Nemko Korea Co., Ltd.

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

NComputing Co., Ltd.
(Gasan-dong, JEI-Platz B/D),
804, 186, Gasandigital1-ro,
Geumcheon-gu, Seoul, Korea,
Republic of (Post code : 08502)
Attn. : Chang Yu

Dates of Issue : April 3, 2017
Test Report No. : NK-17-R-009
Test Site : Nemko Korea Co., Ltd.

FCC ID	**SMJRX3**
Brand Name	**NComputing**
Contact Person	**NComputing Co., Ltd.** **(Gasan-dong, JEI-Platz B/D), 804, 186, Gasandigital1-ro,** **Geumcheon-gu, Seoul, Korea, Republic of** **Chang Yu** **Telephone No. : +82-2-2028-7010**

Applied Standard: FCC 47 CFR Part 15.247
Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
EUT Type: Network virtual desktop

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

April. 3. 2017

Tested By : Seungyong Shin
Engineer

April 03. 2017

Reviewed By : Deokha Ryu
Technical Manager

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1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.

Responsible Party :	NComputing Co., Ltd.
Contact Person :	Chang Yu
Manufacturer :	(Gasan-dong, JEI-Platz B/D), 804, 186, Gasandigital1-ro, Geumcheon-gu, Seoul, Korea, Republic of

- FCC ID SMJRX3
- Model: RX300
- Variants Model RX310, RX320, RX330, RX340, RX350, RX360, RX370, RX380, RX390
- Brand Name: NComputing
- EUT Type: Network virtual desktop
- Classification: Part 15 Spread Spectrum Transmitter
- Applied Standard: FCC 47 CFR Part 15.247
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: March 20, 2017 ~ March 31, 2017
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating from **NComputing Co., Ltd. FCC ID : SMJRX3.**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address 159, Osan-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 16885, Republic of Korea.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014 according to §2.948.

Nemko Korea Co., Ltd.
EMC Lab.
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Cheoin-gu, Yongin-si, Gyeonggi-do,
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	KCC(RRL)Designated Lab.	Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the transceiver which is the Bluetooth 4.1 module supporting BDR/EDR/LE mode. Internal program was used to control the EUT to transmit the wanted TX channel and modulation. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test power setting

Mode	Frequency Band	Power Setting Level
GFSK/ π/4 DQPSK/ 8DPSK	2402 MHz ~ 2480 MHz	default

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
2.4 GHz	GFSK, π/4DQPSK, 8DPSK	0	2402
		39	2441
		78	2480

3.1.3 Antenna TX mode information

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	GFSK, π/4DQPSK, 8DPSK	■ 1TX, □ 2TX	□ Yes, ■ No

3.1.4. Additional Information Related to Testing

The cable and attenuator loss from 30MHz to 25GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

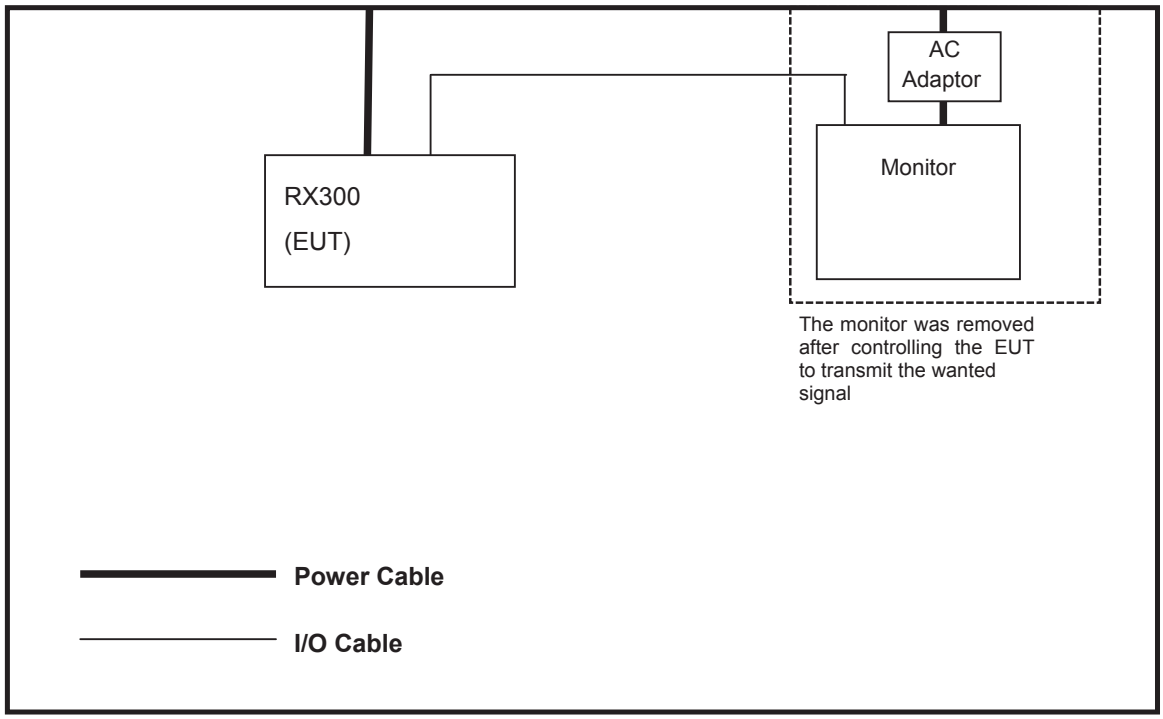
3.1.5 Table of test modes

Test Items	Mode	Test Channel (CH)
Conducted Emissions	GFSK, π/4DQPSK, 8DPSK	39
Radiated Emissions		39
20 dB Bandwidth		0/39/78
Carrier Frequency Separation		0/39/78
Transmitter Average Time of Occupancy		0/39/78
Peak Output Power		0/39/78
Conducted Spurious Emission		0/39/78
Radiated Spurious Emission, Band edge Emission		0/39/78
Number of Hopping channels		All channels

3.2 Support Equipment

EUT	Ncomputing Co., Ltd. Model : RX300	S/N: N/A
Laptop Computer	Not used	
AC/DC Adapter	Not used	

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Ncomputing Co., Ltd. FCC ID: SMJRX3.**
This unit supports full qualified Bluetooth 4.1 with EDR/LE standard system.

Specifications:

EUT Type	Network Virtual Desktop
Model Name	RX300
Variant Name	RX310, RX320, RX330, RX340, RX350, RX360, RX370, RX380, RX390
Brand Name	NComputing
RF Frequency	2402 MHz ~ 2480 MHz
Peak Power Output (Conducted)	4.25 dBm
FCC Classification	FCC Part 15 Spread Spectrum Transmitter (DSS)
Method/System	Frequency Hopping Spread Spectrum (FHSS)
Channel Number	79 ch
Modulation	GFSK, π/4DQPSK, 8DPSK
Antenna Gain (Peak)	1.5 dBi
Antenna Setup	1TX / 1RX
Voltage	5.1Vdc
Temperature Range	0℃ ~ +40 ℃
Size (W x H x D)	About 9.0 cm x 11.0 cm x 4.0 cm
Weight	About 90 g
H/W Status	
S/W Status	
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	Result	Remark
Conducted Emission	15.207	Complies	
Radiated Emission	15.209	Complies	
20dB Bandwidth	15.247(a)(1)	Complies	
Carrier Frequency Separation	15.247(a)(1)	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	Complies	
Peak Output Power	15.247(b)(1)	Complies	
Conducted Spurious Emission	15.247(d)	Complies	
Radiated Spurious Emission	15.247(d)	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **NComputing Co., Ltd.** **FCC ID: SMJRX3** is in compliance with Part 15.247 of the FCC Rule.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: 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 antenna of the **NComputing Co., Ltd.** **FCC ID: SMJRX3** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 meter shielded enclosure. It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room Rohde & Schwarz and (ESH2-Z5) of the 50 ohm/50 µH Line Impedance Stabilization Network (LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ESH2-Z5). Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ". If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs, All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentinefashion) to a 1 meter length. Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150 kHz to 30 MHz with 200 msec sweep time. The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCI). The detector functions were set to CISPR quasi-peak mode & average mode. The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; whichever determined the worst case emission.

Each EME reported was calibrated using the R&S signal generator.

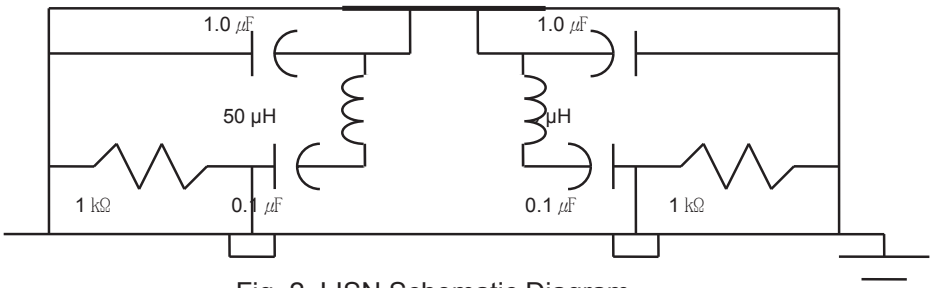


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz) was used.

For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0˚ to 360˚ and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI C63.10-2013. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 1 kHz, Detector = Peak, Trace mode = max hold.

Frequency (MHz)	Field strength (microvolts/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

Radiated Emissions Limits per 47 CFR 15.209(a)

7.3 20 dB Bandwidth

Test Setup

Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 1% to 5% of the OBW

VBW = approximately 3 x RBW

Sweep = auto

Detector function = peak

Trace = max hold

7.4 Carrier Frequency Separation

Test Setup

Test Procedure

The EUT must have its hopping function enabled. The following spectrum analyzer setting is used.

Span = wide enough to capture the peaks of two adjacent channels

RBW ≥ approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

7.5 Transmitter Average Time of Occupancy

Test Setup

Test Procedure

The transmitter output is connected to a spectrum analyzer. The following spectrum analyzer setting is used.

Span = Zero span, centered on a hopping channel

RBW >> 1 / *T*, where *T* is the expected dwell time per channel.

VBW ≥ RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = Peak

Trace = Single sweep

Use the marker-delta function to determine the width of pulse

7.6 Number of Hopping Channels

Test Setup

Test Procedure

Span = The frequency band of operation.

RBW = less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW ≥ RBW

Sweep = Auto

Detector function = Peak

Trace = Max hold

7.7 Peak Output Power

Test Setup

Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

7.8 Conducted Spurious Emission

Test Setup

Test Procedure

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the Lowest, middle and highest channels.

RBW = 100kHz

VBW = 300kHz

Sweep = auto

Detector function = peak

Trace = max hold

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207

Frequency (MHz)	Level (dBμV)		Factor (dB)	Line	Limit (dBμV)		Margin (dB)	
	Q-Peak	Average			Q-Peak	Average	Q-Peak	Average
0.19	53.2	41.8	9.90	L	63.7	53.7	10.5	11.9
0.26	46.5	34.8	9.70	N	61.3	51.2	14.8	16.4
0.32	41.9	29.6	9.80	N	59.5	49.4	17.6	19.8
0.52	35.2	22.0	9.90	N	56.0	46.0	20.8	24.0
0.59	34.2	19.9	9.90	N	56.0	46.0	21.8	26.1
2.86	26.5	13.6	9.80	L	56.0	46.0	29.5	32.4

Line Conducted Emissions Tabulated Data

Notes:

