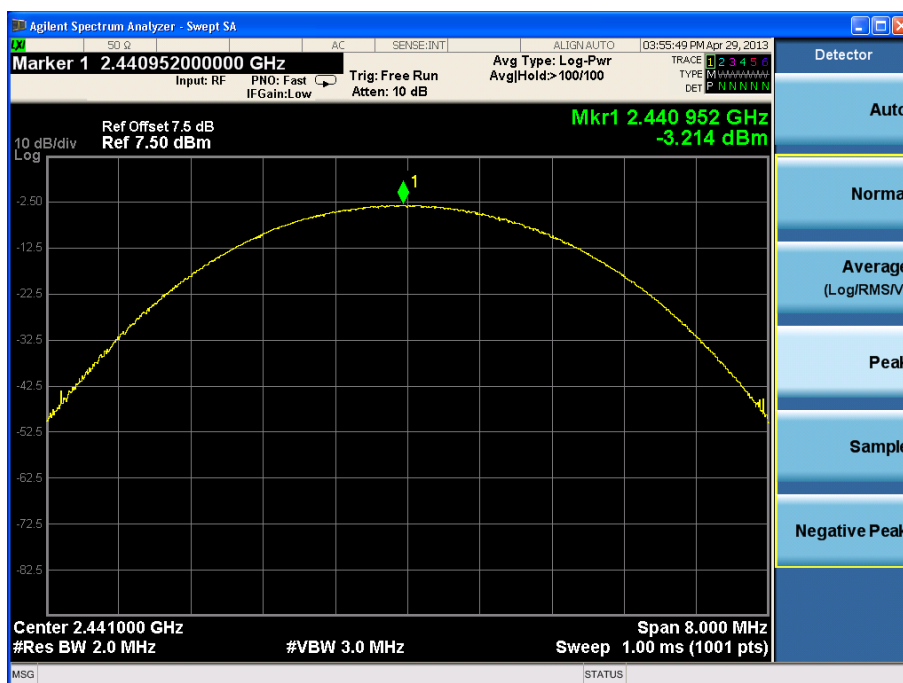
Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2402

Channel No.:0

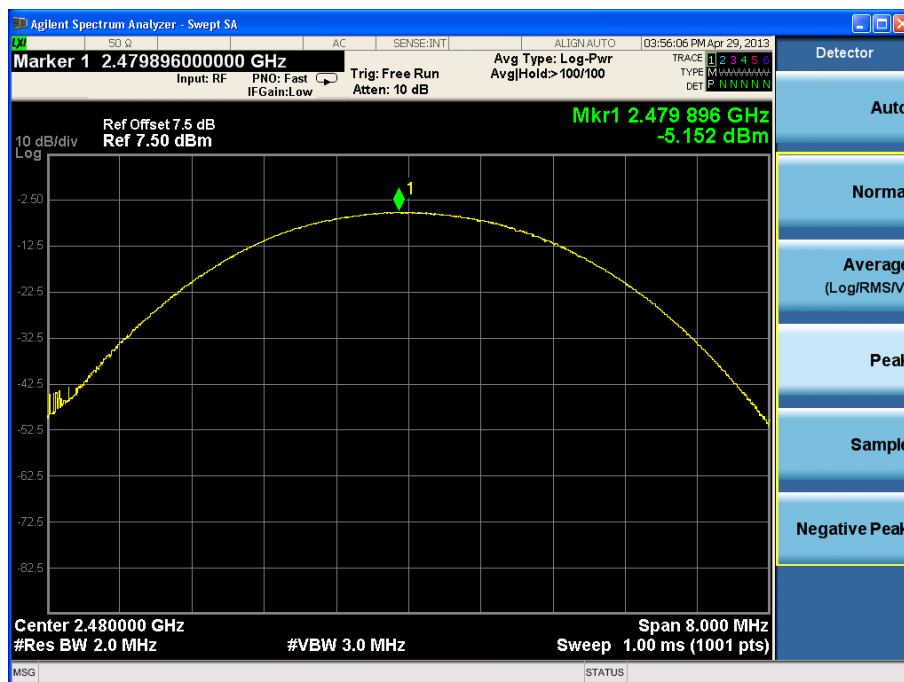
Modulation type: 8DPSK



Carrier frequency (MHz): 2441

Channel No.:39

Modulation type: 8DPSK



Carrier frequency (MHz): 2480

Channel No.:79

Modulation type: 8DPSK

2.2.3 Spurious RF Conducted Emissions

2.2.3.1 Ambient condition:

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.3.2 Test Description

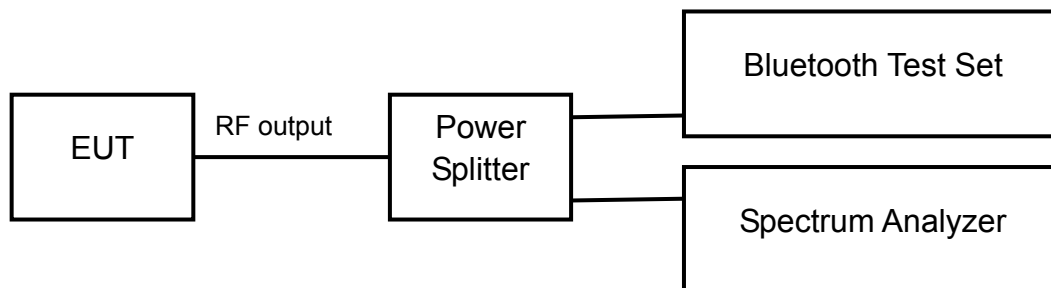
The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Frequency range: 30 ~25000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz

The reference value for the measurement of the spurious RF conducted emissions is determined during the test “band edge compliance” (cf. chapter 4.5). This value is used to calculate the 20 dBc limit.



2.2.3.3 Test limit

FCC Part15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

2.2.3.4 Test result

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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---	---	---	---	---

Carrier frequency (MHz): 2441

Channel No.:39

Modulation type: GFSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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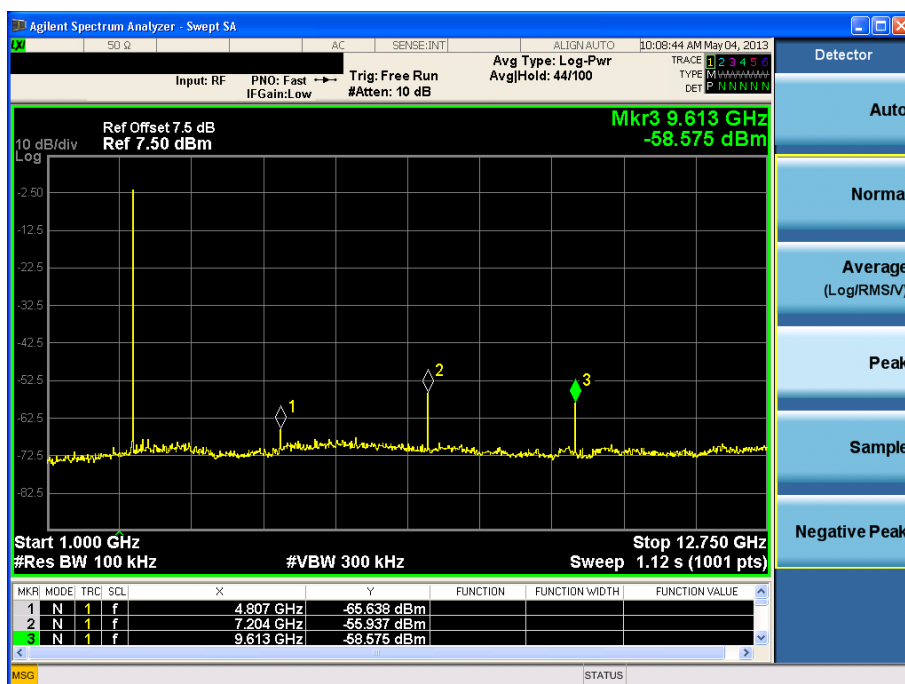
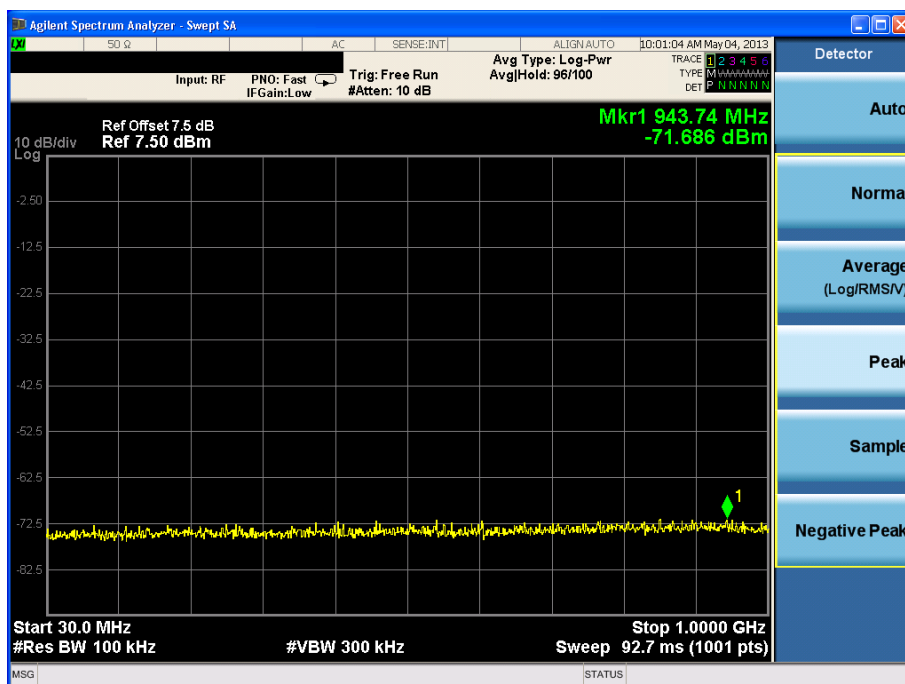
Carrier frequency (MHz): 2480

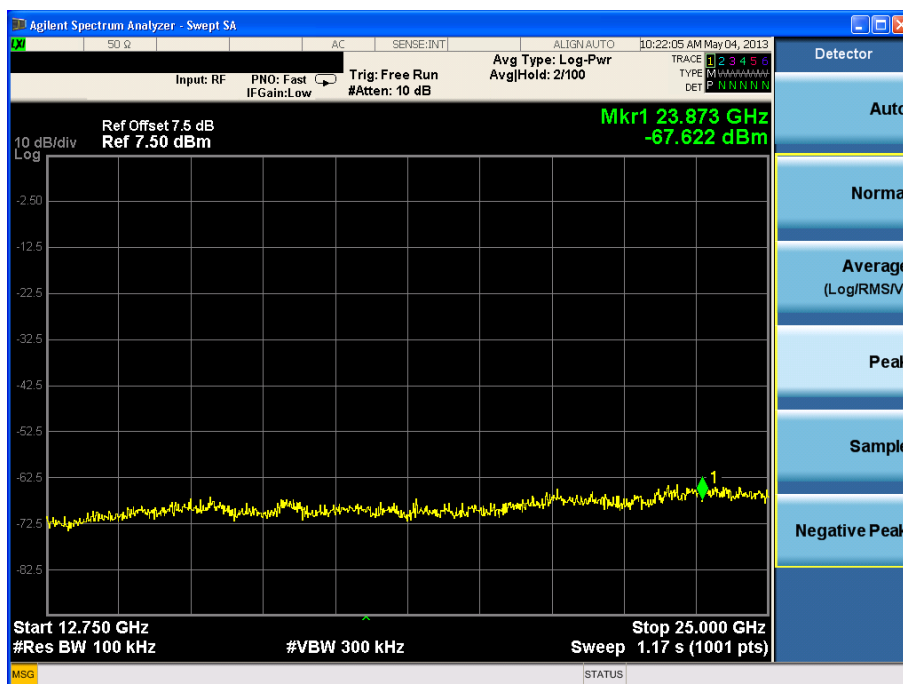
Channel No.:79

Modulation type: GFSK

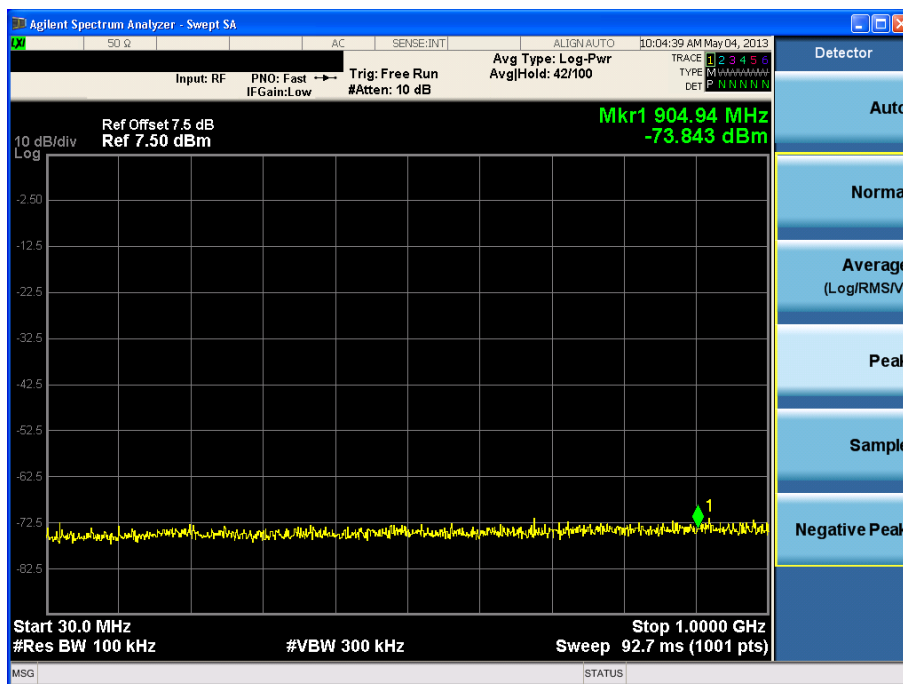
Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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---	---	---	---	---

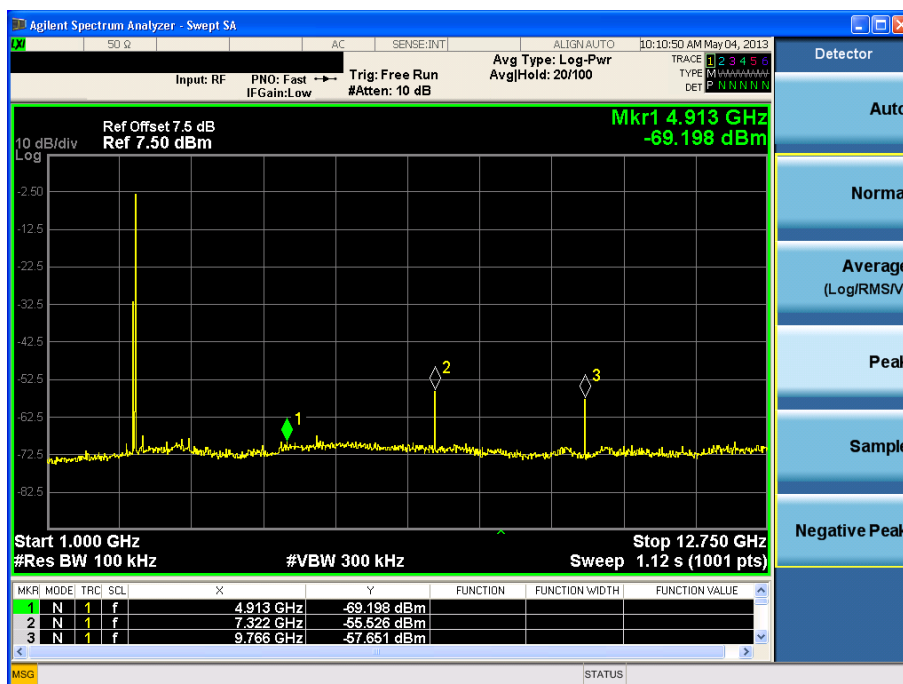
Note: The Reference value see 2.2.5 Band edge compliance



