Nemko Korea Co., Ltd.

159 Osan-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 16885, Republic of Korea
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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: Digital Transmission System (DTS)
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 Mode: RX310, RX320, RX330, RX340, RX350, RX360, RX370, RX380, RX390
- Brand Name: NComputing
- EUT Type: Network virtual desktop
- Classification: Digital Transmission System (DTS)
- Applied Standard: FCC 47 CFR Part 15.247
- Test Procedure(s): ANSI C63.10-2013 and FCC guidance of Guidance 558074 D01 DTS Meas Guidance v03r05
- 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.
159, Osan-ro, Mohyeon-myeon,
Cheoin-gu, Yongin-si, Gyeonggi-do,
16885, Republic of Korea.
Tel)+82-31-330-1700
Fax)+82-31-322-2332

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

Frequency	Mode	Power setting Level
2412 MHz ~ 2462 MHz	802.11b	16
	802.11g	13
	802.11n (20 MHz)	13

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
2.4 GHz	802.11b,g,n (20 MHz)	1	2412
		6	2437
		11	2462

3.1.3 Antenna TX mode information

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	802.11b,g,n (20 MHz)	■ 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

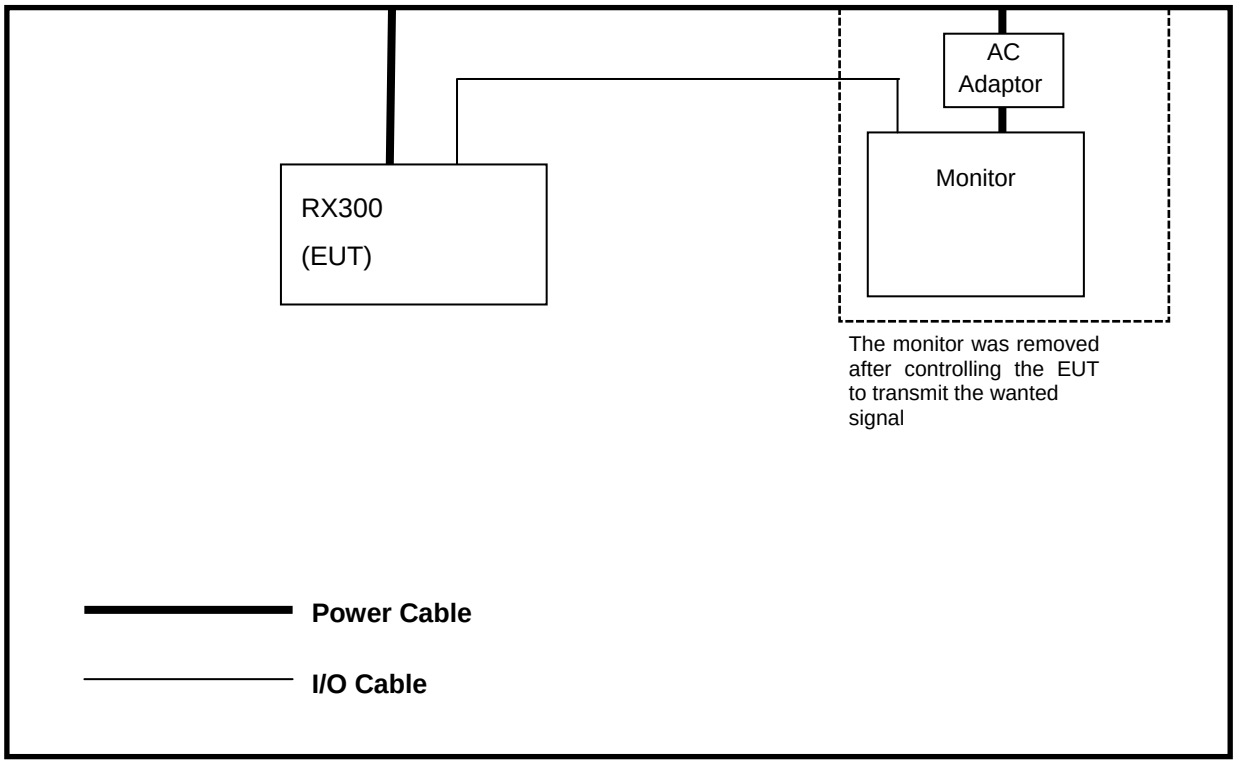
3.1.5 Table of test modes

Test Items	Mode	Data rate (Mbps)	Test Channel (CH)
Conducted Emissions	802.11b	2Mbps	1
Radiated Emissions	802.11b	2Mbps	1
6 dB Bandwidth	802.11b	2Mbps	1/6/11
	802.11g	36Mbps	1/6/11
	802.11n (20 MHz)	MCS4	1/6/11
Maximum conducted Output Power	802.11b	2Mbps	1/6/11
	802.11g	36Mbps	1/6/11
	802.11n (20 MHz)	MCS4	1/6/11
Power Spectral Density	802.11b	2Mbps	1/6/11
	802.11g	36Mbps	1/6/11
	802.11n (20 MHz)	MCS4	1/6/11
Conducted Spurious Emission, Radiated Spurious Emission, Band edge Emission	802.11b	2Mbps	1/6/11
	802.11g	36Mbps	1/6/11
	802.11n (20 MHz)	MCS4	1/6/11

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.**

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	802.11b,g,n (20 MHz): 2412 MHz ~ 2462 MHz
Peak Power Output (Conducted)	802.11g : 20.42 dBm
FCC Classification	Digital Transmission System (DTS)
Channel Number	802.11b,g,n (20 MHz): 11 CH
Modulation	DSSS(BPSK,QPSK,CCK) for 802.11b OFDM(BPSK,QPSK,16QAM,64QAM) for 802.11g/n
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	
6 dB Bandwidth	15.247(a)(2)	Complies	
Peak Output Power	15.247(b)(3)	Complies	
Peak Power Spectral Density	15.247(e)	Complies	
Conducted Spurious Emission	15.247(d)	Complies	
Radiated Spurious Emission	15.247(d)	Complies	
Maximum Permissible Exposure	1.1307(b)	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.

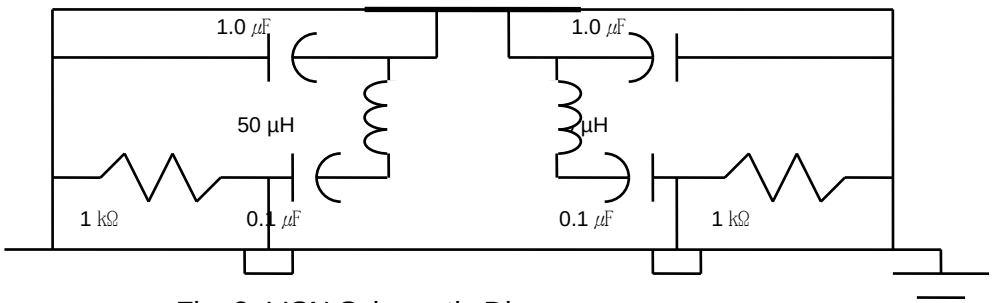


Fig. 2. LISN Schematic Diagram

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.

