

Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA

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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.
416, Maetan-3Dong, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, Korea.
(Post code : 443-742)
Attn. : Mr. Jay-woo, Lee

Dates of Issue : January 6, 2012
Test Report No. : NK-11-R-256
Test Site : Nemko Korea Co., Ltd.

FCC ID
IC ID

A3LWIBT30A
649E-WIBT30A

Brand Name

SAMSUNG

Contact Person

Samsung Electronics Co., Ltd.
416, Maetan-3Dong, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, Korea, 442-742.
Mr. Jaywoo. Lee
Telephone No. : +82-31-277-2569

Applied Standard: FCC 47 CFR Part 15C and IC RSS-210
Classification: FCC Part 15 Spread Spectrum Transmitter(DSS)
EUT Type: Bluetooth Module

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 C63.4-2003. 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.



Tested By : Jinha. Ko
Engineer

Jan. 6, 2012

 Jan. 06, 2012

Reviewed By : H.H. Kim
Manager & Chief Engineer

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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 and IC RSS-210.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Jaywoo. Lee
Manufacturer :	Samsung Electronics Co., Ltd. 416 Maetan-3Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742 KOREA

- FCC ID: A3LWIBT30A
- Model: WIBT30A
- Brand Name: SAMSUNG
- EUT Type: Bluetooth Module
- Classification: FCC Class B
- Applied Standard: FCC 47 CFR Part 15 subpart C and IC RSS-210
- Test Procedure(s): ANSI C63.4-2003 and FCC Public Notice DA 00-705 dated March 30, 2000 entitled "Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"
- Dates of Test: Aug. 31, 2011 ~ Oct. 09, 2011
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

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 40GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**

FCC ID : **A3LWIBT30A** and IC ID : **649E-WIBT30A**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilo-meters (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (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 § 2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.
EMC Lab.
300-2, Osan-Ri, Mohyeon-Myeon,
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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.

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT was Controlled and monitored by Broadcom Bluetool testing program which manufacturer supported through USB cable with Laptop computer.

The test was performed at the Lowest, Middle, Highest channel.

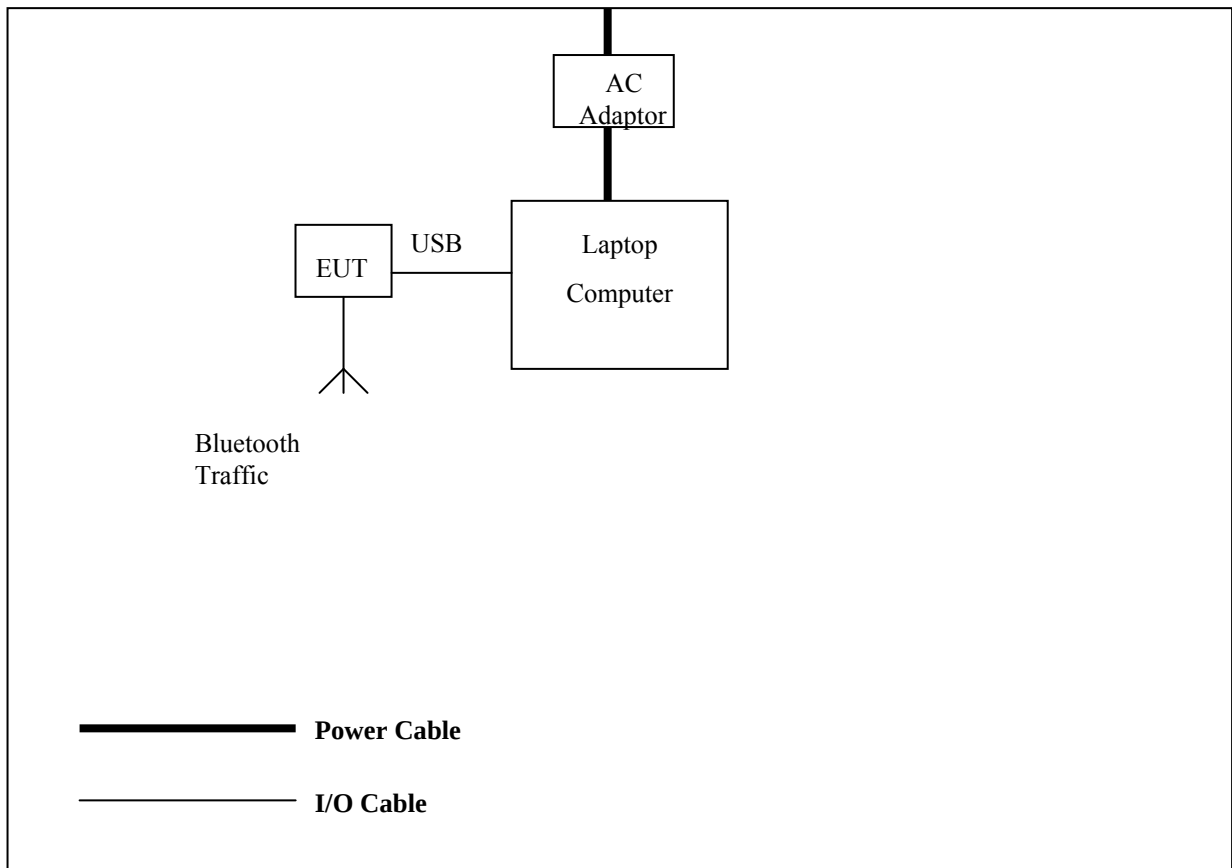
For the Maximum Peak output power, Carrier Frequency separation, 20 dB Bandwidth, Band Edge tests were tested with both GFSK and 8DPSK modulation.

For the Radiation test was tested with GFSK modulation mode which was the worst case.

3.2 Support Equipment

Laptop Computer	Sony Corporation Model : PCG-472P 0.3 m unshielded USB cable	FCC DOC S/N: 28100670 7201548
AC Adaptor	GUANLAN NJRC ELECTRONICS Model : VGP-AC16V14 1.2 m unshielded power cable	FCC DOC S/N: 148015511 0223767
Bluetooth Module (EUT)	Samsung Electronics Co., Ltd. FCC ID : A3LWIBT30A	S/N: N/A

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Bluetooth Module FCC ID: A3LWIBT30A, IC ID: 649E-WIBT30A.**

This unit supports full qualified Bluetooth v2.1 with EDR system.

Specifications:

EUT Type	Bluetooth Module
Model Name	WIBT30A
Brand Name	SAMSUNG
RF Frequency	2402 MHz ~ 2480 MHz
Peak Power Output (Conducted)	10.63 dBm
Channel Number	79
Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Gain	3.69 dBi (Peak)
Power	5 Vdc
Size	37 mm x 20.8 mm x 7.8 mm
Weight	5 g

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Conducted Emission	15.207	RSS-GEN 7.2.4	Complies	
Radiated Emission	15.209	RSS-210 A8.5	Complies	
20dB Bandwidth and	15.247(a)(1)(iii)	RSS-210 A8.1	Complies	
Carrier Frequency Separation	15.247(a)(1)	RSS-210 A8.1(2)	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	RSS-210 A8.1(4)	Complies	
Peak Power Output	15.247(b)(1)	RSS-210 A8.4(2)	Complies	
Conducted Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	RSS-210 A8.1(4)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Bluetooth Module FCC ID: A3LWIBT30A, IC ID: 649E-WIBT30A** is in compliance with Part 15 Subpart C 15.247 of the FCC Rules.

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 **Samsung Bluetooth Module FCC ID: A3LWIBT30A, IC ID: 649E-WIBT30A** 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 (ESH3-Z5) and Rohde & Schwarz (ESH2-Z5) of the 50 ohm/50 μ H Line Impedance Stabilization Network(LISN) are bonded to the shielded room.

The EUT is powered from the Rohde & Schwarz LISN (ESH3-Z5) 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 (serpentine fashion) 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 ms sweep time.

The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).

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; which ever determined the worst case emission.

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

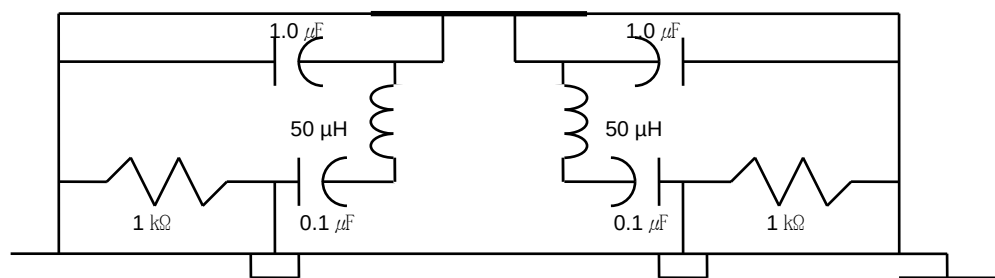


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

Preliminary measurements were made indoors at 3 meter using broad band antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found. The spectrum was scanned from 9 kHz to 30 MHz using Loop Antenne(EMCO, 6502) and 30 to 1000 MHz using Bi-conical log Antenna(ARA, LPB-2520/A). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz , Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used. Final Measurements were made outdoors at 3 or 10 m test range using Loop Antenne(EMCO, 6502) and Logbicon Super Antenna (Schwarzbeck, VULB9168) or Horn antenna.(Schwarzbeck BBHA 9120D: up to 18 GHz , Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz).

The test equipment was placed on a wooden table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was reexamined and investigated using EMI test receiver (ESCS30) & (FSP40). The detector function was set to CISPR peak mode or quasi-peak mode or average mode and the band-width of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal. The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non- metallic 1.0 m x 1.5 m table. The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turn table containing the Technology was rotated; the antenna height was varied 1 m to 4m and stopped at the azimuth or height producing the maximum 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; which ever determined the worst case emission.

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

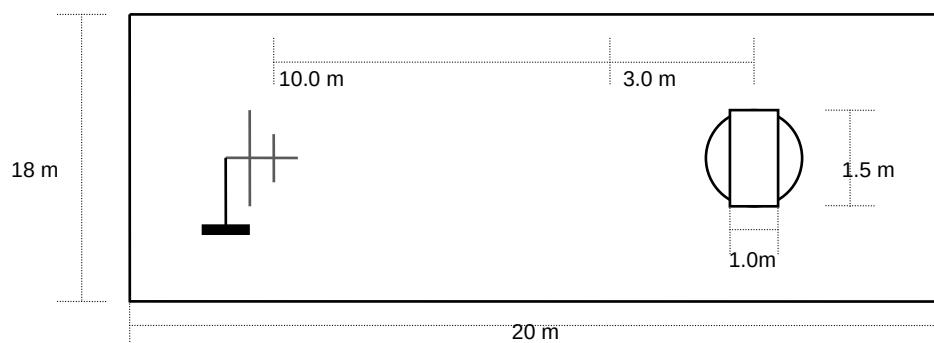
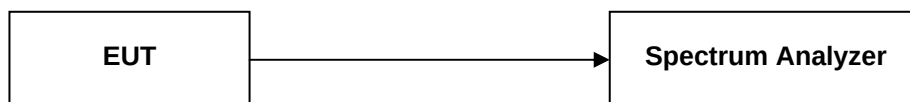


Fig. 3. Dimensions of Outdoor Test Site

7.3 20 dB Bandwidth and Carrier Frequency Separation

Test Setup



Test Procedure

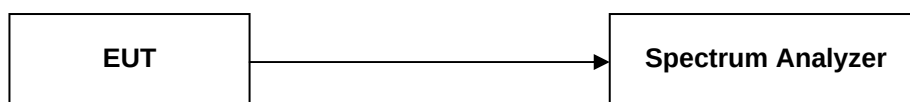
The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer. The RBW of spectrum analyzer is set to 100 kHz and VBW is set to the 100 kHz. The sweep time is coupled.

The spectrum analyzer is set for peak detected and Max hold scan mode.

When Carrier Frequency separation is tested, Frequency hopping is set.

7.4 Transmitter Average Time of Occupancy

Test Setup



Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to zero, centered on a single, selected hopping channel.

The width of a single pulse is measured in a fast scan. The number of pulses is measured in 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels x 0.4 second) is equal to 10 x number of pulses in 3.16 second x pulse width.

7.5 Number of Hopping Channels

Test Setup



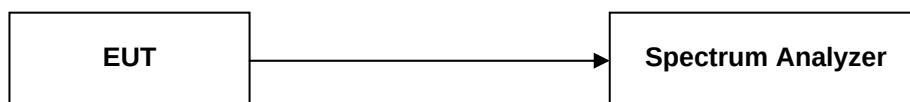
Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, In either a single sweep or in multiple continuous sweeps. The RBW is set to 1 % of the span.

The spectrum analyzer is set to Max Hold.

7.6 Maximum Peak Output Power

Test Setup

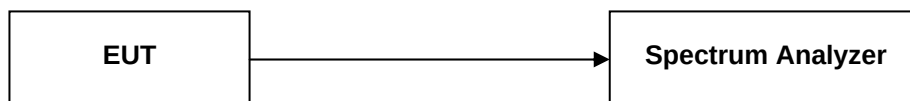


Test Procedure

The transmitter is set to the Low , Middle, High channels is connected to the spectrum analyzer. The RBW of spectrum analyzer is set to 3 MHz and VBW is set to the 3 MHz. The sweep time is coupled.

7.7 Conducted Spurious Emission

Test Setup



Test Procedure

The transmitter is connected to the spectrum analyzer.

The RBW of spectrum analyzer is set to 100 kHz and VBW is set to the 100 kHz.

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

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen 7.2.2

Frequency (MHz)	Level(dBµV)		*)Factor (dB)	**) Line	Limit(dBµV)		Margin(dB)	
	Q-Peak	Average			Q-Peak	Average	Q-Peak	Average
0.19	50.7	40.8	0.2	L	64.0	54.0	13.3	13.2
0.27	43.0	29.2	0.2	L	61.1	51.1	18.1	21.9
0.50	38.3	25.7	0.2	N	56.0	46.0	17.7	20.3
0.63	32.2	15.7	0.1	N	56.0	46.0	23.8	30.3
17.34	47.1	39.7	0.9	N	60.0	50.0	12.9	10.3
21.20	41.6	35.0	1.6	N	60.0	50.0	18.4	15.0

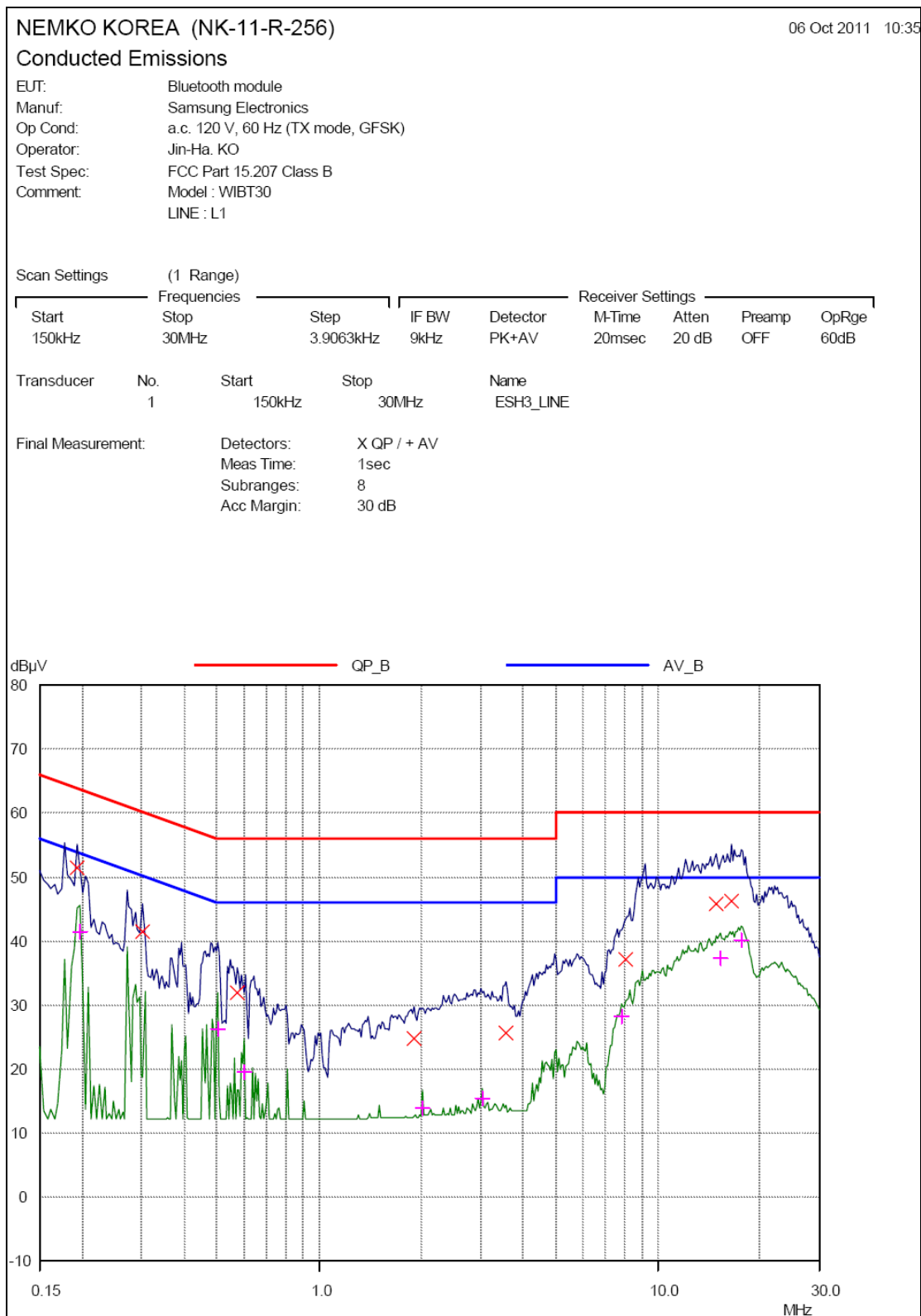
Line Conducted Emissions Tabulated Data

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. Factor = LISN + Cable Loss
4. LINE : L = Line , N = Neutral
5. The limit is on the FCC Part section 15.207(a).