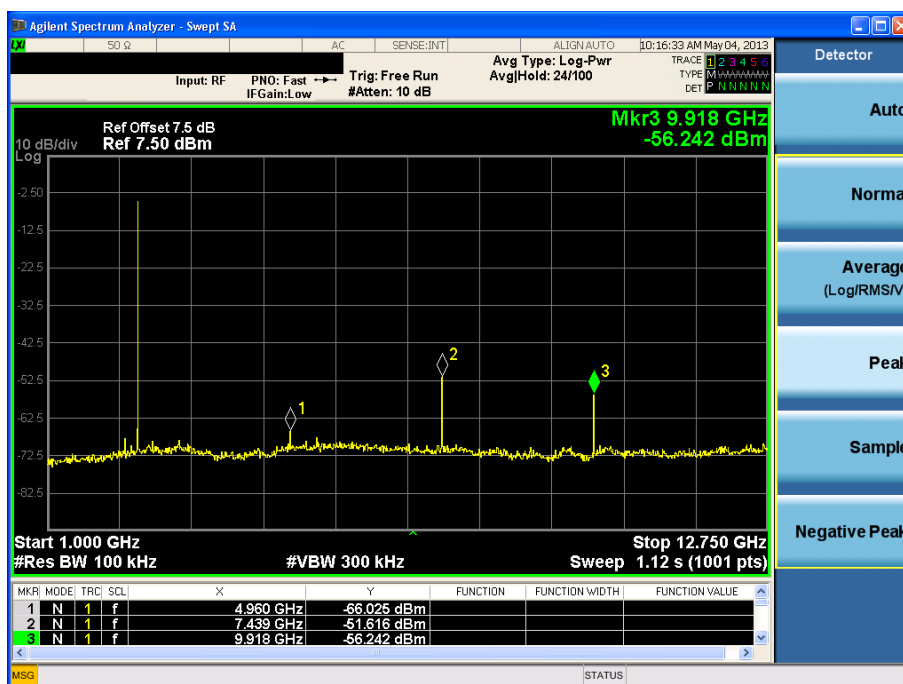
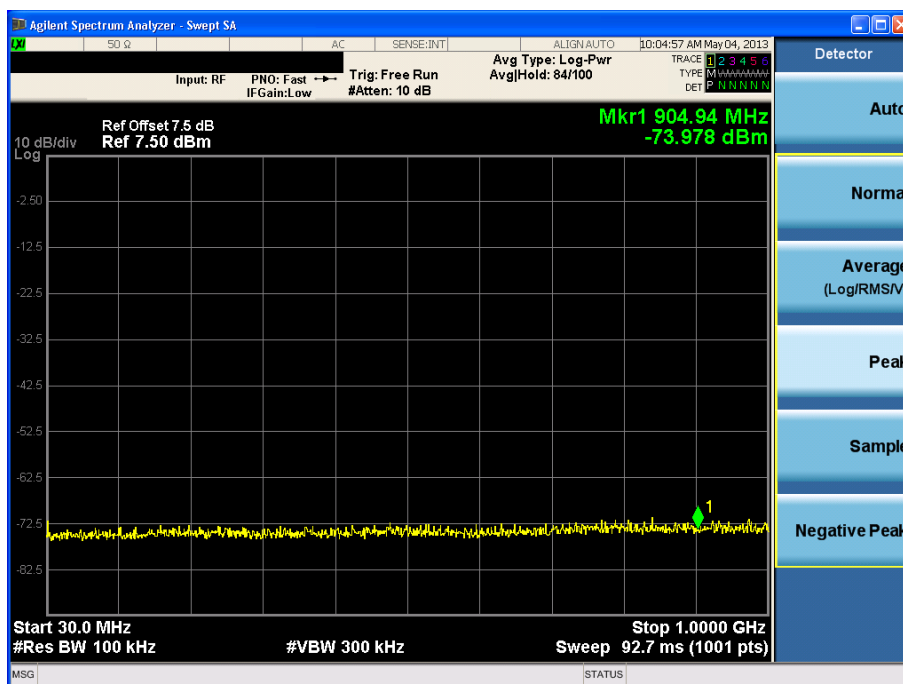


Carrier frequency (MHz): 2402
Channel No.:0
Modulation type: GFSK





Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: GFSK





Carrier frequency (MHz): 2480
Channel No.:79
Modulation type: GFSK

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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---	---	---	---	---

Carrier frequency (MHz): 2441

Channel No.:39

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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---	---	---	---	---

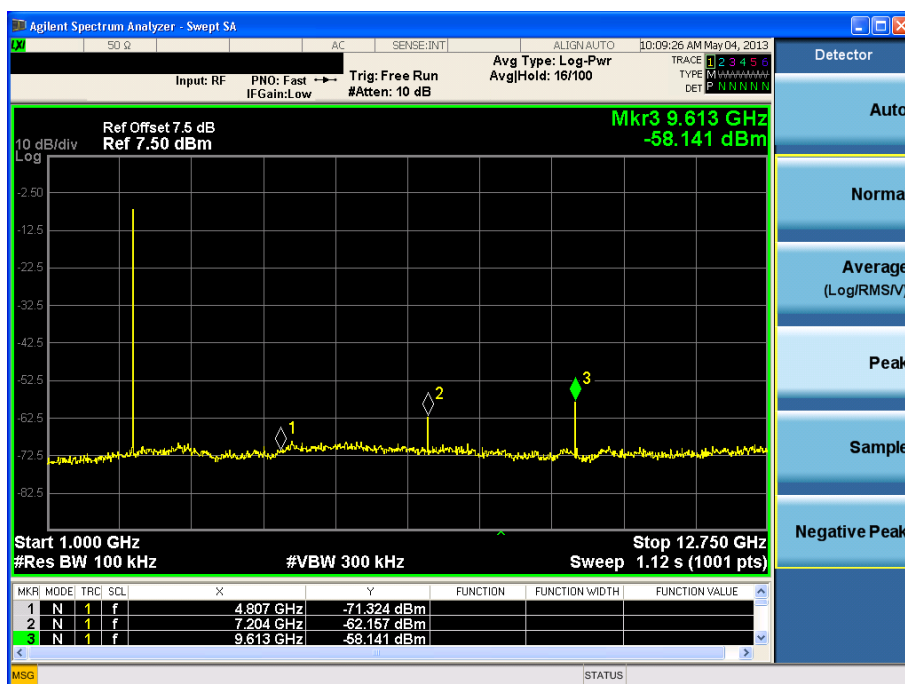
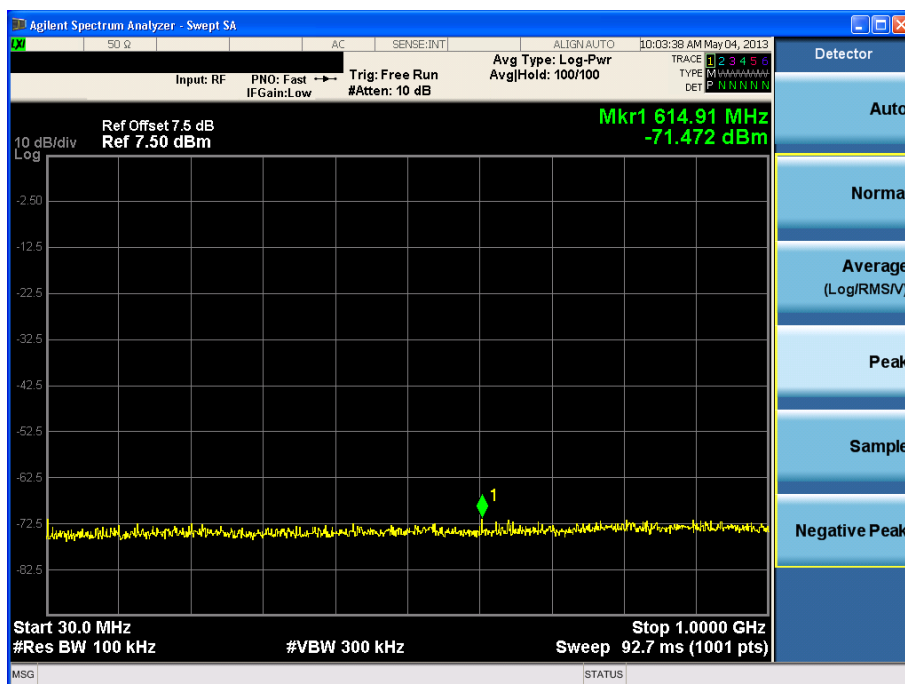
Carrier frequency (MHz): 2480

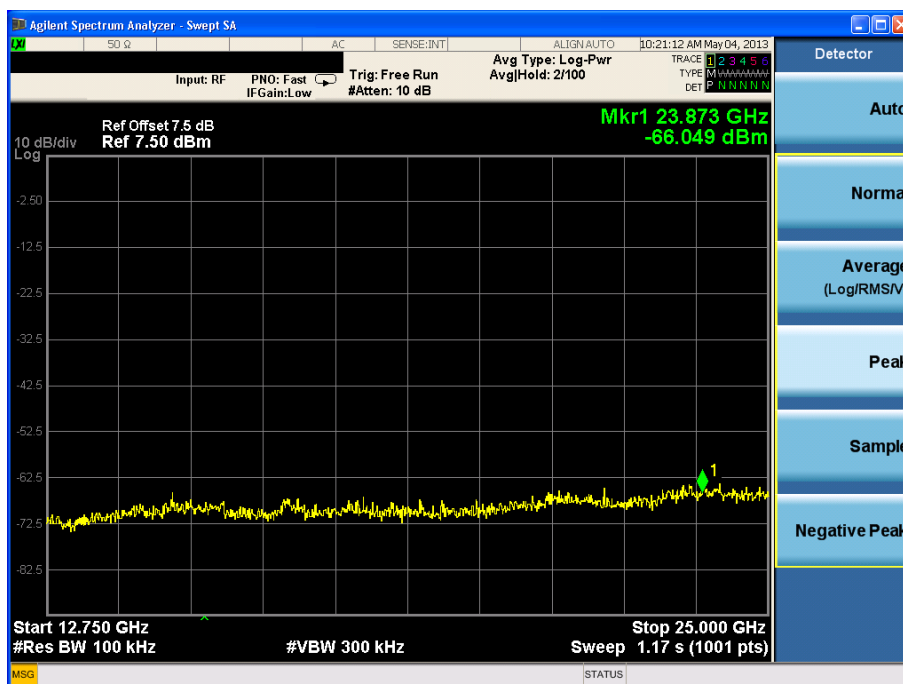
Channel No.:79

Modulation type: $\pi/4$ DQPSK

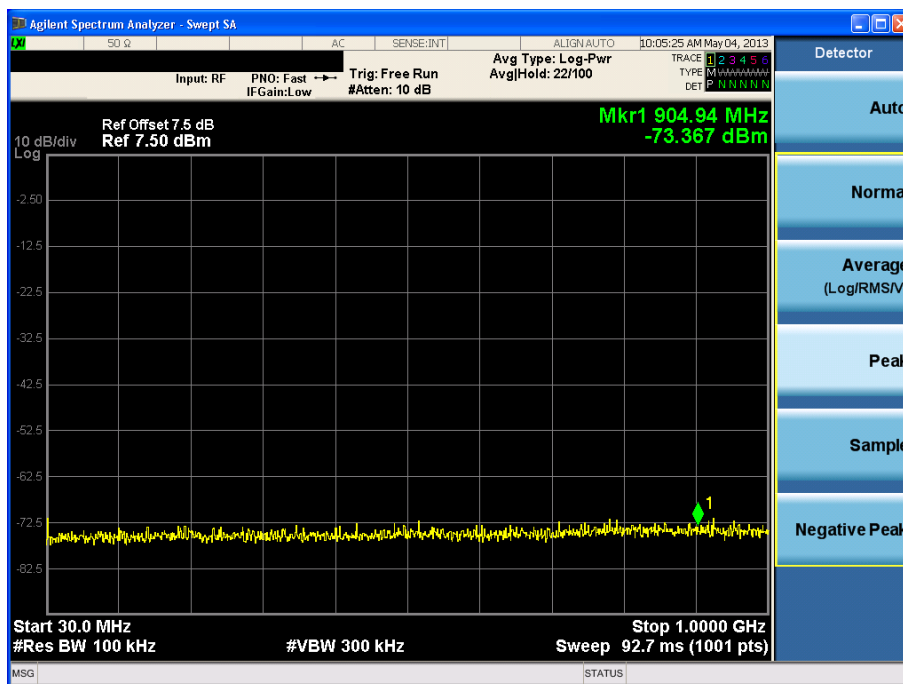
Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
---	---	---	---	---
---	---	---	---	---

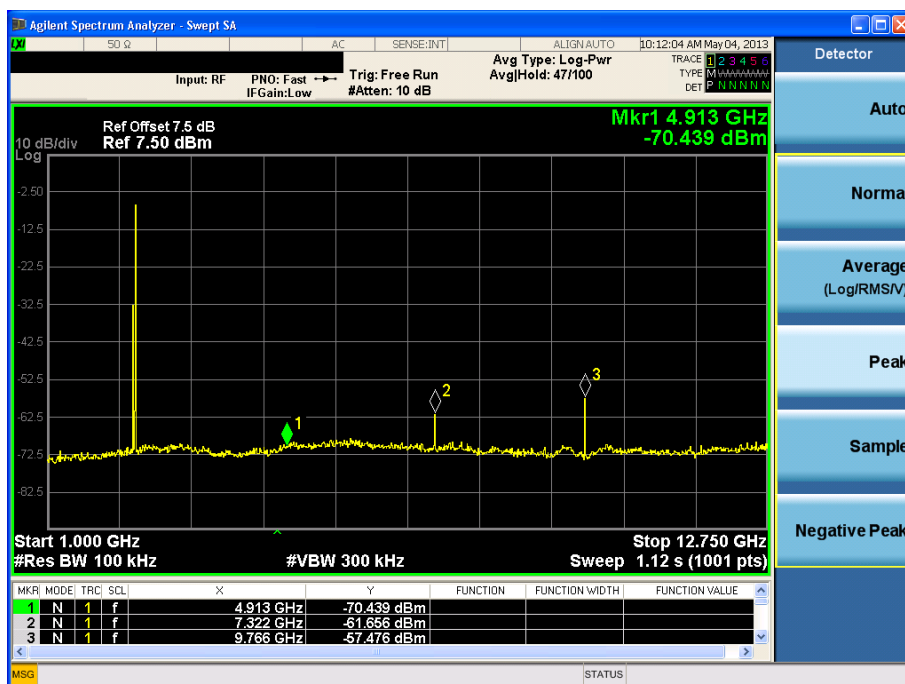
Note: The Reference value see 2.2.5 Band edge compliance