1. Measurements using CISPR quasi-peak mode & average mode.

2. All modes of operation were investigated and the worst -case emission are reported.
See attached Plots.

3. LINE : L = Line , N = Neutral

4. The limit is on FCC §15.207(a)

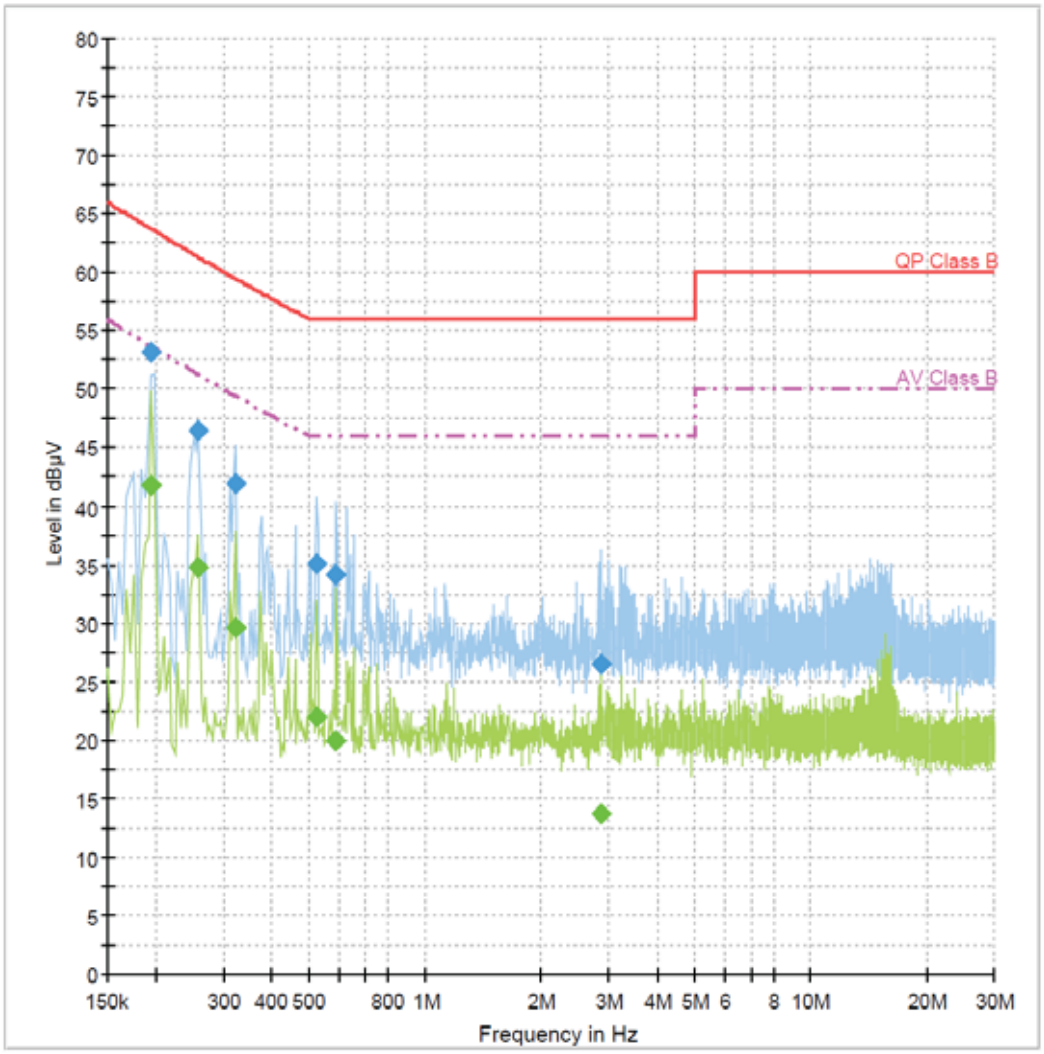
PLOTS OF EMISSIONS

Common Information

Test Site:	Nemko Korea(NK-17-R-009)
Test Description:	Conducted emission
Test Standard:	FCC Part 15
Environment Conditions:	a.c. 120 V, 60 Hz
Operator Name:	Yonghwan Kim
Model:	RX300
Mode:	Line

1.EMI Auto Test 2-Line Voltage LISN

1.EMI Auto Test_2-Line Voltage LISN



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TEST DATA

8.2 Radiated Emissions

FCC §15.209

Result

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
33.24	40.54	H	192	208	-23.5	17.0	40.0	23.0
41.68	40.84	V	100	353	-22.0	18.8	40.0	21.2
84.08	50.79	V	121	268	-27.5	23.3	40.0	16.7
133.79	52.22	V	111	60	-27.2	25.0	43.5	18.5
183.42	48.17	H	191	159	-25.9	22.3	43.5	21.2
480.01	46.86	H	201	180	-17.0	29.9	46.0	16.1

Radiated Measurements at 3 meters

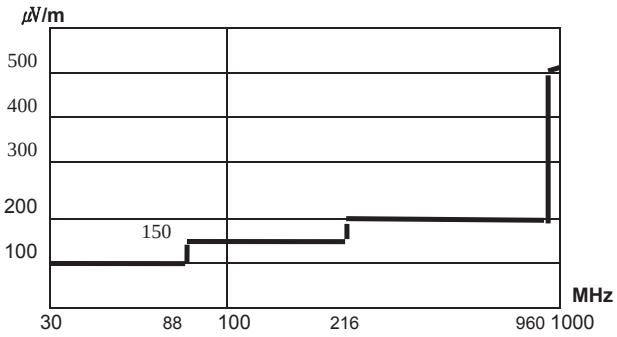


Fig. 3. Limits at 3 meters

Notes:

1. All modes were measured and the worst-case emission was reported.

2 The radiated limits are shown on Figure 3. Above 1GHz the limit is 500 µV /m.

*3. *Pol. H = Horizontal, V = Vertical*

*4. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

5. Measurements using CISPR quasi-peak mode below 1 GHz.

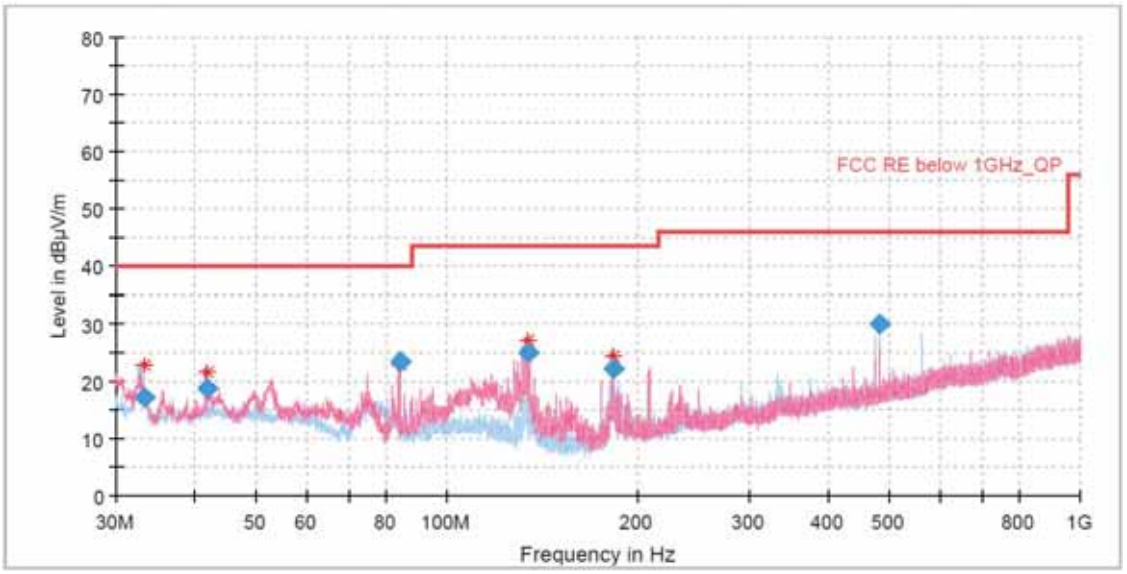
6. The radiated emissions testing were made by rotating the receive antenna with horizontal, Vertical polarization. The worst date was recorded.

7. 8DPSK on the highest channel (2480MHz) is the worst case channel.

8. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

PLOTS OF EMISSIONS

Worst Case : 2480 MHz (below 1GHz)_8DPSK modulation



8.3 20 dB Modulated Bandwidth

FCC §15.247(a)(1)(iii)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Modulation Mode	Frequency (MHz)	Result (kHz)	Limit (kHz)
GFSK	2402	953.5	Non specified
GFSK	2441	988.1	Non specified
GFSK	2480	994.3	Non specified
π/4DQPSK	2402	956.6	Non specified
π/4DQPSK	2441	989.3	Non specified
π/4DQPSK	2480	992.6	Non specified
8DPSK	2402	955.6	Non specified
8DPSK	2441	987.7	Non specified
8DPSK	2480	992.7	Non specified

PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, GFSK Mode)

20 dB Bandwidth, Middle Channel (2441 MHz, GFSK Mode)

PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, GFSK Mode)

20 dB Bandwidth, Lowest Channel (2402 MHz, π/4DQPSK Mode)

PLOTS OF EMISSIONS

20 dB Bandwidth, Middle Channel (2441 MHz, π/4DQPSK Mode)

20 dB Bandwidth, Highest Channel (2480 MHz, π/4DQPSK Mode)

PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, 8DPSK Mode)

20 dB Bandwidth, Middle Channel (2441 MHz, 8DPSK Mode)

PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, 8DPSK Mode)

8.4 Carrier Frequency Separation

FCC §15.247(a)(1)

Test Mode : Set to Hopping mode

Result

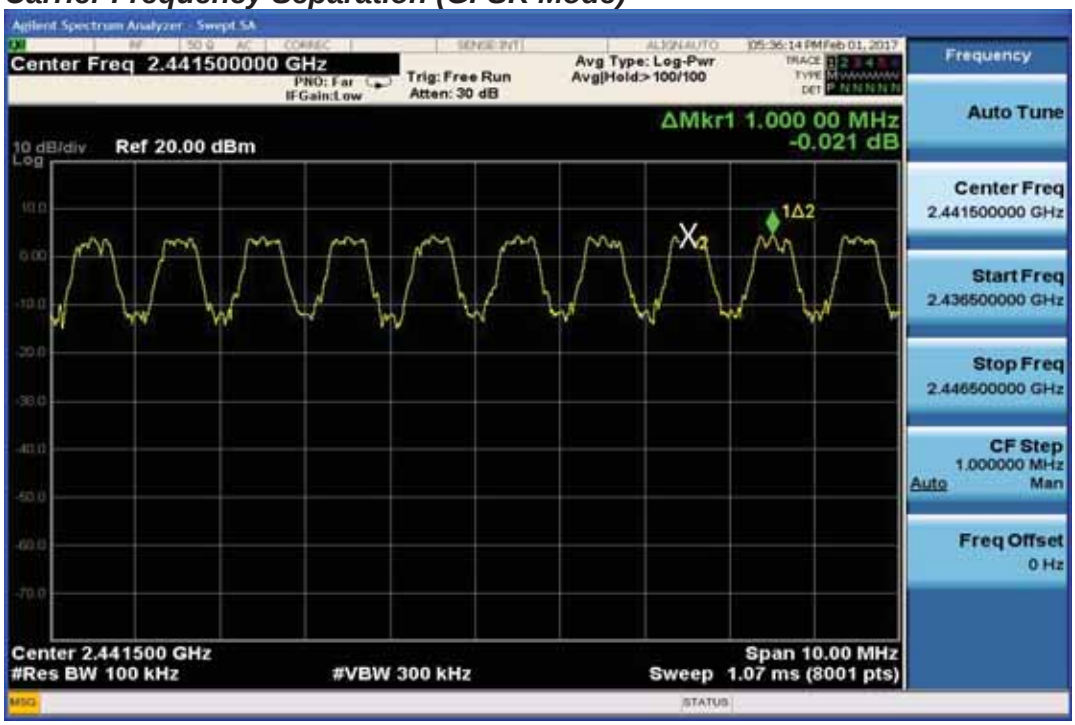
Modulation Mode	Carrier Frequency Separation (kHz)	Limit (2 / 3 of 20dB Bandwidth) (kHz)	Margin (kHz)
GFSK	1000.0	662.9	337.1
π/4DQPSK	1152.5	661.7	490.8
8DPSK	938.8	661.8	277.0

Note:

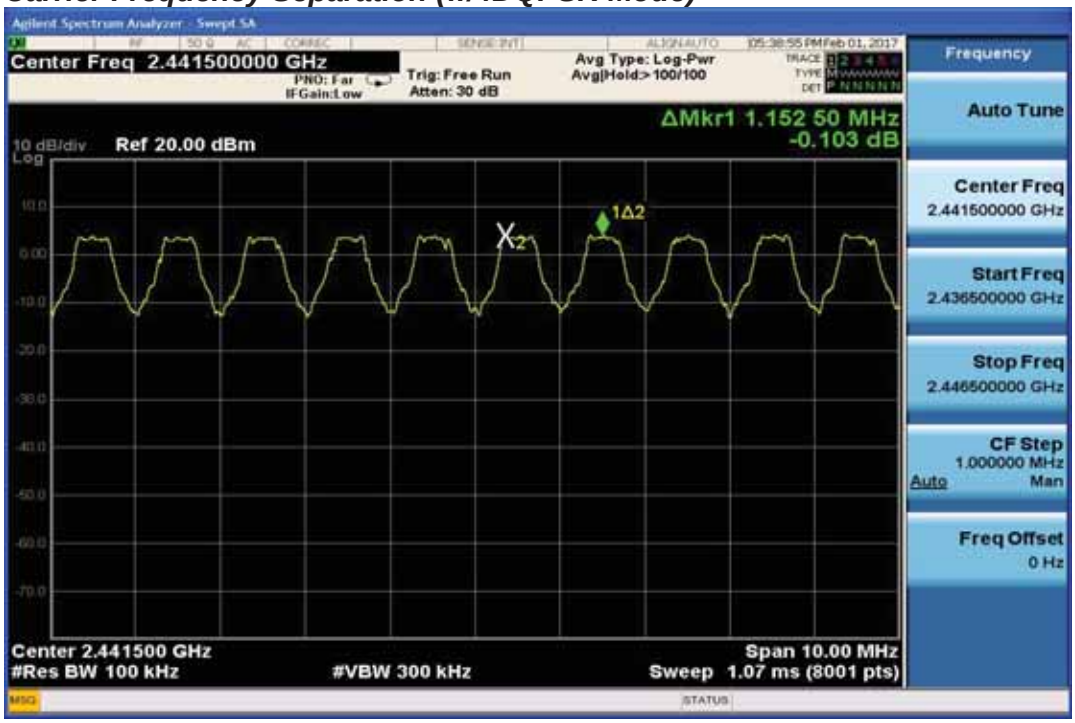
*The EUT complies with the minimum channel separation requirement when it is operating **1x/EDR mode using 79 channels** and when operating in **AFH mode using 20 channels**.*