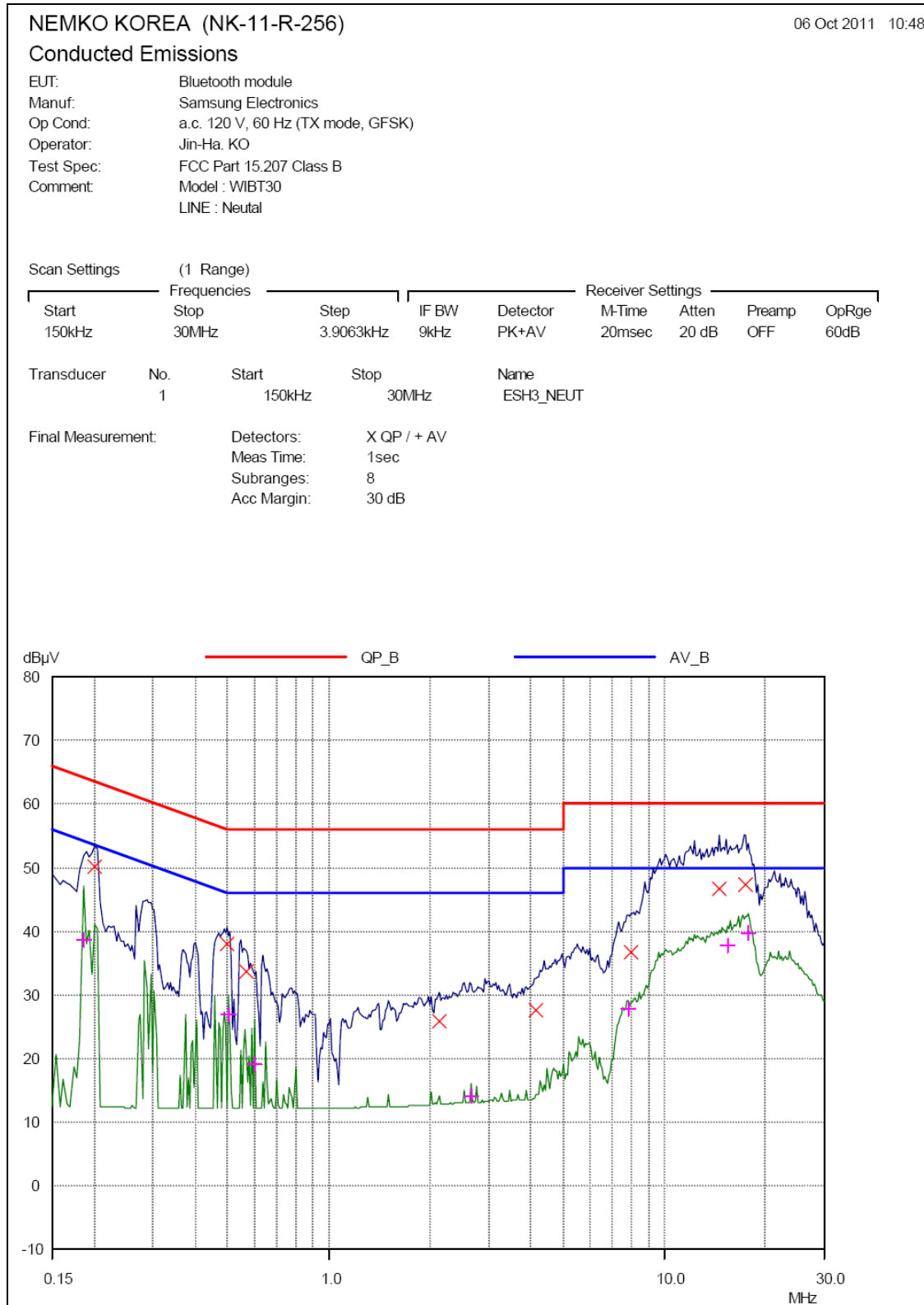
PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Line)



PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Neutral)



TEST DATA

8.2 Radiated Emissions

FCC §15.209, IC RSS-210 A8.5

Frequency (MHz)	Reading (dBμV/m)	Pol* (H/V)	Antenna Heights (cm)	Tumtable Angles (°)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
36.73	45.1	V	104	238	-18.0	27.1	40.0	12.9
146.87	49.2	H	217	15	-17.1	32.1	43.5	11.4
159.92	51.2	H	280	174	-15.5	35.7	43.5	7.8
260.00	45.3	H	164	264	-15.5	29.8	46.0	16.2
298.15	44.2	H	153	221	-15.5	28.7	46.0	17.3
397.49	51.2	H	104	271	-13.6	37.6	46.0	8.4

Radiated Measurements at 3 meters

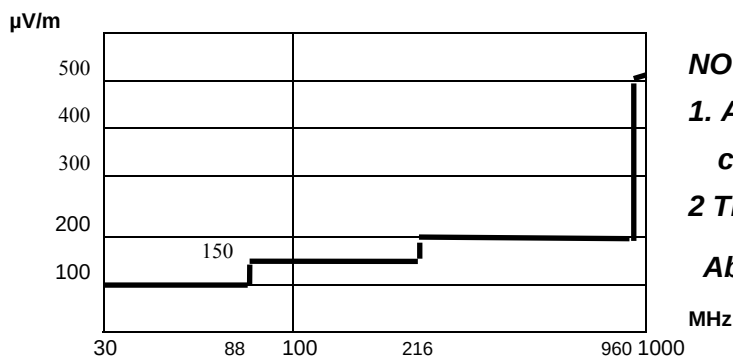


Fig. 4. Limits at 3 meters

NOTES:

1. All modes were measured and the worst-case emission was reported.
 - 2 The radiated limits are shown on Figure 4.
- Above 1GHz the limit is 500 μV/m.

NOTES:

1. *Pol. H = Horizontal V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Measurements using CISPR quasi-peak mode below 1 GHz.
4. The radiated emissions testing were made by rotating through three orthogonal axes.
The worst date was recorded.
5. The limit is on the FCC Part section 15.209(a).

TEST DATA

8.3 20 dB Modulated Bandwidth

FCC §15.247(a)(1)(iii), RSS-210 A8.1

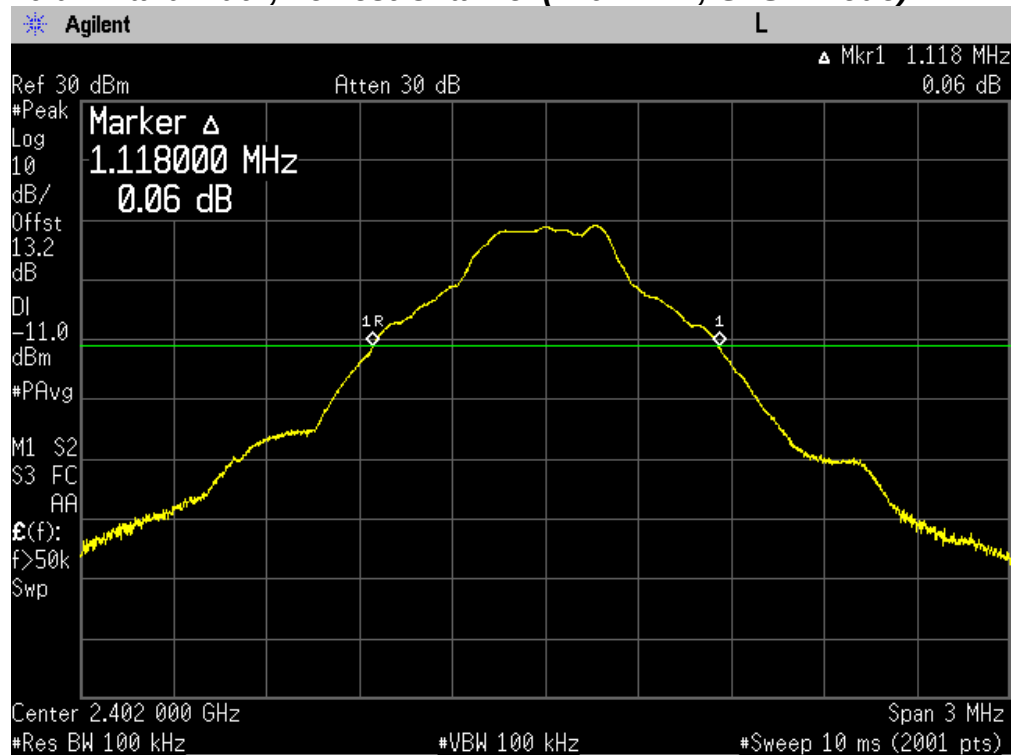
Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result:

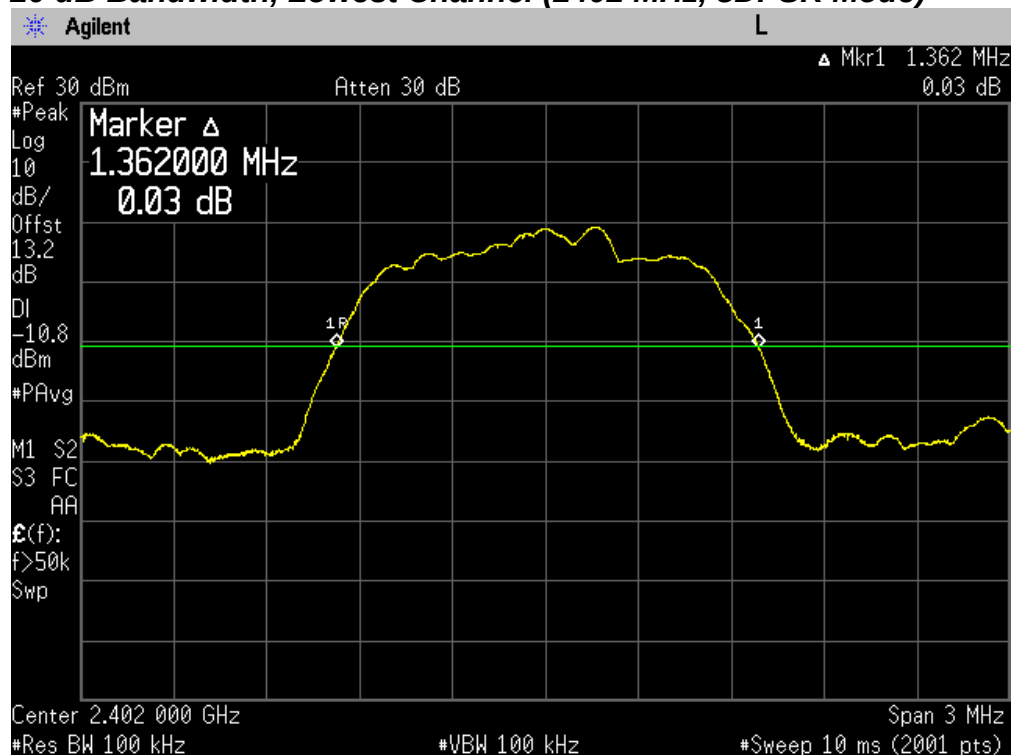
Modulation Mode	Frequency (MHz)	Result (kHz)	Limit (kHz)
GFSK	2402	1118	Non specified
GFSK	2441	1112	Non specified
GFSK	2480	1110	Non specified
8DPSK	2402	1362	Non specified
8DPSK	2441	1364	Non specified
8DPSK	2480	1364	Non specified

PLOTS OF EMISSIONS

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

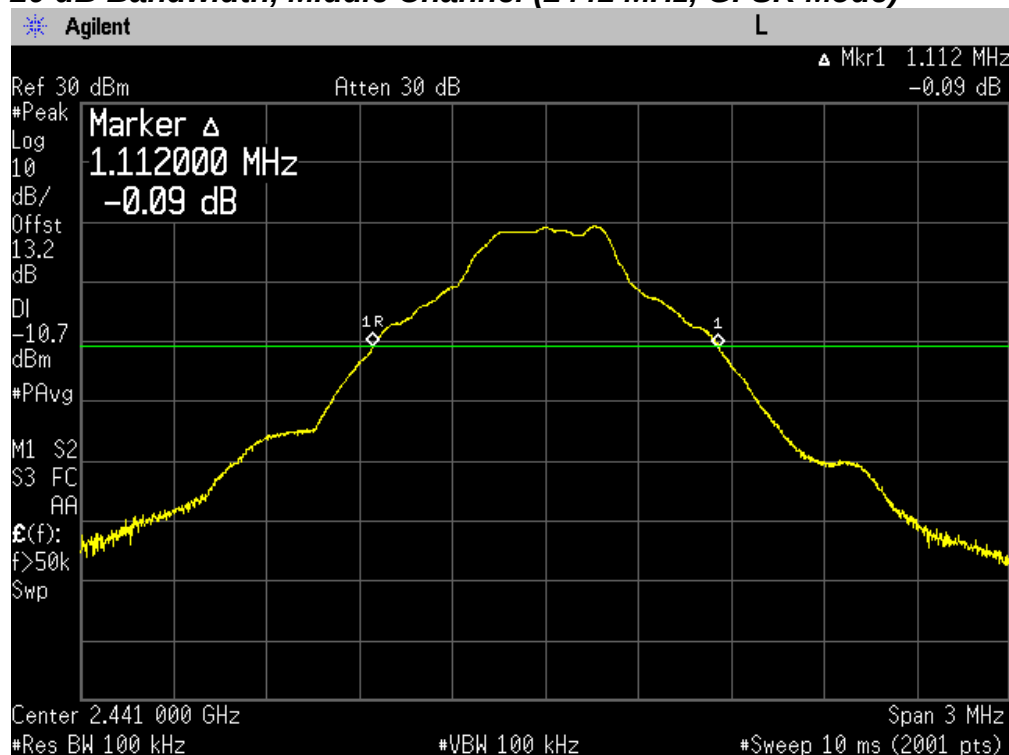


20 dB Bandwidth, Lowest Channel (2402 MHz, 8DPSK Mode)

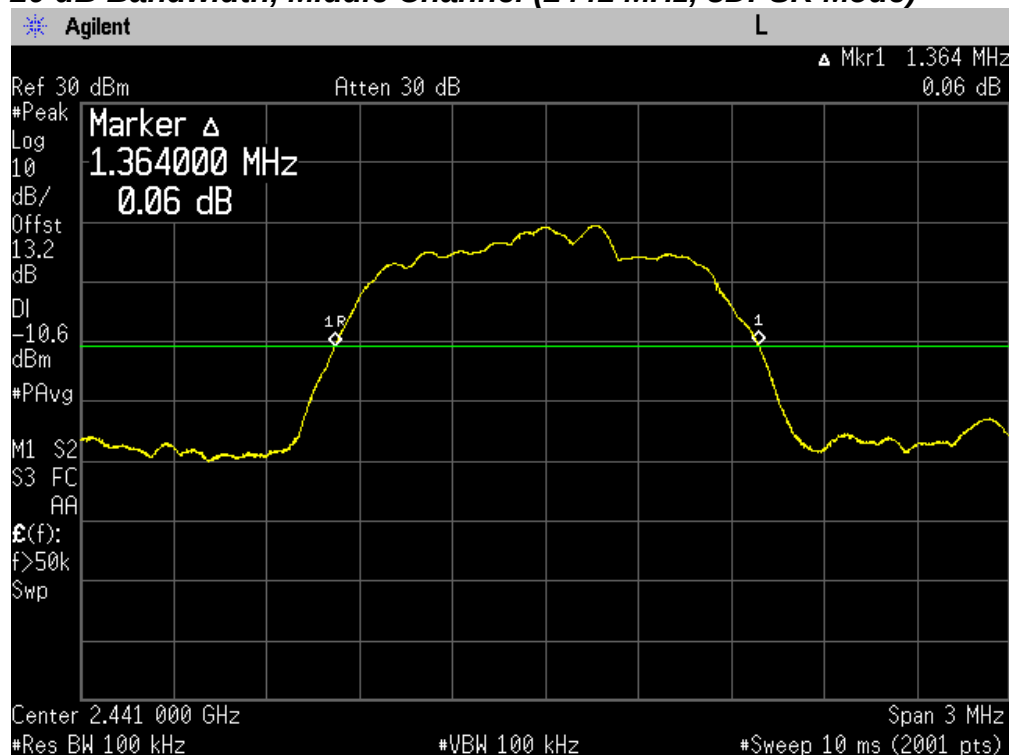


PLOTS OF EMISSIONS

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

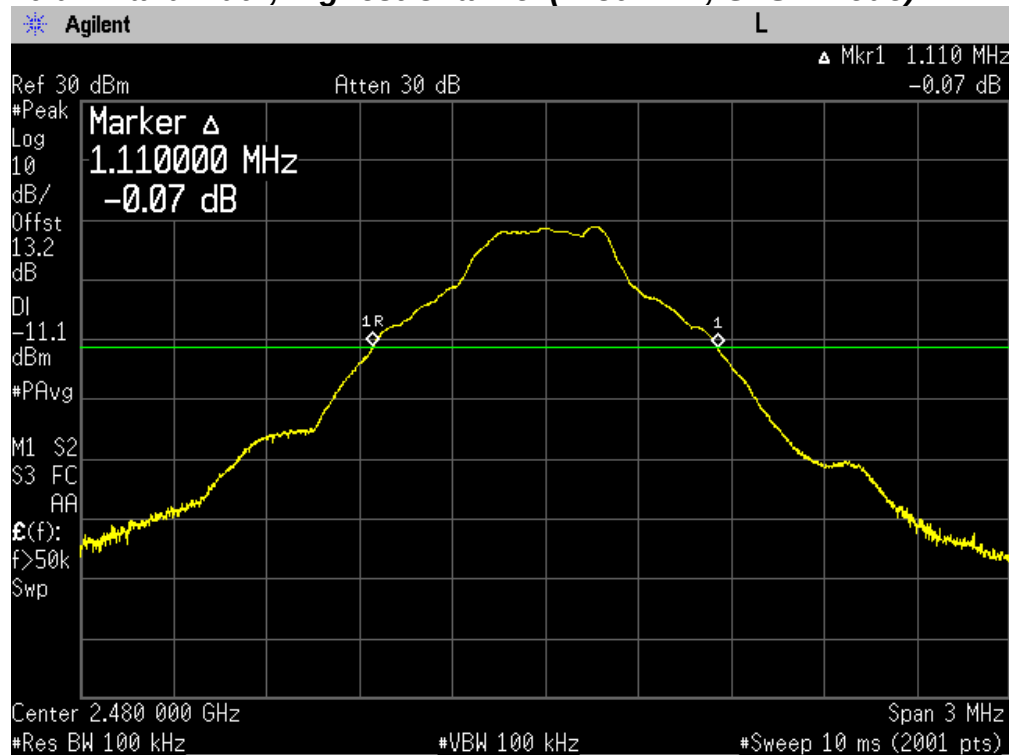


20 dB Bandwidth, Middle Channel (2441 MHz, 8DPSK Mode)