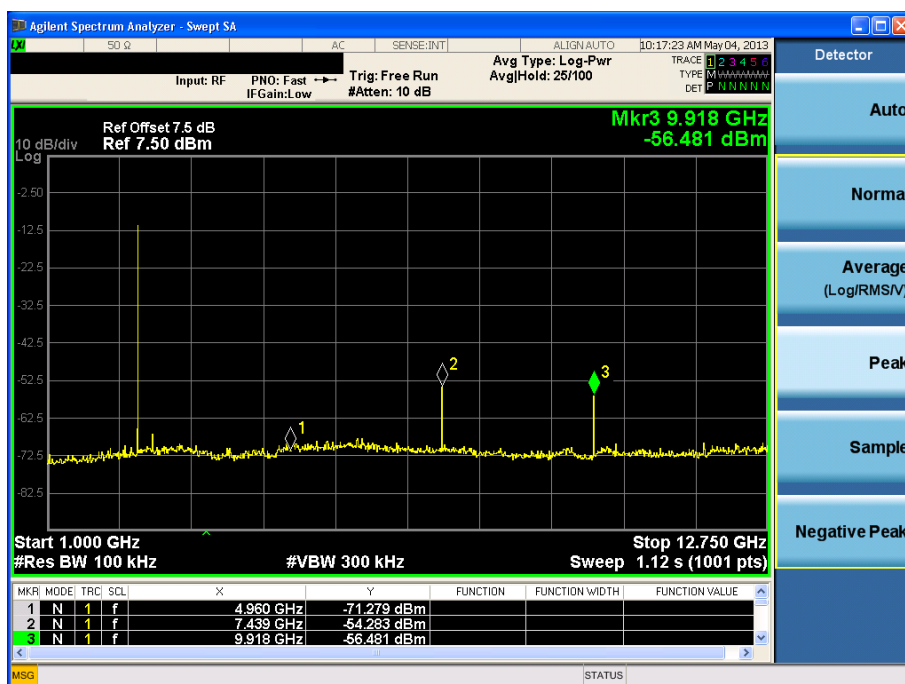
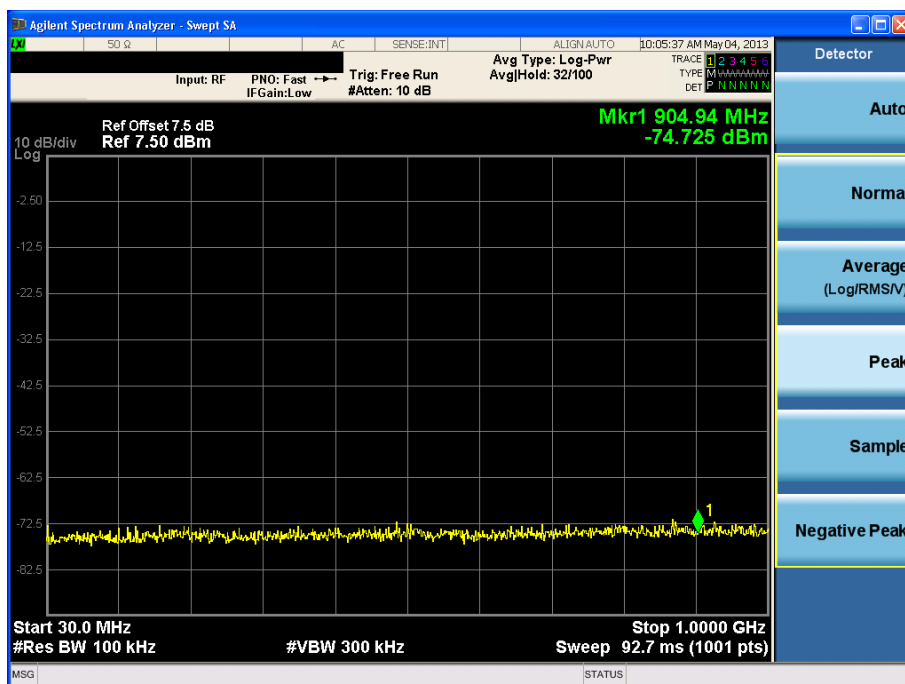


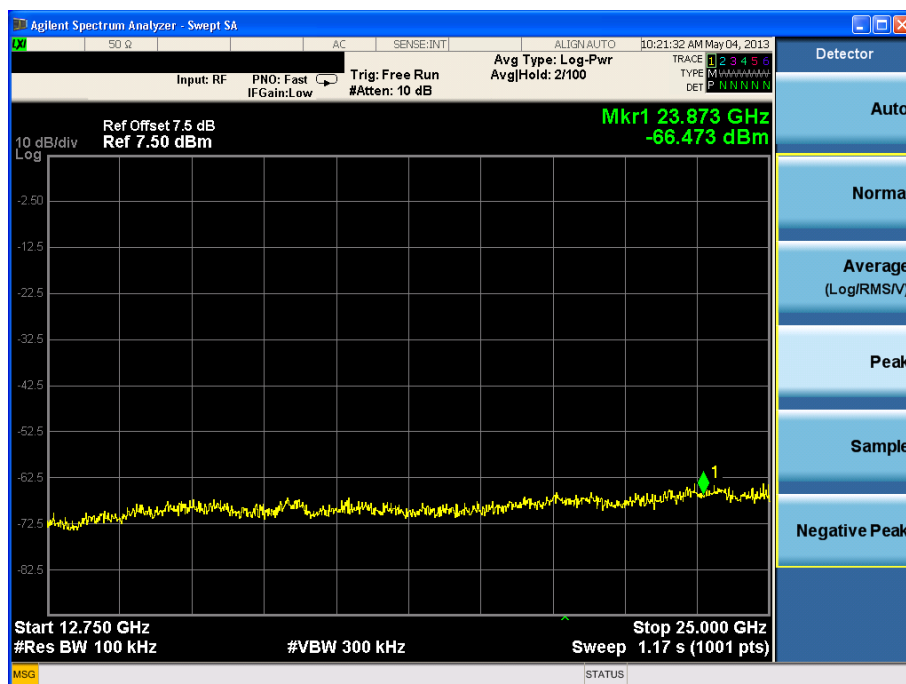
Carrier frequency (MHz): 2402
Channel No.:0
Modulation type: $\pi/4$ DQPSK





Carrier frequency (MHz): 2441
Channel No.: 39
Modulation type: $\pi/4$ DQPSK





Carrier frequency (MHz): 2480
Channel No.:79
Modulation type: $\pi/4$ DQPSK

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: 8DPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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Carrier frequency (MHz): 2441

Channel No.:39

Modulation type: 8DPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
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---	---	---	---	---

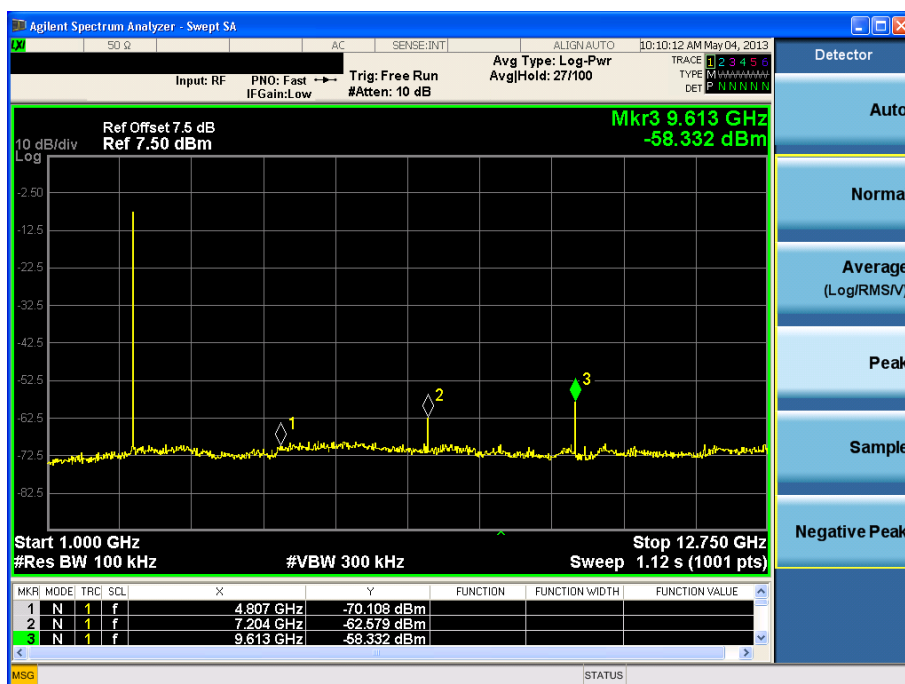
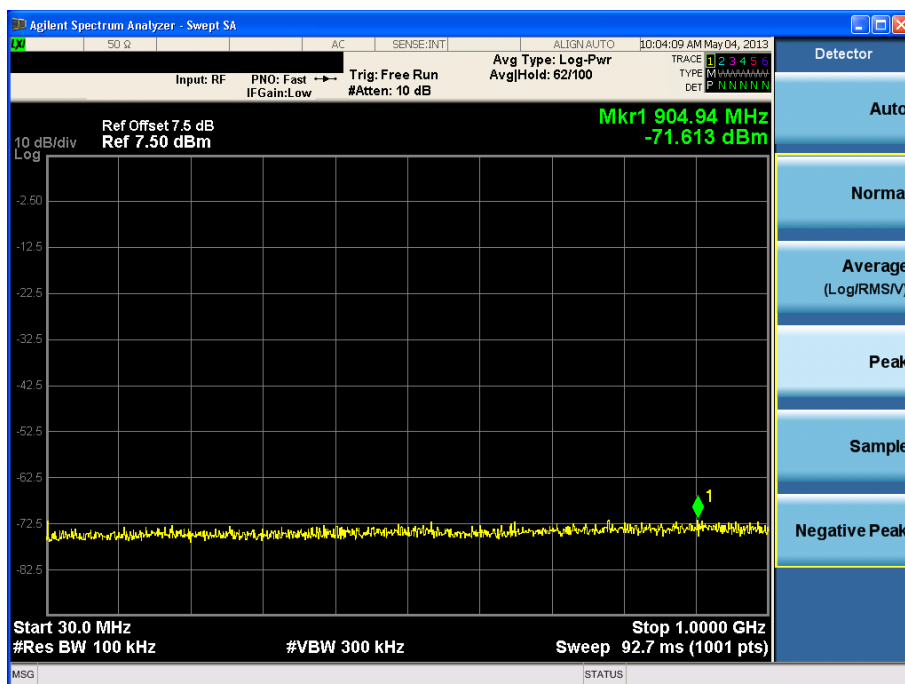
Carrier frequency (MHz): 2480

Channel No.:79

Modulation type: 8DPSK

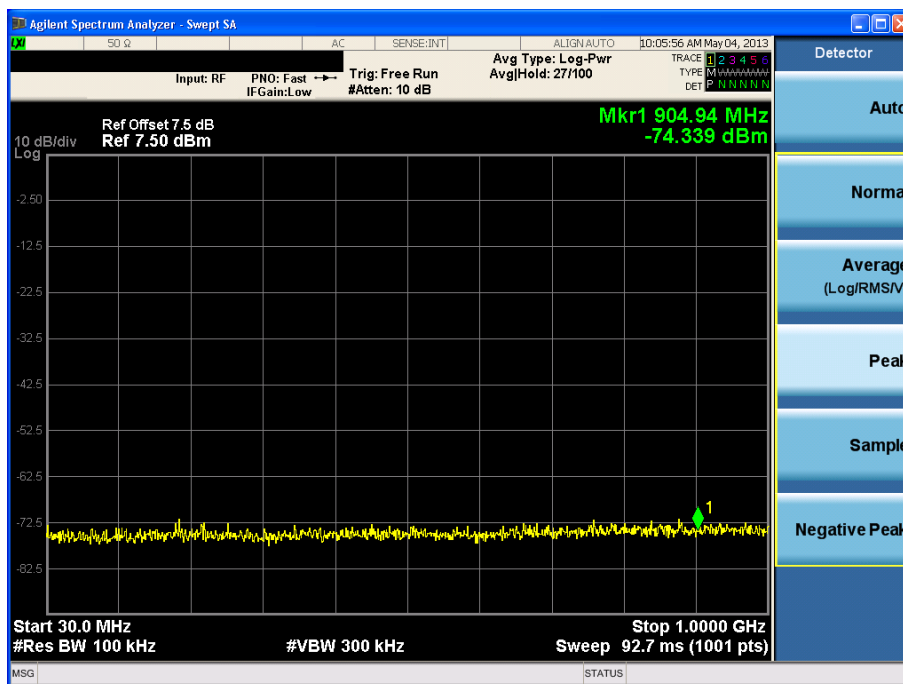
Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
---	---	---	---	---
---	---	---	---	---

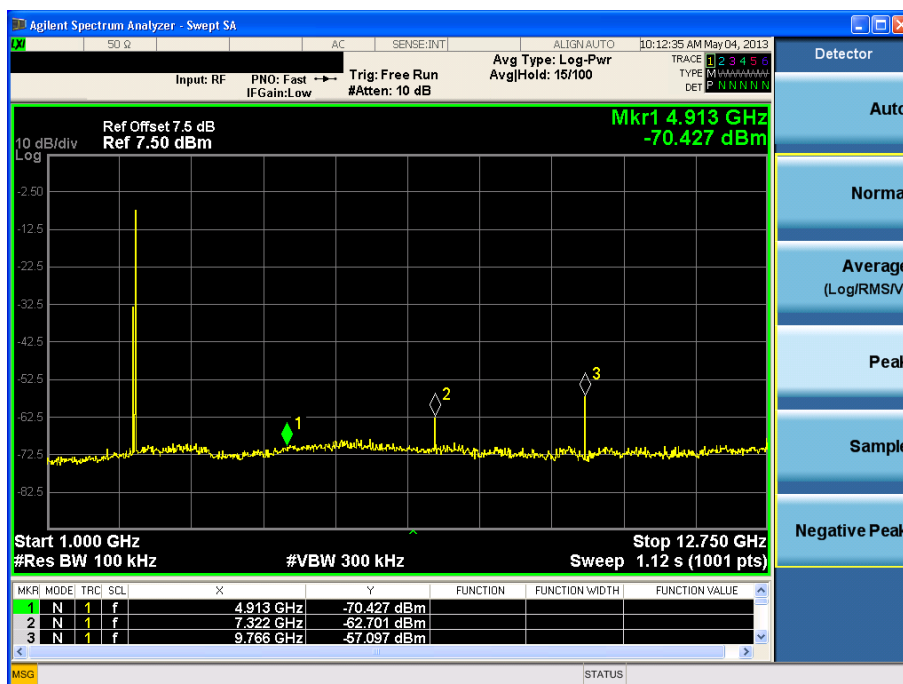
Note: The Reference value see 2.2.5 Band edge compliance