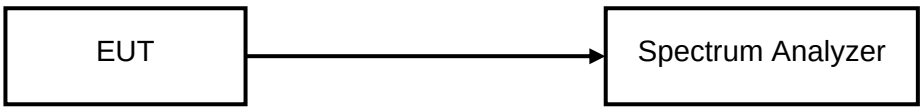
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in KDB “558074 D01 DTS Meas Guidance v03r05” in section 12.2.4 and 12.2.5.3. Peak emission levels 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. Allow max hold to run for at least 50 times (1/duty cycle) traces.

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 6 dB Bandwidth

Test Setup

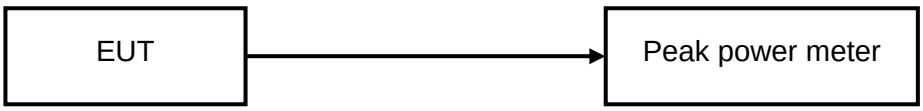


Test Procedure

EUTs 6 dB bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.
RBW = 100 kHz
VBW ≥ 3 x RBW
Detector = Peak
Trace mode = max hold
Sweep = auto couple
The bandwidth measurement function on the spectrum analyzer is used to measure the 6 dB bandwidth.

7.4 Peak Output Power

Test Setup

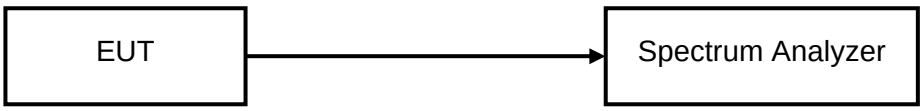


Test Procedure

EUTs Peak Output Power is measured at low, middle, high channels with Peak power meter connected to the antenna terminal while the EUTs operating at its maximum power control level.

7.5 Peak Power Spectral Density

Test Setup



Test Procedure

EUTs Peak Power Spectral Density is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

Center frequency = DTS channel center frequency

Span = 1.5 times the DTS channel bandwidth

RBW ≥ 10 kHz

VBW ≥ 3 x RBW

Detector = peak

Sweep time = auto couple

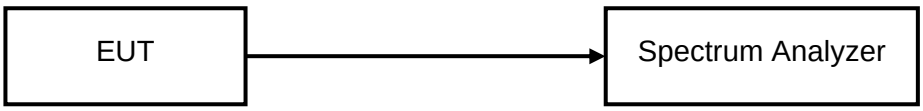
Trace mode = max hold

Allow the trace to stabilize.

The peak search function on the spectrum analyzer is used to determine the maximum amplitude level within the RBW.

7.6 Conducted Spurious Emissions

Test Setup



Test Procedure

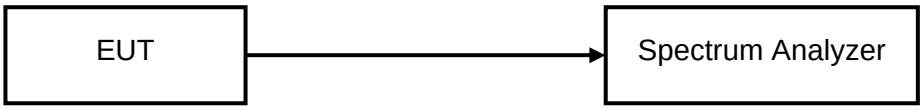
EUTs Conducted spurious emissions are measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

1) Reference Level
Center frequency = DTS channel center frequency
Span ≥ 1.5 times the DTS bandwidth
RBW = 100 kHz
VBW ≥ 3 x RBW
Detector = peak
Sweep time = auto couple
Trace mode = max hold
Allow trace to fully stabilize.
The peak search function on the spectrum analyzer is used to determine the maximum PSD level.

2) Unwanted Emissions
Set the center frequency and span to encompass frequency range to be measured.
RBW = 100 kHz
VBW ≥ 3 x RBW
Detector = peak
Sweep time = auto couple
Trace mode = max hold
Allow trace to fully stabilize.
The peak marker function on the spectrum analyzer is used to determine the maximum amplitude level of all unwanted emissions outside of the authorized frequency band. The unwanted emissions are attenuated by at least the minimum requirements specified.

7.7 Duty Cycle

Test Setup



Test Procedure

EUTs duty cycle are measured at middle channel with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

Center frequency = Center frequency of the transmission
Span = zero
RBW = 8 MHz
VBW = 8 MHz
Detector = peak
Sweep time = at least 3 ms
Sweep mode = Single
The marker function on the spectrum analyzer is used to determine the duty cycle.

The worst results of the duty cycle measurement according to the above test procedure

	Data rate	On time (ms)	On + Off time (ms)	Duty Cycle (%)	Duty Factor (dB)
b mode	2Mbps	4.200	4.244	99	1.01
g mode	36Mbps	0.250	0.292	86	1.17
n(20MHz)mode	MCS4	0.248	0.290	86	1.17

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)