PLOTS OF EMISSIONS

Carrier Frequency Separation (GFSK Mode)

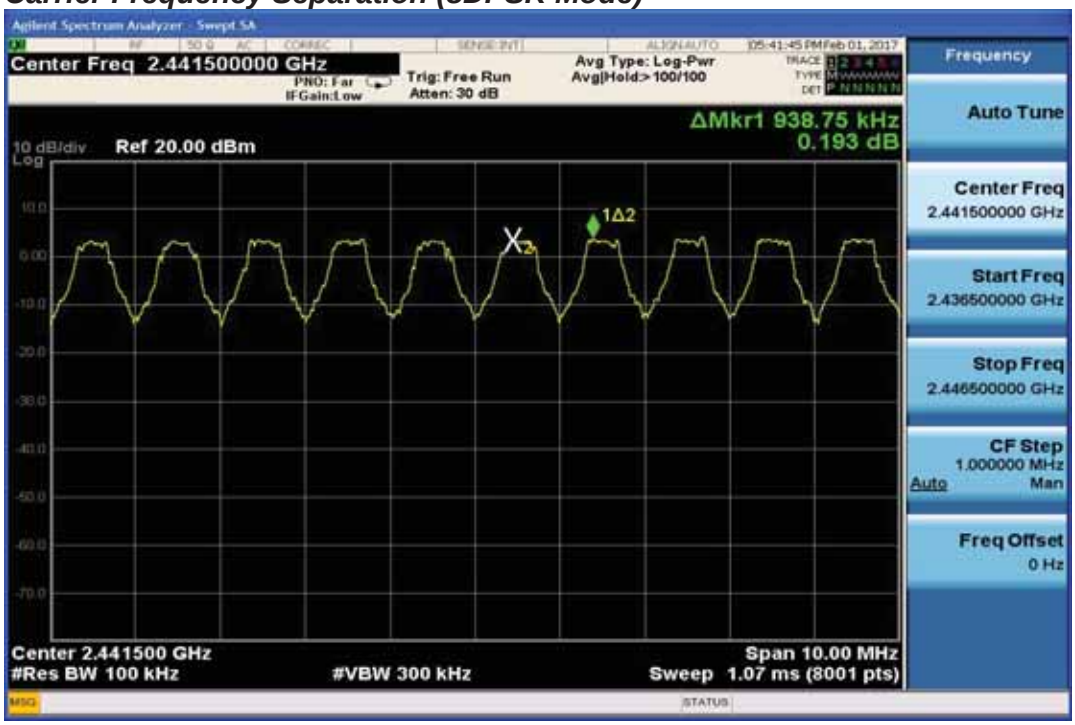


Carrier Frequency Separation (π/4DQPSK Mode)



PLOTS OF EMISSIONS

Carrier Frequency Separation (8DPSK Mode)



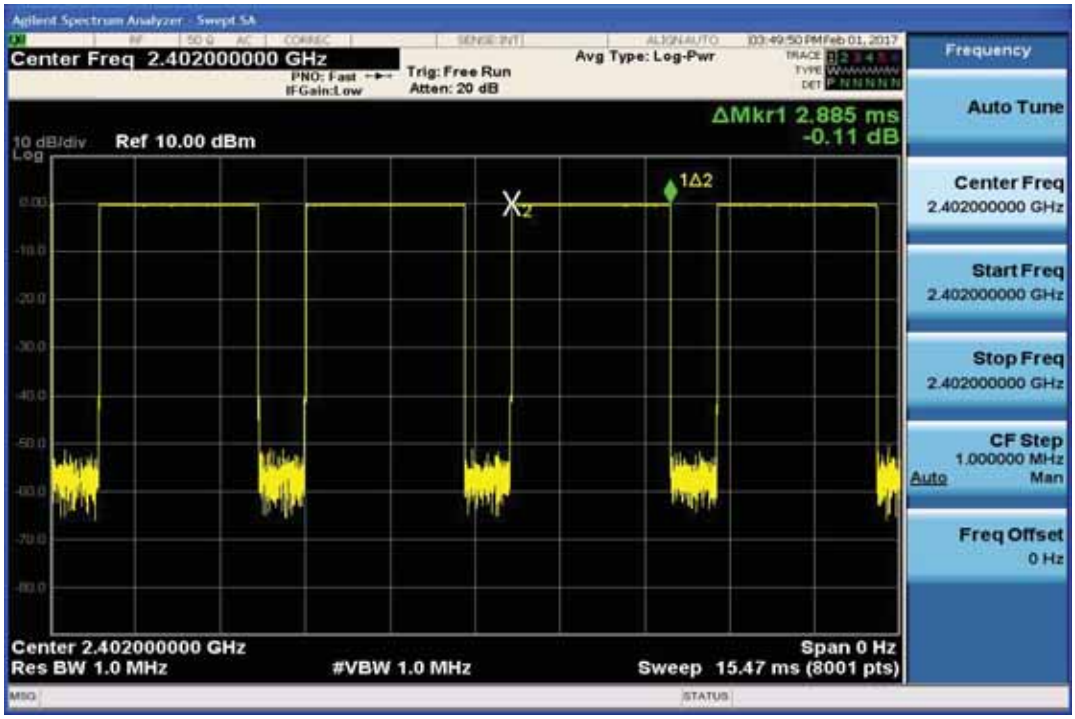
8.5 Transmitter Average Time of Occupancy

FCC §15.247(a)(1)

Test mode : Set to Hopping mode

Result

Mode	Pulse width (ms)	*)Numbers of slots	**) Average time of Occupancy (ms)	Limit (ms)	Margin (ms)
1x/EDR	2.89	106.7	308.4	≤400	91.6
AFH	2.89	53.3	154.7	≤400	245.9



1x/EDR mode

1) This result was measured at DH5 mode in **1x/EDR mode**, which has longest time in one transmission burst.
2) Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s and 79 hopping channels.
3) The average time of occupancy in the specified 31.6 second period (79 channels x 0.4 s) is equal to pulse width x (hopping rate / 6) / 79 x (0.4 x hopping channels).
4) *) Numbers of slots in 31.6 sec = (1600 / 6) / 79 x 31.6
5) **) Average time of Occupancy = 2.89 ms x 106.7 = 308.4 ms

AFH mode

1) This result was measured at DH5 mode in **AFH mode**, which has longest time in one transmission burst.
2) Bluetooth AFH mode has a channel hopping rate of 800 hops/s and 20 hopping channels.
3) The average time of occupancy in the specified 8 second period (20 channels x 0.4 s) is equal to pulse width x (hopping rate / 6) / 20 x (0.4 x hopping channels).
4) *) Numbers of slots in 20 sec = (800 / 6) / 20 x 8
5) **) Average time of Occupancy = 2.89 ms x 53.33 = 154.1 ms

TEST DATA

8.6 Number of Hopping Channels

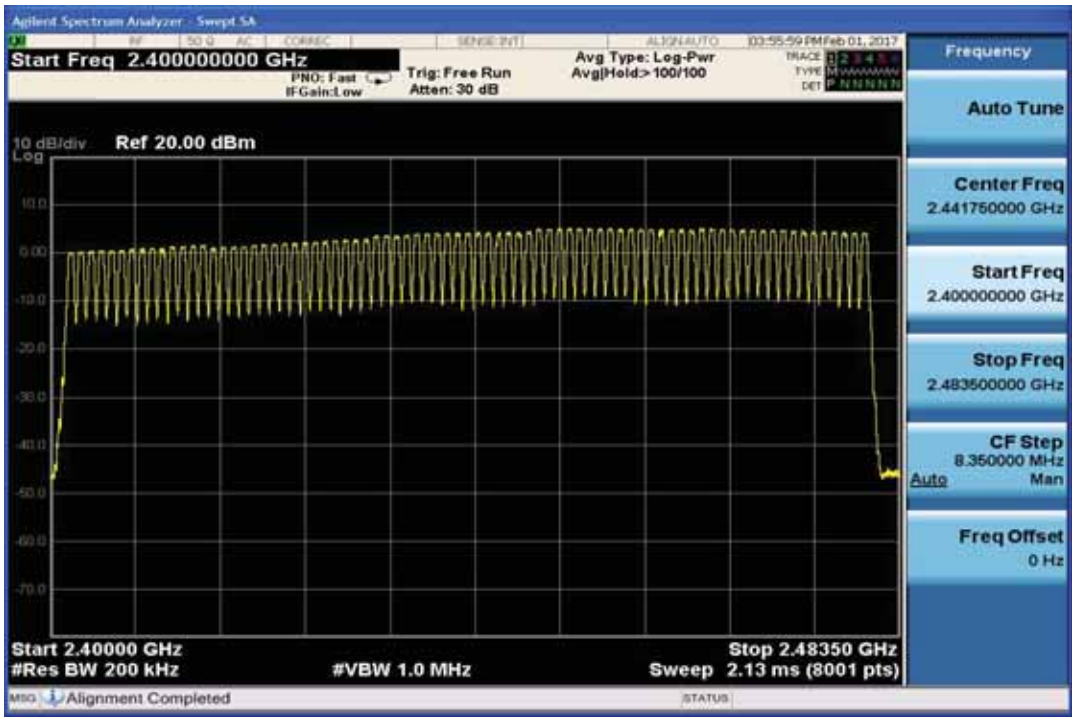
FCC §15.247(a)(1)(iii)

Test mode : Set to Hopping mode

Result

The EUT complies with the minimum number of hopping channels when it is operating **1x/EDR mode using 79 channels** and when operating in **AFH mode using 20 channels**.

GFSK mode



TEST DATA

8.7 Peak Output Power

FCC §15.247(b)(1)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Modulation	Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	2402	0.00	30.00	Complies
GFSK	2441	4.19	30.00	Complies
GFSK	2480	4.09	30.00	Complies
π/4DQPSK	2402	-0.03	30.00	Complies
π/4DQPSK	2441	4.25	30.00	Complies
π/4DQPSK	2480	4.11	30.00	Complies
8DPSK	2402	-0.03	30.00	Complies
8DPSK	2441	4.25	30.00	Complies
8DPSK	2480	4.09	30.00	Complies

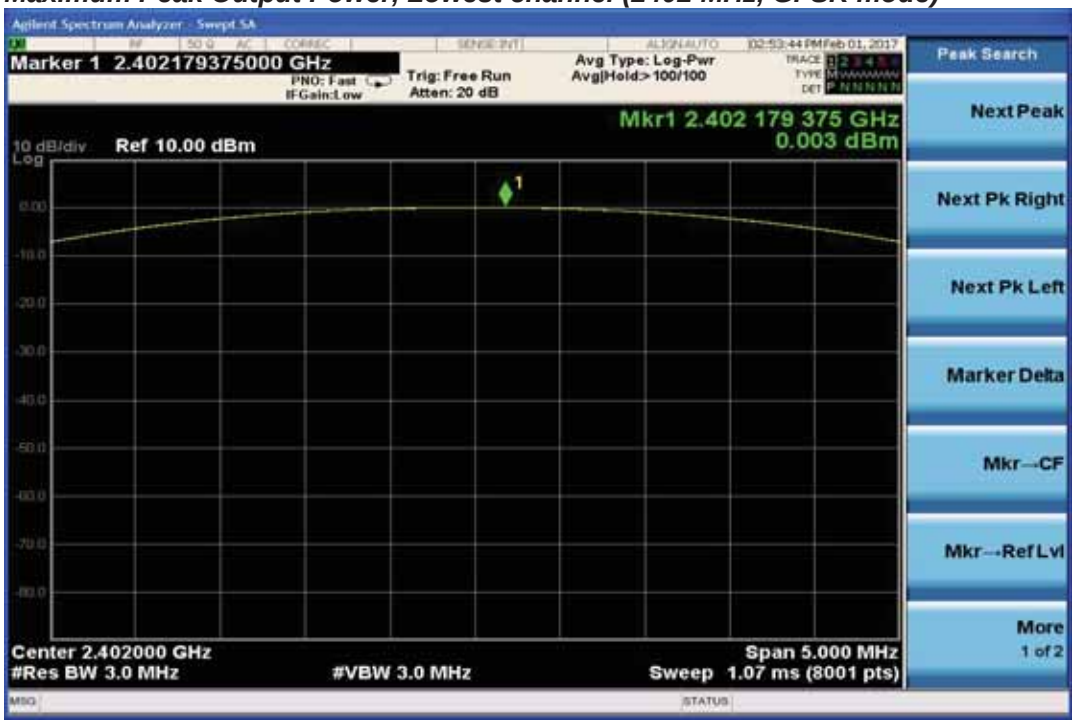
Note:

The following formular was used for spectrum offset:

Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

PLOT OF TEST DATA

Maximum Peak Output Power, Lowest channel (2402 MHz, GFSK mode)

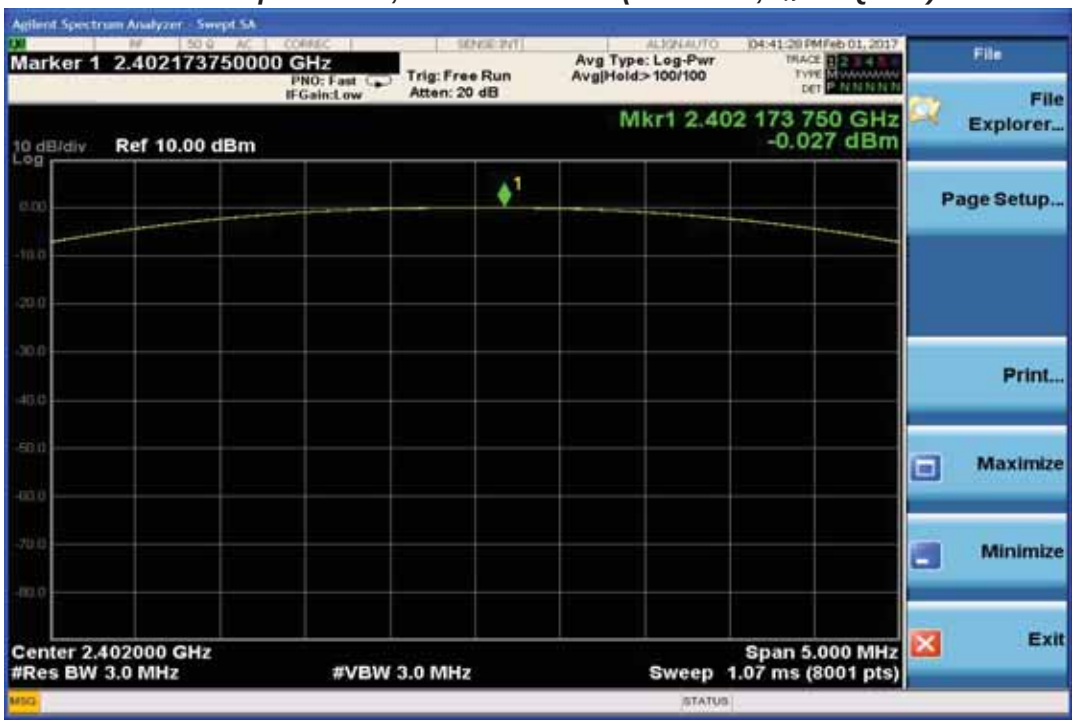


Maximum Peak Output Power, Middle channel (2441 MHz, GFSK mode)

PLOT OF TEST DATA

Maximum Peak Output Power, Highest channel (2480 MHz, GFSK mode)

Maximum Peak Output Power, Lowest channel (2402 MHz, π/4DQPSK)



PLOT OF TEST DATA

Maximum Peak Output Power, Middle channel (2441 MHz, π/4DQPSK)

Maximum Peak Output Power, Highest channel (2480 MHz, π/4DQPSK)

PLOT OF TEST DATA

Maximum Peak Output Power, Lowest channel (2402 MHz, 8DPSK)

Maximum Peak Output Power, Middle channel (2441 MHz, 8DPSK)

PLOT OF TEST DATA

Maximum Peak Output Power, Highest channel (2480 MHz, 8DPSK)

TEST DATA

8.8 Conducted Spurious Emission

FCC §15.247(d)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

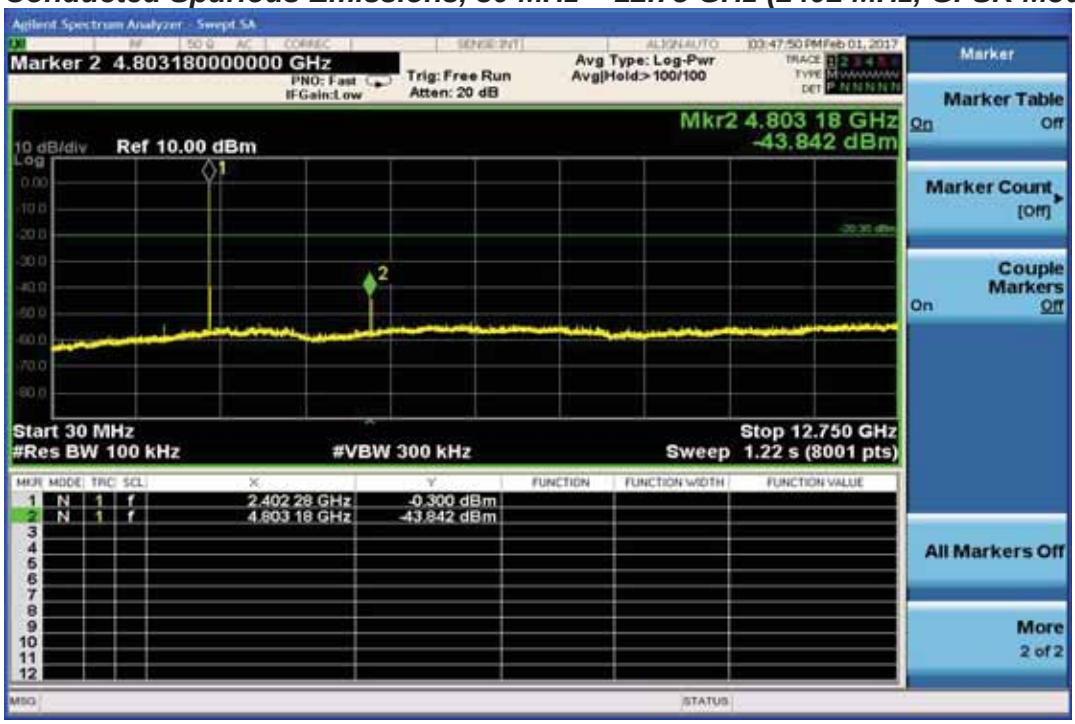
Modulation Mode	Frequency (MHz)	Result	Limit (dBc)
GFSK	2402	More than 20 dBc	20
GFSK	2441	More than 20 dBc	20
GFSK	2480	More than 20 dBc	20
π/4DQPSK	2402	More than 20 dBc	20
π/4DQPSK	2441	More than 20 dBc	20
π/4DQPSK	2480	More than 20 dBc	20
8DPSK	2402	More than 20 dBc	20
8DPSK	2441	More than 20 dBc	20
8DPSK	2480	More than 20 dBc	20

Note:

1. *The cable and attenuator loss from 30 MHz to 26.5 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.*
2. *The spectrum was measured from 9 kHz to 10^{th} harmonic.*
   No significant emissions were found beyond the 5rd harmonic for this device.

PLOT OF TEST DATA

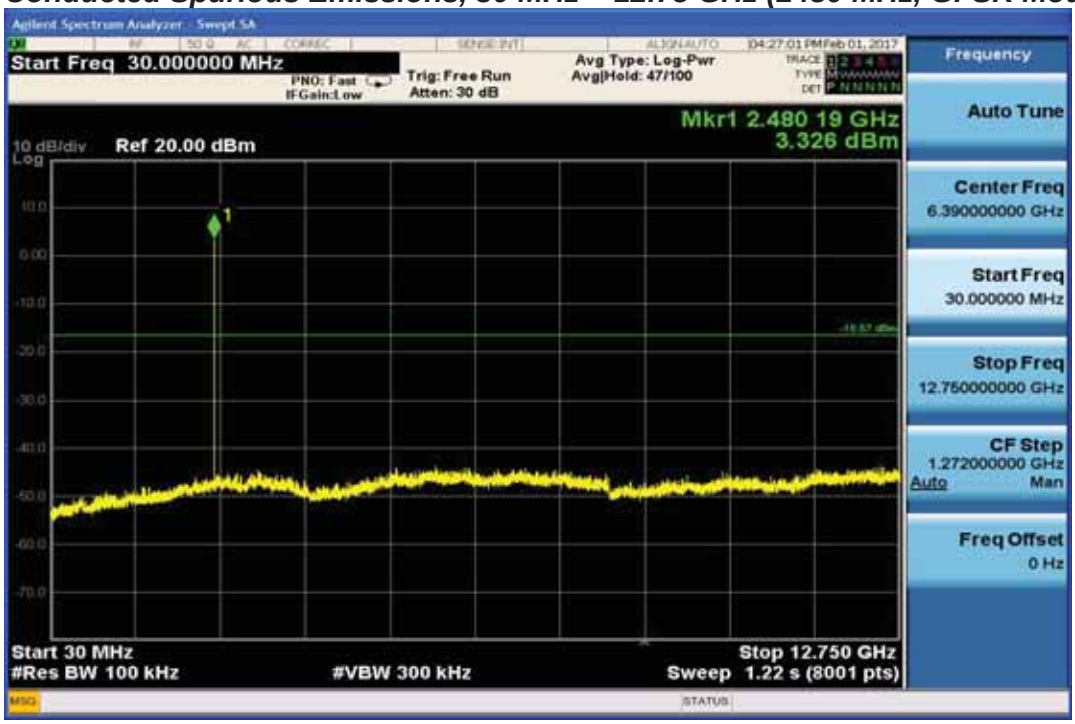
Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2402 MHz, GFSK Mode)



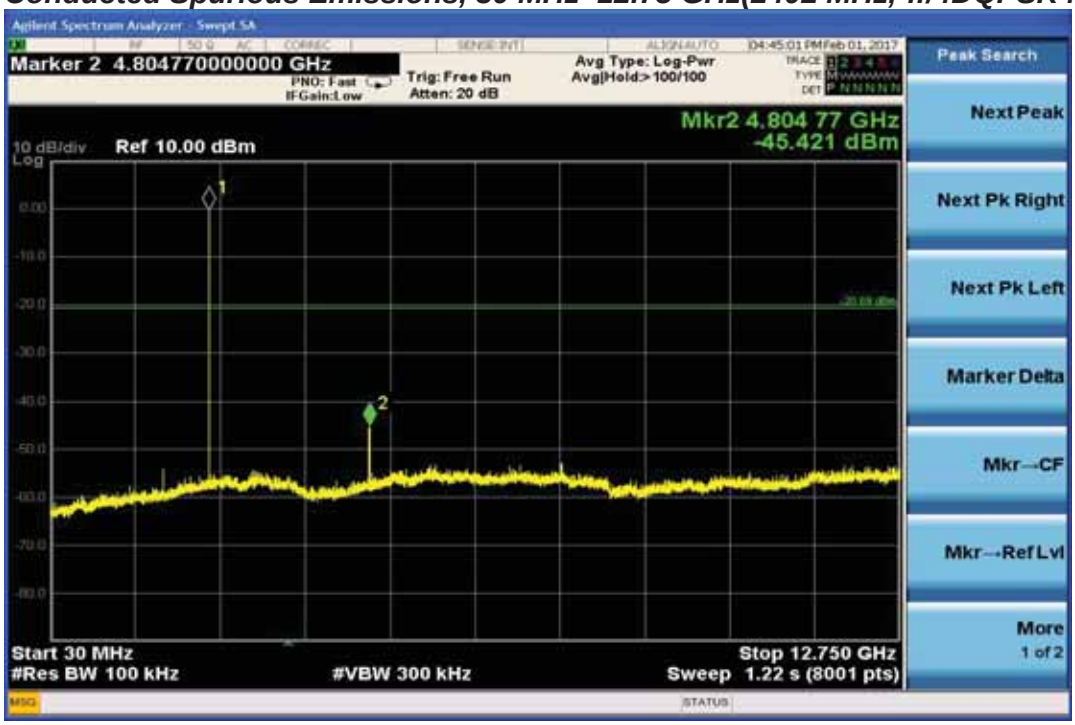
Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2441 MHz, GFSK Mode)

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2480 MHz, GFSK Mode)