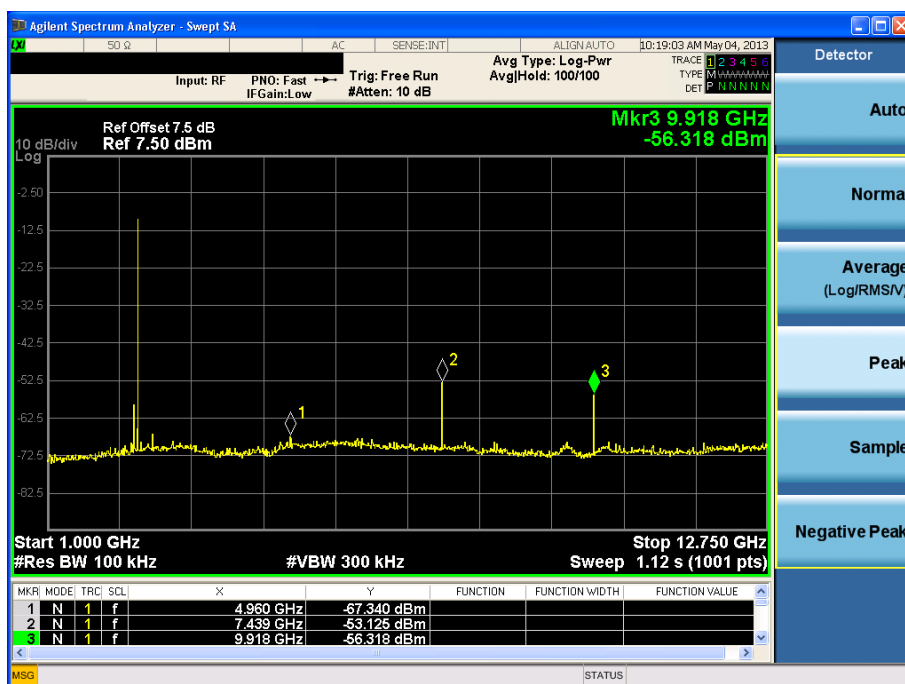
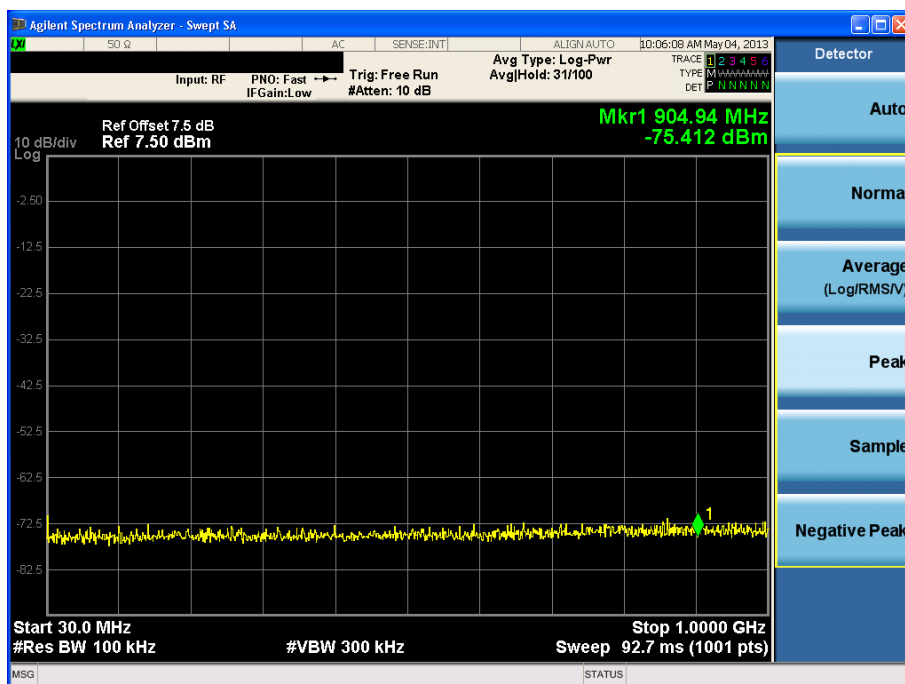


Carrier frequency (MHz): 2402
Channel No.:0
Modulation type: 8DPSK





Carrier frequency (MHz): 2441
Channel No.: 39
Modulation type: 8DPSK





Carrier frequency (MHz): 2480
Channel No.: 79
Modulation type: 8DPSK

2.2.4 Spurious Radiated Emissions

2.2.4.1 Ambient condition

Temperature	Relative humidity	Pressure
27.5°C	35.0%	99.8kPa

2.2.4.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4.

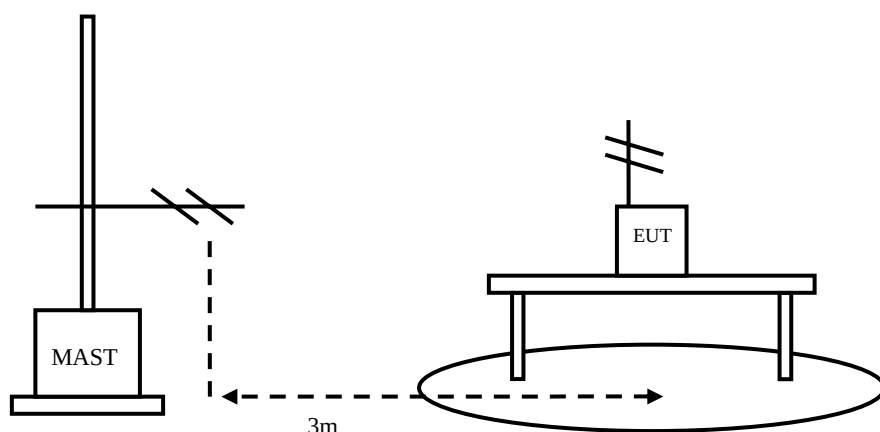
The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration.

Then start the test software ES-K1. Sweep the whole frequency band through the range from 9kHz to 1GHz or above, using receive loop antenna HFH2-Z2, log period antenna HL562 or Ridge horn antenna HF906.

During the test, the antenna height and EUT azimuth were varied in order to identify the maximum level of emission from the EUT. The height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees. The measurements shall be repeated with orthogonal polarization of the test antenna.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.



2.2.4.3 Test limit

FCC Part15.247(d):

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part15.209:

Frequency Range (MHz)	Field Strength($\mu\text{V}/\text{m}$)	Class B Limit ($\text{dB}\mu\text{V}/\text{m}$)
0.009 – 0.490	$2400/\text{F}(\text{kHz})$	$20\log(2400/\text{F}(\text{kHz})/ 1\mu\text{V}/\text{m})$
0.490 – 1.705	$24000/\text{F}(\text{kHz})$	$20\log(24000/\text{F}(\text{kHz})/ 1\mu\text{V}/\text{m})$
1.705 – 30	30	29.5
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
above 960	500	54.0

FCC Part15.35(b):

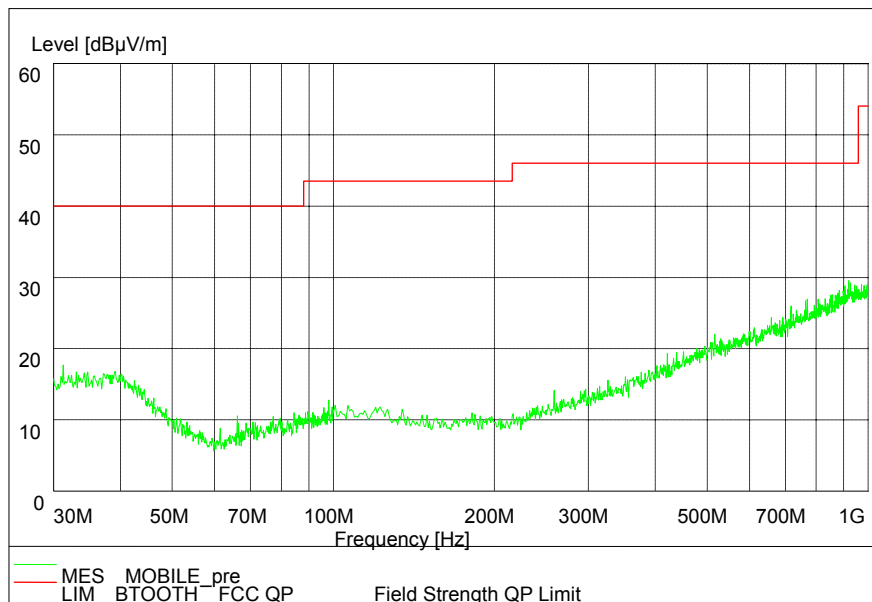
..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: $\text{Limit} (\text{dB}\mu\text{V}/\text{m}) = 20 \log (\text{Limit} (\mu\text{V}/\text{m})/1\mu\text{V}/\text{m})$