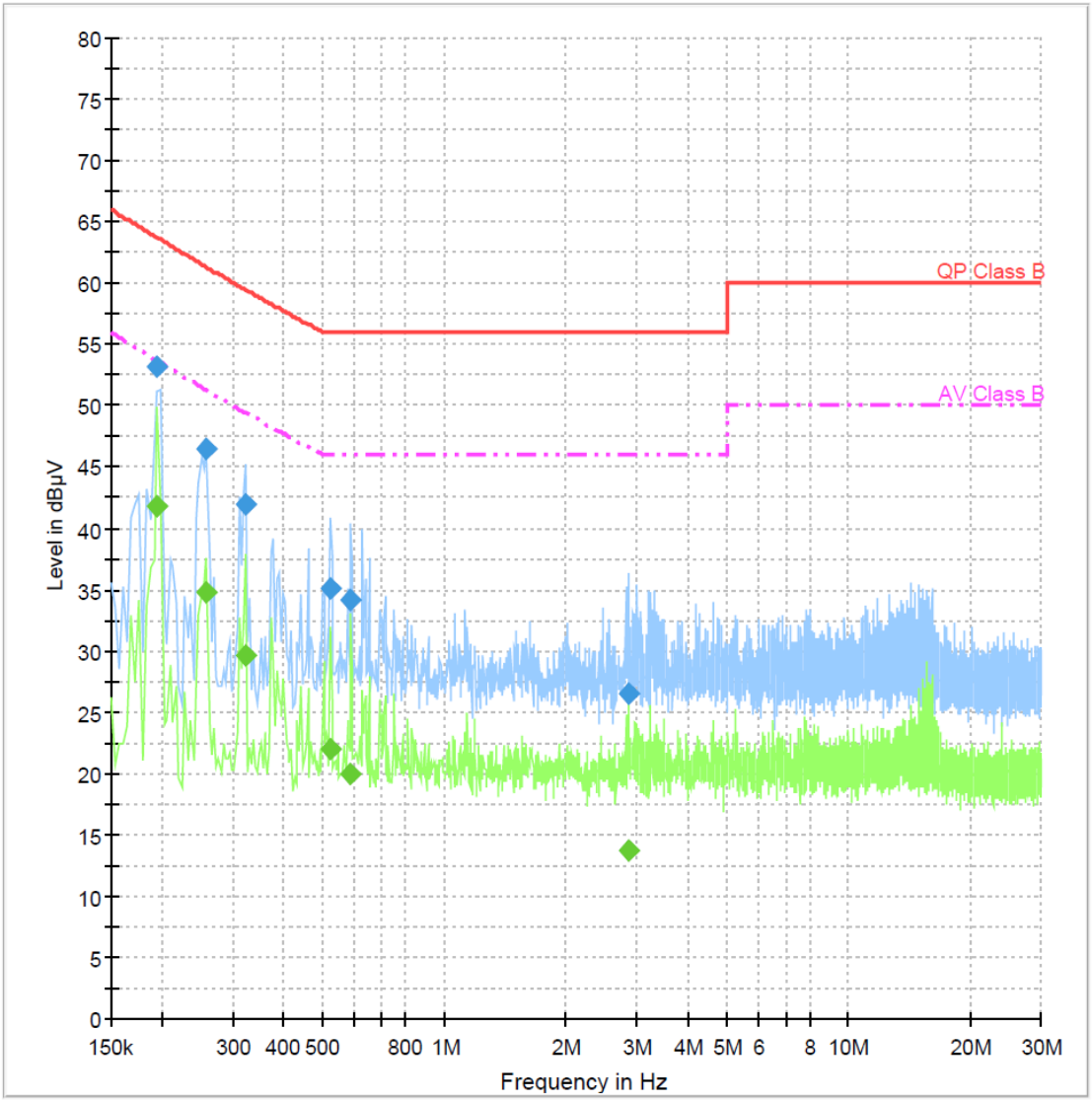
PLOTS OF EMISSIONS

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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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)
52.39	38.58	V	100	248	-22.3	16.3	40.0	23.7
53.90	45.35	V	150	165	-27.5	17.9	40.0	22.2
124.99	50.88	V	100	91	-26.5	24.4	43.5	19.1
131.66	52.51	V	111	54	-27.2	25.3	43.5	18.2
183.30	47.11	H	150	156	-25.9	21.2	43.5	22.3
480.01	48.28	H	191	184	-17.0	31.3	46.0	14.7

Radiated Measurements at 3meters

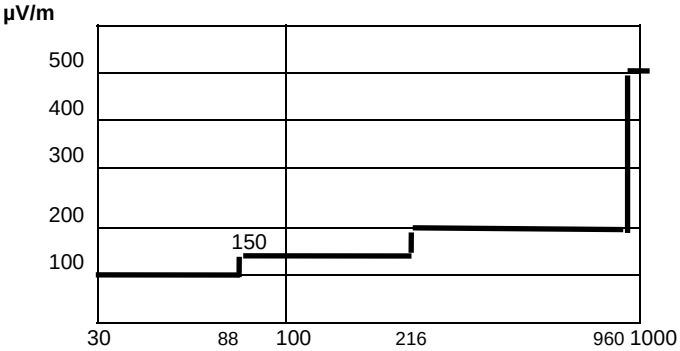


Fig. 3. Limits at 3 meters

Notes:

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

2 The radiated limits are shown on Figure 3.

Above 1 GHz 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 through three orthogonal axes. The worst date was recorded.

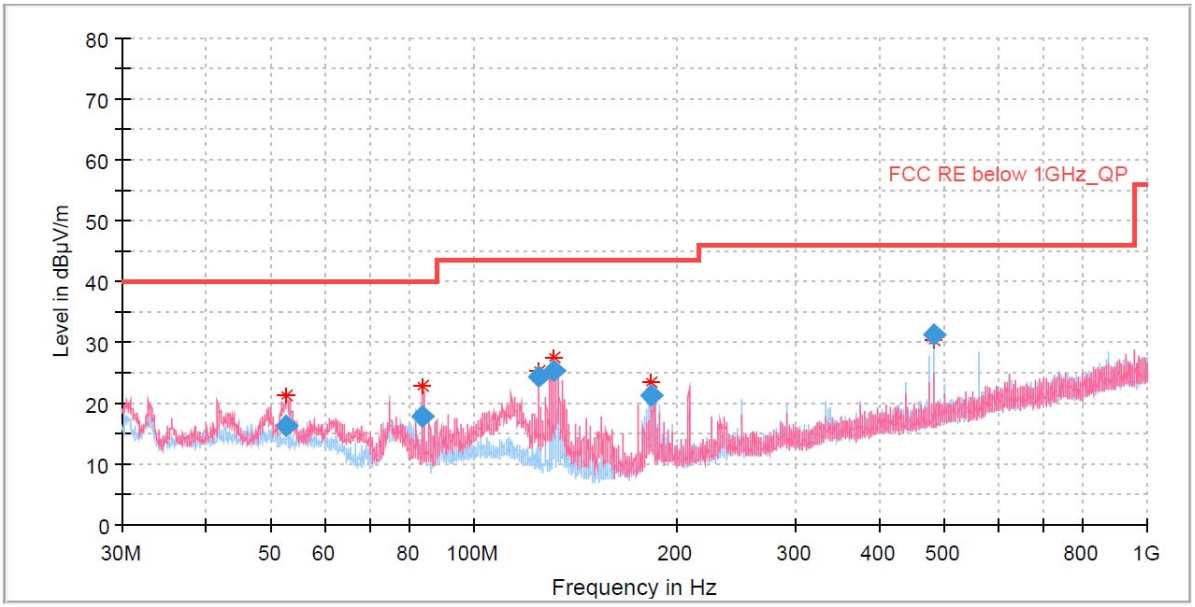
7. b mode on the lowest channel (2412MHz) is the worst case channel.

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

9. The limit is on the FCC §15.209

PLOTS OF EMISSIONS

Worst Case : 2412 MHz(below 1GHz)



8.3 6 dB Modulated Bandwidth

FCC §15.247(a)(2)

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

802.11b mode

Channel	Frequency (MHz)	Result (MHz)	Limit (MHz)
Low	2412	8.76	0.5
Middle	2437	9.39	0.5
High	2462	8.85	0.5

802.11g mode

Channel	Frequency (MHz)	Result (MHz)	Limit (MHz)
Low	2412	15.40	0.5
Middle	2437	15.37	0.5
High	2462	15.11	0.5