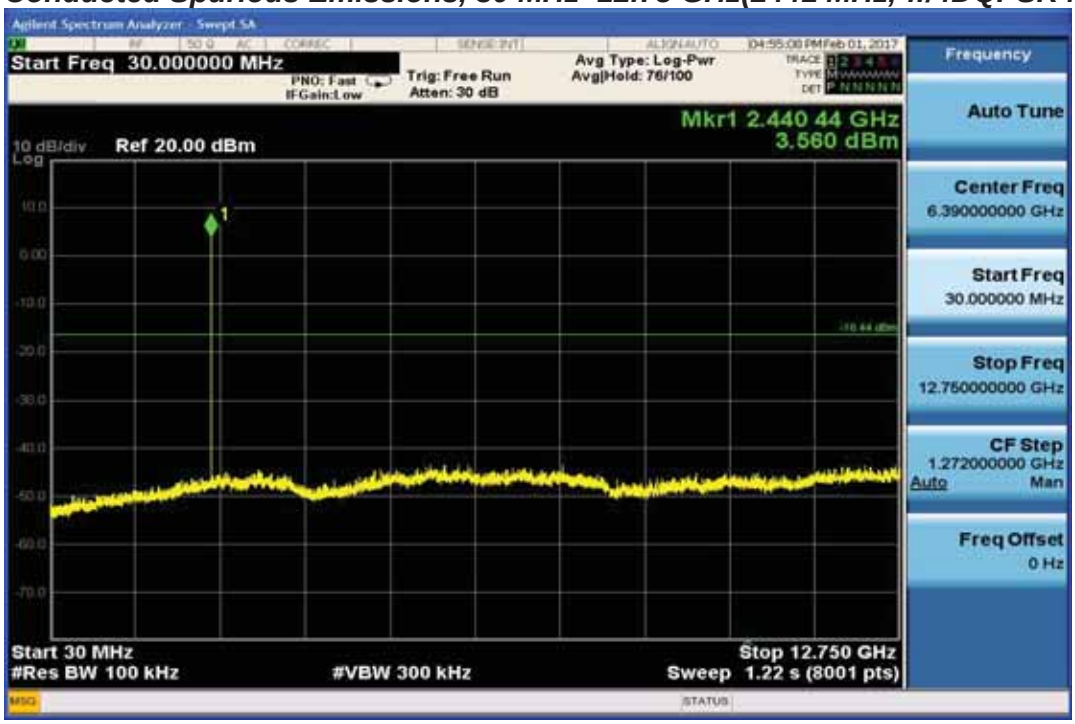


Conducted Spurious Emissions, 30 MHz~12.75 GHz(2402 MHz, π/4DQPSK Mode)



PLOT OF TEST DATA

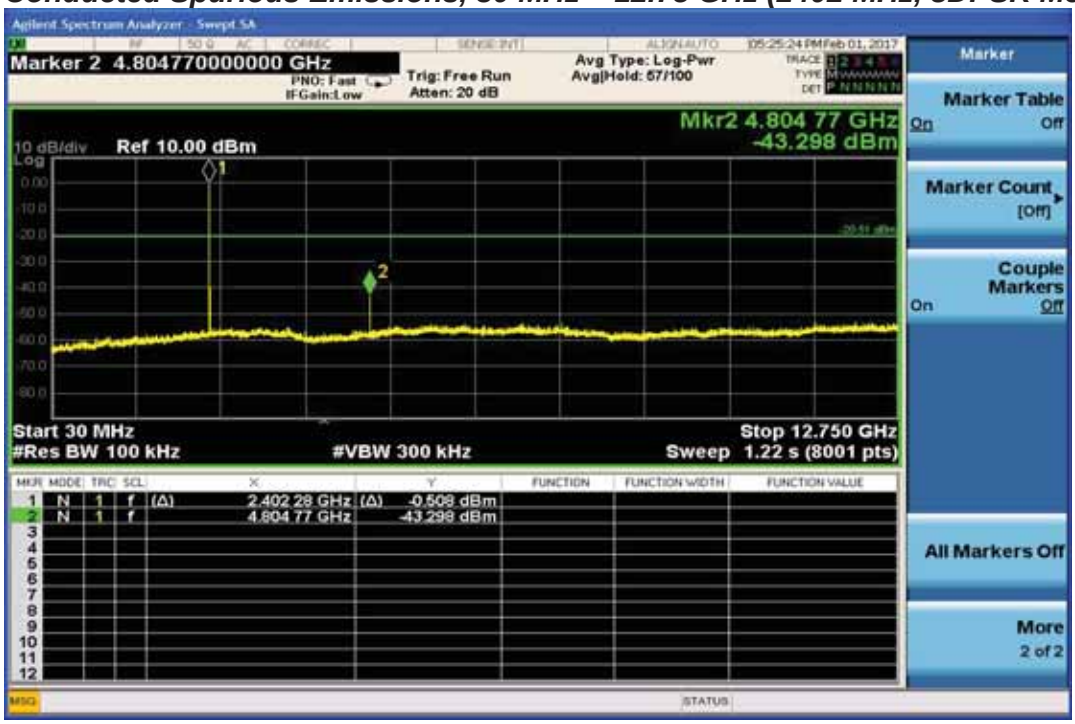
Conducted Spurious Emissions, 30 MHz~12.75 GHz(2441 MHz, π/4DQPSK Mode)



Conducted Spurious Emissions, 30 MHz~12.75 GHz(2480 MHz, π/4DQPSK Mode)

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2402 MHz, 8DPSK Mode)



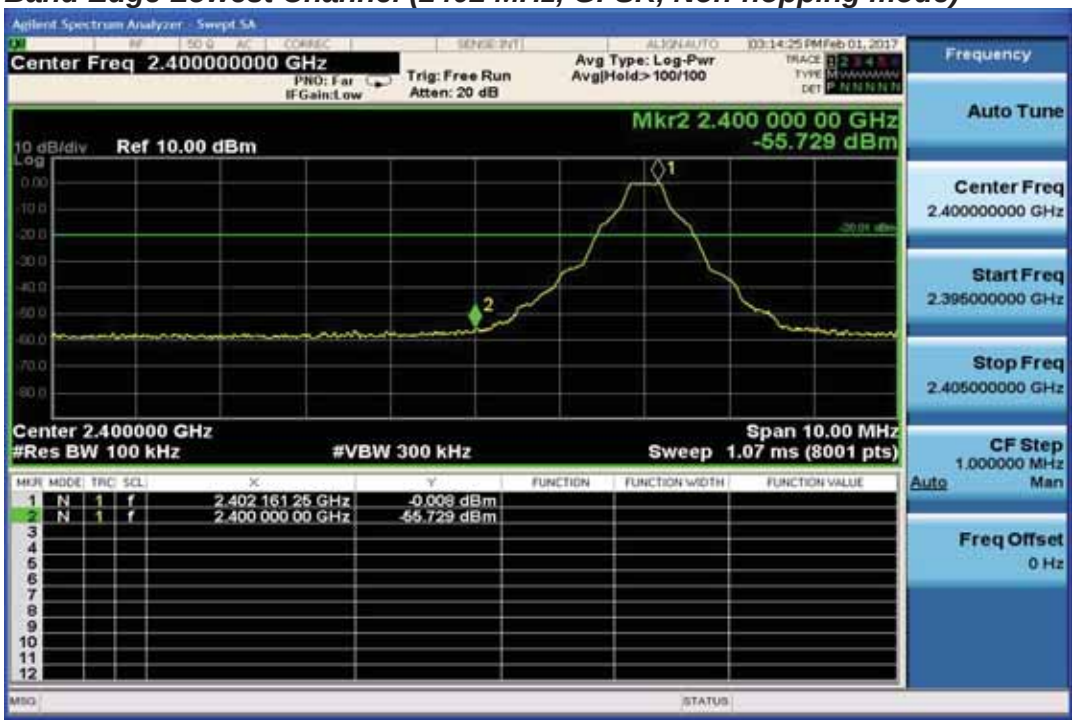
Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2441 MHz, 8DPSK Mode)

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 12.75 GHz (2480 MHz, 8DPSK Mode)

PLOT OF TEST DATA

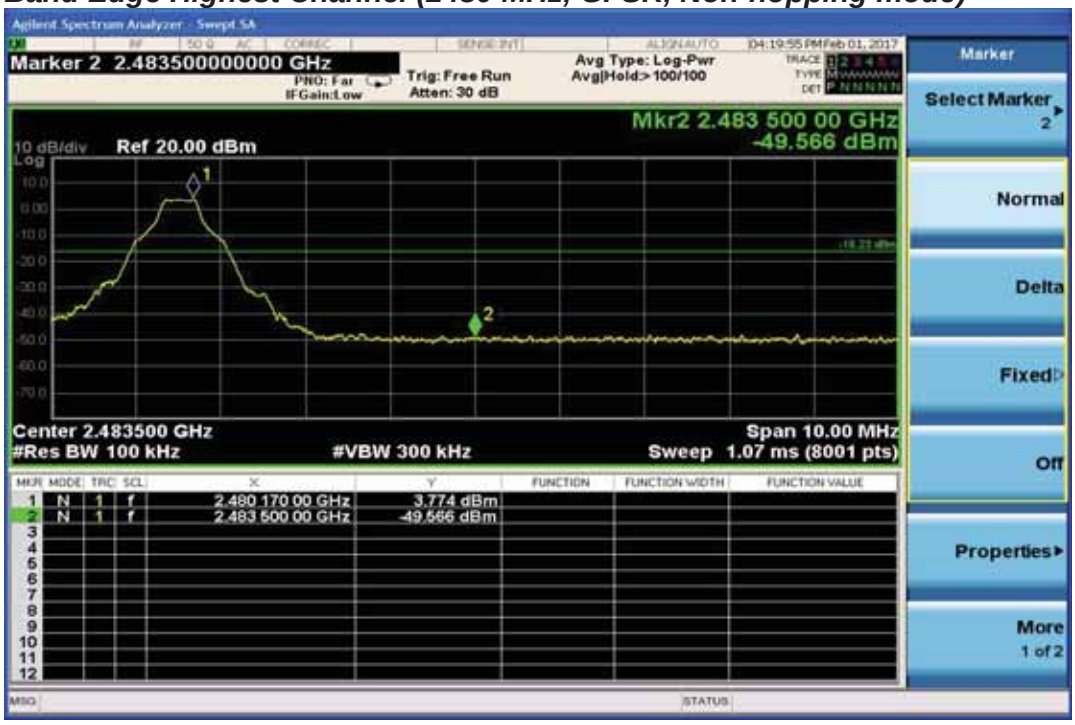
Band Edge Lowest Channel (2402 MHz, GFSK, Non-hopping mode)



Band Edge Lowest Channel (2402 MHz, GFSK, Hopping mode)

PLOT OF TEST DATA

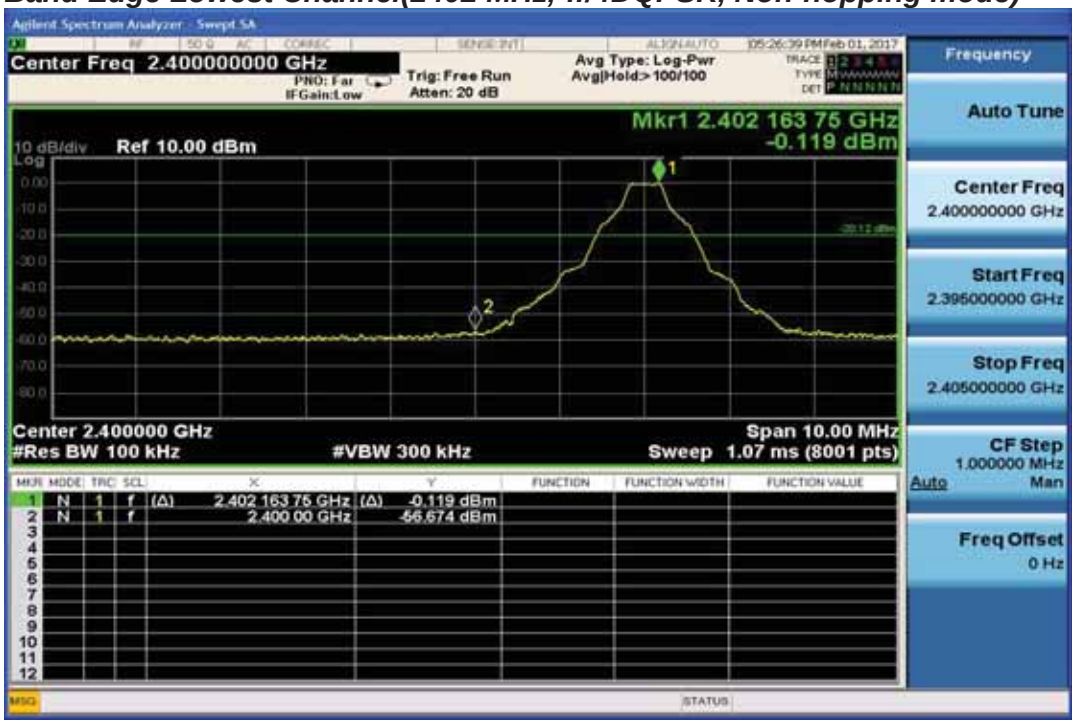
Band Edge Highest Channel (2480 MHz, GFSK, Non-hopping mode)