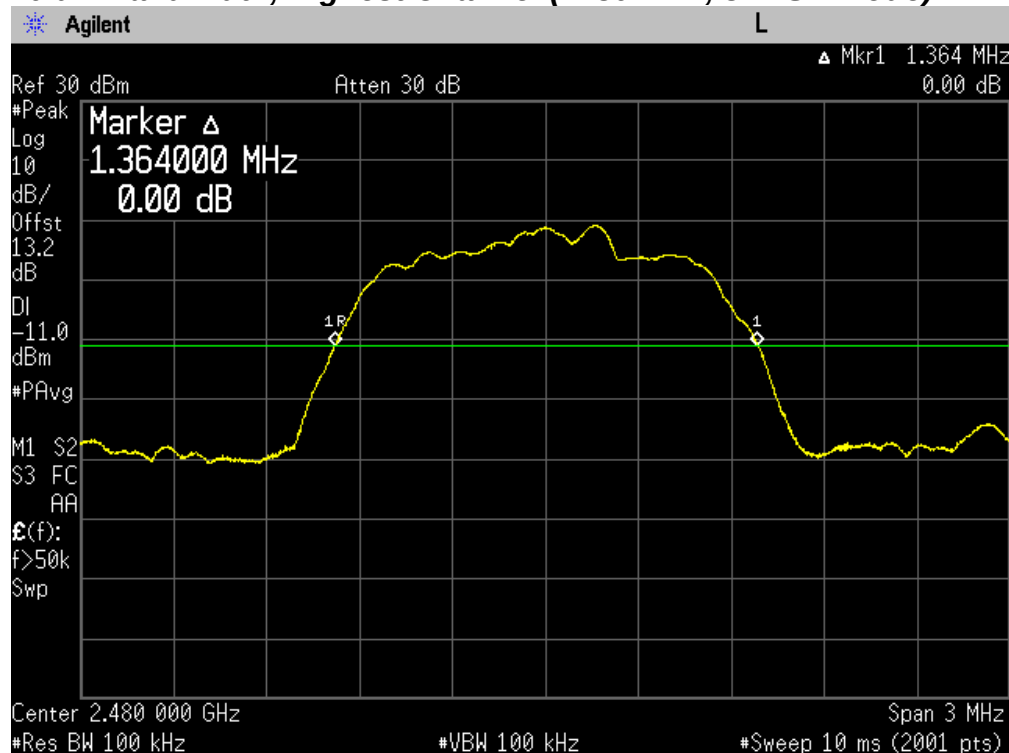


PLOTS OF EMISSIONS

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



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



TEST DATA

8.4 Carrier Frequency Separation

FCC §15.247(a)(1), RSS-210 A8.1(2)

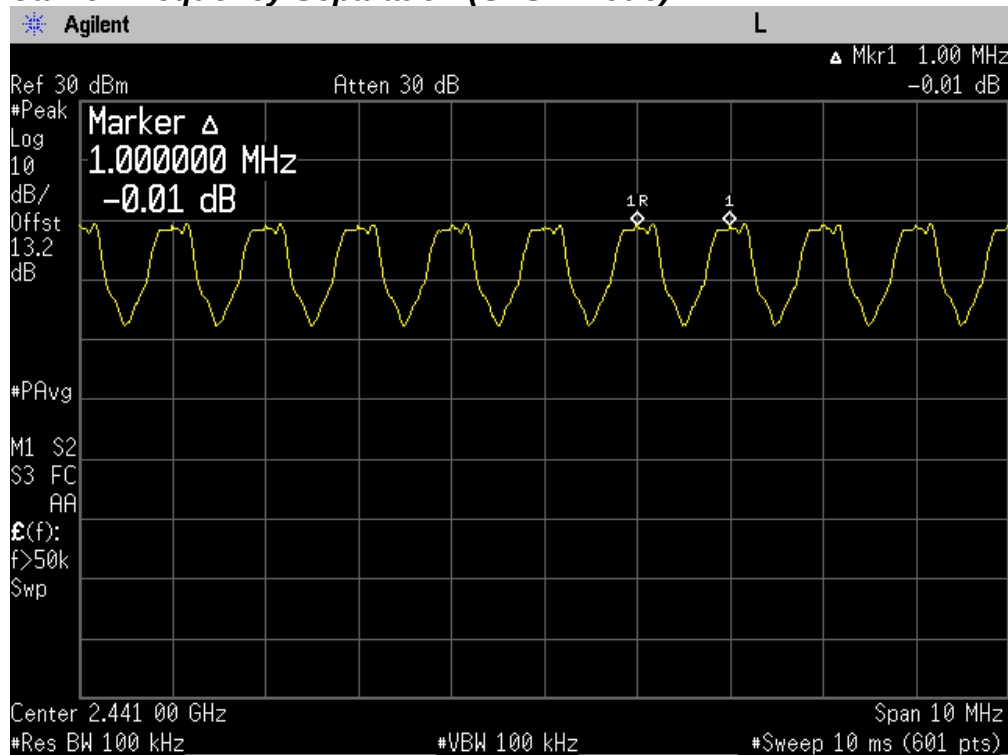
Test Mode : Set to Hopping mode

Result:

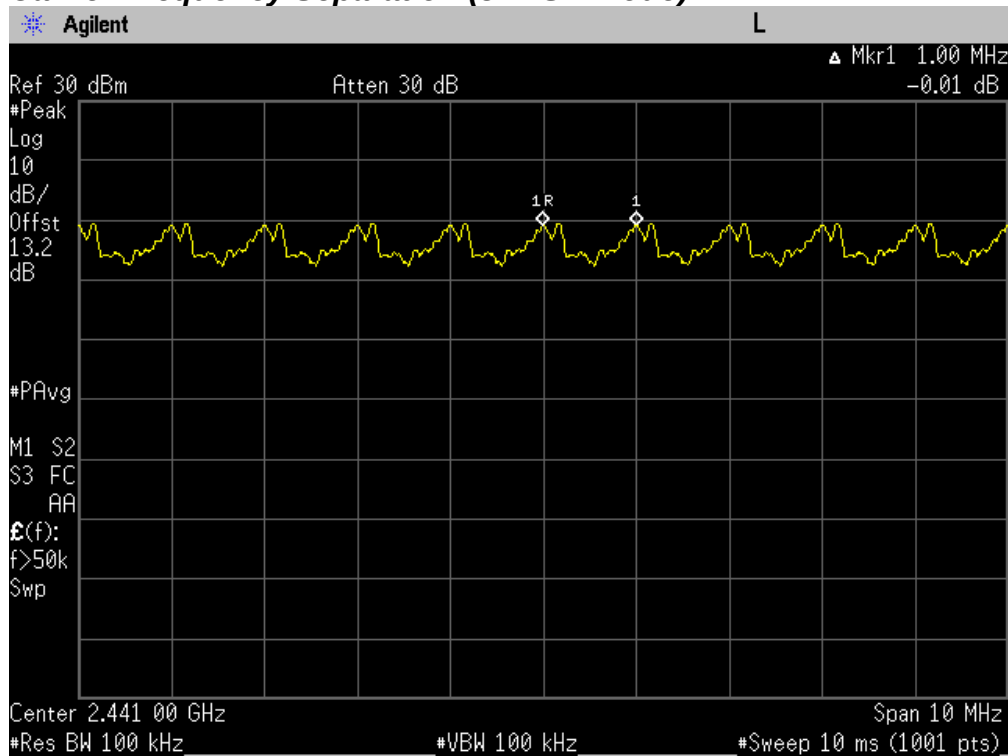
Modulation Mode	Carrier Frequency Separation (kHz)	Limit (2/3 of 20dB Bandwidth) (kHz)	Margin (kHz)
GFSK	1000.0	745	255
8DPSK	1000.0	909	91

PLOTS OF EMISSIONS

Carrier Frequency Separation (GFSK Mode)



Carrier Frequency Separation (8DPSK Mode)



TEST DATA

8.5 Transmitter Average Time of Occupancy

FCC §15.247(a)(1)(iii), RSS-210 A8.1(4)

Test Mode : Set to Hopping mode

Result:

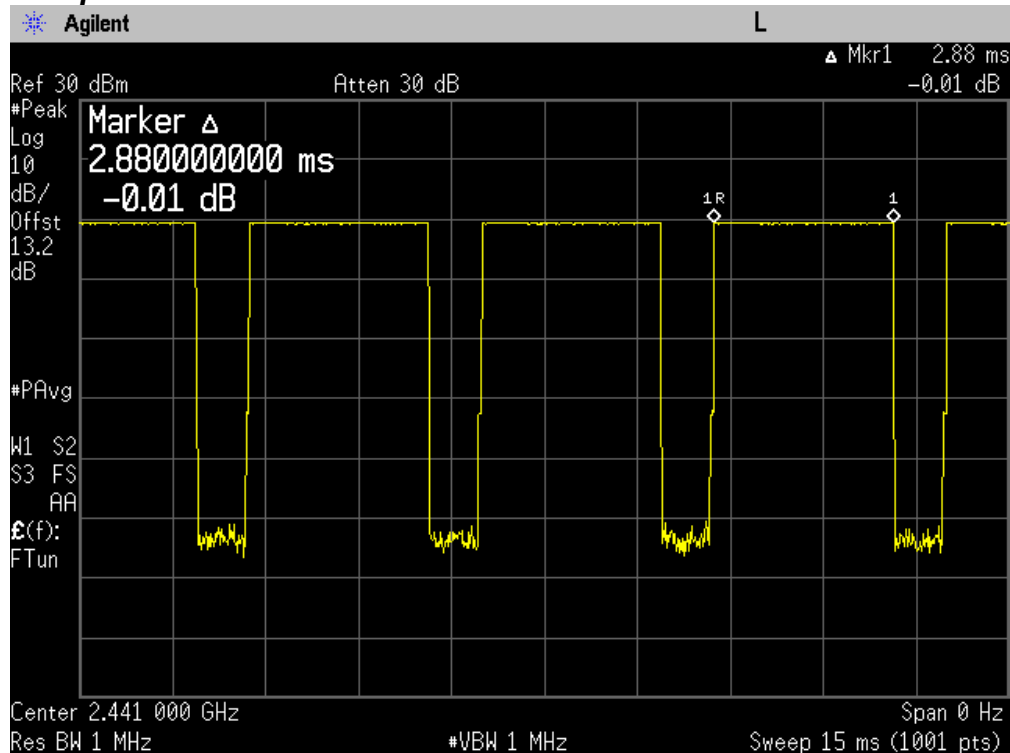
Modulation Mode	Pulse width (μs)	Number of 3.16 sec	¹⁾ Average time of Occupancy(s)	Margin (s)
GFSK	2880	12	0.346	0.054

Notes:

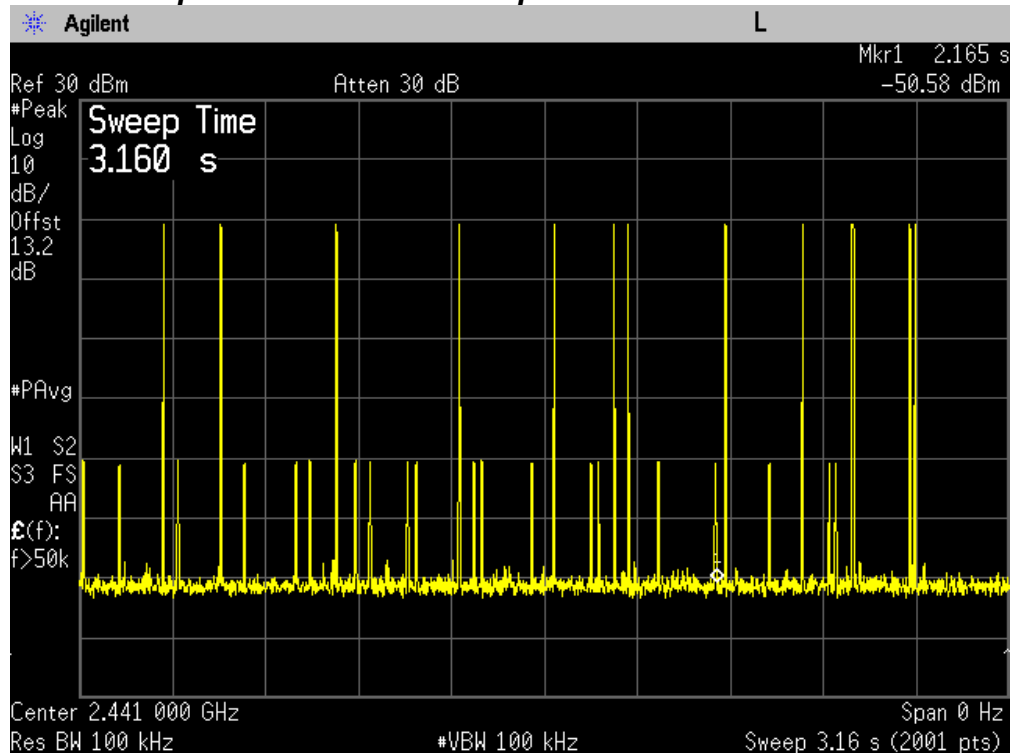
¹⁾ Average time of Occupancy = pulse width x Number of 3.16 sec x 10

PLOT OF TEST DATA

One pulse width



Number of pulses in 3.16 second period



TEST DATA

8.6 Number of Hopping Channels

FCC §15.247(a)(1)(iii), RSS-210 A8.1(4)

Test Mode : Set to Hopping mode

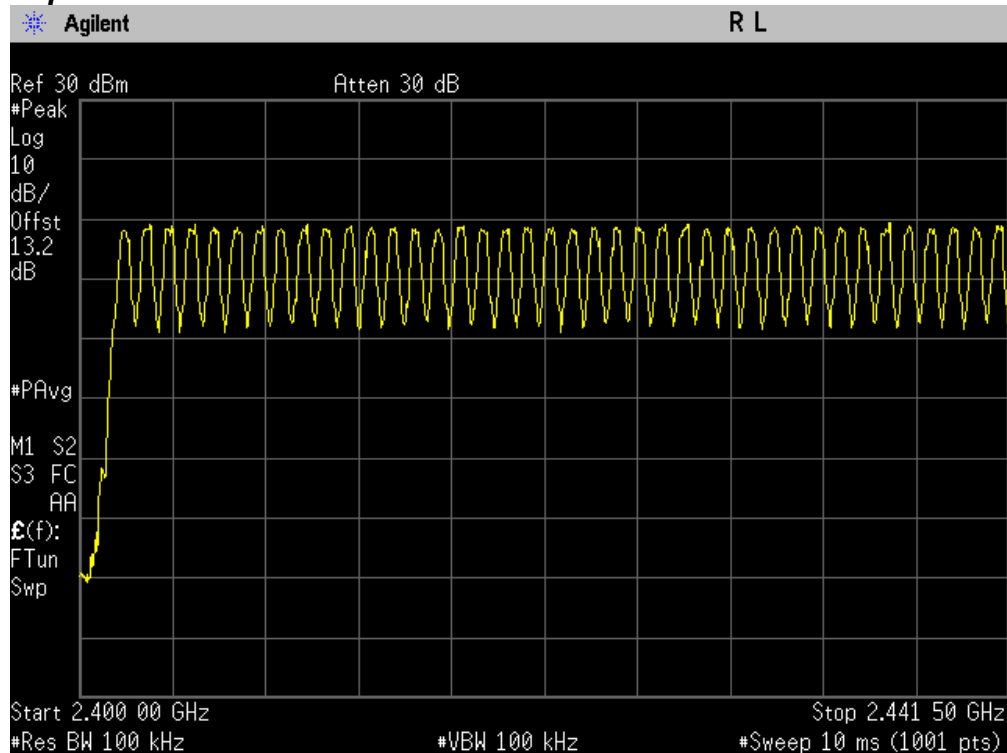
Result:

Total Hopping Channels = 40 + 39 = 79

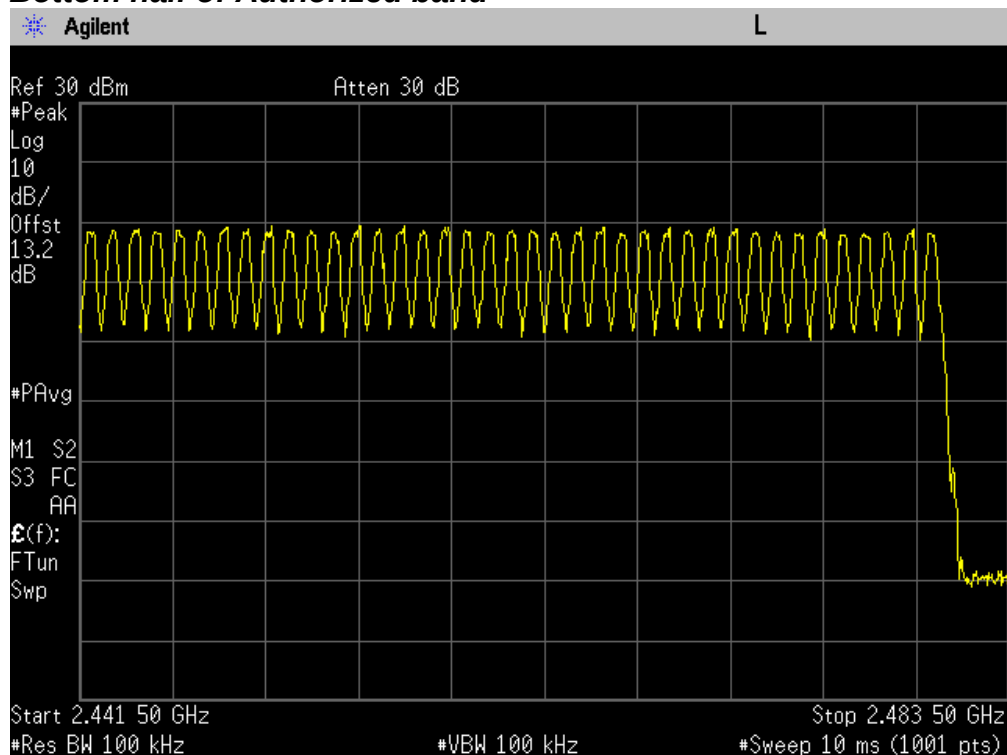
The EUT meets the specifications of Section 15.247(a)(1)(iii) for Number of Hopping Channels.