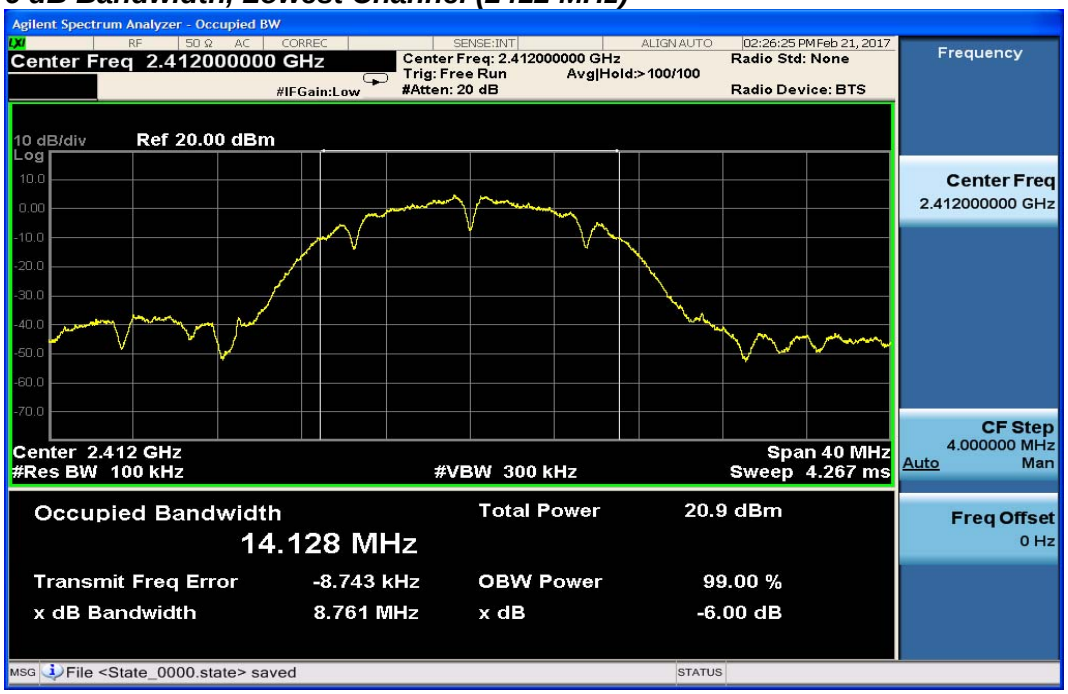
802.11n (20 MHz) mode

Channel	Frequency (MHz)	Result (MHz)	Limit (MHz)
Low	2412	15.10	0.5
Middle	2437	15.11	0.5
High	2462	15.11	0.5

PLOTS OF EMISSIONS

802.11b mode

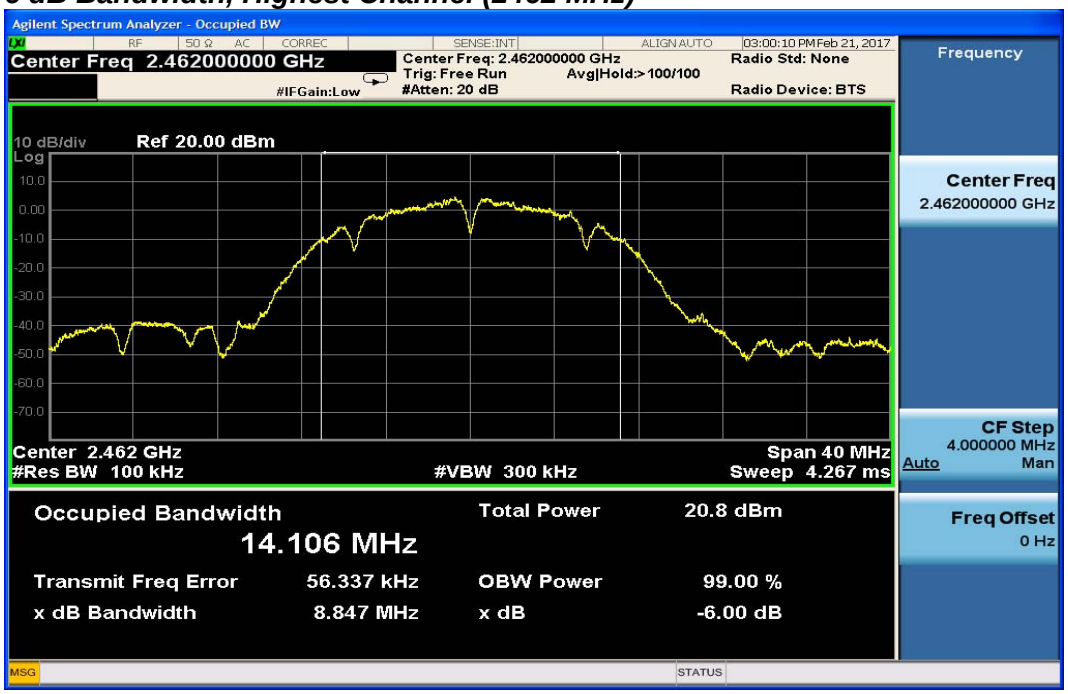
6 dB Bandwidth, Lowest Channel (2412 MHz)



6 dB Bandwidth, Middle Channel (2437 MHz)

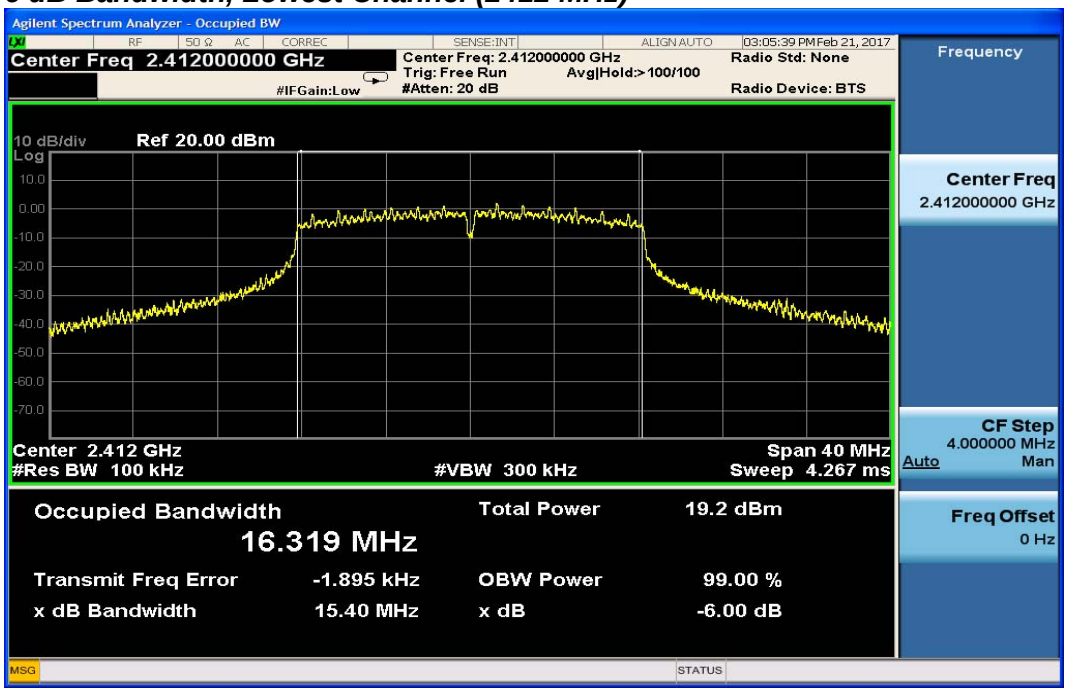
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2462 MHz)