2.2.4.4 Test result

Carrier frequency (MHz): 2441

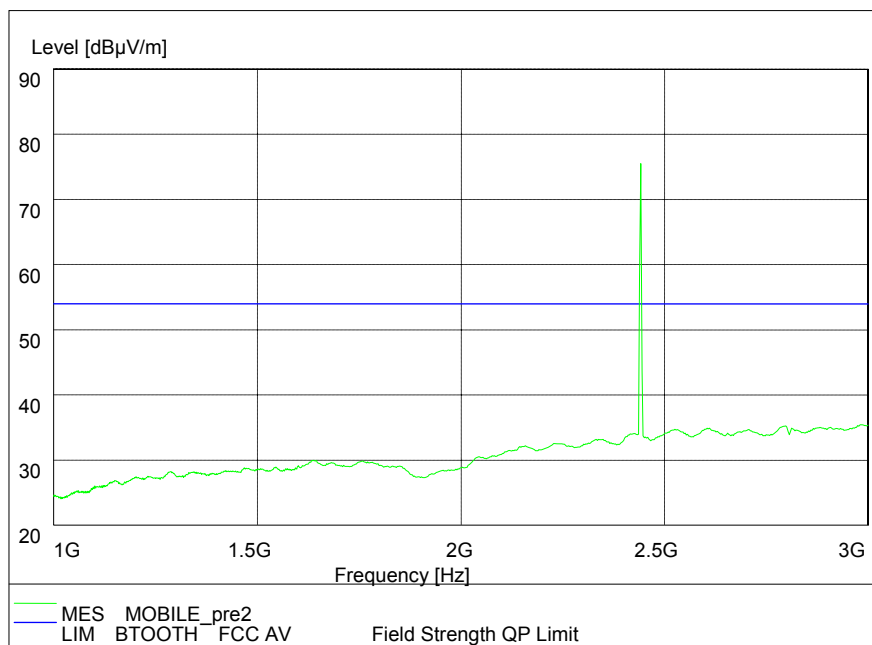
Channel No.:39



Frequency Range: 30 MHz -1000 MHz

Detector: PK mode

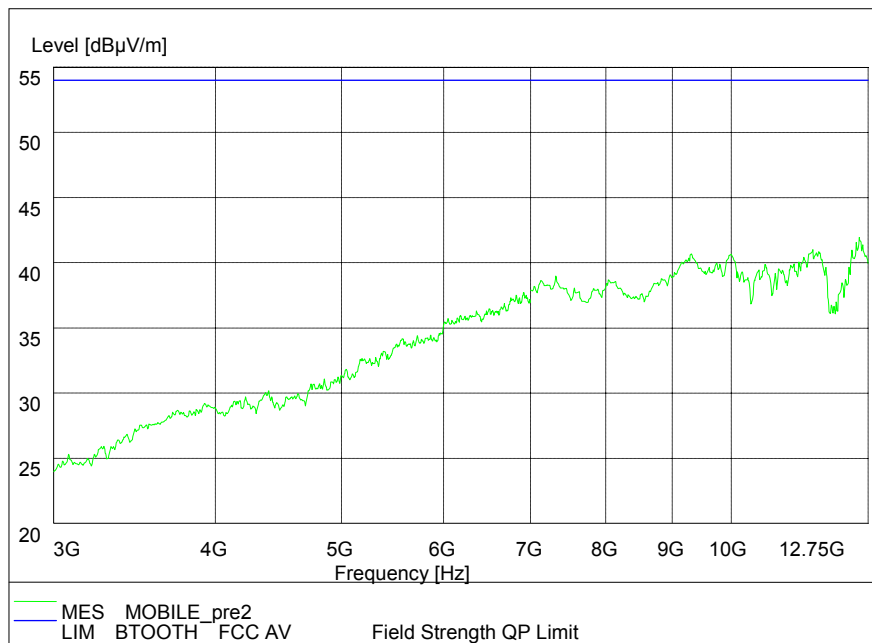
Modulation type: GFSK



Frequency Range: 1 GHz -3 GHz

Detector: PK mode

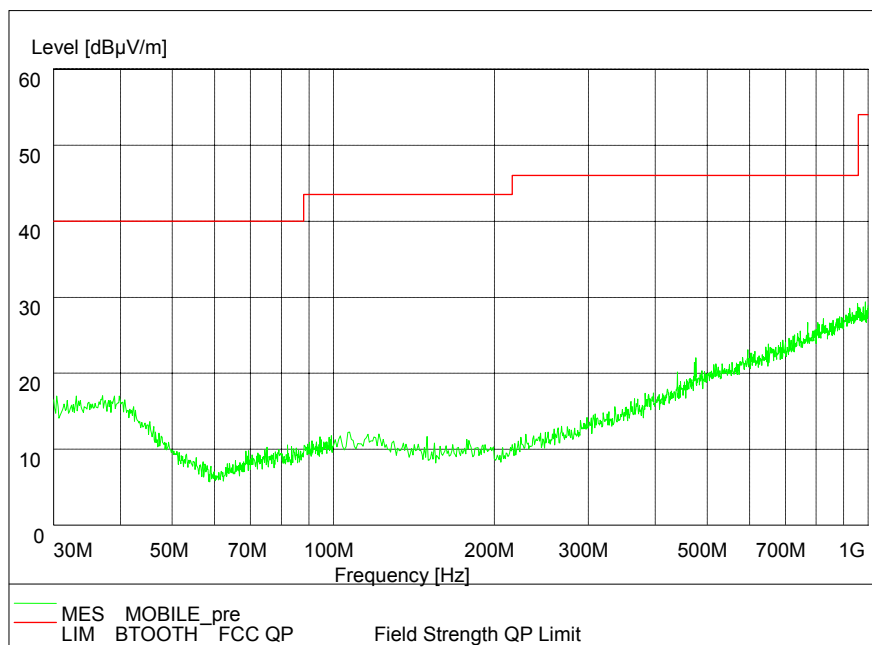
Modulation type: GFSK



Frequency Range: 3 GHz – 12.75 GHz

Detector: PK mode

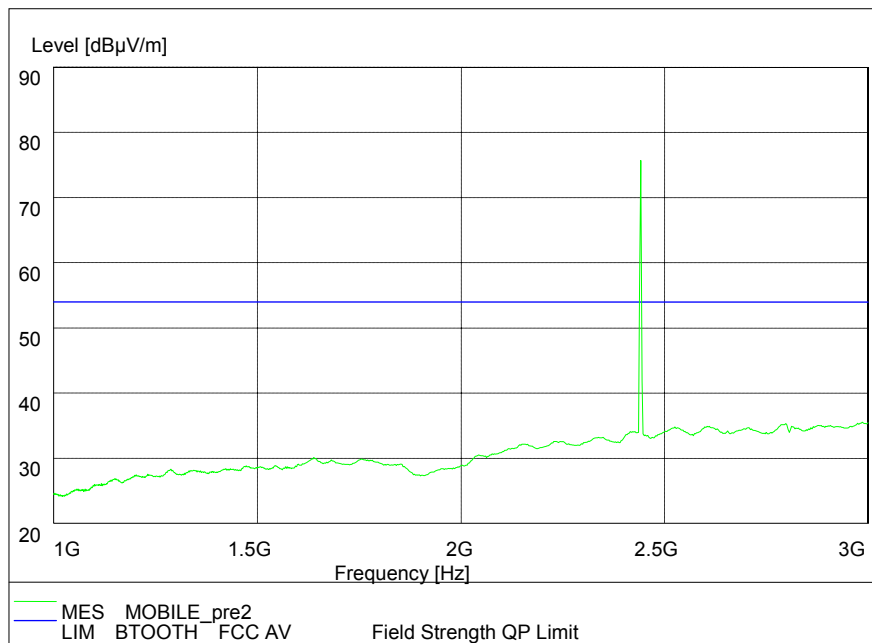
Modulation type: GFSK



Frequency Range: 30 MHz -1000 MHz

Detector: PK mode

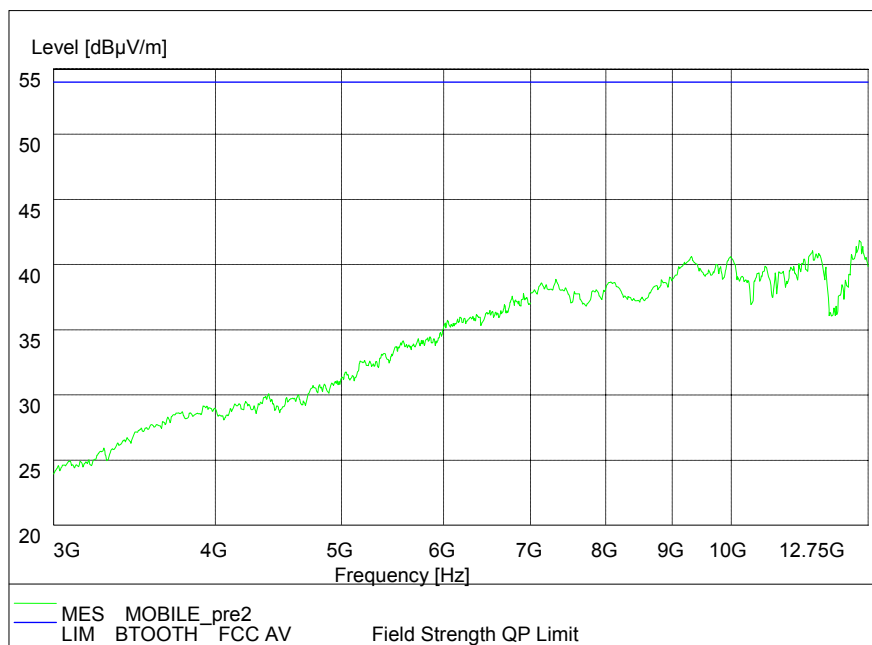
Modulation type: $\pi/4$ DQPSK



Frequency Range: 1 GHz - 3 GHz

Detector: PK mode

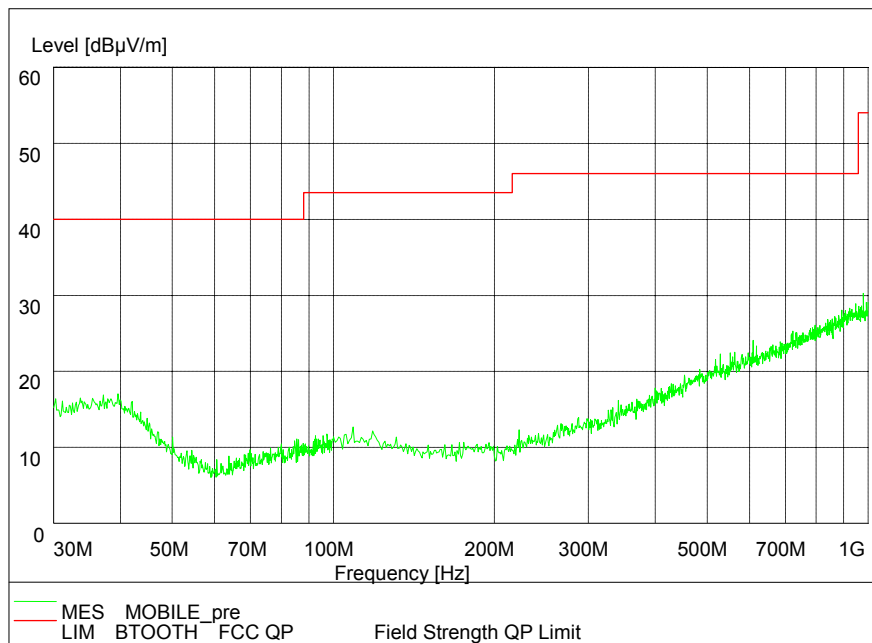
Modulation type: $\pi/4$ DQPSK



Frequency Range: 3 GHz – 12.75 GHz

Detector: PK mode

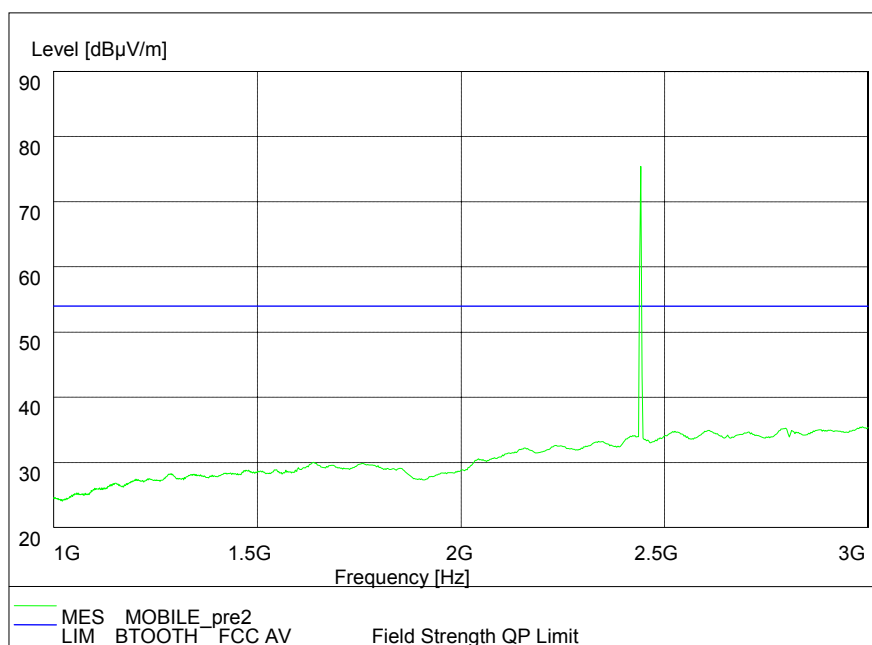
Modulation type: $\pi/4$ DQPSK



Frequency Range: 30 MHz -1000 MHz

Detector: PK mode

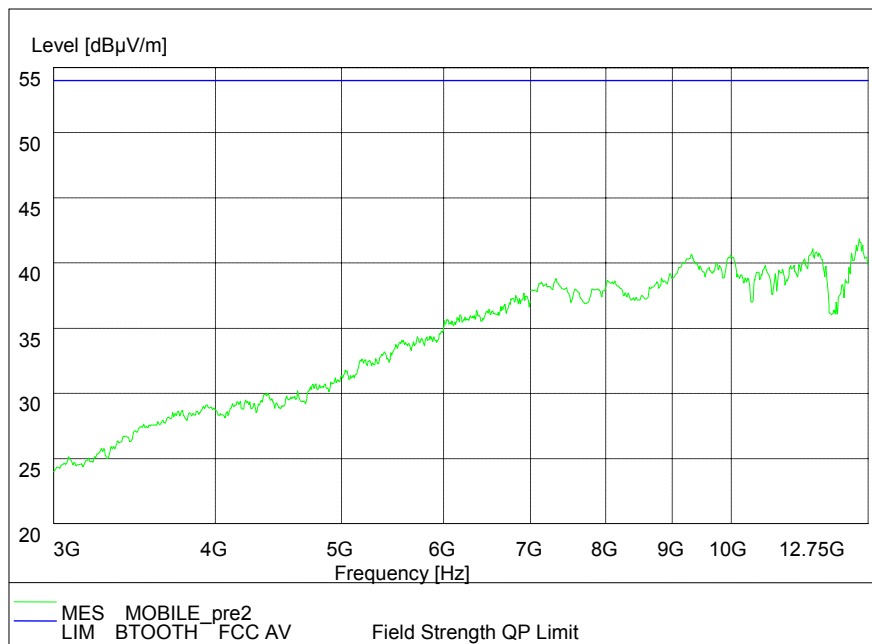
Modulation type: 8DPSK



Frequency Range: 1 GHz - 3 GHz

Detector: PK mode

Modulation type: 8DPSK



Frequency Range: 3 GHz – 12.75 GHz

Detector: PK mode

Modulation type: 8DPSK

2.2.5 Band Edge Compliance

2.2.5.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.5.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

2.2.5.2.1 RF Conducted Measurement:

The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

For the first measurement the EUT is set to transmit on the lowest channel (2402 MHz). The lower band edge is 2390 MHz.

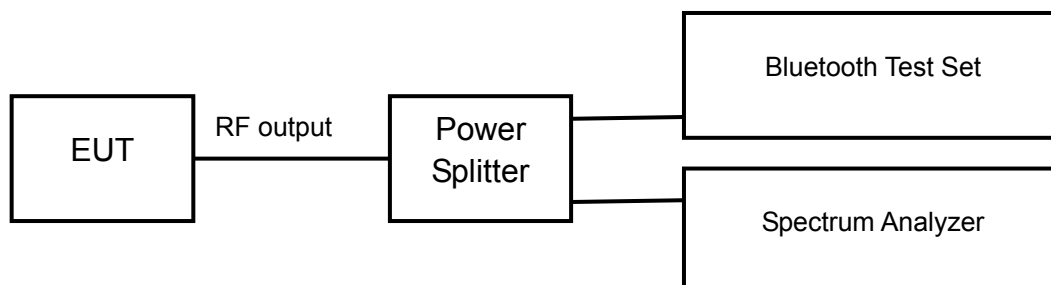
Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz

For the second measurement the EUT is set to transmit on the highest channel (2480MHz). The higher band edge is 2483.5 MHz.

Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz



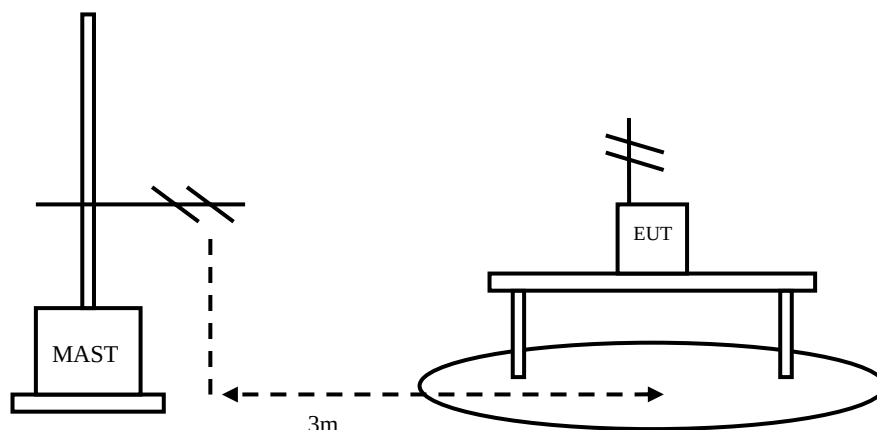
2.2.5.2.2 RF Radiated Measurement

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration.

During the test, the antenna height and EUT azimuth were varied in order to identify the maximum level of emission from the EUT. The height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.



2.2.5.3 Test limit

FCC Part15.247(d):

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

2.2.5.4 Test result

RF Conducted Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2390	-71.82	-1.68	-21.68	70.14

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2483.5	-69.22	-4.39	-24.39	64.83

RF Radiated Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2402	2.7	72.82	75.52	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2480	2.5	73.13	75.63	Peak

Band Edge Test Data

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2390	75.52	70.14	5.38	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2483.5	75.63	64.83	10.80	Peak

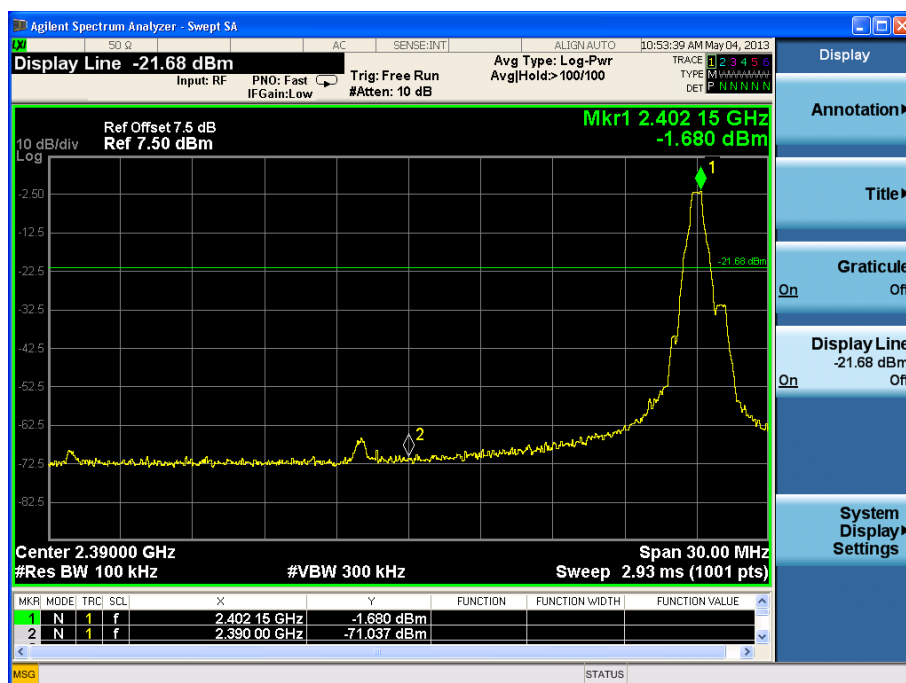
Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge Field Strength = F - Delta

F = Fundamental Field Strength (Peak or Average)

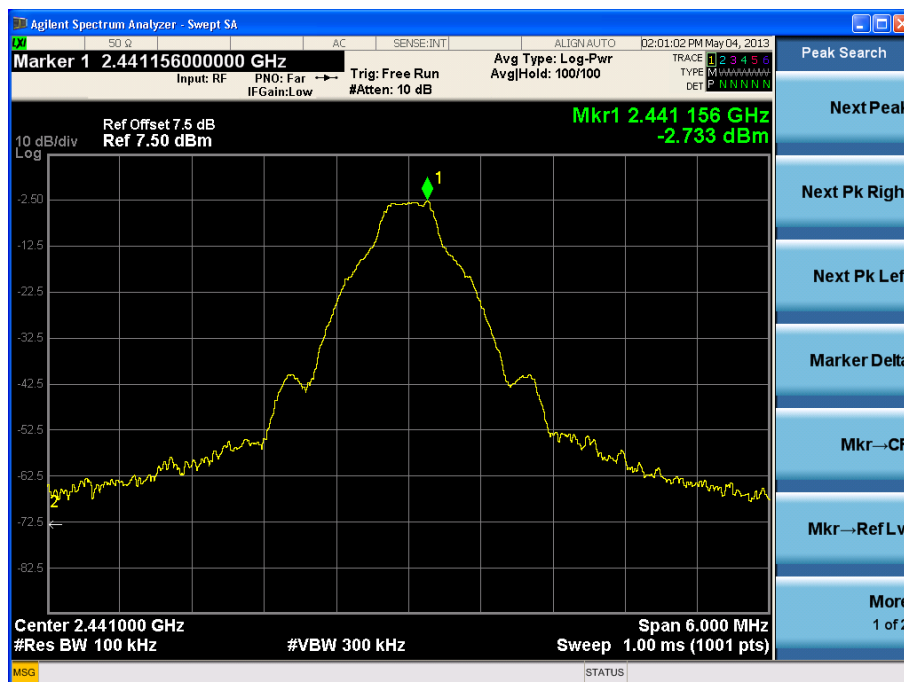
Delta= Conducted Band Edge Delta (Peak or Average)