PLOT OF TEST DATA

Top half of Authorized band



Bottom half of Authorized band



TEST DATA

8.7 Peak Power Output

FCC §15.247(b)(1), RSS-210 A8.4(2)

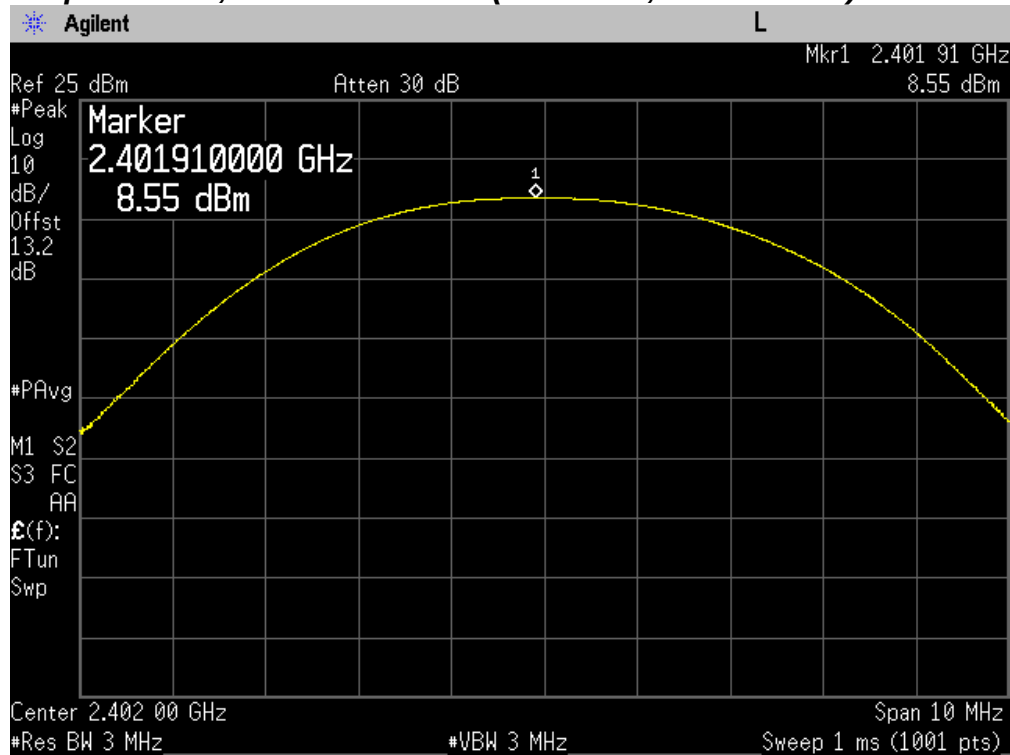
Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result:

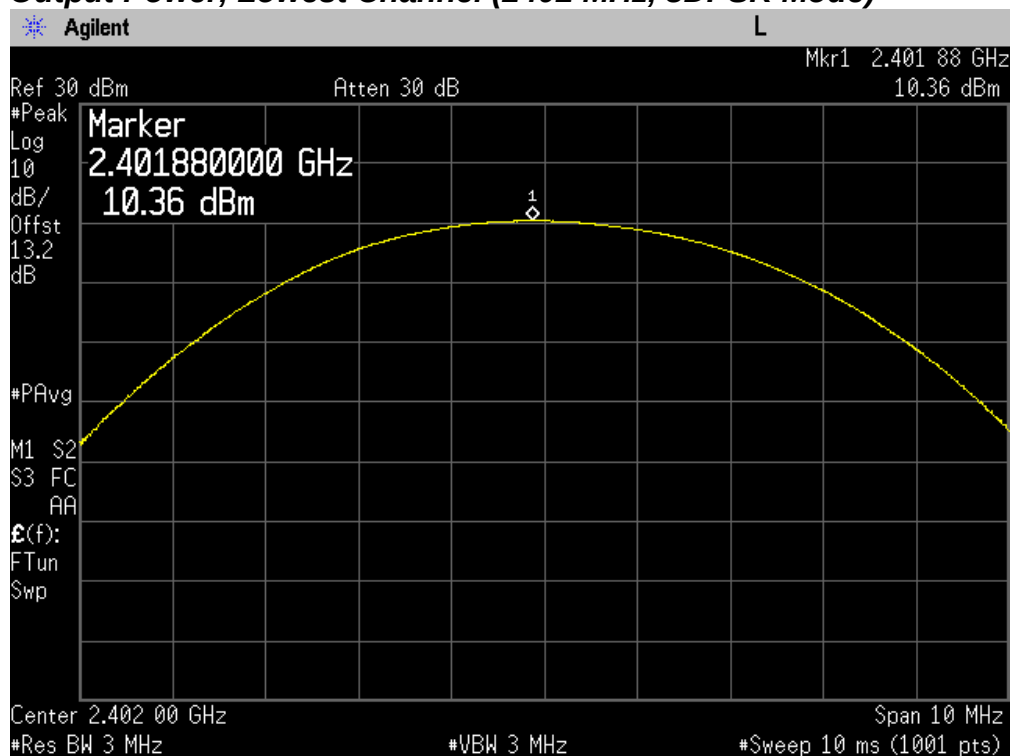
Modulation Mode	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)
GFSK	2402	8.55	30.00
GFSK	2441	9.54	30.00
GFSK	2480	9.12	30.00
8DPSK	2402	10.36	30.00
8DPSK	2441	10.63	30.00
8DPSK	2480	10.28	30.00

PLOT OF TEST DATA

Output Power, Lowest Channel (2402 MHz, GFSK Mode)

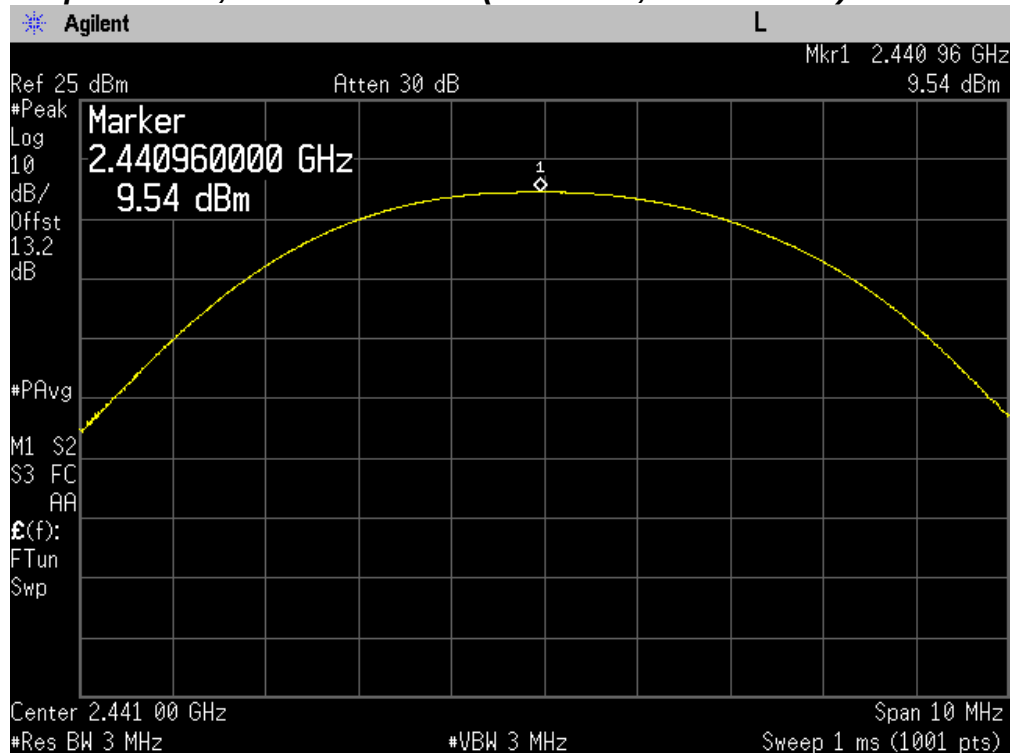


Output Power, Lowest Channel (2402 MHz, 8DPSK Mode)

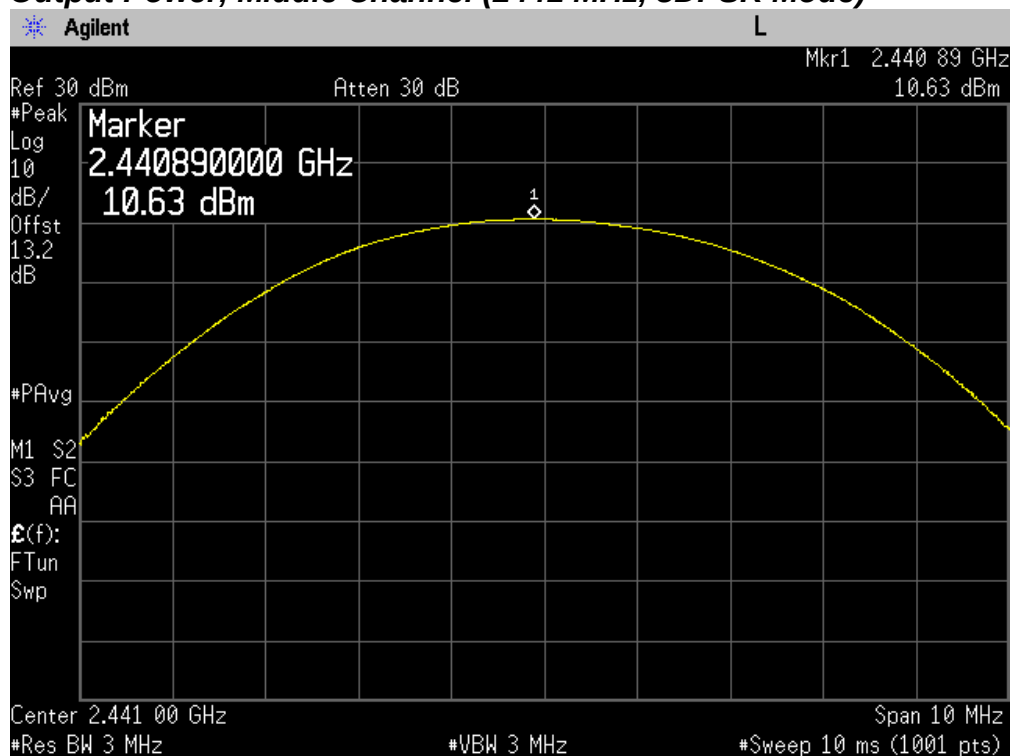


PLOT OF TEST DATA

Output Power, Middle Channel (2441 MHz, GFSK Mode)

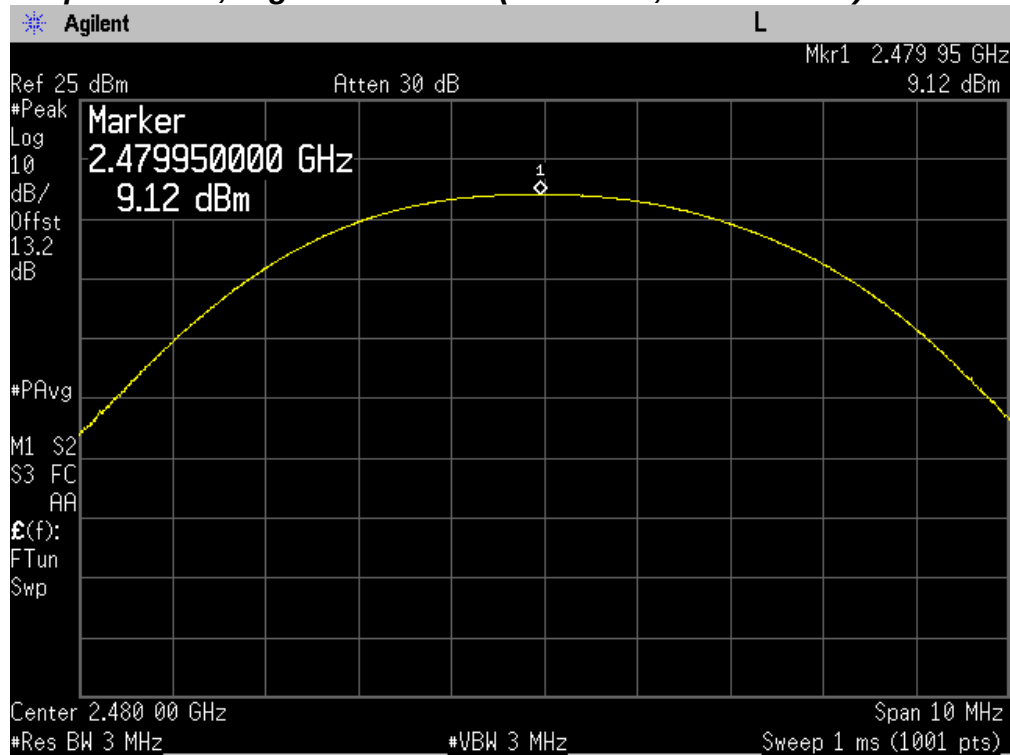


Output Power, Middle Channel (2441 MHz, 8DPSK Mode)

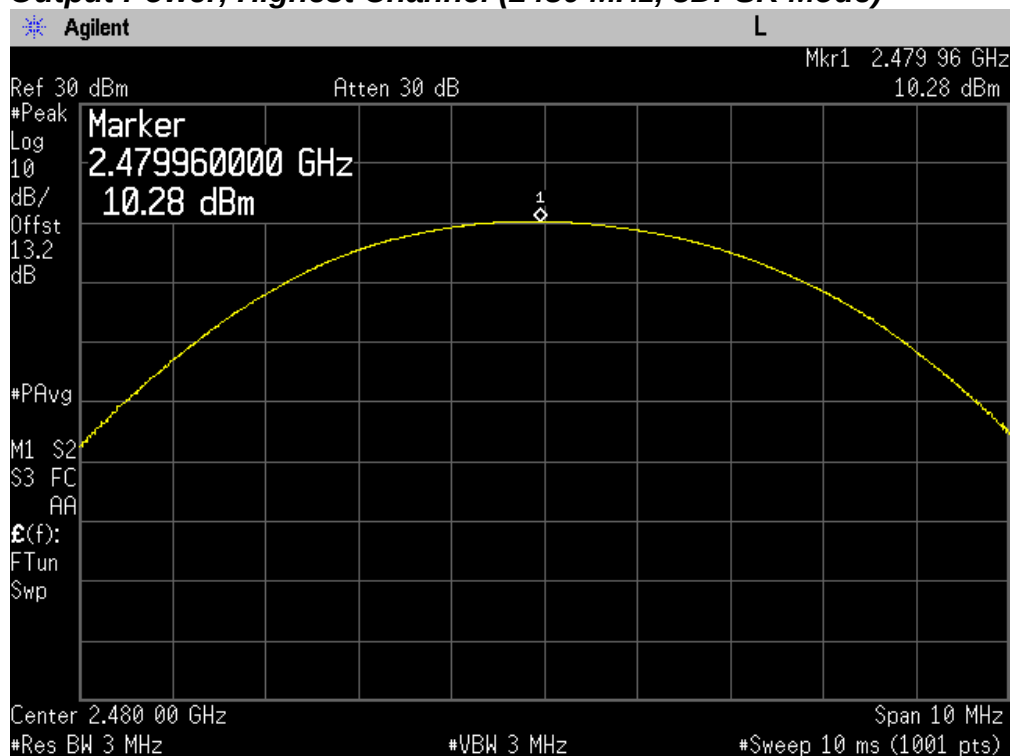


PLOT OF TEST DATA

Output Power, Highest Channel (2480 MHz, GFSK Mode)



Output Power, Highest Channel (2480 MHz, 8DPSK Mode)