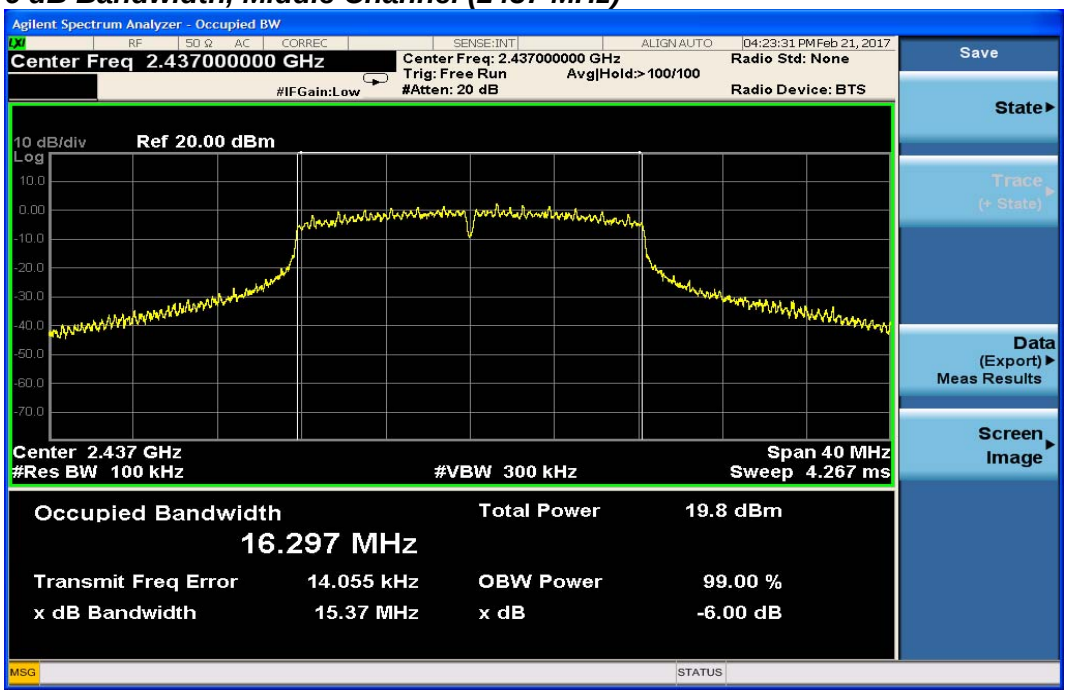
802.11g mode

6 dB Bandwidth, Lowest Channel (2412 MHz)



PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (2437 MHz)

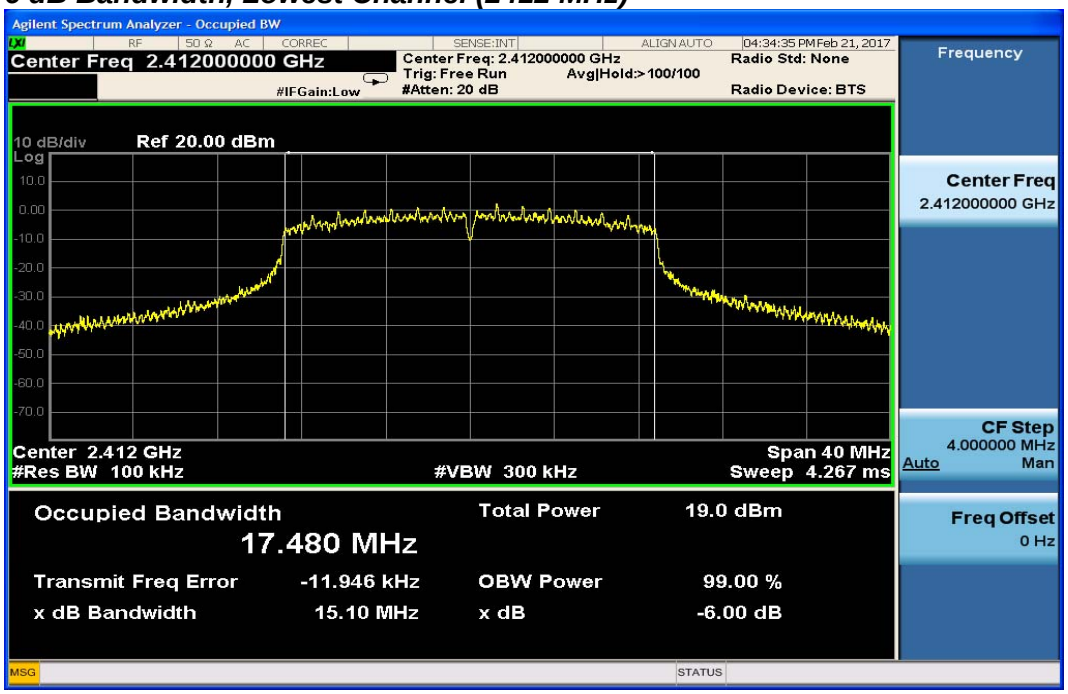


6 dB Bandwidth, Highest Channel (2462 MHz)

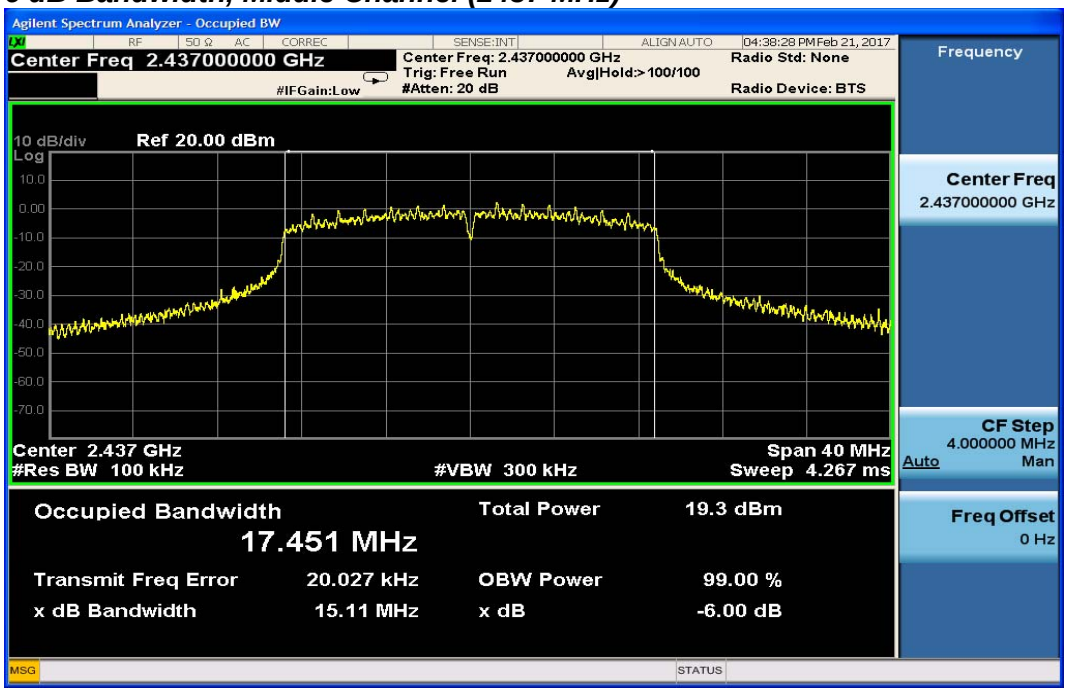
PLOTS OF EMISSIONS

802.11n (20 MHz) mode

6 dB Bandwidth, Lowest Channel (2412 MHz)