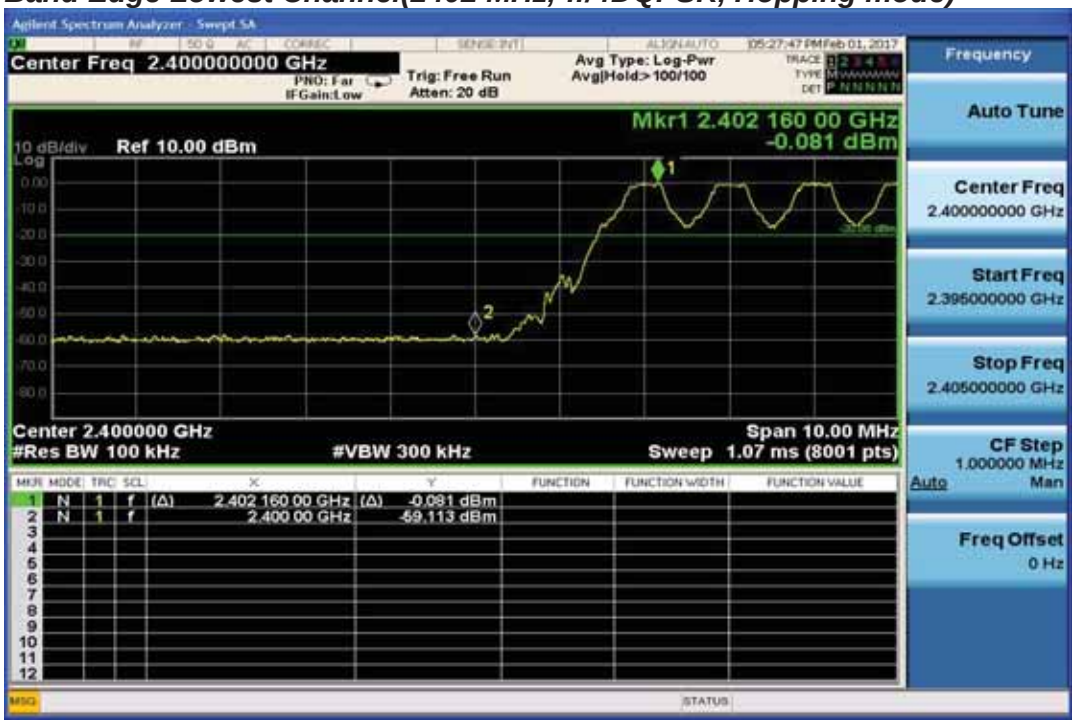
Band Edge Highest Channel (2480 MHz, GFSK, Hopping mode)

PLOT OF TEST DATA

Band Edge Lowest Channel(2402 MHz, π/4DQPSK, Non-hopping mode)

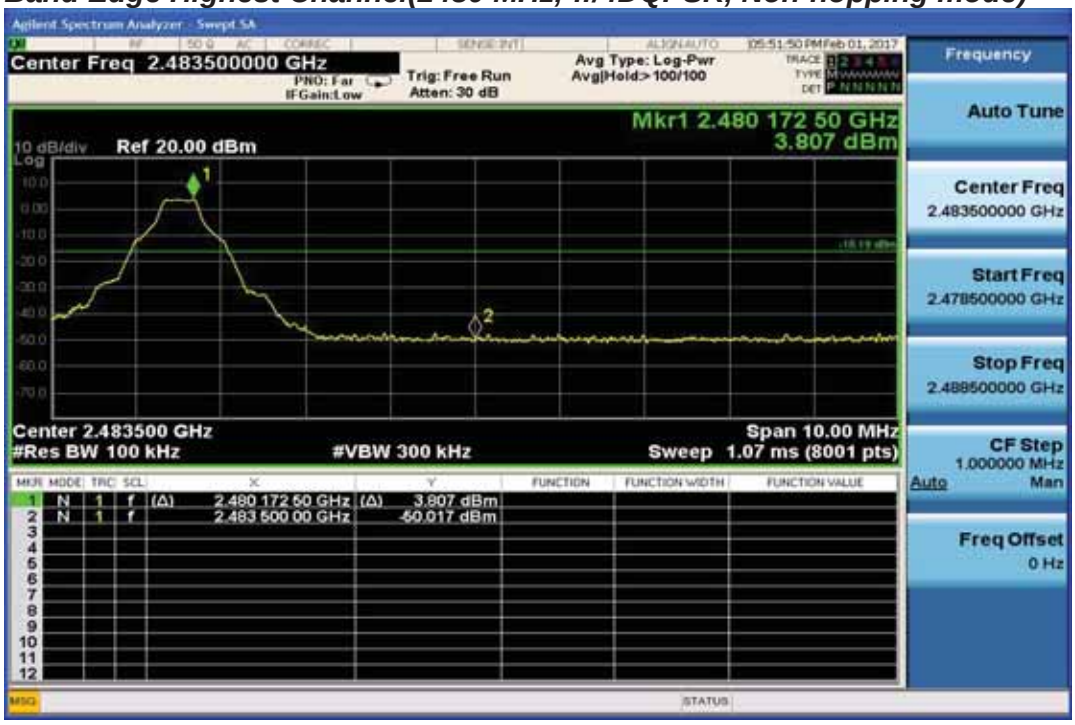


Band Edge Lowest Channel(2402 MHz, π/4DQPSK, Hopping mode)

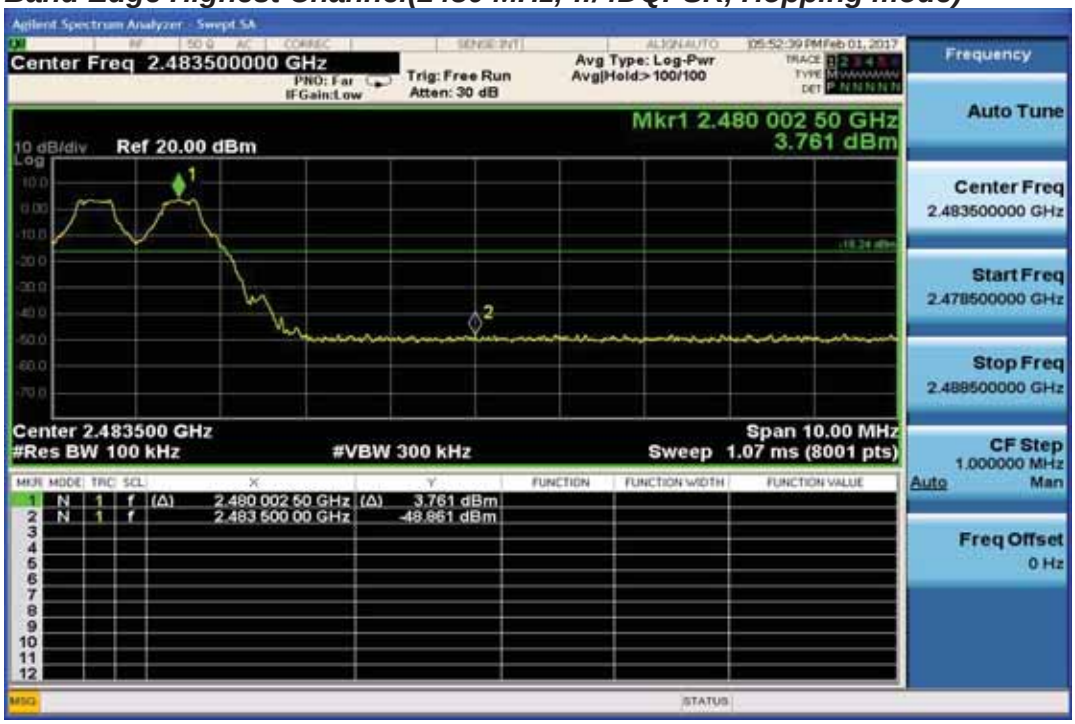


PLOT OF TEST DATA

Band Edge Highest Channel(2480 MHz, π/4DQPSK, Non-hopping mode)

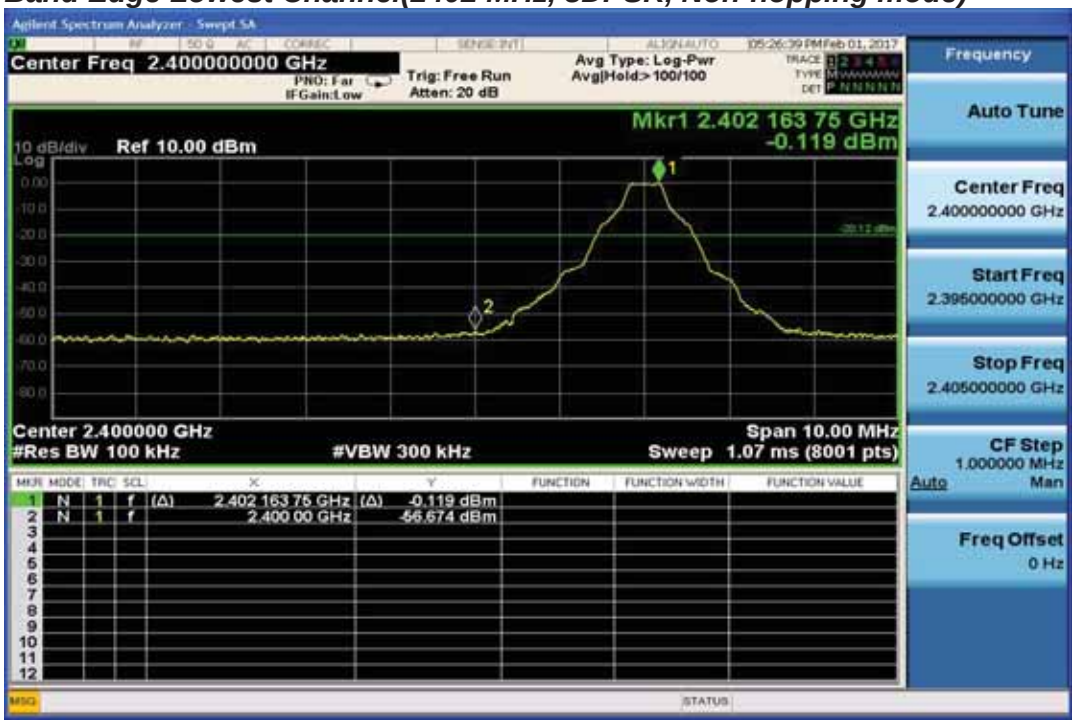


Band Edge Highest Channel(2480 MHz, π/4DQPSK, Hopping mode)



PLOT OF TEST DATA

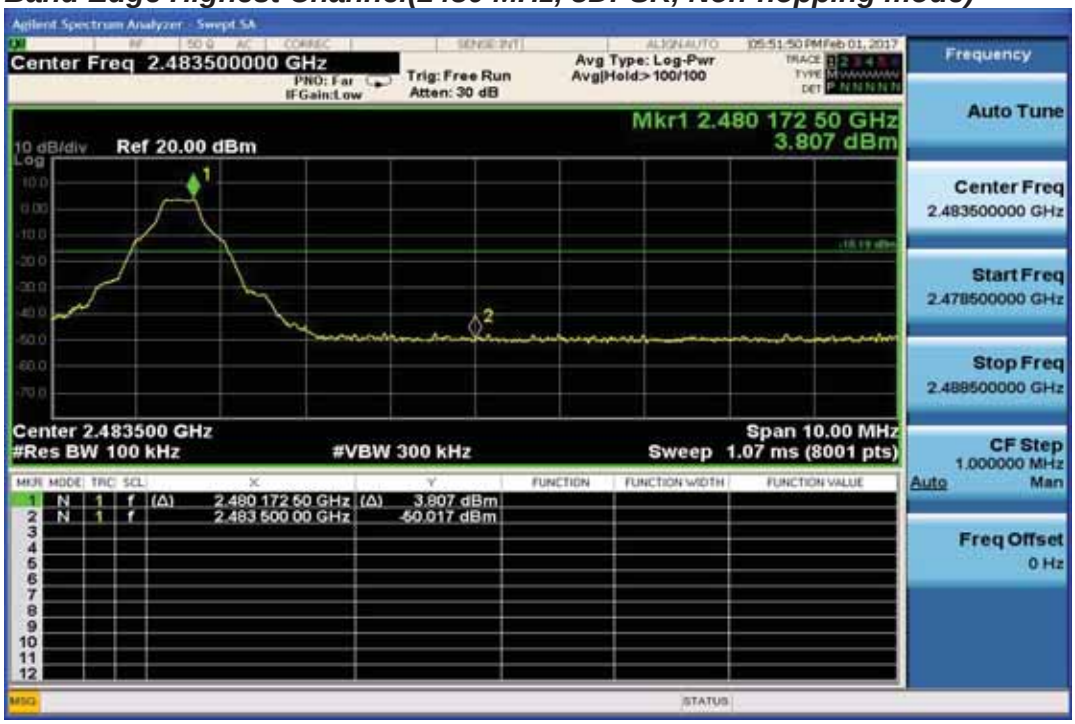
Band Edge Lowest Channel(2402 MHz, 8DPSK, Non-hopping mode)