TEST DATA

8.8 Conducted Spurious Emission

FCC §15.247(d), RSS-210 A8.5

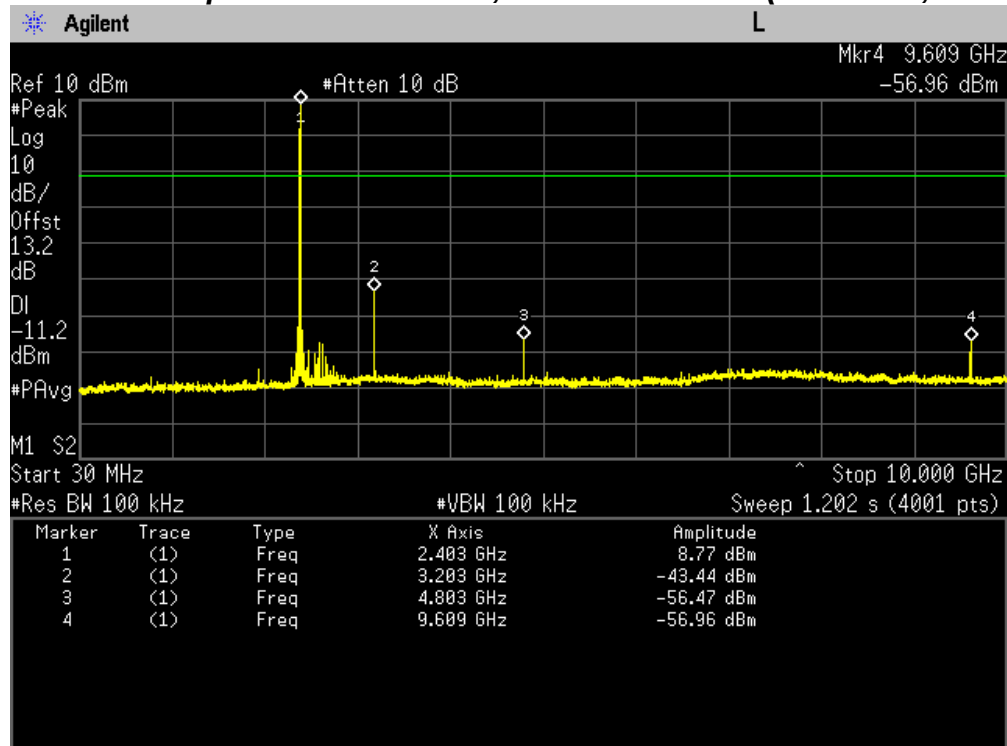
Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result:

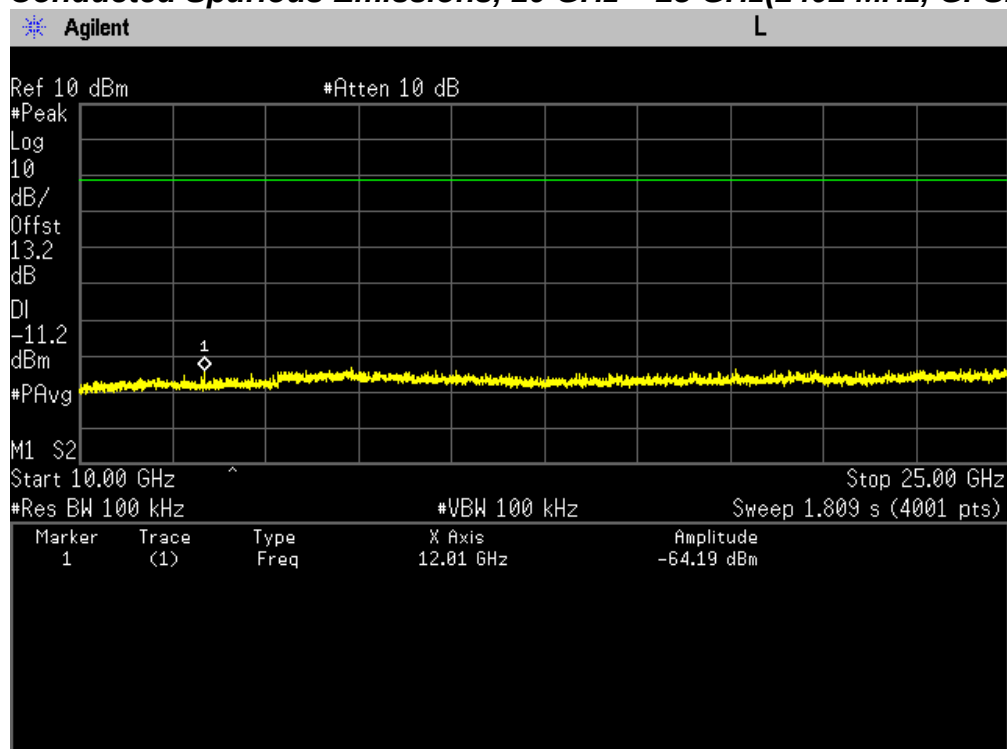
Modulation Mode	Frequency(MHz)	Result	Limit(dBc)
GFSK	2402	More than 30 dBc	20
GFSK	2441	More than 30 dBc	20
GFSK	2480	More than 30 dBc	20
8DPSK	2402	More than 30 dBc	20
8DPSK	2441	More than 30 dBc	20
8DPSK	2480	More than 30 dBc	20

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2402 MHz, GFSK Mode)

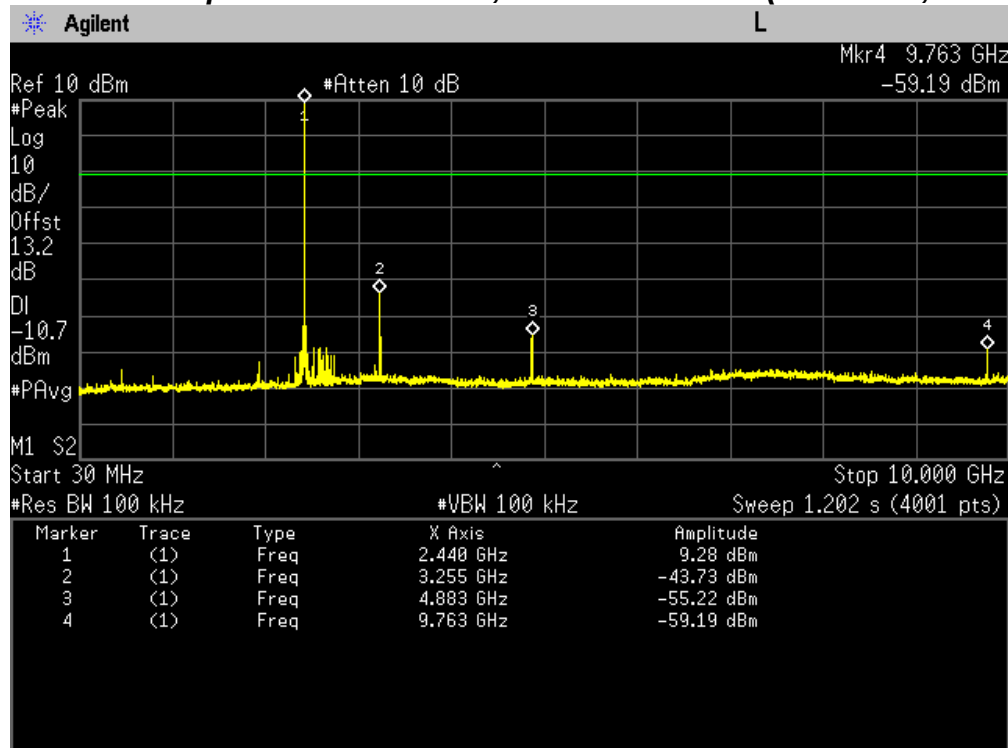


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2402 MHz, GFSK Mode)

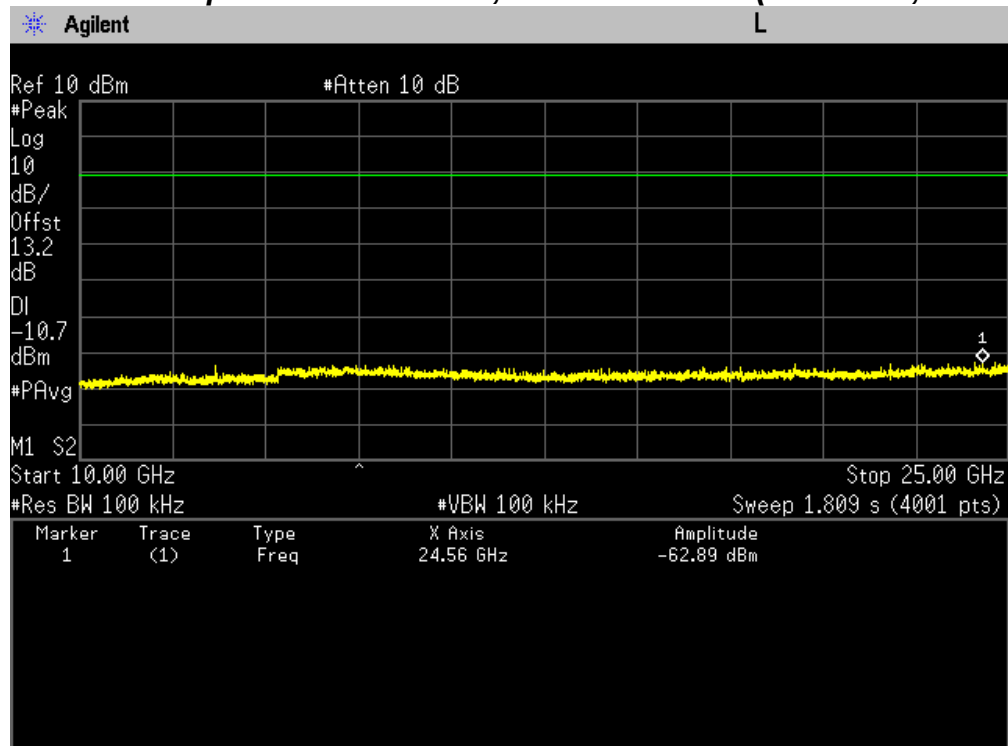


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2441 MHz, GFSK Mode)

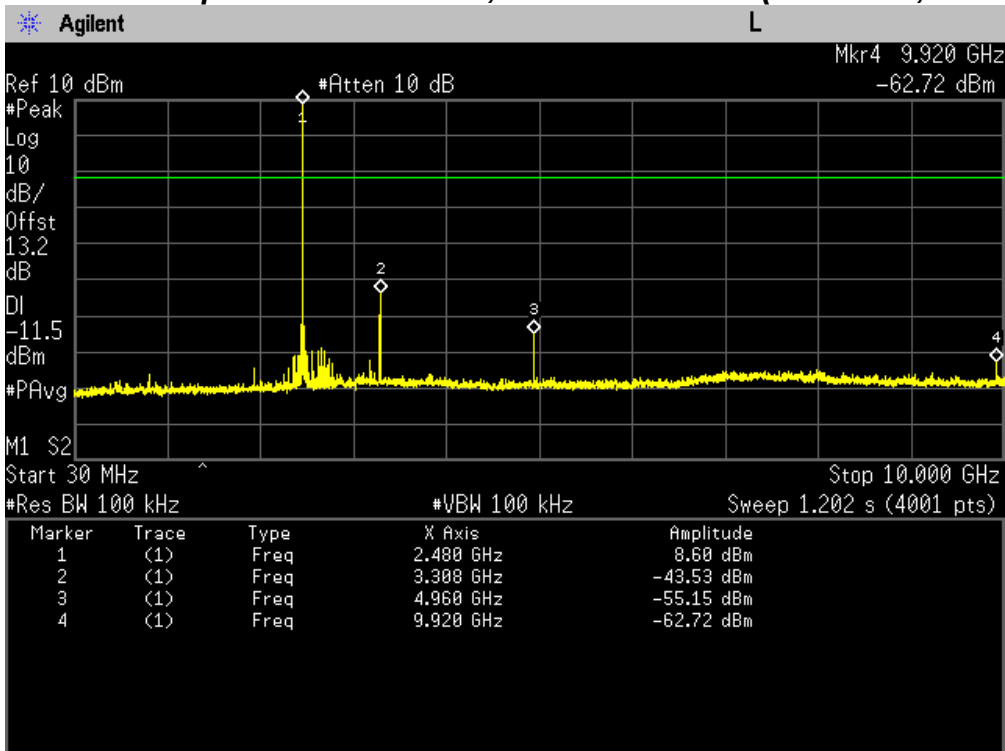


Conducted Spurious Emissions, 10 GHz ~ 25GHz(2441 MHz, GFSK Mode)

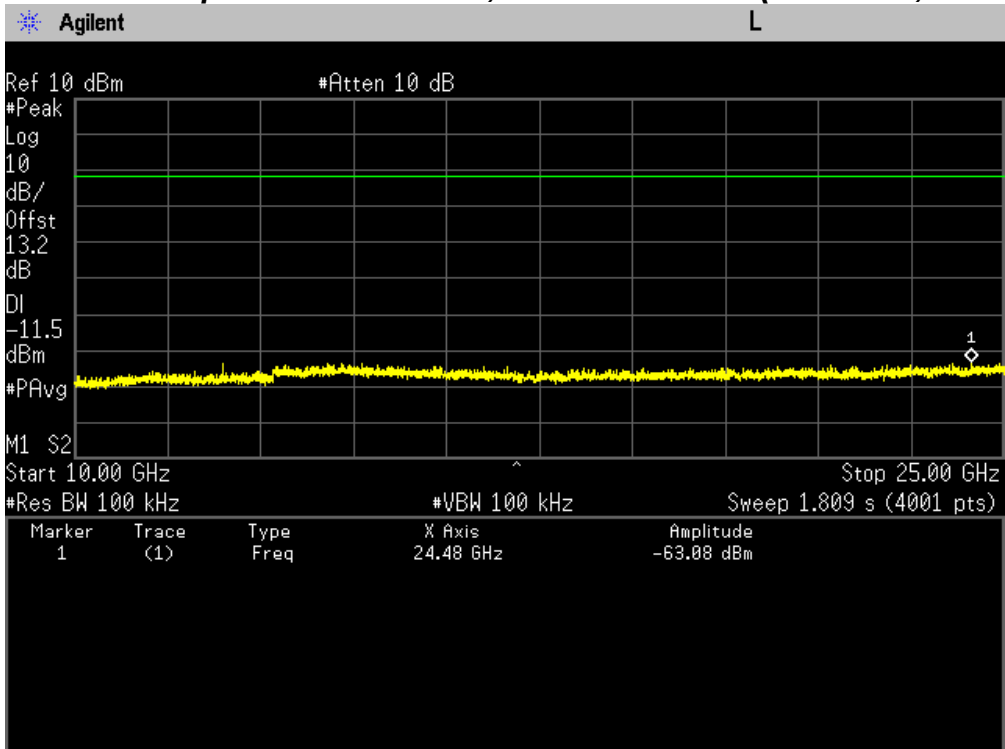


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2480 MHz, GFSK Mode)

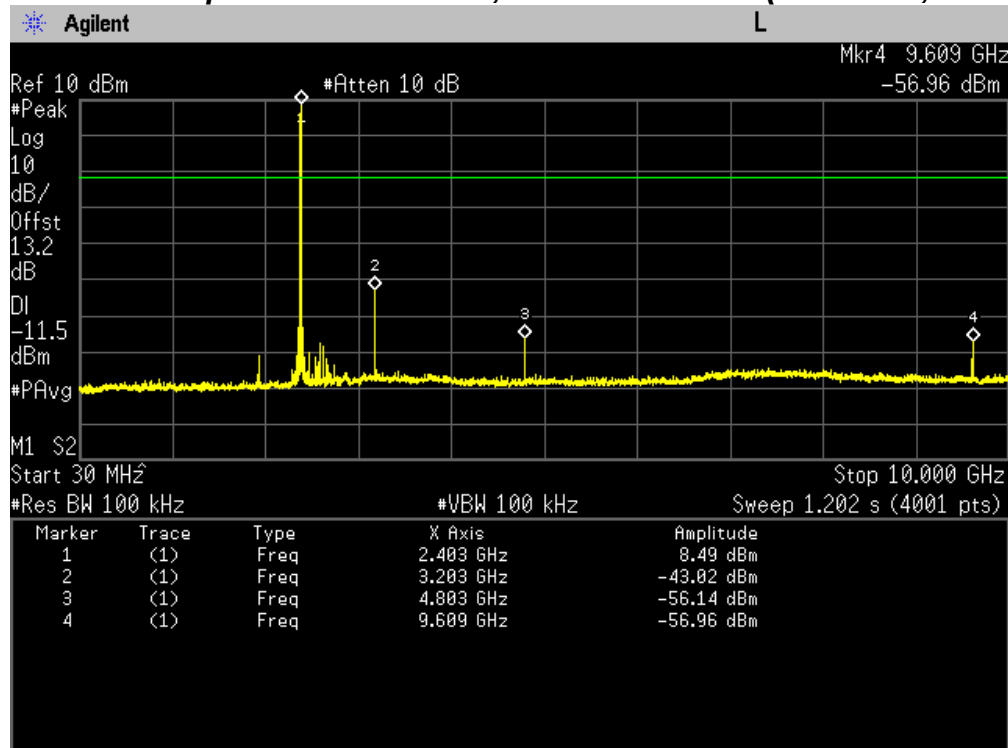


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2480 MHz, GFSK Mode)

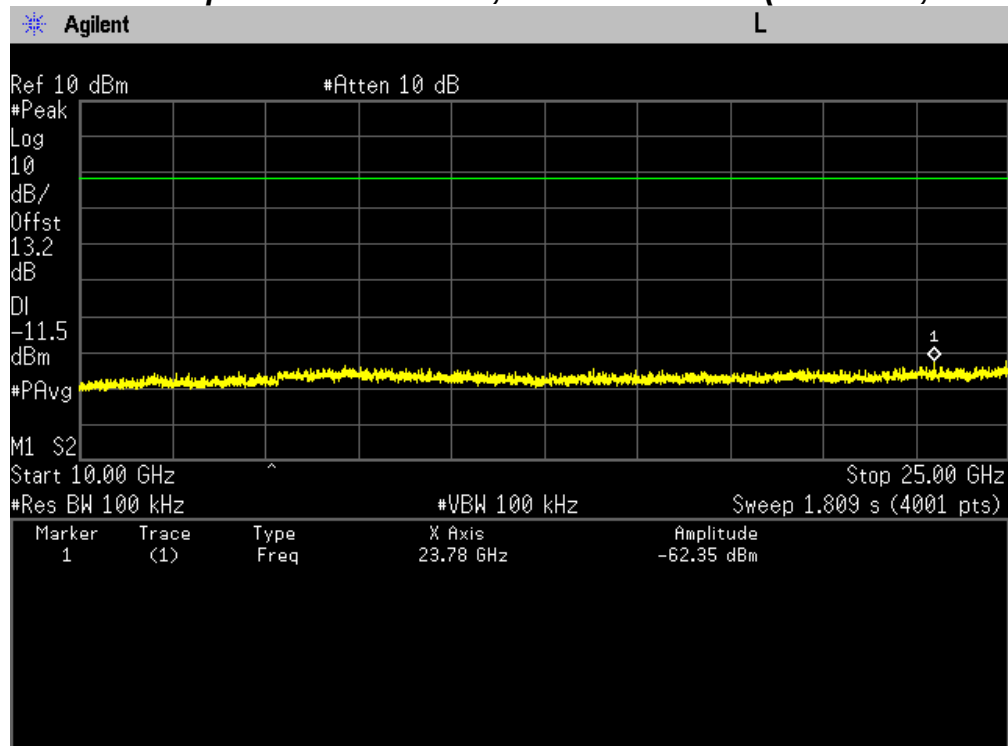


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2402 MHz, 8DPSK Mode)