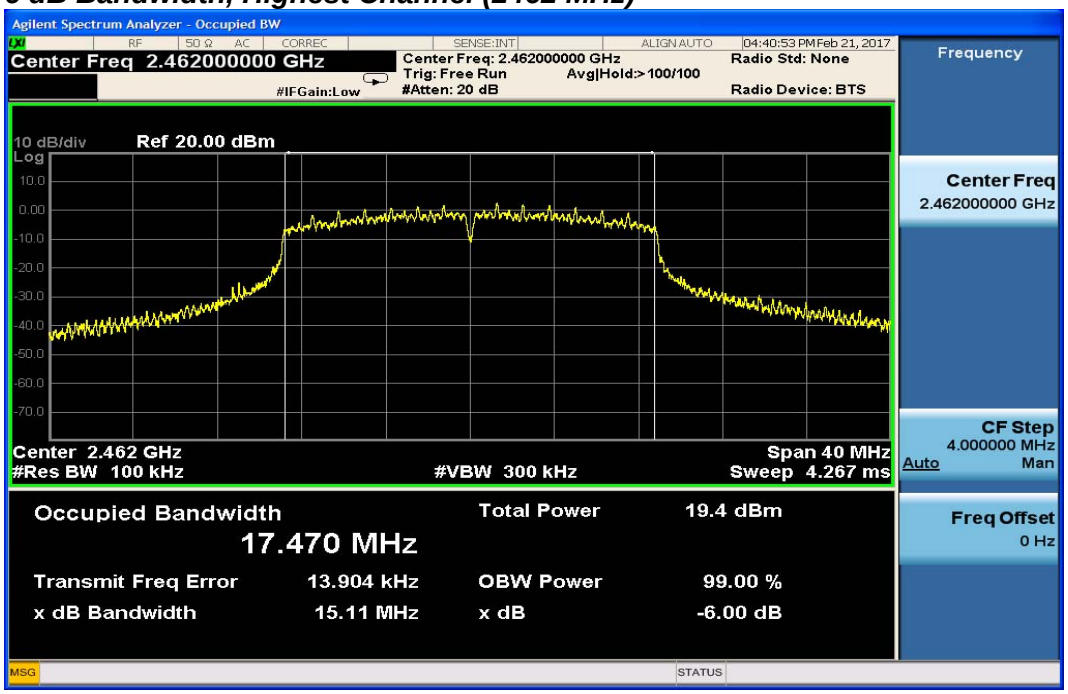


6 dB Bandwidth, Middle Channel (2437 MHz)



PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2462 MHz)



8.4 Peak Output Power

FCC §15.247(b)(3)

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

802.11b mode

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	2412	14.39	30.00	Complies
Middle	2437	14.62	30.00	Complies
Highest	2462	14.90	30.00	Complies

802.11g mode

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	2412	19.56	30.00	Complies
Middle	2437	20.13	30.00	Complies
Highest	2462	20.42	30.00	Complies

802.11n (20MHz) mode

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	2412	19.50	30.00	Complies
Middle	2437	20.01	30.00	Complies
Highest	2462	20.38	30.00	Complies

TEST DATA

Note:

The following formular was used for powermeter offset:

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

8.5 Peak Power Spectral Density

FCC §15.247(e)

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

802.11b mode

Channel	Frequency(MHz)	Result(dBm)	Limit (dBm)
Lowest	2412	4.08	8.0
Middle	2437	4.51	8.0
Highest	2462	4.44	8.0

802.11g mode

Channel	Frequency(MHz)	Result(dBm)	Limit (dBm)
Lowest	2412	1.73	8.0
Middle	2437	1.97	8.0
Highest	2462	2.48	8.0

802.11n (20 MHz) mode

Channel	Frequency(MHz)	Result(dBm)	Limit (dBm)
Lowest	2412	1.72	8.0
Middle	2437	2.20	8.0
Highest	2462	2.47	8.0

TEST DATA

Note:

The following equation was used for spectrum offset:

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

PLOT OF TEST DATA

802.11b mode

Peak Power Spectral Density, Lowest Channel (2412 MHz)

Peak Power Spectral Density, Middle Channel (2437 MHz)

PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (2462 MHz)

802.11g mode

Peak Power Spectral Density, Lowest Channel (2412 MHz)

PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (2437 MHz)

Peak Power Spectral Density, Highest Channel (2462 MHz)

PLOT OF TEST DATA

802.11n (20 MHz) mode

Peak Power Spectral Density, Lowest Channel (2412 MHz)

Peak Power Spectral Density, Middle Channel (2437 MHz)

PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (2462 MHz)

8.6 Conducted Spurious Emissions

FCC §15.247(d)

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

802.11b mode

Channel	Frequency (MHz)	Reference Level (dBm)	Conducted Spurious Emissions (dBc)	Limit (dBc)
Low	2412	4.08	More than 20 dBc	20
Middle	2437	4.51	More than 20 dBc	20
High	2462	4.44	More than 20 dBc	20

802.11g mode

Channel	Frequency (MHz)	Reference Level (dBm)	Conducted Spurious Emissions (dBc)	Limit (dBc)
Low	2412	1.73	More than 20 dBc	20
Middle	2437	1.97	More than 20 dBc	20
High	2462	2.48	More than 20 dBc	20

802.11n (20 MHz) mode

Channel	Frequency (MHz)	Reference Level (dBm)	Conducted Spurious Emissions (dBc)	Limit (dBc)
Low	2412	1.72	More than 20 dBc	20
Middle	2437	2.20	More than 20 dBc	20
High	2462	2.47	More than 20 dBc	20

TEST DATA

Notes:

1. *The cable and attenuator loss from 30 MHz to 25 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.*
2. *The display line shown in the following plots indicates the limit at 30 dB below the fundamental emission level measured in a 100 kHz bandwidth.*

PLOT OF TEST DATA

Reference level

802.11b mode

Reference Power Spectral Density, Lowest Channel (2412 MHz)

Reference Power Spectral Density, Middle Channel (2437 MHz)

PLOT OF TEST DATA

Reference Power Spectral Density, Highest Channel (2462 MHz)

802.11g mode

Reference Power Spectral Density, Lowest Channel (2412 MHz)

PLOT OF TEST DATA

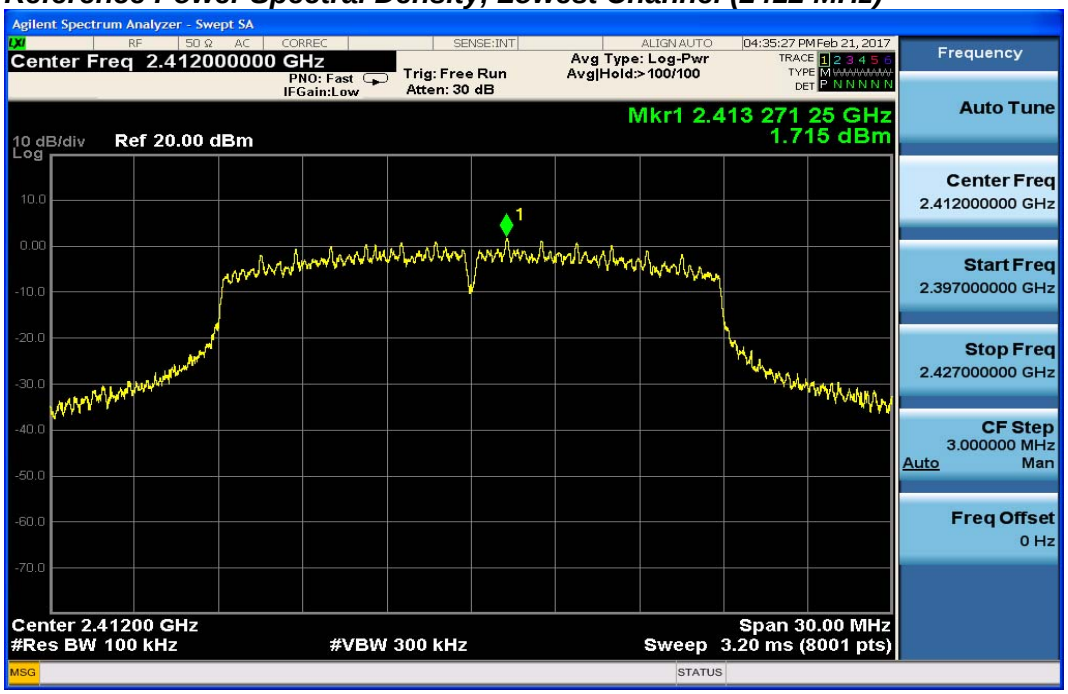
Reference Power Spectral Density, Middle Channel (2437 MHz)