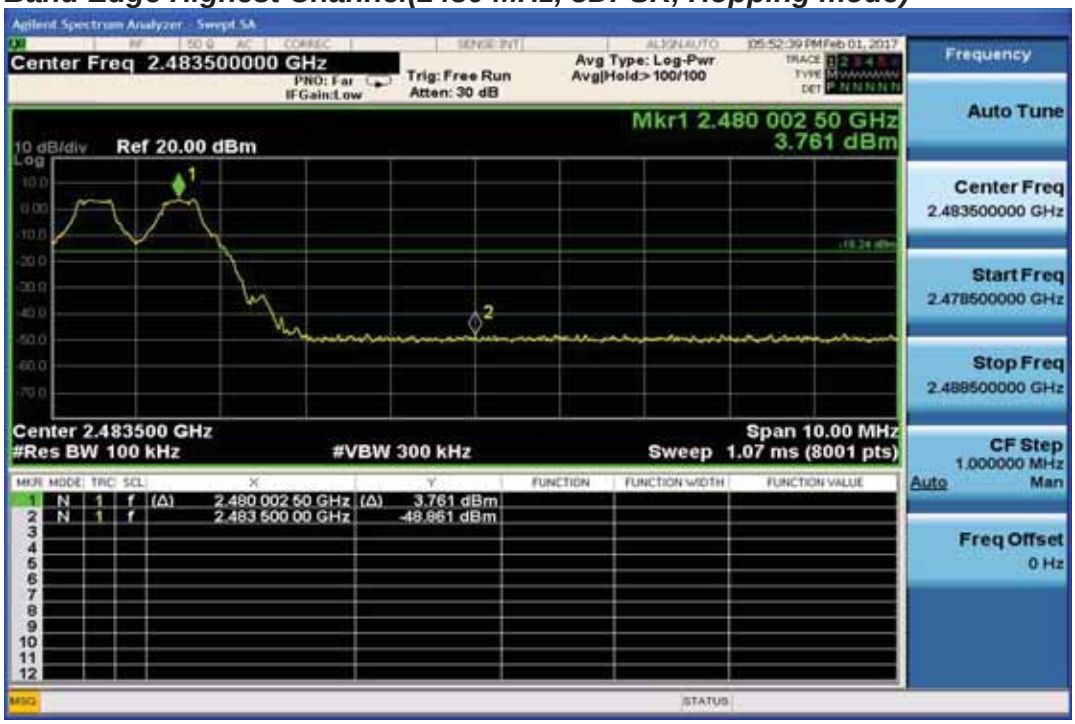
Band Edge Lowest Channel(2402 MHz, 8DPSK, Hopping mode)

PLOT OF TEST DATA

Band Edge Highest Channel(2480 MHz, 8DPSK, Non-hopping mode)



Band Edge Highest Channel(2480 MHz, 8DPSK, Hopping mode)



8.9 Radiated Spurious Emission

FCC §15.247(d)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Lowest Channel

Frequency (MHz)	Reading (dBμV)	Pol** (H/V)	mode	AF+CL+Amp (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1179.50*	58.5	V	peak	-9.7	48.8	74.0	25.2
4804.00*	44.1	H	peak	2.1	46.2	74.0	27.8

Middle Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1196.50*	55.5	V	peak	-10.0	45.5	74.0	28.5
4884.67*	46.2	H	peak	2.0	48.2	74.0	25.8

Highest Channel

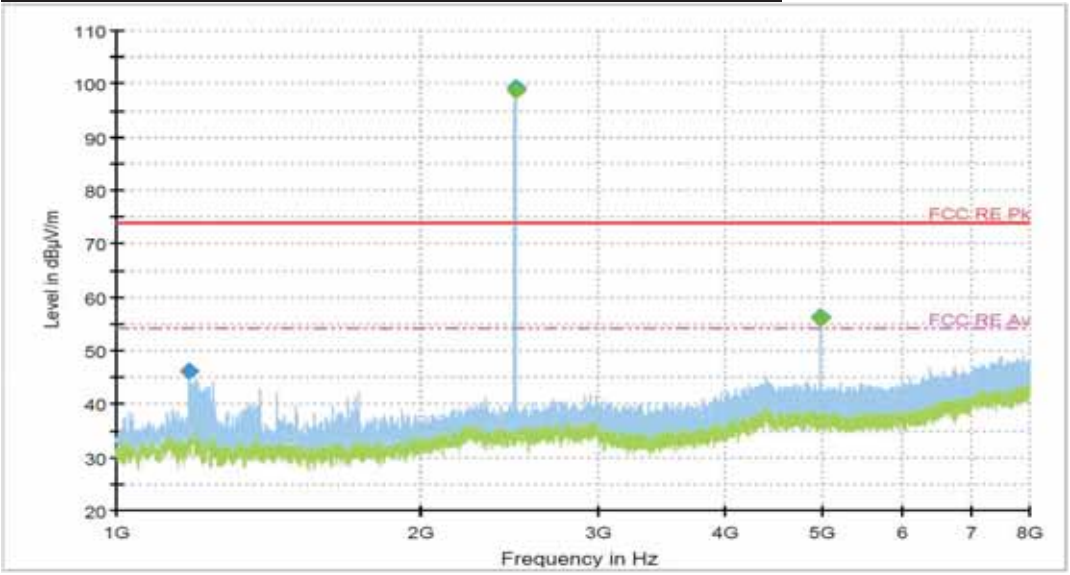
Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1179.50*	55.9	V	peak	-9.7	46.2	74.0	27.8
4960.20	56.2	H	peak	2.0	58.2	74.0	15.8
4960.05	49.4	H	average	2.0	51.4	54.0	2.7

Notes:

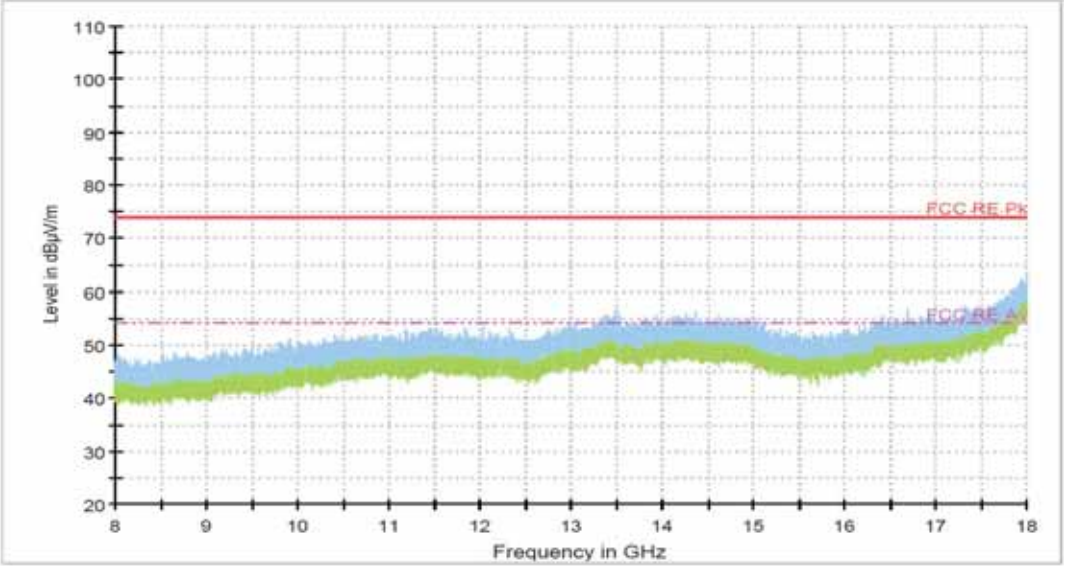
1. *Average emissions on lowest, middle channels were not performed since peak results satisfy the average limit.
2. **Pol. H = Horizontal V = Vertical
3. ***AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
4. Other spurious was under 20 dB below Fundamental.
5. 8DPSK modulation mode was the worst condition.
6. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
7. Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
8. Average emissions were measured using RBW = 1 MHz, VBW = 1 kHz, Detector = Peak.
9. The spectrum was measured from 9 kHz to 10^{th} harmonic and the worst-case emissions were reported. No significant emissions were found beyond the 3rd harmonic for this device.

PLOTS OF EMISSIONS

Worst Case : 2480 MHz 8DPSK modulation : 1 GHz to 8 GHz

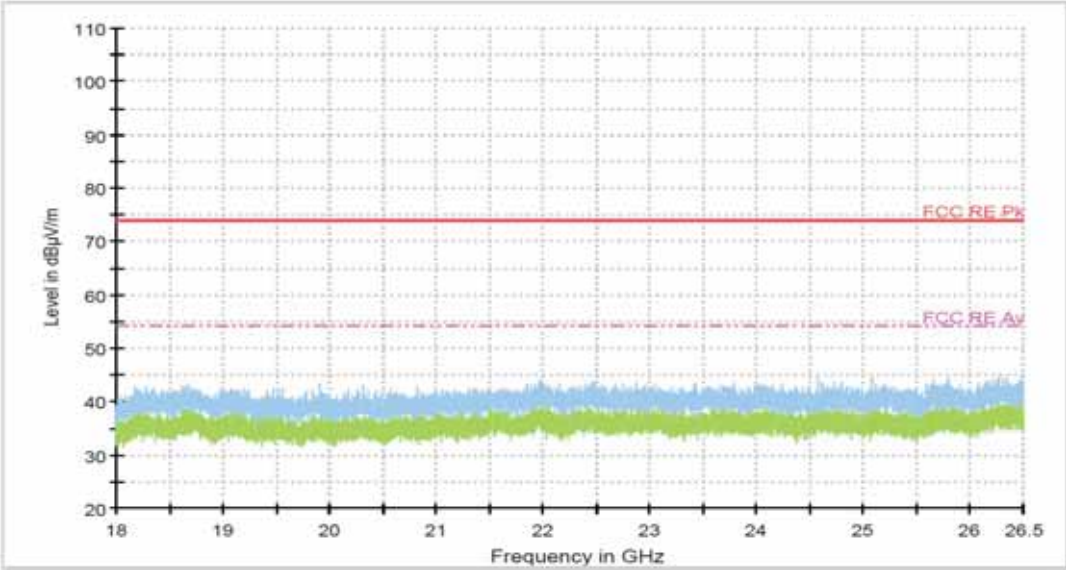


Worst Case : 2480 MHz 8DPSK modulation : 8 GHz to 18 GHz

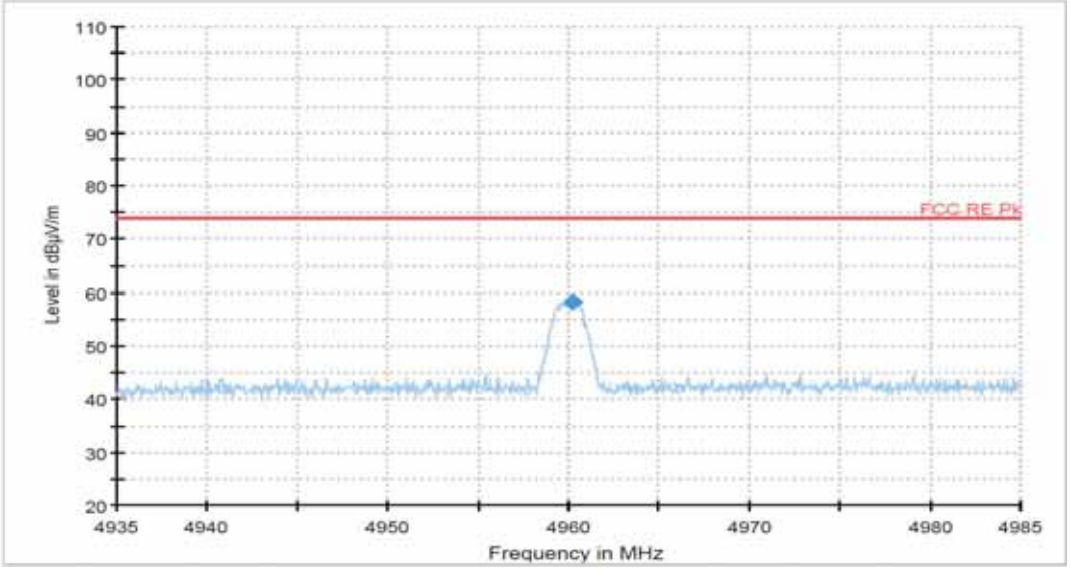


PLOTS OF EMISSIONS

Worst Case : 2480 MHz GFSK modulation : 18 GHz to 26.5 GHz

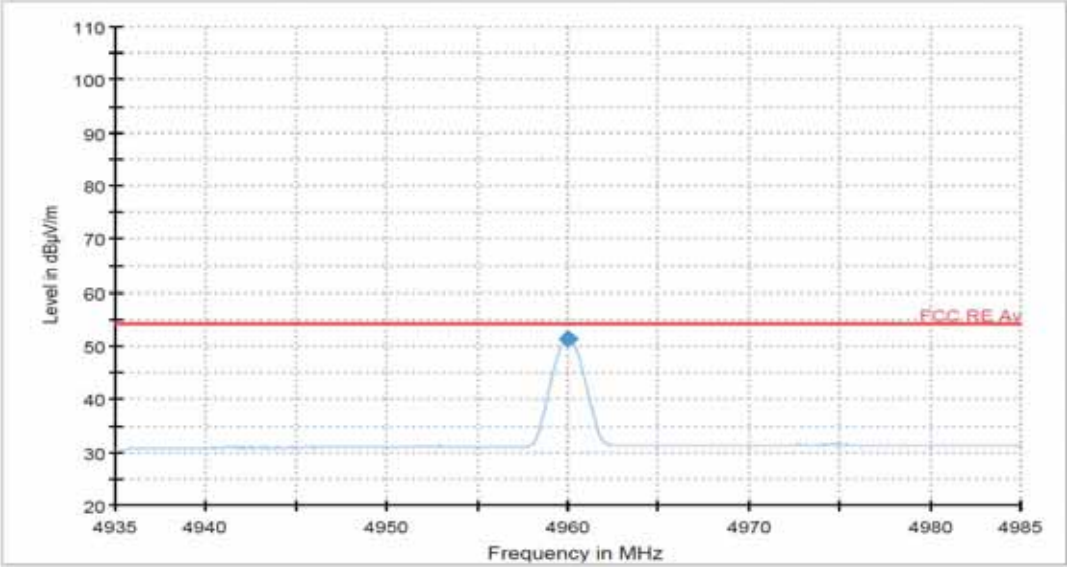


Worst Case : 2480 MHz 8DPSK modulation : 2nd Harmonic Pk



PLOTS OF EMISSIONS

Worst Case : 2480 MHz 8DPSK modulation : 2nd Harmonic Av



TEST DATA

8.10 Radiated Bandedge

FCC §15.247(d)

Test Mode : Set to Lowest channel, Highest channel

Result

Lowest and Highest Channels

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2390.00	55.1	V	peak	-7.3	47.8	74.0	26.2
2390.00	42.6	V	average	-7.3	35.3	54.0	18.7
2483.50	55.6	H	peak	-7.3	48.3	74.0	25.7
2483.50	44.4	H	average	-7.3	37.1	54.0	16.9

Note:

*1. *Pol. H = Horizontal V = Vertical*

*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

3. Other spurious was under 20 dB below Fundamental.

4. 8DPSK modulation mode was the worst condition.