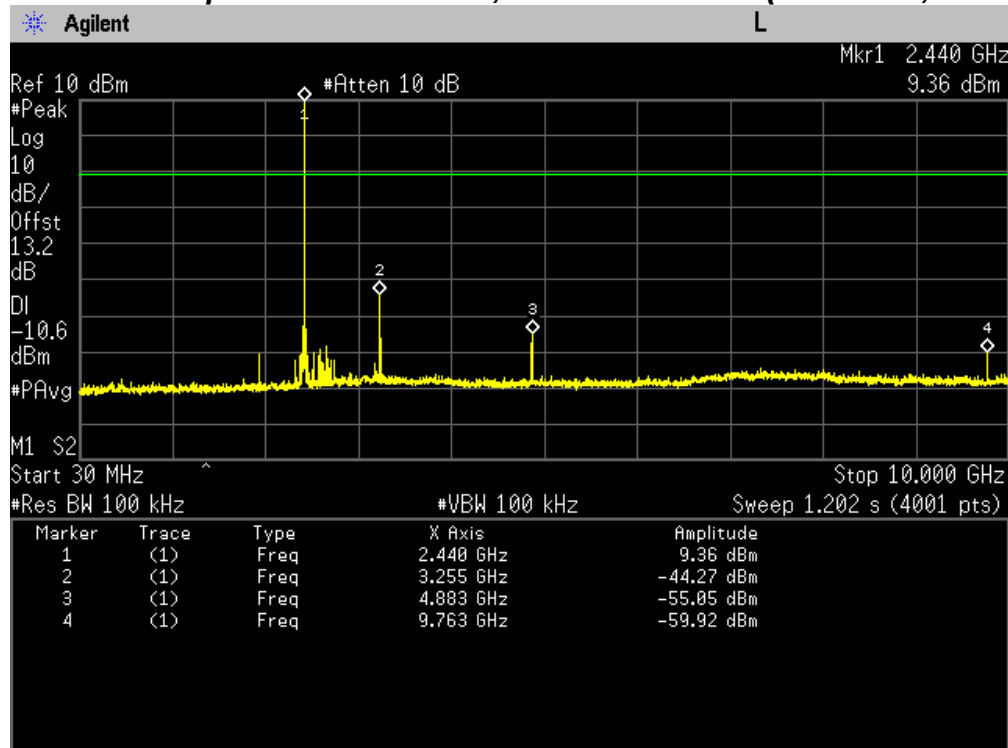


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2402 MHz, 8DPSK Mode)

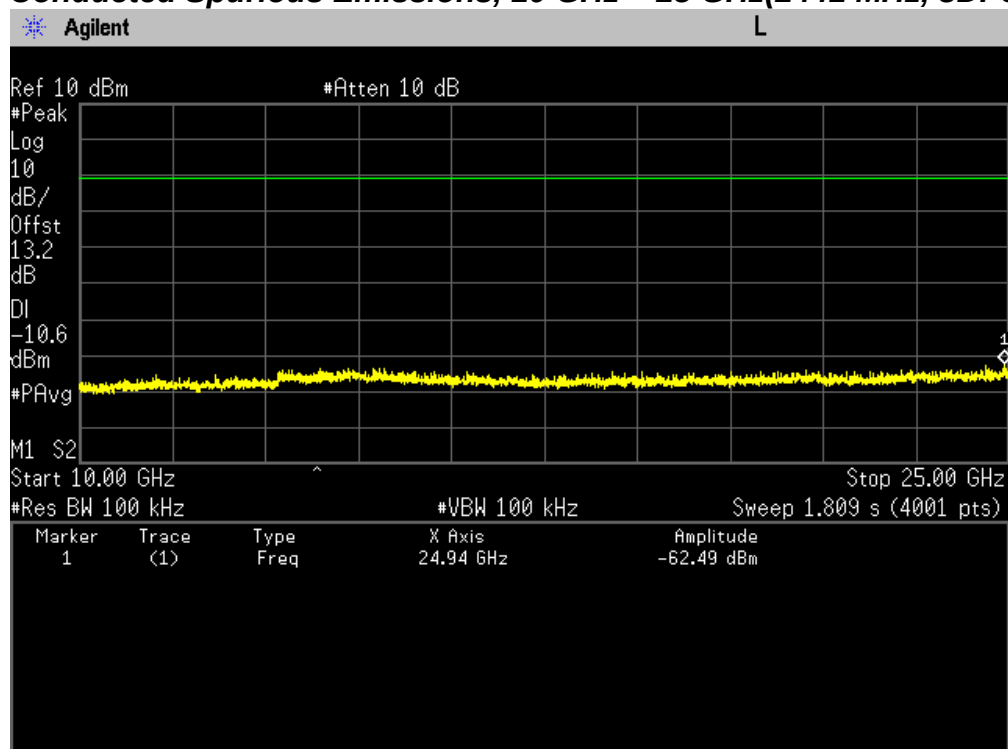


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2441 MHz, 8DPSK Mode)

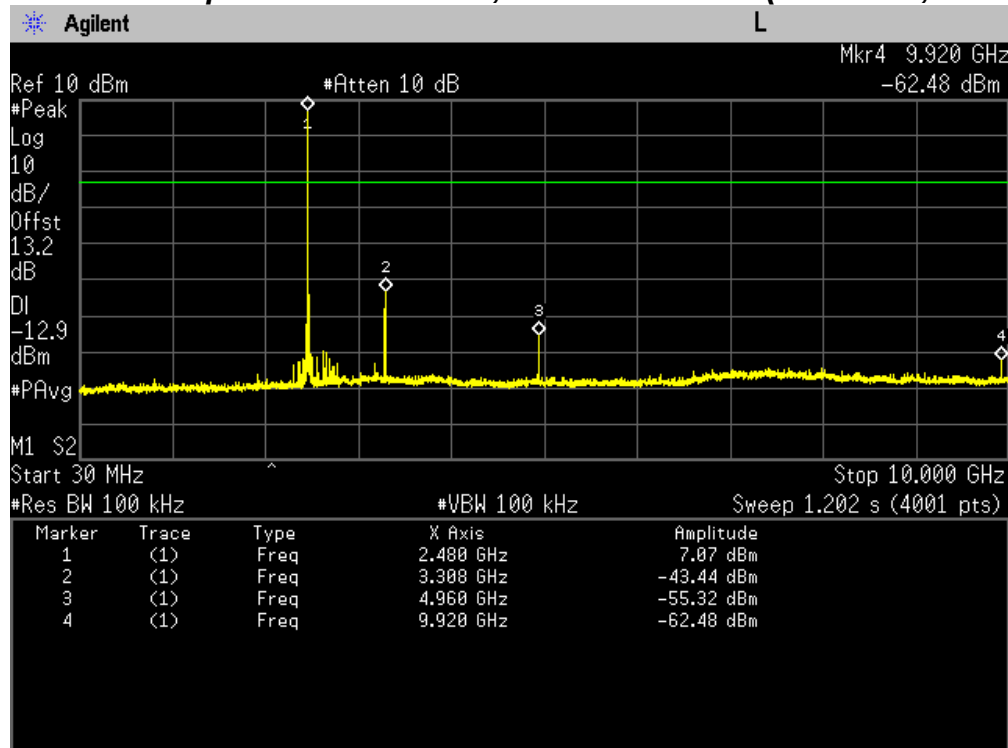


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2441 MHz, 8DPSK Mode)

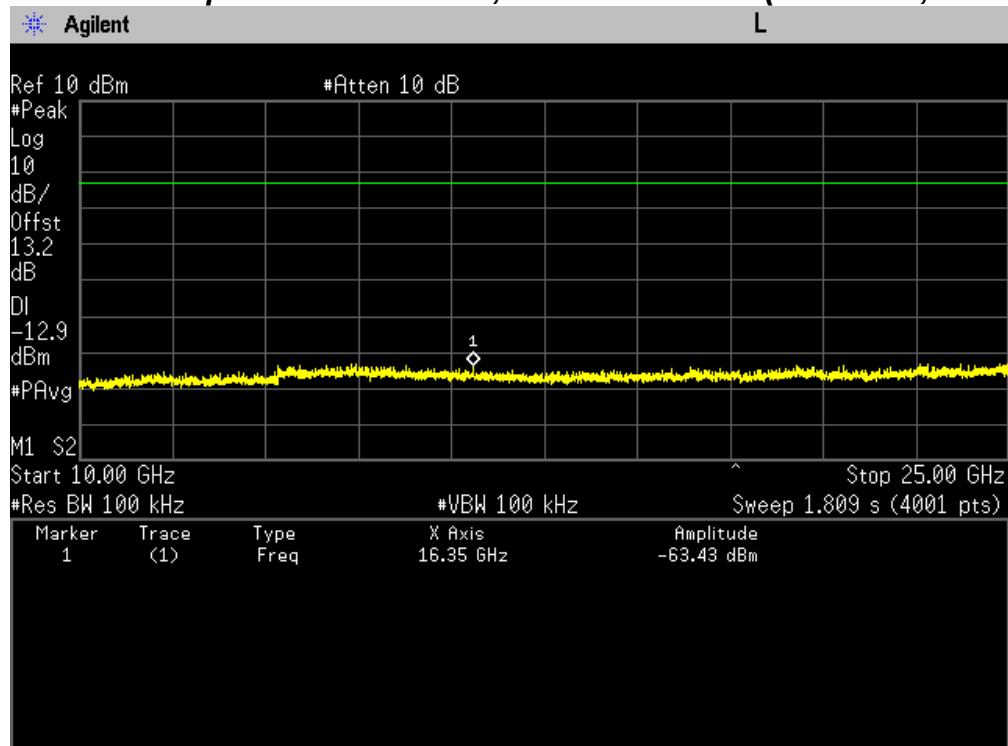


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2480 MHz, 8DPSK Mode)

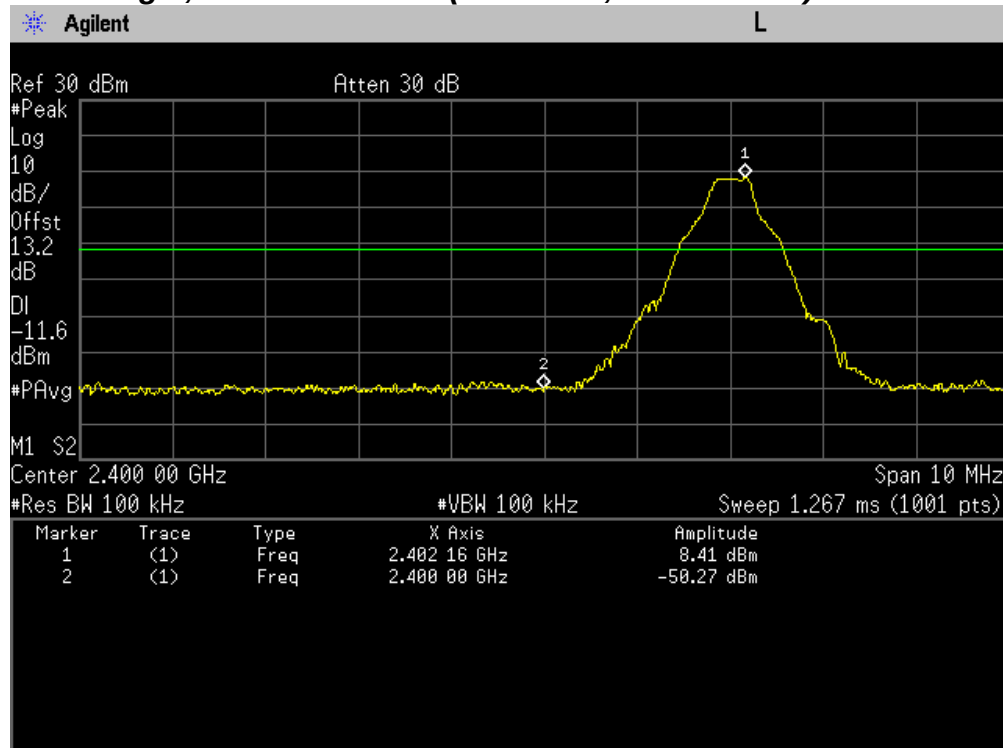


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2480 MHz, 8DPSK Mode)

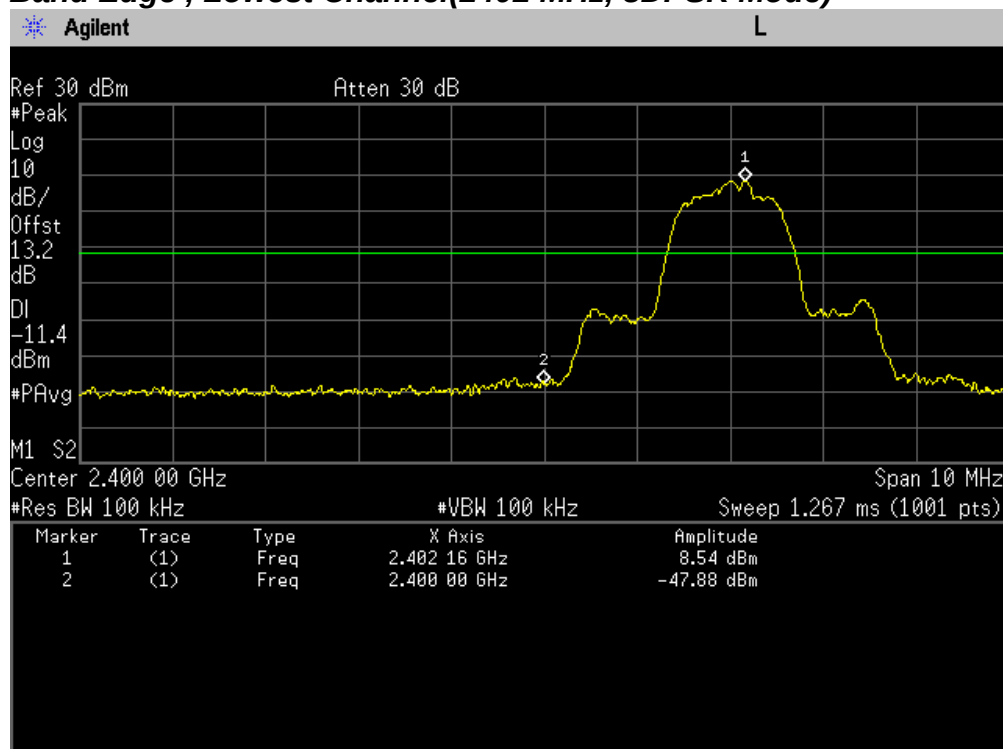


PLOT OF TEST DATA

Band Edge , Lowest Channel(2402 MHz, GFSK Mode)

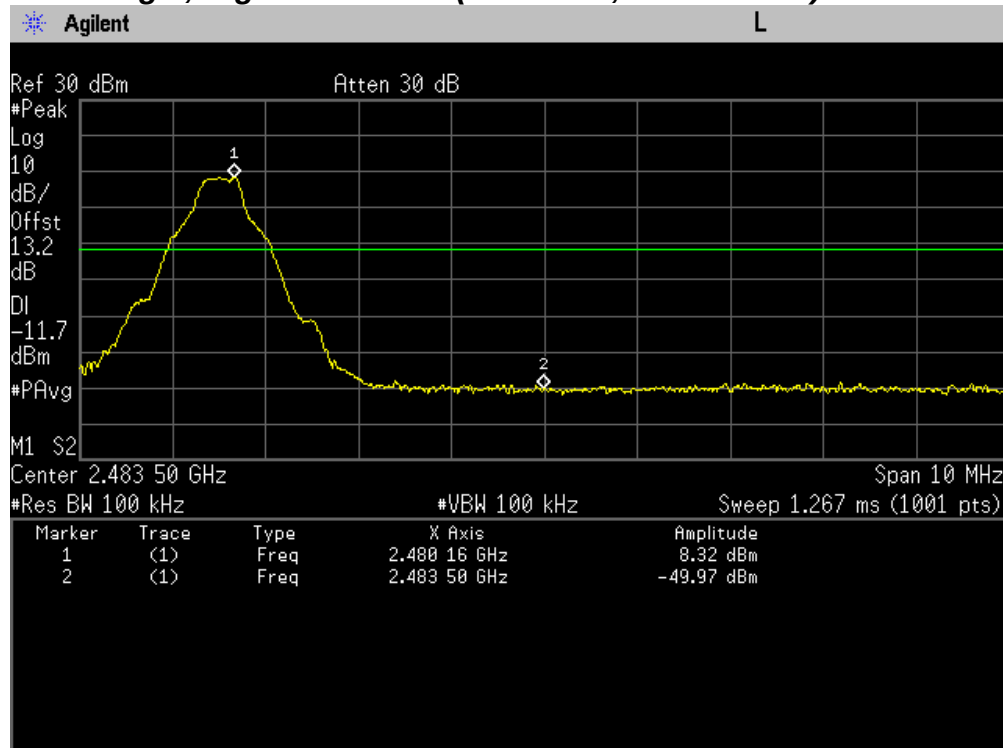


Band Edge , Lowest Channel(2402 MHz, 8DPSK Mode)