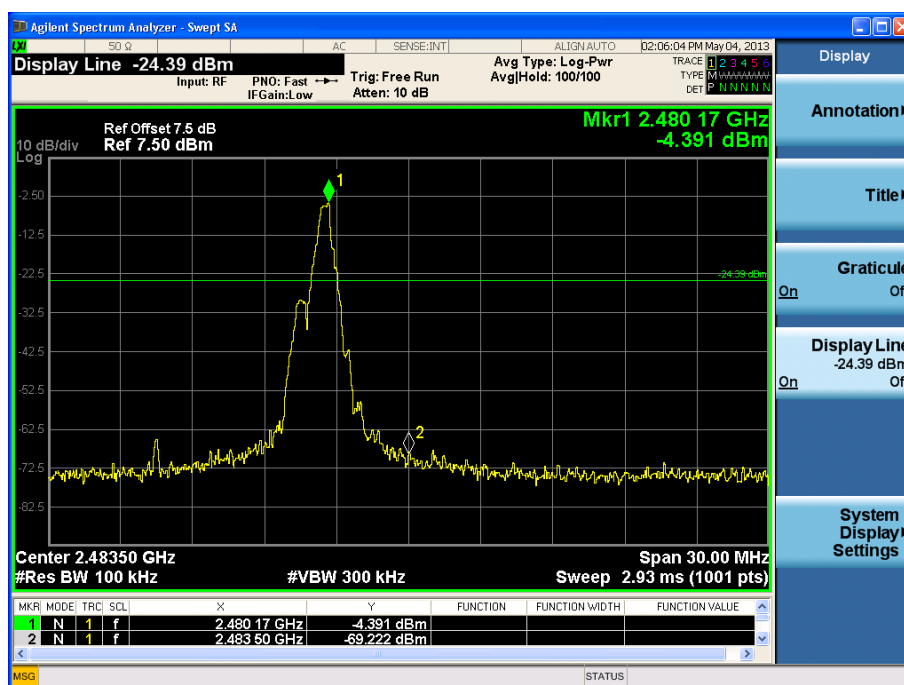
Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK



Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: GFSK



Carrier frequency (MHz): 2480
Channel No.:78
Modulation type: GFSK

RF Conducted Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2390	-70.32	-2.84	-22.84	67.48

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2483.5	-70.61	-7.12	-27.12	63.49

RF Radiated Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2402	2.7	73.77	76.47	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2480	2.5	73.11	75.61	Peak

Band Edge Test Data

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2390	76.47	67.48	8.99	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: $\pi/4$ DQPSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2483.5	75.61	63.49	12.12	Peak

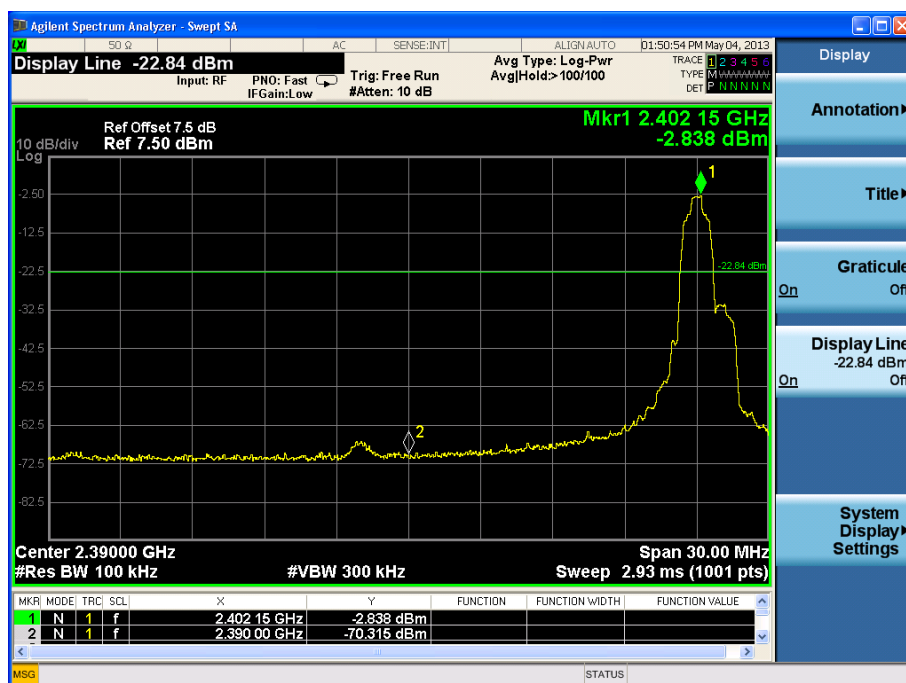
Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge Field Strength = F - Delta

F = Fundamental Field Strength (Peak or Average)

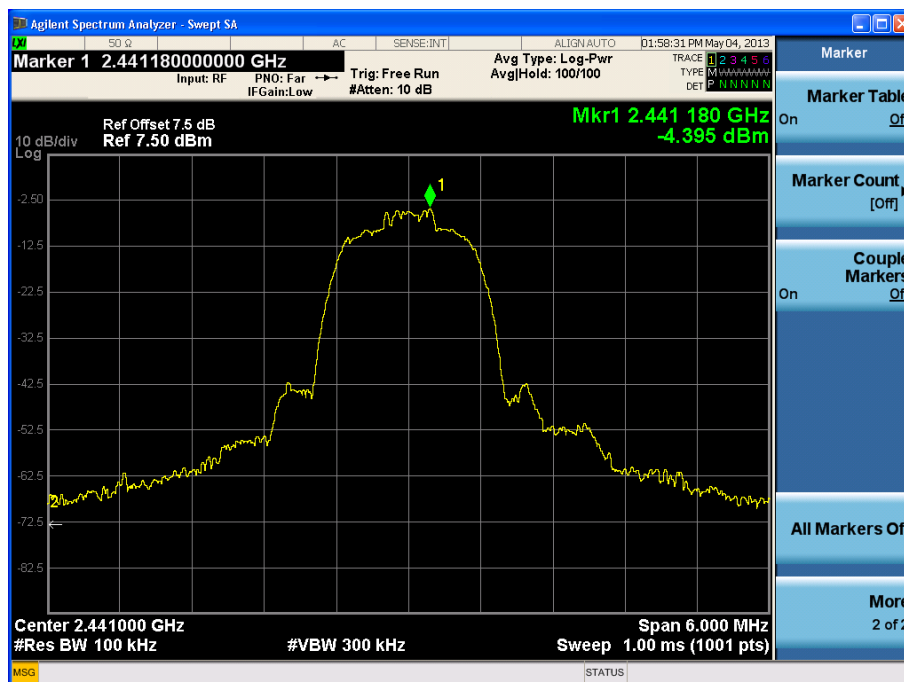
Delta= Conducted Band Edge Delta (Peak or Average)



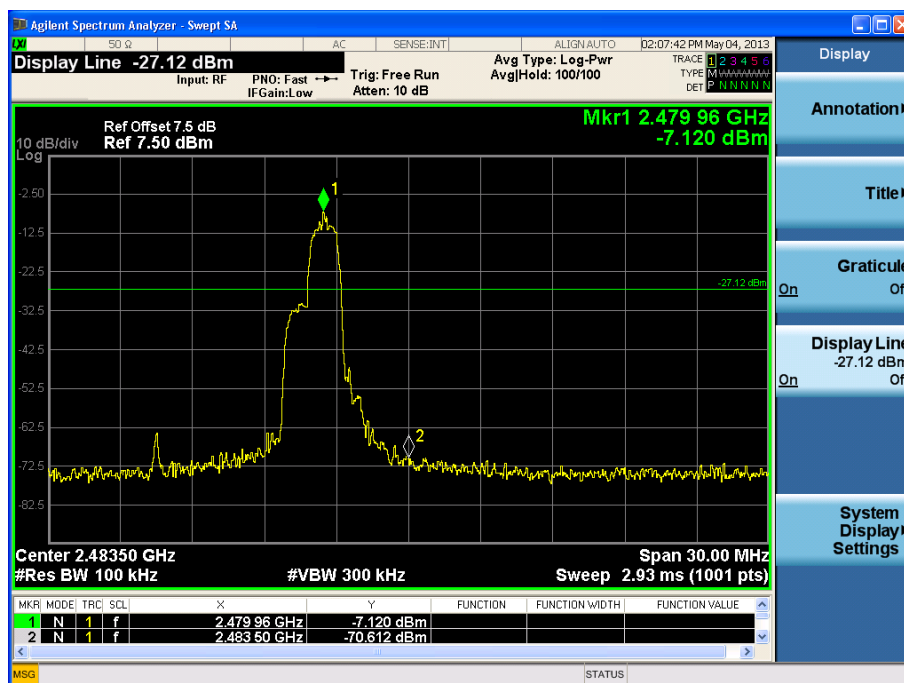
Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2480
Channel No.:78
Modulation type: $\pi/4$ DQPSK

RF Conducted Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: 8DPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2390	-72.46	-3.06	-23.06	69.40

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: 8DPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2483.5	-71.03	-8.00	-28.00	63.03

RF Radiated Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: 8DPSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2402	2.7	73.23	75.93	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: 8DPSK

Frequency MHz	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2480	2.5	73.41	75.91	Peak

Band Edge Test Data

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: 8DPSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2390	75.93	69.4	6.53	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: 8DPSK

Frequency MHz	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2483.5	75.91	63.03	12.88	Peak

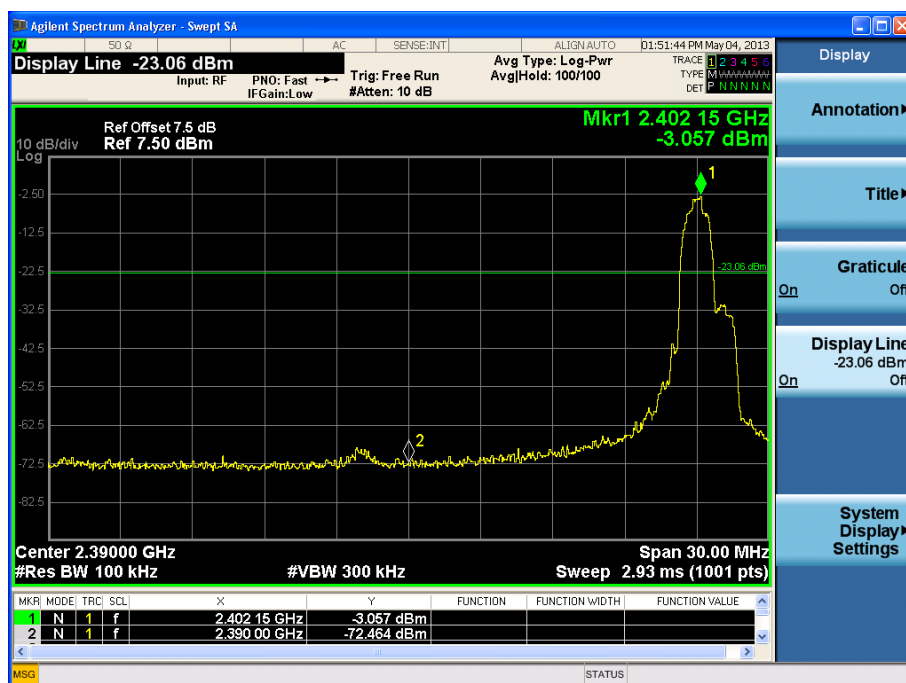
Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge Field Strength = F - Delta

F = Fundamental Field Strength (Peak or Average)

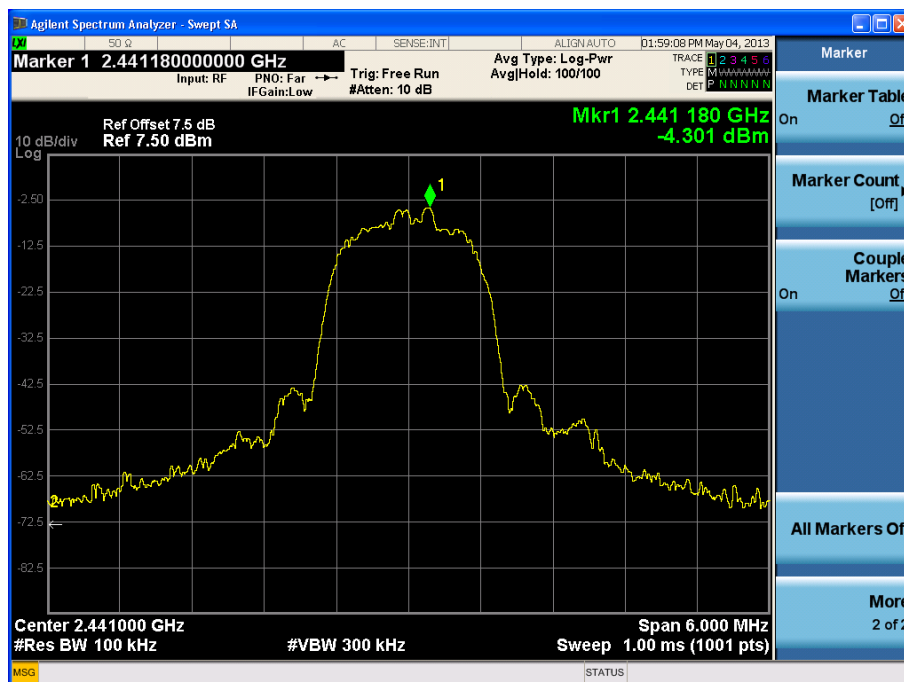
Delta= Conducted Band Edge Delta (Peak or Average)



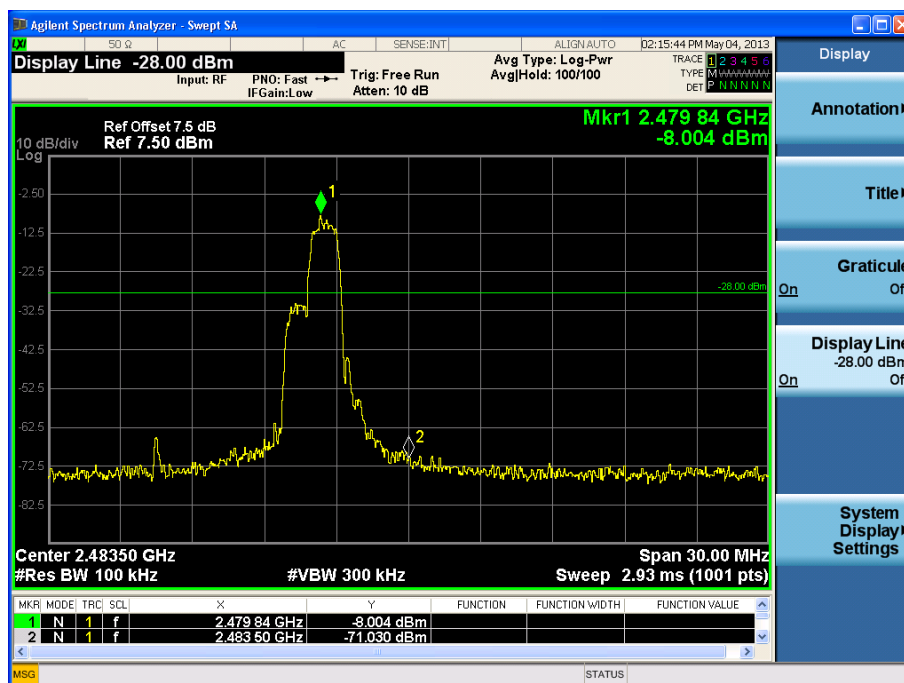
Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: 8DPSK



Carrier frequency (MHz): 2441
Channel No.:39
Modulation type: 8DPSK



Carrier frequency (MHz): 2480
Channel No.:78
Modulation type: 8DPSK

2.2.6 Dwell Time

2.2.6.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.6.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the dwell time measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

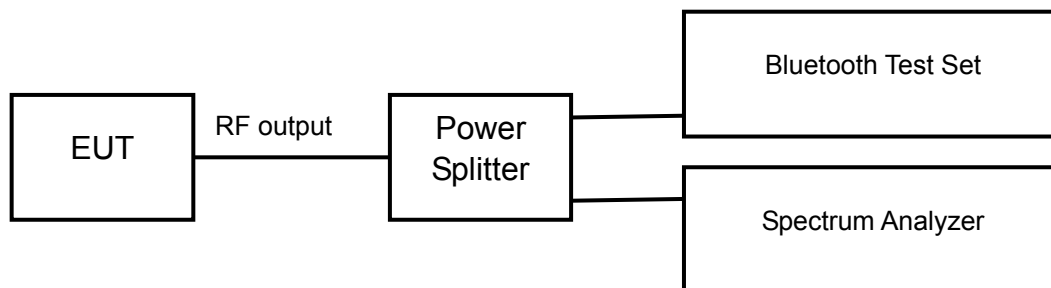
The time slot length is measured of three different packet types which are available in the Bluetooth technology. Those are DH1, DH3 and DH5 packets.