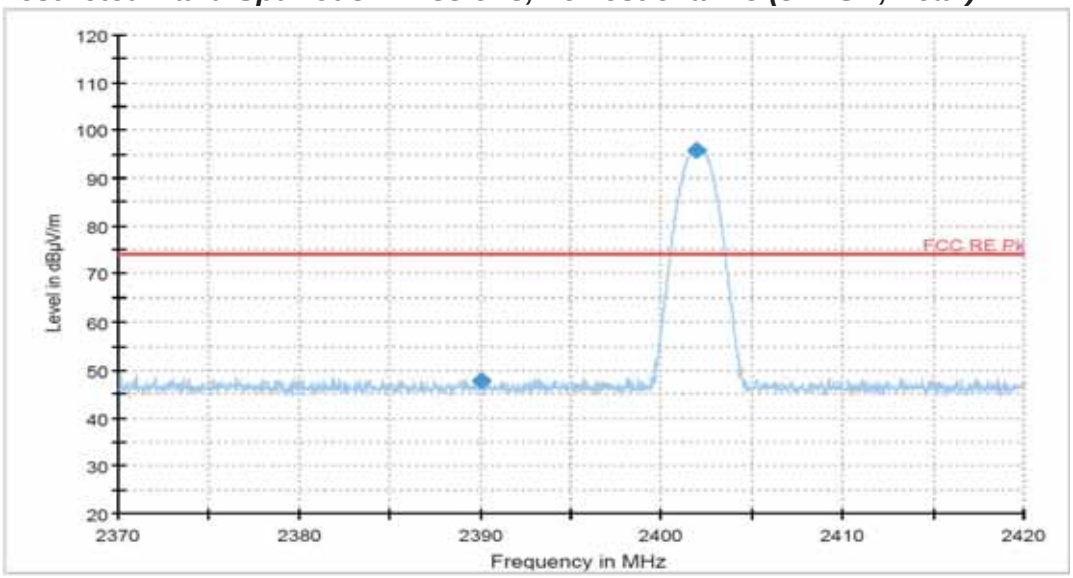
6. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.

7. Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.

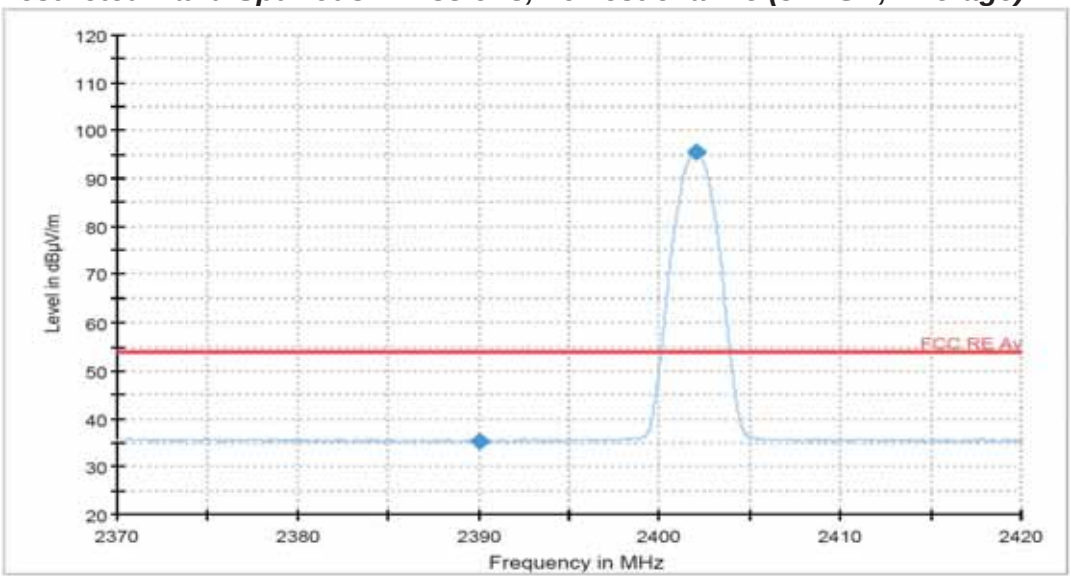
8. Average emissions were measured using RBW = 1 MHz, VBW = 1kHz, Detector = Peak

PLOT OF TEST DATA

Restricted Band Spurious Emissions, Lowest channel(8DPSK, Peak)

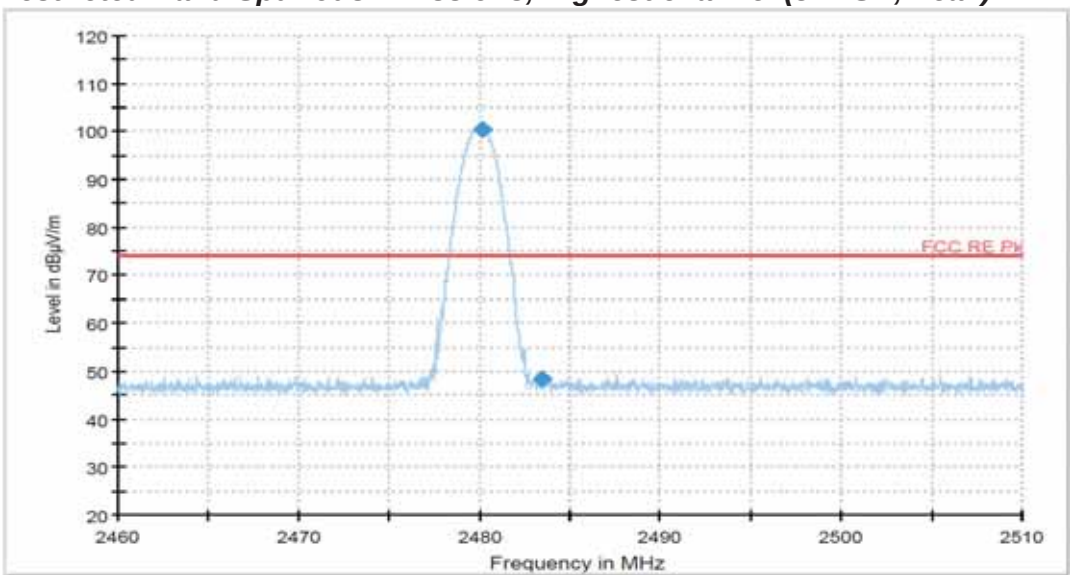


Restricted Band Spurious Emissions, Lowest channel(8DPSK, Average)

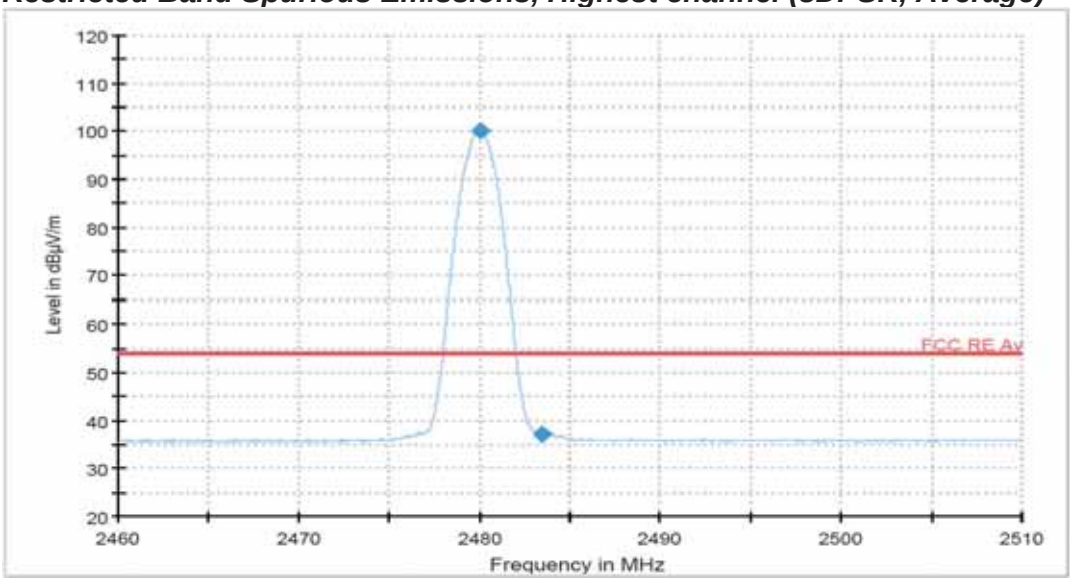


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel (8DPSK, Peak)



Restricted Band Spurious Emissions, Highest channel (8DPSK, Average)



9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	Test Receiver	R & S	ESU 40	100202	Apr. 04 2016	1 year
2	*Test Receiver	R & S	ESCI	101041	Apr. 04 2016	1 year
3	*Attenuator	PASTERNACK	PE7395-10	1441-1	Jul. 25 2016	1 year
4	*Attenuator	FAIRVIEW	SA3N5W-06	N/A	Jan. 09 2017	1 year
5	Attenuator	FAIRVIEW	SA3N5W-10	N/A	Apr. 04 2016	1 year
6	Attenuator	WEINSCHEL	56-10	58765	Oct. 09 2016	1 year
7	*Amplifier	R & S	SCU 01	10029	Apr. 04 2016	1 year
8	*Amplifier	R & S	SCU18	10065	Apr. 04 2016	1 year
9	*Amplifier	R & S	SCU26	10011	Jul. 15 2016	1 year
10	Amplifier	R & S	SCU40	10008	Jul. 15 2016	1 year
11	*Pre Amplifier	HP	8449B	3008A00107	Jan. 10 2017	1 year
12	*Spectrum Analyzer	R & S	FSW43	100732	Apr. 05 2016	1 year
13	Spectrum Analyzer	Agilent	N9020A	MY51110087	Oct. 07 2016	1 year
14	*Spectrum Analyzer	R&S	FSP40	100361	Jul. 15 2016	1 year
15	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 22 2016	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Sep. 30 2016	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 30 2015	2 year
18	Horn Antenna	Q-par Angus	QSH22K20	8180	Apr. 30 2015	2 year
19	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 11 2016	2 year
20	*Two-Line V-Network	R & S	ENV216	101156	Apr. 04 2016	1 year
21	*Controller	INNCO	CO3000	CO3000/937/38330516/L	N/A	N/A
22	*Turn Table	INNCO	DT3000-3T	N/A	N/A	N/A
23	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
24	*Open Switch And Control Unit	R & S	OSP-120	100015	N/A	N/A
25	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
26	*Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
27	*Turn Table	INNCO	DS1200S	N/A	N/A	N/A
28	*Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
29	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
30	Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Open Switch And Control Unit	R & S	OSP-120	100081	N/A	N/A

*) Test equipment used during the test

10. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	LAMN	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	dVSW	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dVPA	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dVPR	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dVNF	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	**RI**	0.34	normal 1	1.00	0.34	1	0.34
Receiver reading	**dVsw**	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	**dVpa**	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	**dVpr**	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	**dVnf**	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	**AF**	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	**CL**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	**AD**	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	**AH**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	**AP**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	**AI**	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	**SI**	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	**DV**	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	**Dbal**	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	**DCross**	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	**M**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.18
Mismatch	**M**	+ 0.98 - 1.11	U-Shaped	$\sqrt{2}$	0.74	1	0.74
EUT Volume Diameter	**M**	0.33	normal 1	1.00	0.33	1	0.11
Remark							
Combined Standard Uncertainty	Normal						
Expended Uncertainty U	Normal (k = 2)						