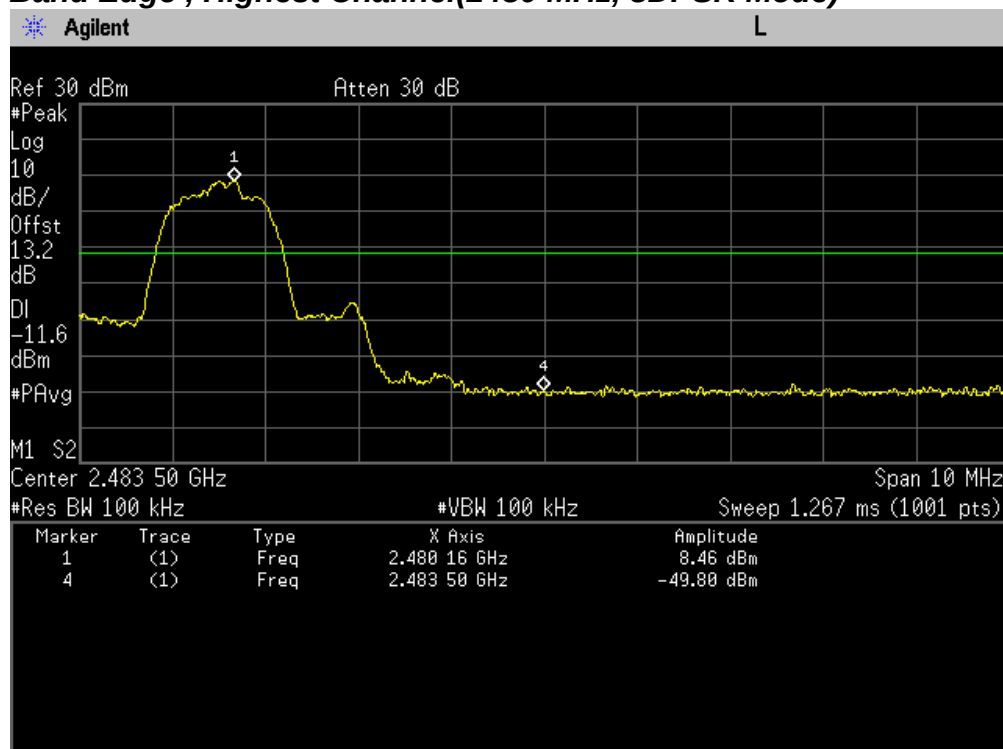


PLOT OF TEST DATA

Band Edge , Highest Channel(2480 MHz, GFSK Mode)



Band Edge , Highest Channel(2480 MHz, 8DPSK Mode)



TEST DATA

8.9 Radiated Spurious Emission

FCC §15.247(d), RSS-210 A8.5

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)	Lim it (dBμV/m)	Margin (dB)
1390.50	50.80	H	peak	-4.90	45.90	74.0	28.10
1390.50	37.60	H	average	-4.90	32.70	54.0	21.30
1491.50	54.10	V	peak	-4.60	49.50	74.0	24.50
1491.50	38.40	V	average	-4.60	33.80	54.0	20.20
1591.50	54.10	V	peak	-4.30	49.80	74.0	24.20
1591.50	37.20	V	average	-4.30	32.90	54.0	21.10
1687.50	55.10	V	peak	-4.10	51.00	74.0	23.00
1687.50	36.40	V	average	-4.10	32.30	54.0	21.70
4804.00	39.20	V	peak	11.50	50.70	74.0	23.30
4804.00	31.00	V	average	11.50	42.50	54.0	11.50

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+ Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1093.00	50.80	H	peak	-5.80	45.00	74.00	29.00
1093.00	39.30	H	average	-5.80	33.50	54.00	20.50
1488.00	52.10	V	peak	-4.60	47.50	74.00	26.50
1488.00	37.00	V	average	-4.60	32.40	54.00	21.60
1687.00	52.70	V	peak	-4.10	48.60	74.00	25.40
1687.00	36.40	V	average	-4.10	32.30	54.00	21.70
4882.00	42.30	V	peak	9.50	51.80	74.00	22.20
4882.00	35.50	V	average	9.50	45.00	54.00	9.00

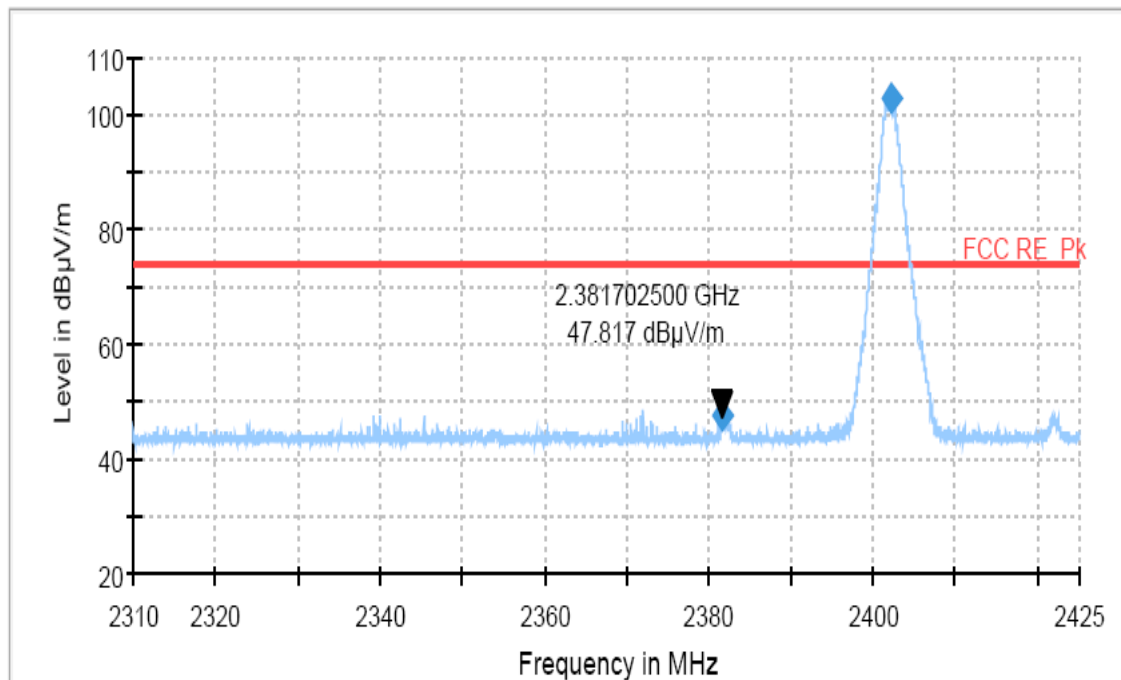
Highest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+ Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1371.50	52.90	H	peak	-5.00	47.90	74.00	26.10
1371.50	37.30	H	average	-5.00	32.30	54.00	21.70
1488.50	54.80	V	peak	-4.60	50.20	74.00	23.80
1488.50	38.30	V	average	-4.60	33.70	54.00	20.30
1590.00	53.30	V	peak	-4.30	49.00	74.00	25.00
1590.00	37.40	V	average	-4.30	33.10	54.00	20.90
1690.50	55.50	V	peak	-4.10	51.40	74.00	22.60
1690.50	36.40	V	average	-4.10	32.30	54.00	21.70
4960.00	41.50	V	peak	9.60	51.10	74.00	22.90
4960.00	34.50	V	average	9.60	44.10	54.00	9.90

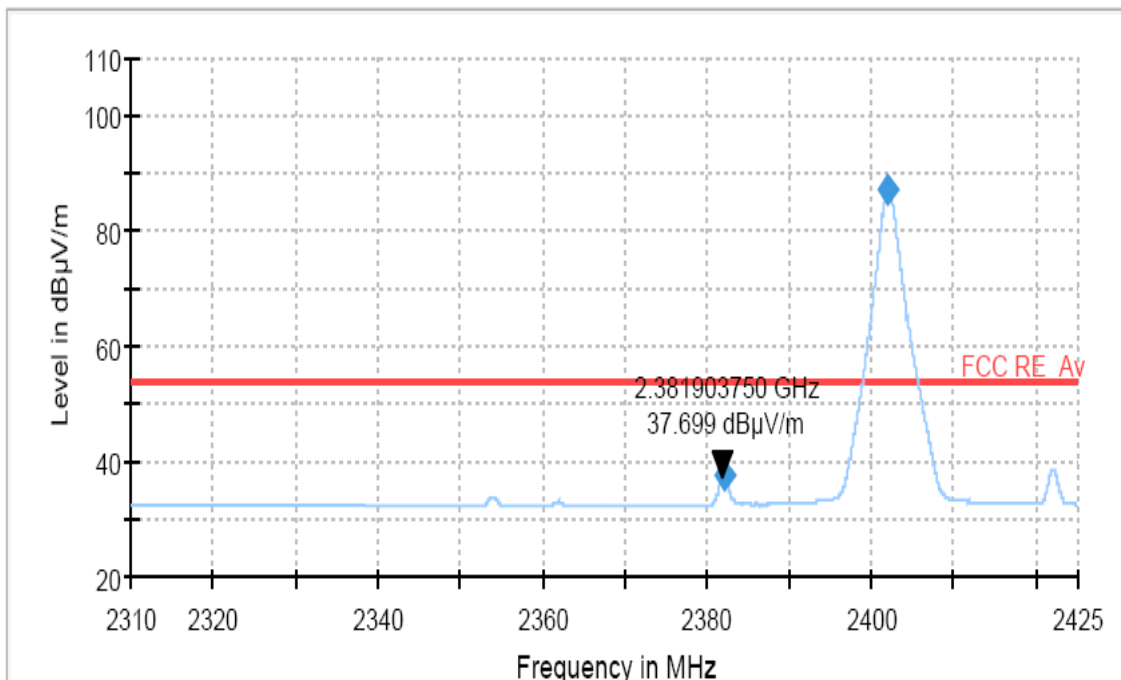
1. **Pol. H = Horizontal V = Vertical*
2. ***AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*
3. *Other spurious are under 20 dB below Fundamental.*
4. *The radiated emissions testing were made by rotating through three orthogonal axes.
The worst data was recorded.*
5. *GFSK modulation mode is the worst condition.*
6. *For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.*
7. *The spectrum is measured from 9 kHz to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.*

PLOT OF TEST DATA

Restricted Band Spurious Emissions, Lowest channel(GFSK, Peak)

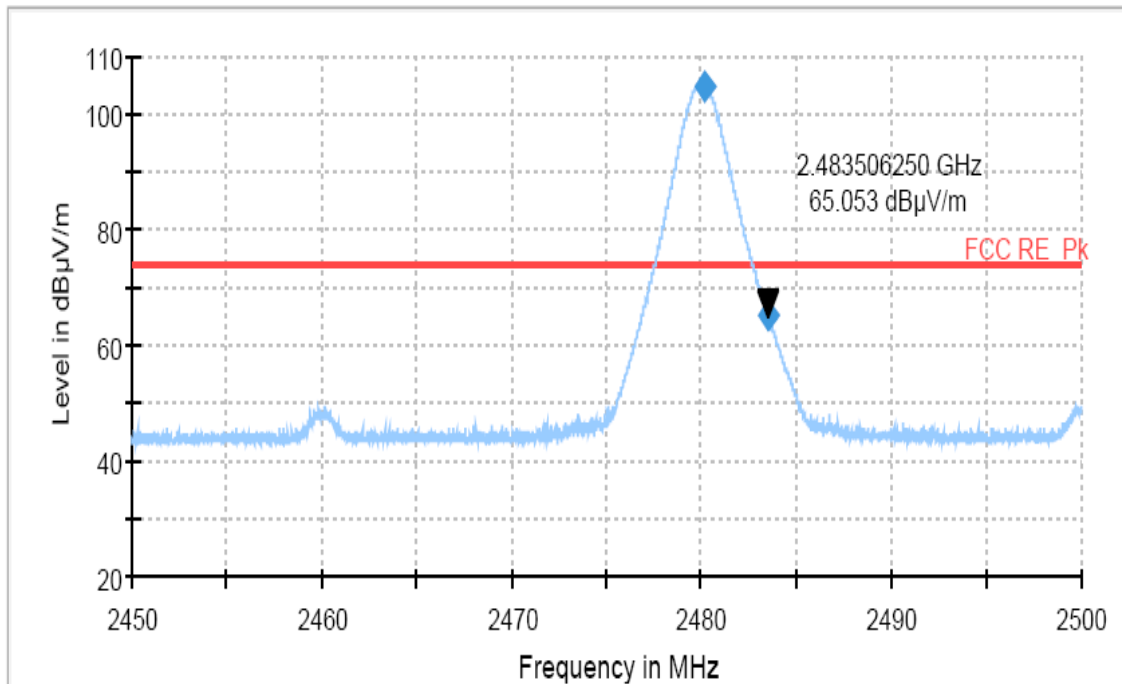


Restricted Band Spurious Emissions, Lowest channel(GFSK, Average)



PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel(GFSK, Peak)



Restricted Band Spurious Emissions, Highest channel (GFSK, Peak, RBW/VBW: 100 kHz)

The result of Step2 on KDB publication No. 913591

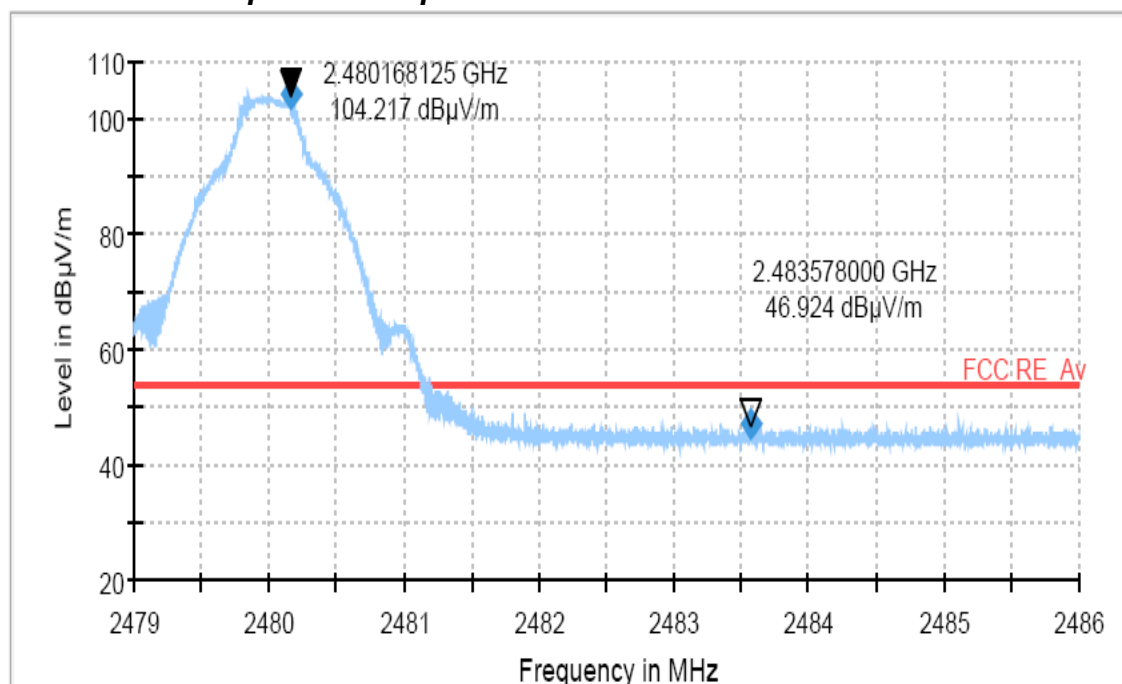


Table 1

Frequency (MHz)	Reading (dBμV)	Pol. H/V	Ant + Cl + Amp (dB)	Result (dBμV/m)
2480.16	105.7	H	-1.5	104.2
2483.57	48.4	V	-1.5	46.9

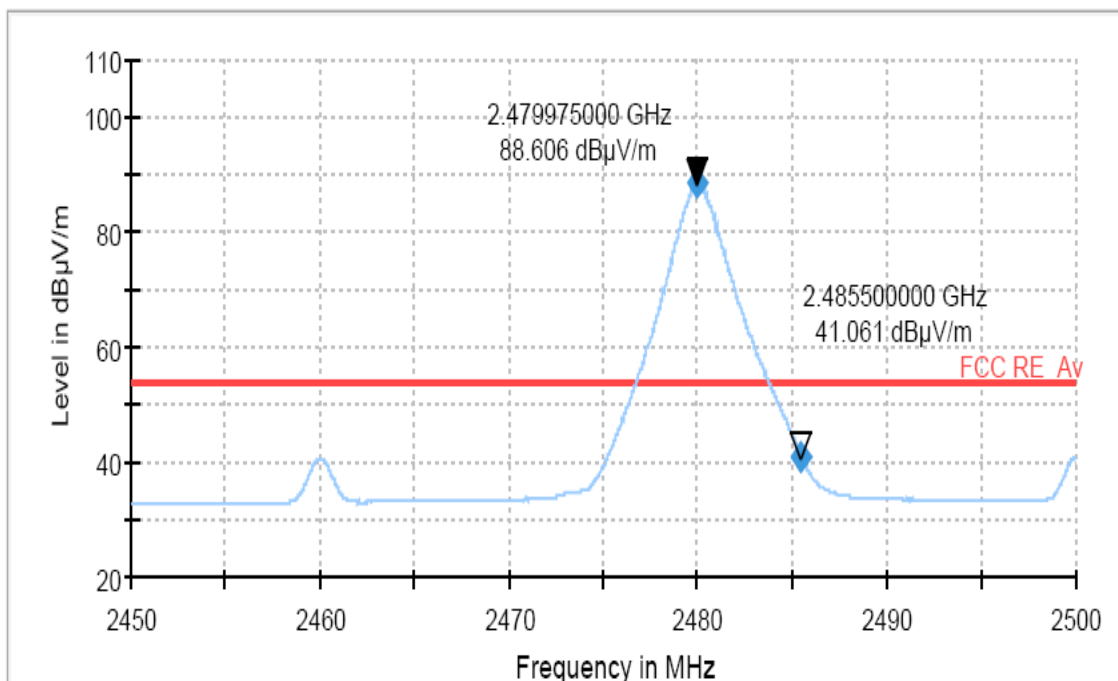
Equation 1

The amount of emission drop factor is,

$$104.2 - 46.9 = \underline{57.3 \text{ dB}}$$

Restricted Band Spurious Emissions, Highest channel (GFSK, Average)