Reference Power Spectral Density, Highest Channel (2462 MHz)

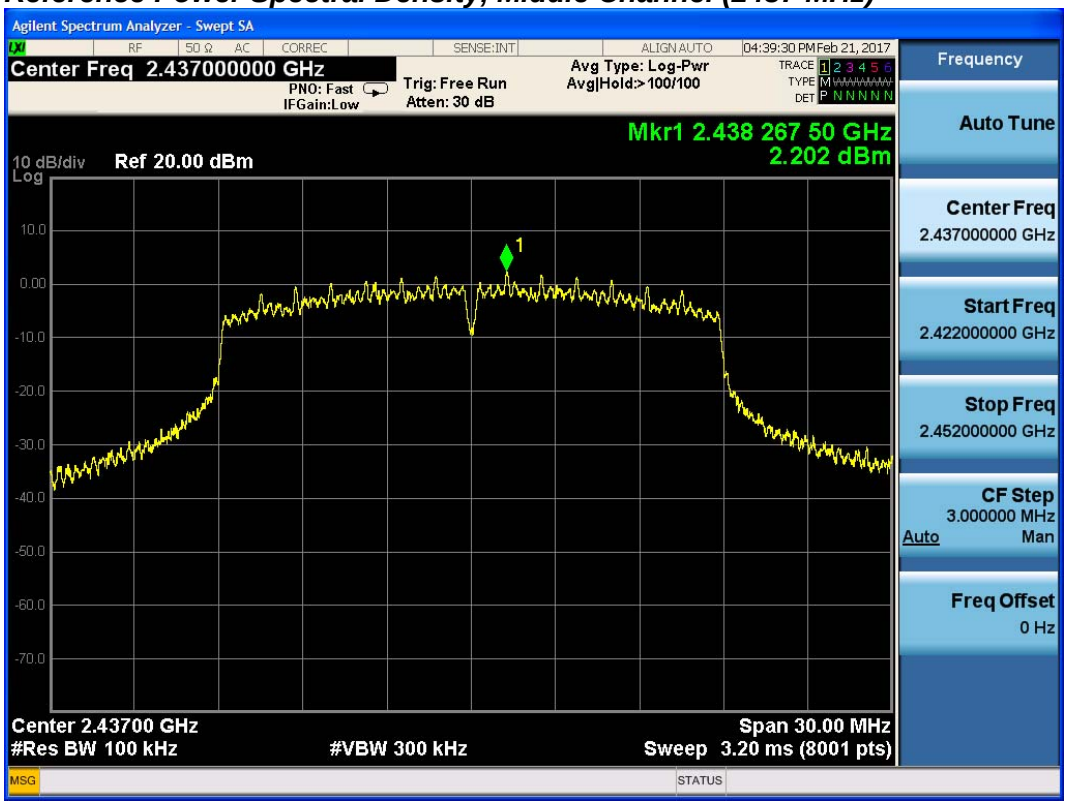
PLOT OF TEST DATA

802.11n (20 MHz) mode

Reference Power Spectral Density, Lowest Channel (2412 MHz)

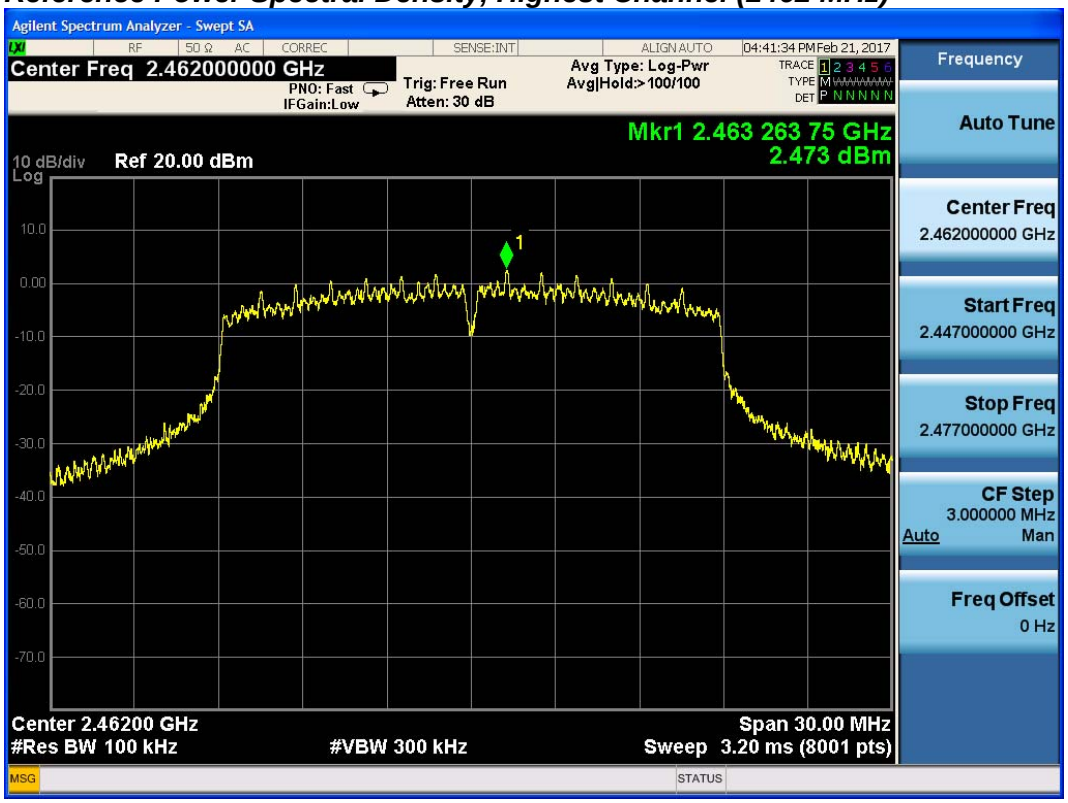


Reference Power Spectral Density, Middle Channel (2437 MHz)



PLOT OF TEST DATA

Reference Power Spectral Density, Highest Channel (2462 MHz)