The dwell time is calculated by:

Dwell time = time slot length * hop rate * 31.6/ number of hopping channels

with:

- hop rate=1600/2 * 1/s for DH1 packets =800
- hop rate=1600/4 * 1/s for DH3 packets =400
- hop rate=1600/6 * 1/s for DH5 packets =266.67
- number of hopping channels=79
- 31.6 s=0.4 seconds multiplied by the number of hopping channels=0.4s * 79



2.2.6.3 Test limit

FCC Part15.247(a)(1)(iii):

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

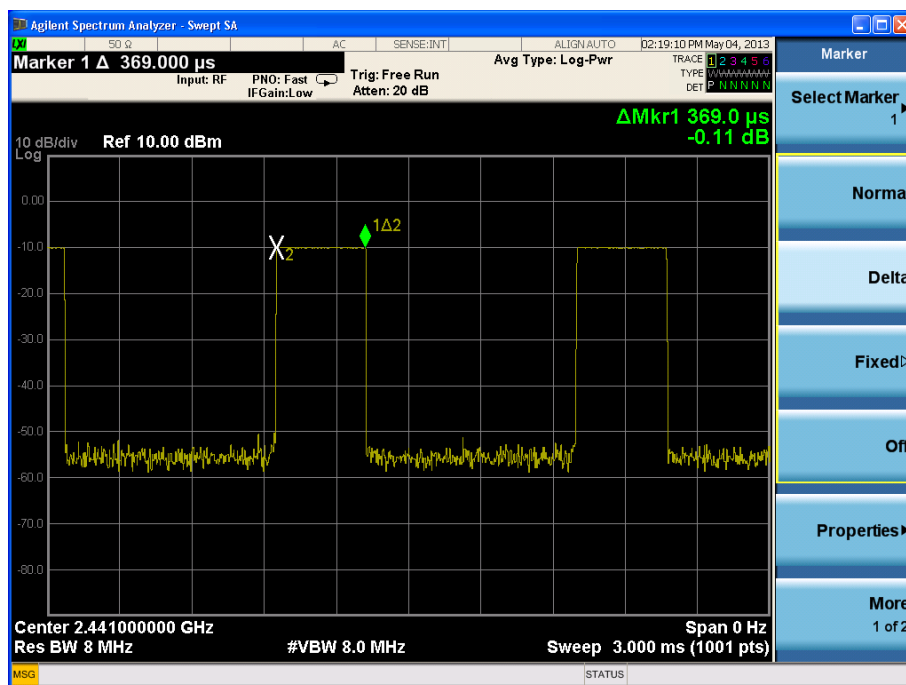
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Since the Bluetooth technology uses 79 channels this period is calculated to be 31.6 seconds.

2.2.6.4 Test result

Modulation type: GFSK

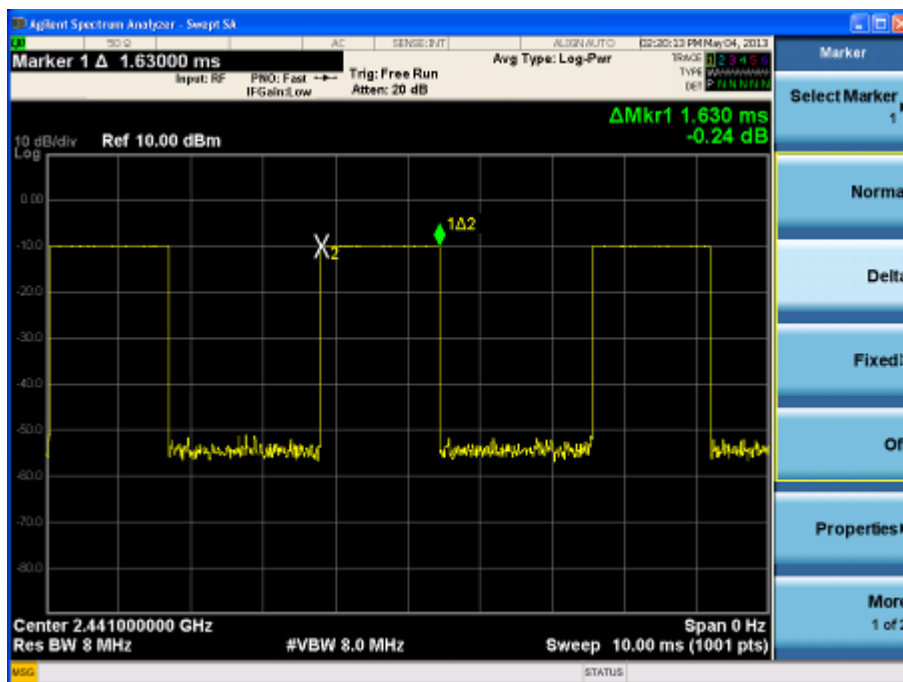
Packet type	Time slot length ms	Dwell time	Dwell time ms
DH1	0.369	time slot length *31.6 *1600/2 /79	118.08
DH3	1.630	time slot length * 31.6 *1600/4 /79	260.80
DH5	2.880	time slot length * 31.6 *1600/6 /79	307.20



Carrier frequency (MHz): 2441

Packet type: DH1

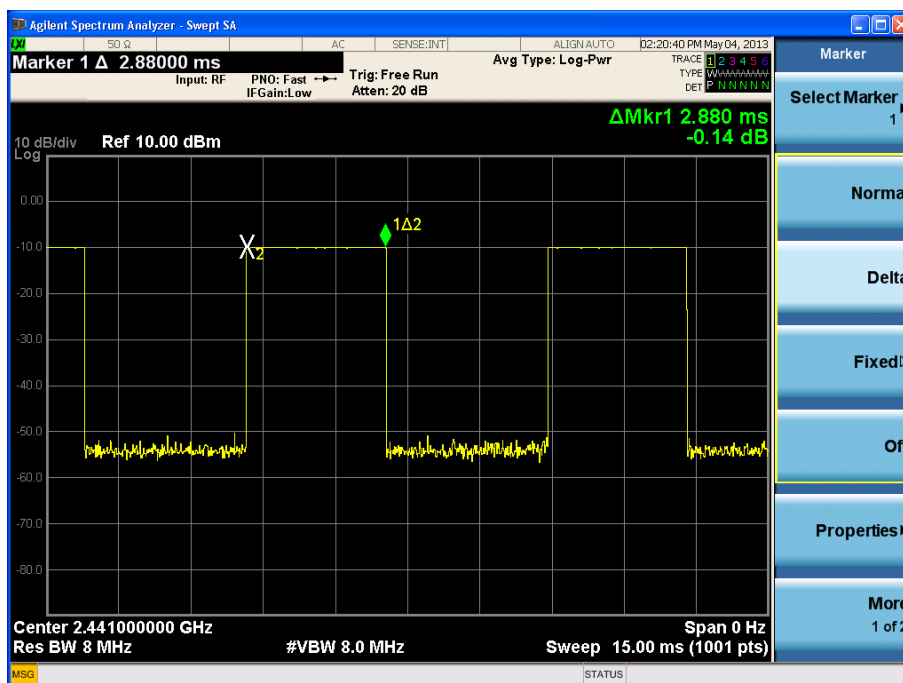
Modulation type: GFSK



Carrier frequency (MHz): 2441

Packet type: DH3

Modulation type: GFSK



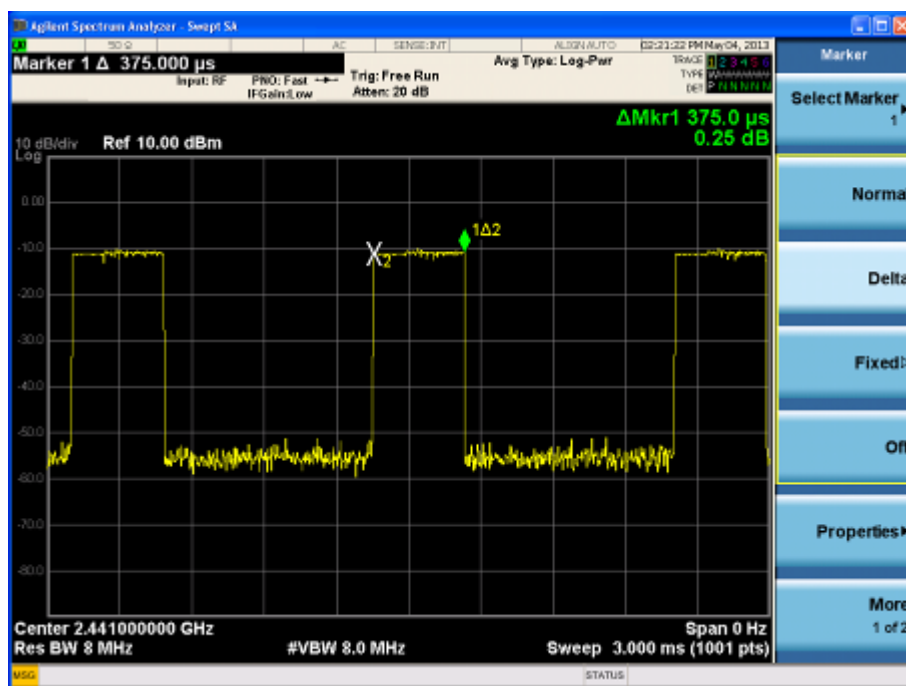
Carrier frequency (MHz): 2441

Packet type: DH5

Modulation type: GFSK

Modulation type: $\pi/4$ DQPSK

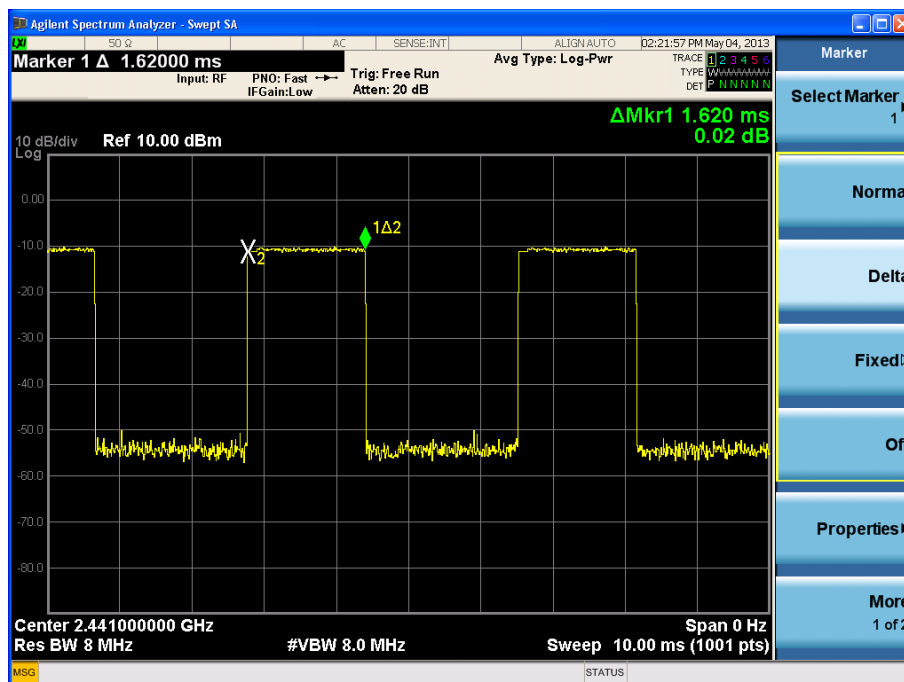
Packet type	Time slot length ms	Dwell time	Dwell time ms
DH1	0.375	time slot length *31.6 1600/2 /79	120.00
DH3	1.620	time slot length * 31.6 *1600/4 /79	259.20
DH5	2.880	time slot length * 31.6 *1600/6 /79	307.20



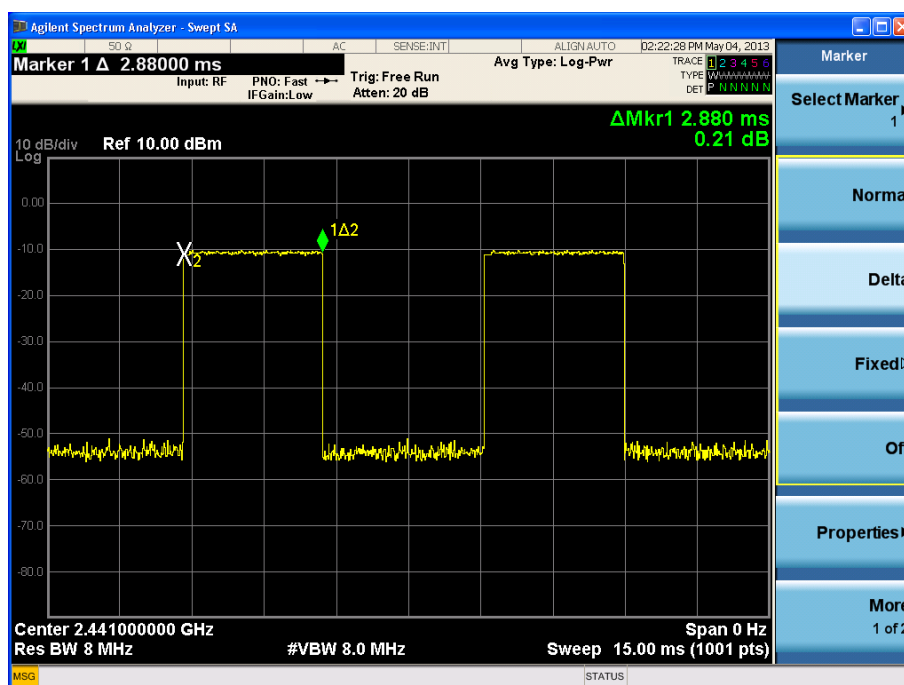
Carrier frequency (MHz): 2441

Packet type: DH1

Modulation type: $\pi/4$ DQPSK



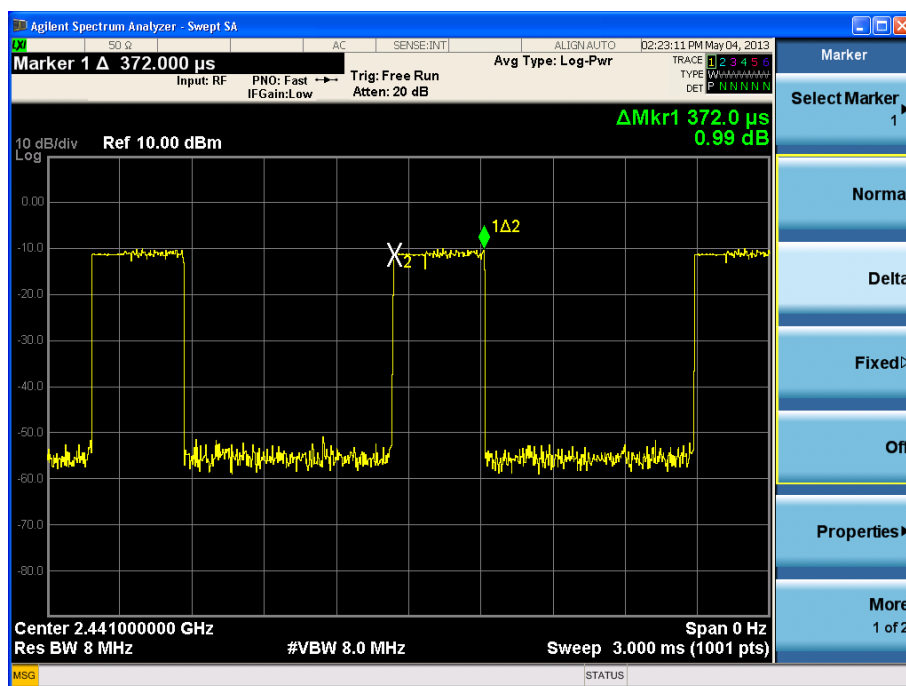
Carrier frequency (MHz): 2441
Packet type: DH3
Modulation type: $\pi/4$ DQPSK