The result of Step3 & 4 on KDB publication No. 913591

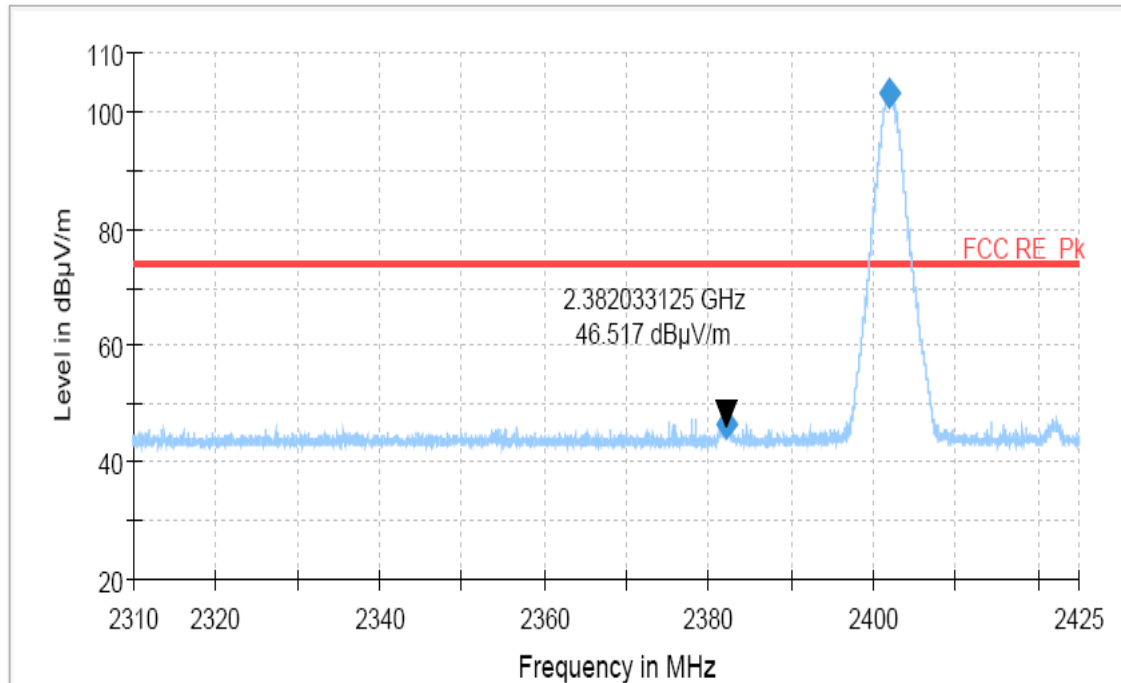

Equation 2

The band edge emission average level is, (at 2483.5 MHz)

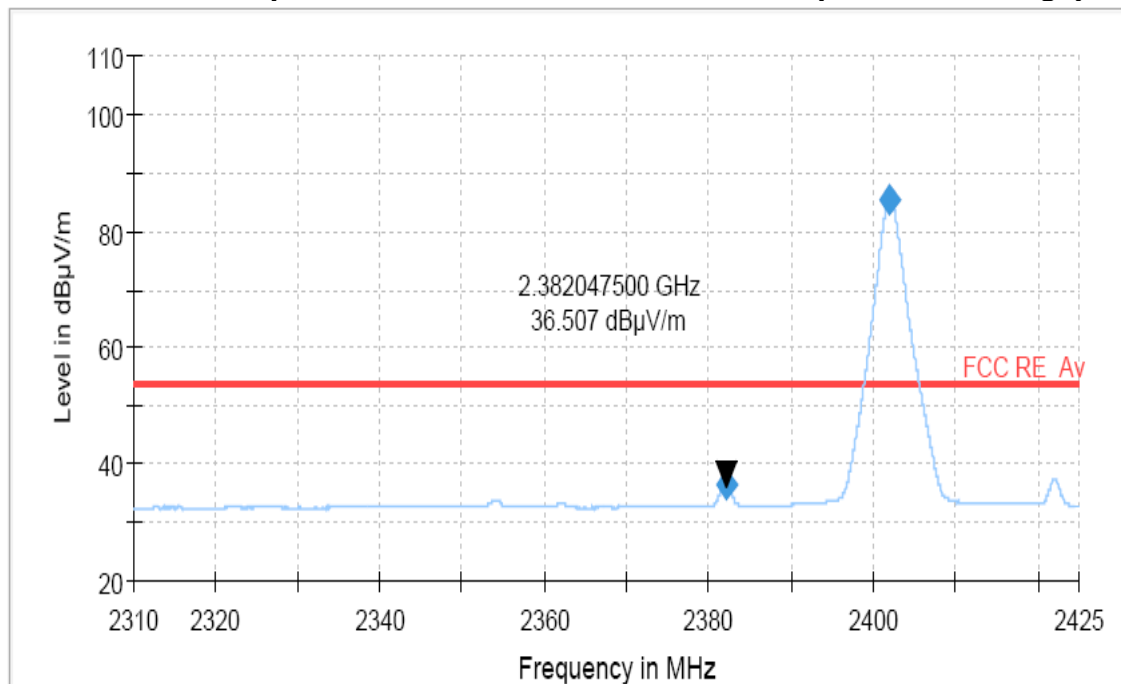
$$88.6 - 57.3 = \underline{31.3 \text{ dBμV/m}}$$

PLOT OF TEST DATA

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

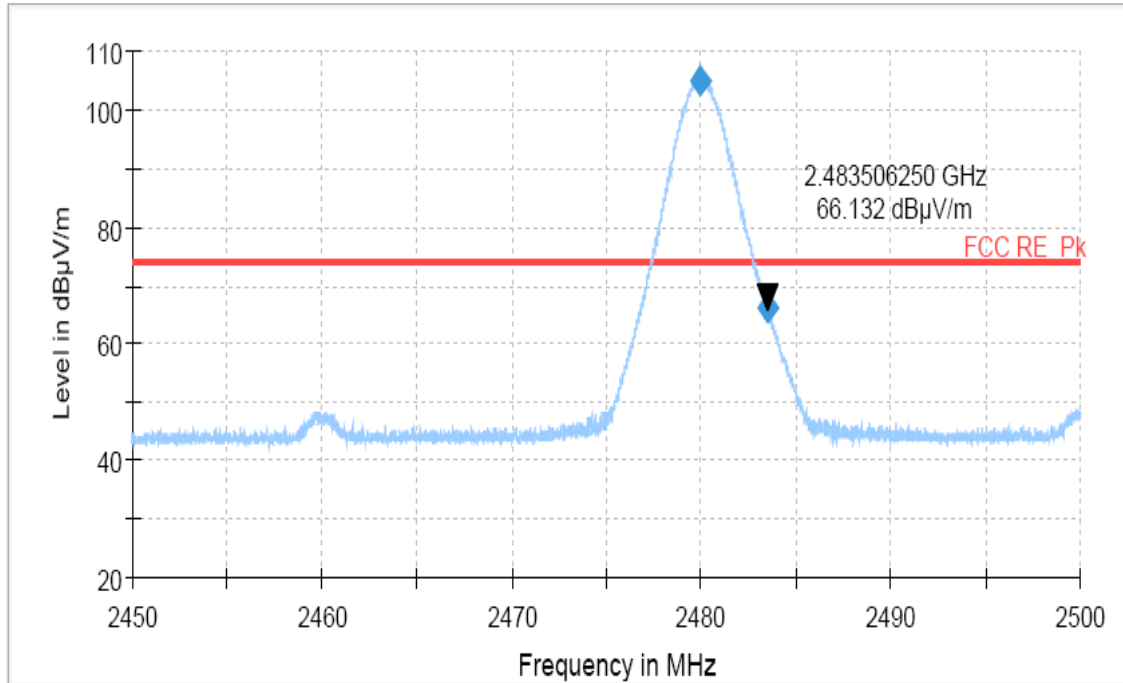


Restricted Band Spurious Emissions, Lowest channel(8DPSK, Average)



PLOT OF TEST DATA

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



Restricted Band Spurious Emissions, Highest channel (8DPSK, Peak, RBW/VBW: 100 kHz)

The result of Step2 on KDB publication No. 913591

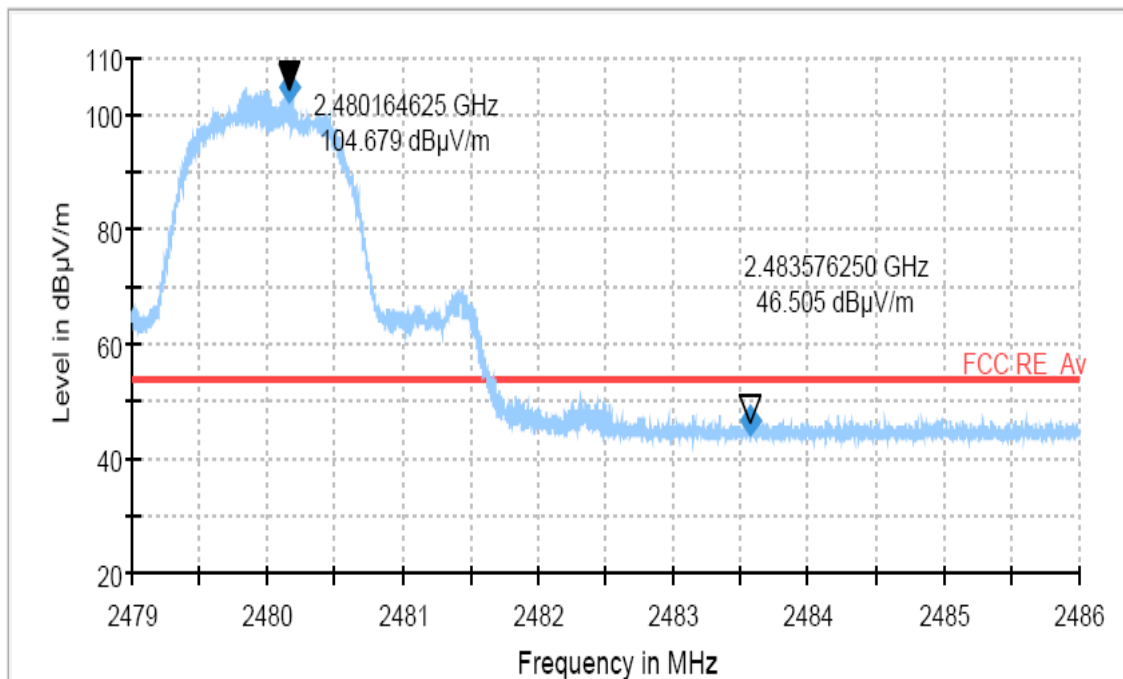


Table 1

Frequency (MHz)	Reading (dBμV)	Pol. H/V	Ant + Cl + Amp (dB)	Result (dBμV/m)
2480.16	106.2	V	-1.5	104.7
2483.57	48	V	-1.5	46.5

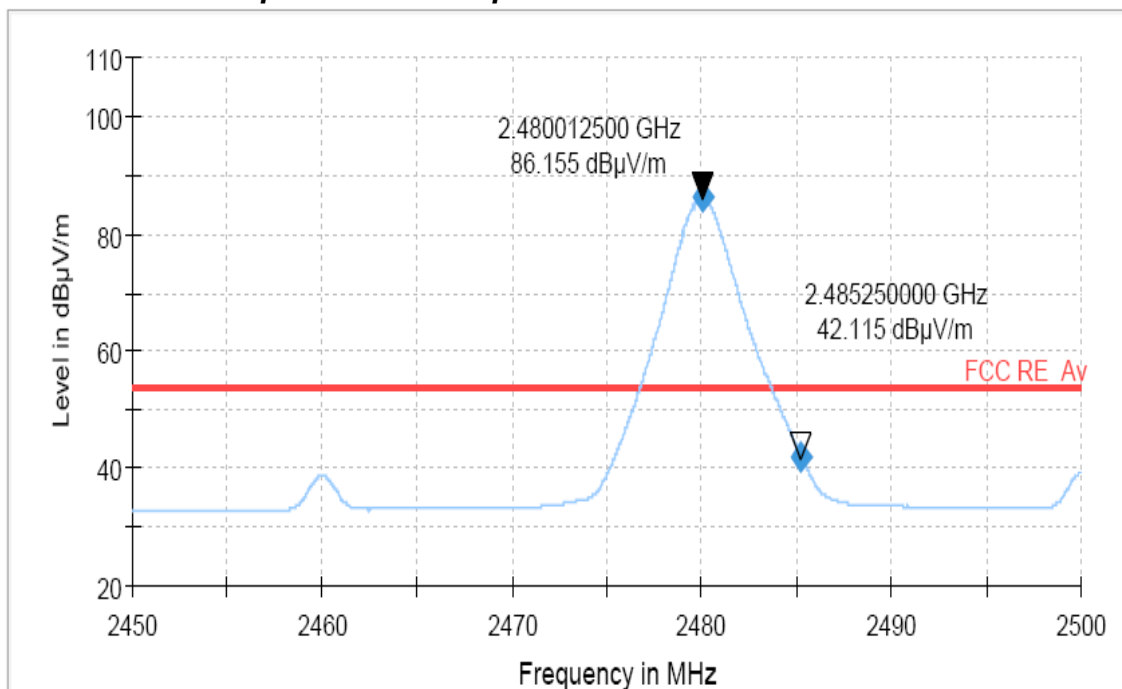
Equation 1

The amount of emission drop factor is,

$$104.7 - 46.5 = \underline{58.2 \text{ dB}}$$

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

The result of Step3 & 4 on KDB publication No. 913591



Equation 2

The band edge emission average level is, (at 2483.5 MHz)

$$86.2 - 58.2 = \underline{28.0 \text{ dBμV/m}}$$

Note)

1. *Pol. H = Horizontal V = Vertical

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

3. The radiated emissions testing were made by rotating through three orthogonal axes.

The worst date was recorded.

4. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

5. Band edge measurement has been performed according to Publication Number: 913591

ANSI Standard C63.4-2003, which is incorporated into the FCC Rules by reference Section 15.31(a)(3), is the procedure the FCC uses for testing intentional radiators. See C63.4-2003 for guidance on the use of a spectrum analyzer.

In making radiated band edge measurements, there can be a problem obtaining meaningful data since a measurement instrument that is tuned to a band edge frequency may also capture some in-band signals when using the resolution bandwidth (RBW) as specified by measurement procedure ANSI C63.4-1992, unless precautions are followed. The following technique may be used for determining band edge compliance in an effort to ensure that the proper precautions are followed.

STEP 1 - Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function for the frequency being measured, as required by C63.4 and FCC Rules. For example, for a device operating in the 902-928 MHz band under Section 15.249, use a 120 kHz RBW with a CISPR Quasi-Peak detector. A peak detector with 100 kHz RBW may also be used. For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector (as required by Section 15.35). Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW). Note: For pulsed emissions, other factors (e.g., pulse desensitization correction factor) must be included in the calculations. Also, note that radiated measurements of the fundamental emission of a transmitter operating under 15.247 are not normally required, but they are necessary in connection with this procedure.

STEP 2 - Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.

STEP 3 - Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band edge compliance as required by Section 15.205.

STEP 4 - The above delta measurement technique may be used for measuring emissions that are up to two standard bandwidths away from the band edge, where a standard bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the delta technique for measuring emissions up to 2 MHz removed from the band edge. Radiated emissions that are removed by more than two standard bandwidths must be measured in the conventional manner.

9. 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	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (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	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.10	normal 1	1.000	0.10	1	0.10
Sine wave voltage	dV_{sw}	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dV_{pa}	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dV_{pr}	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dV_{nf}	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	AF	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	CL	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	AD	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	AH	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	AP	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	AI	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	SI	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	DV	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	$Dbal$	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	$DCross$	± 0.90	rectangular	1.732	0.52	1	0.52
Ⓐ Mismatch	M	+ 0.25	U-Shaped	1.414	0.18	1	0.18
Ⓑ Mismatch	M	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
Ⓒ Mismatch	M	+ 0.98	U-Shaped	1.414	0.69	1	0.69
Ⓓ Mismatch	M	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	RS	0.09	normal 1	1.000	0.09	1	0.09
Remark	Ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) Ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) Ⓒ: Log Periodic Antenna-receiver Mismatch : + ($\geq$ 200 MHz) Ⓓ: Log Periodic Antenna-receiver Mismatch : - ($\geq$ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 ($\geq$ 200 MHz)			
Expanded Uncertainty U	Normal ($k = 2$)			± 5.26 (< 200 MHz) ± 5.48 ($\geq$ 200 MHz)			

10. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 14 2011	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 12 2011	1 year
3	*Amplifier	R & S	SCU01	10029	Apr. 06 2011	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 19 2011	1 year
5	*Amplifier	R & S	SCU-26	10011	Jun. 01 2011	1 year
6	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2011	1 year
7	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
8	Spectrum Analyzer	HP	8593E	3926A04282	Oct. 24 2011	1 year
9	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 19 2011	1 year
10	Spectrum Analyzer	Agilent	N9020A	MY51110087	Apr. 16 2011	1 year
11	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 19 2011	1 year
12	*Loop Antenna	EMCO	6502	8911-2436	Jan. 19 2010	2 year
13	Power Meter	R & S	NRVS	835360/002	Jan. 13 2011	1 year
14	Peak Power Sensor	R & S	NRV-Z32	836019/028	Oct. 25 2011	1 year
15	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 14 2010	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 12 2010	2 year
18	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 14 2010	2 year
19	Logbicon Antenna	SCHWARZBECK	VULB9166	1067	Jul. 14 2010	2 year
20	*LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2011	1 year
21	LISN	R & S	ESH2-Z5	100227	Apr. 06 2011	1 year
22	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
25	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
26	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
27	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
28	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

*) Test equipment used during the test