Carrier frequency (MHz): 2441
Packet type: DH5
Modulation type: $\pi/4$ DQPSK

Modulation type: 8DPSK

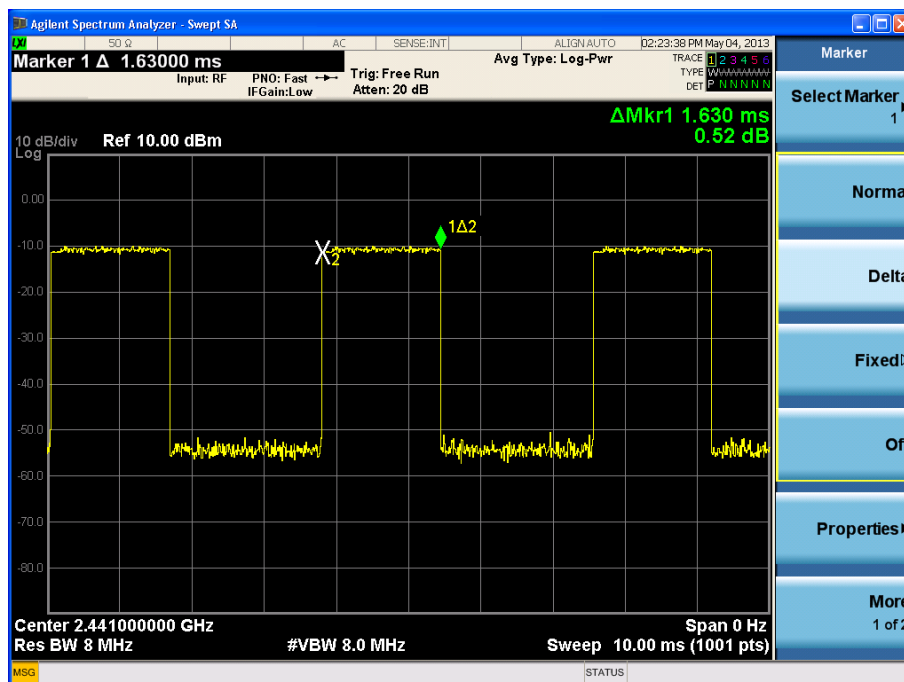
Packet type	Time slot length ms	Dwell time	Dwell time ms
DH1	0.372	time slot length *31.6 1600/2 /79	119.04
DH3	1.630	time slot length * 31.6 *1600/4 /79	260.08
DH5	2.880	time slot length * 31.6 *1600/6 /79	307.20



Carrier frequency (MHz): 2441

Packet type: DH1

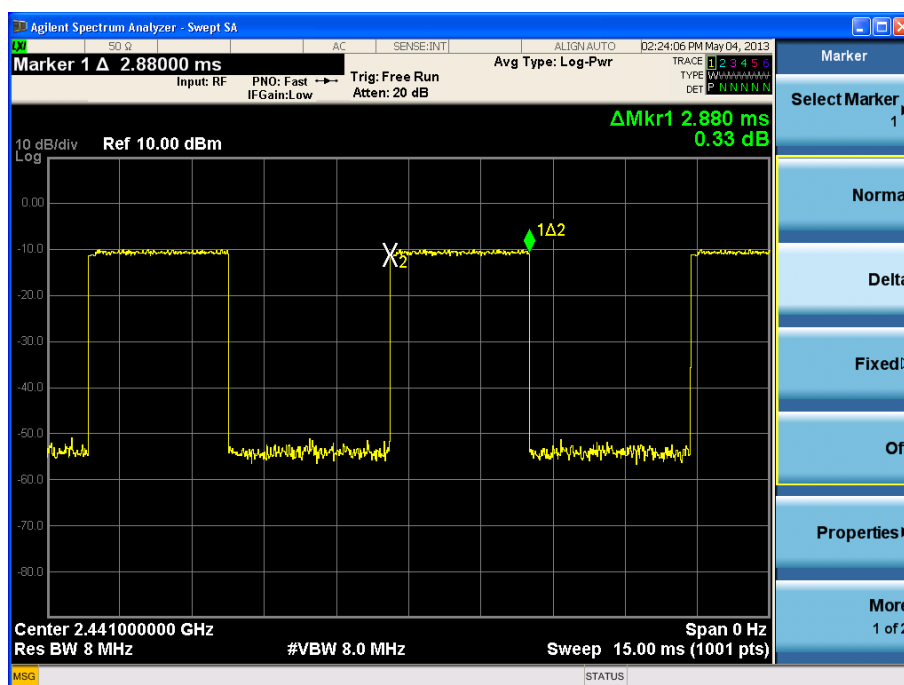
Modulation type: 8DPSK



Carrier frequency (MHz): 2441

Packet type: DH3

Modulation type: 8DPSK



Carrier frequency (MHz): 2441

Packet type: DH5

Modulation type: 8DPSK

2.2.7 Channel Separation

2.2.7.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.7.2 Test Description

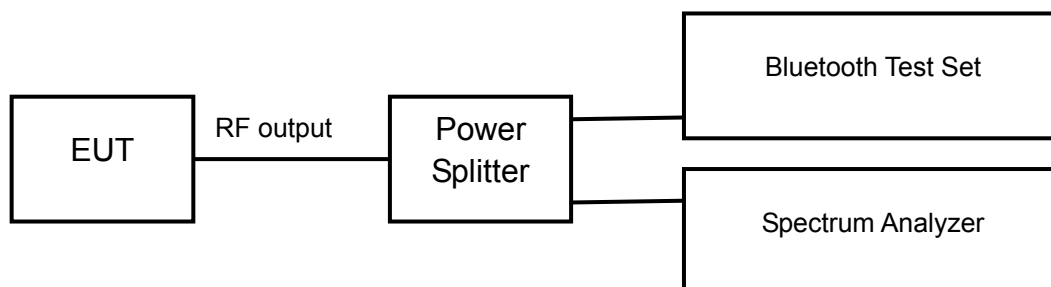
The measurement is made according to Public notice DA 00-705 and ANSI C63.4.

The Equipment Under Test (EUT) was set up in a shielded room to perform the channel separation measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Span: 3 MHz
- Centre Frequency: 2441 MHz
- Resolution Bandwidth (RBW): 30 kHz
- Video Bandwidth (VBW): 1 MHz
- Sweep Time: Coupled



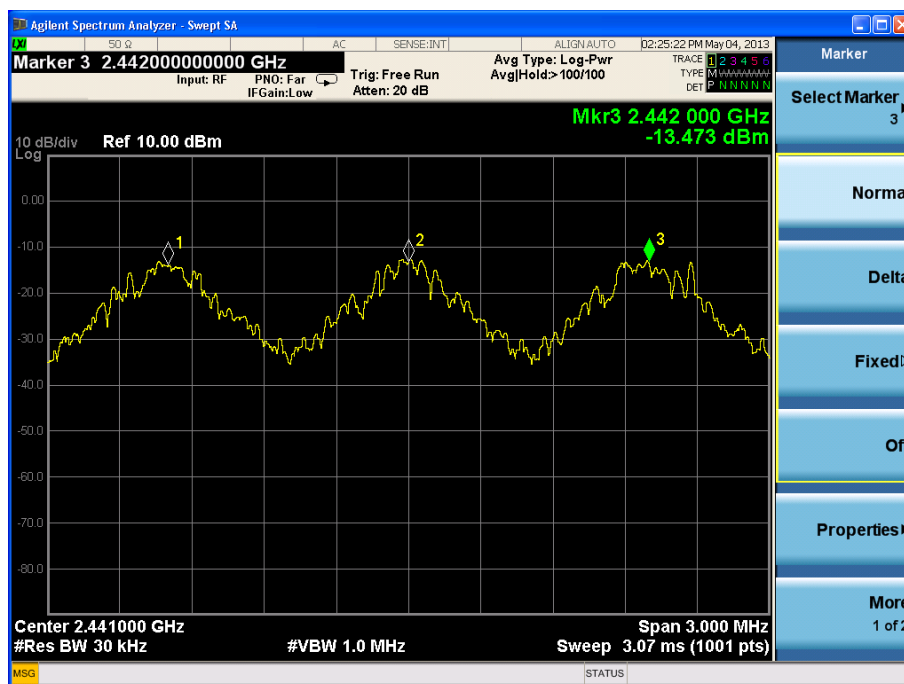
2.2.7.3 Test limit

FCC Part15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

2.2.7.4 Test result

Op-mode	Channel separation MHz
Hopping mode	1



Op-mode: Hopping mode

2.2.8 Number of Hopping Frequencies

2.2.8.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

2.2.8.2 Test Description

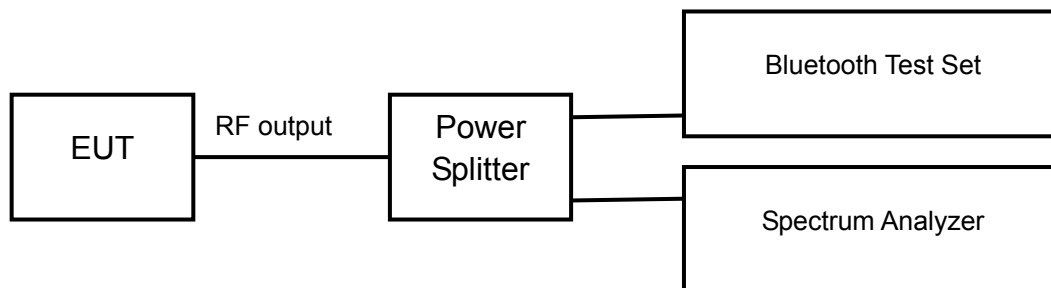
The measurement is made according to Public notice DA 00-705 and ANSI C63.4.

The Equipment Under Test (EUT) was set up in a shielded room to perform the number of hopping frequencies measurement.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Start frequency: 2400 MHz
- Stop frequency: 2483.5 MHz
- Resolution Bandwidth (RBW): 30 kHz
- Video Bandwidth (VBW): 1 MHz
- Sweep Time: Coupled



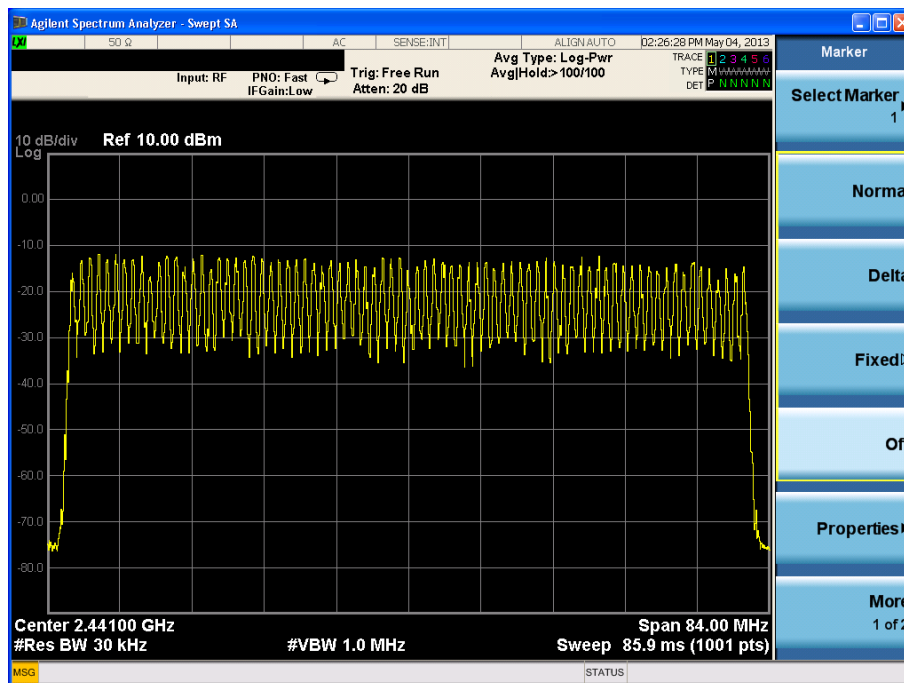
2.2.8.3 Test limit

FCC Part15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

2.2.8.4 Test result

Op-mode	Result
Hopping mode	79



Op-mode: Hopping mode

2.3. Measurement Uncertainty

Items	Uncertainty	
Occupied Bandwidth	3kHz	
Peak power output	0.67dB	
Band edge compliance	1.20dB	
Spurious emissions	30MHz~1GHz	2.83dB
	1GHz~12.75GHz	2.50dB
	12.75GHz~25GHz	2.75dB

2.4. List of test equipment

No.	Name/ Model	Manufacturer	S/N	Cal Due date
1.	Spectrum Analyzer N9020A	Agilent	MY48010771	2013.08.20
2.	Signal Generator E8257D	Agilent	MY46520645	2013.08.20
3.	Bluetooth Test Set MT8852B	Anritsu	1142010	2014.02.19
4.	Cable N-N	Spectrum	6-046	2013.08.20
5.	Cable N-N	Spectrum	6-050	2013.08.20
6.	Power Splitter 11850C	Agilent	026057	2013.08.20
7.	12.65m×8.03m×7.50m Fully-Anechoic Chamber	FRANKONIA	-----	-----
8.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----
9.	Turn table Diameter:1m	HD	-----	-----
10.	Turn table Diameter:5m	HD	-----	-----
11.	Antenna master FAC(MA4.0)	MATURO	-----	-----
12.	Antenna master SAC(MA4.0)	MATURO	-----	-----
13.	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----
14.	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100030	2013.08.20
15.	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100029	2013.08.20
16.	HL562 Ultra log antenna	R&S	100016	2013.08.20
17.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2013.08.20
18.	ESI 40 EMI test receiver	R&S	100015	2013.08.20
19.	Radio tester	CMU 200	114667	2013.08.20
20.	ESCS30 EMI test receiver	R&S	100029	2013.08.20
21.	HL562 Receive antenna	R&S	100167	2013.08.20
22.	ESH3-Z5 LISN	R&S	100020	2013.08.20

Appendix

Appendix1 Test Setup