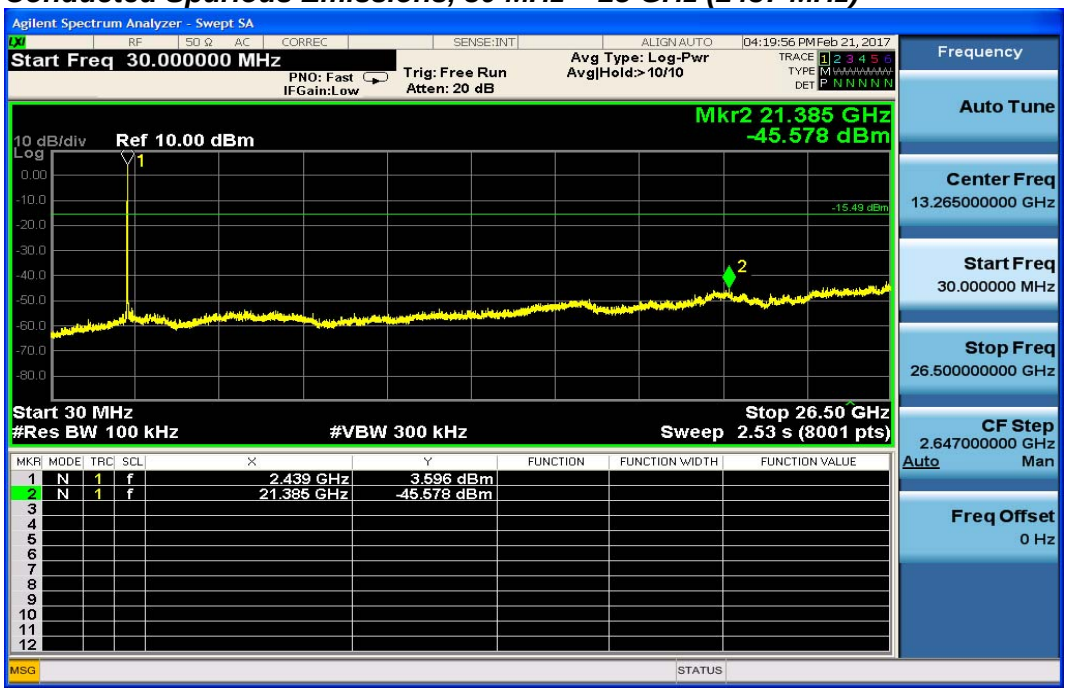


PLOT OF TEST DATA

802.11b mode

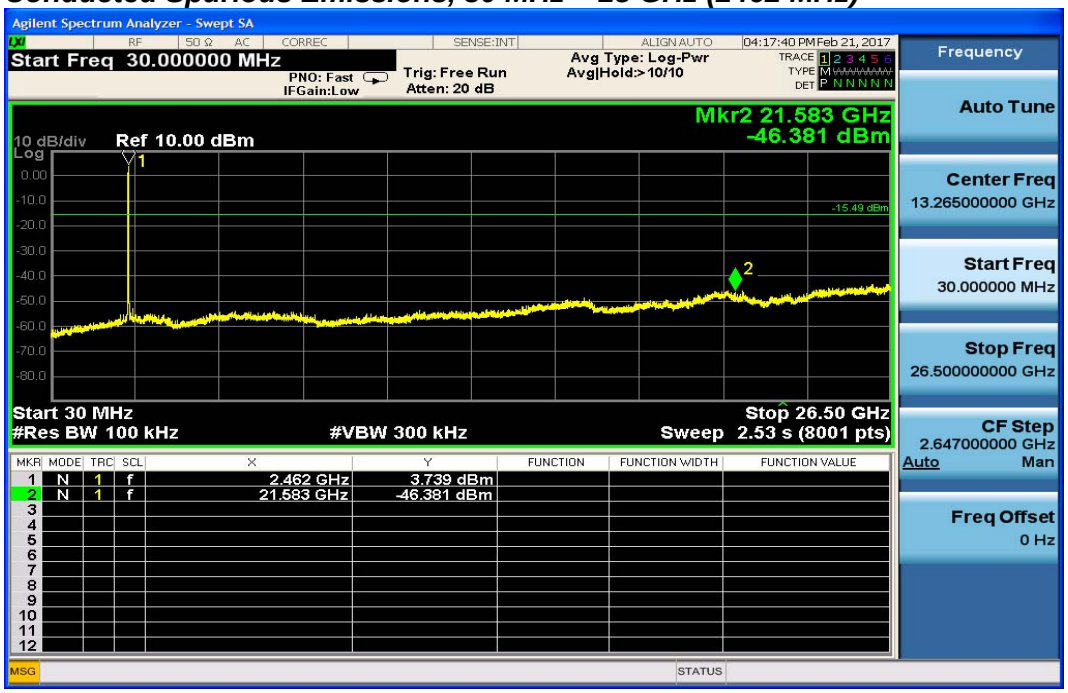
Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2412 MHz)

Conducted Spurious Emissions, 30 MHz ~ 25 GHz (2437 MHz)



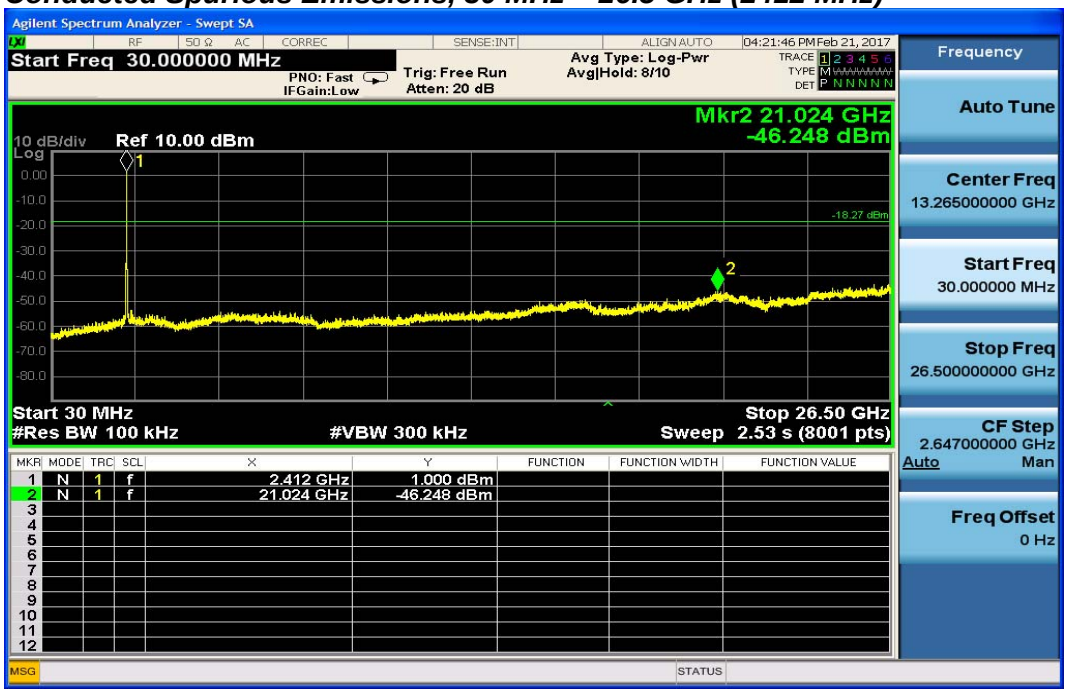
PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 25 GHz (2462 MHz)



802.11g mode

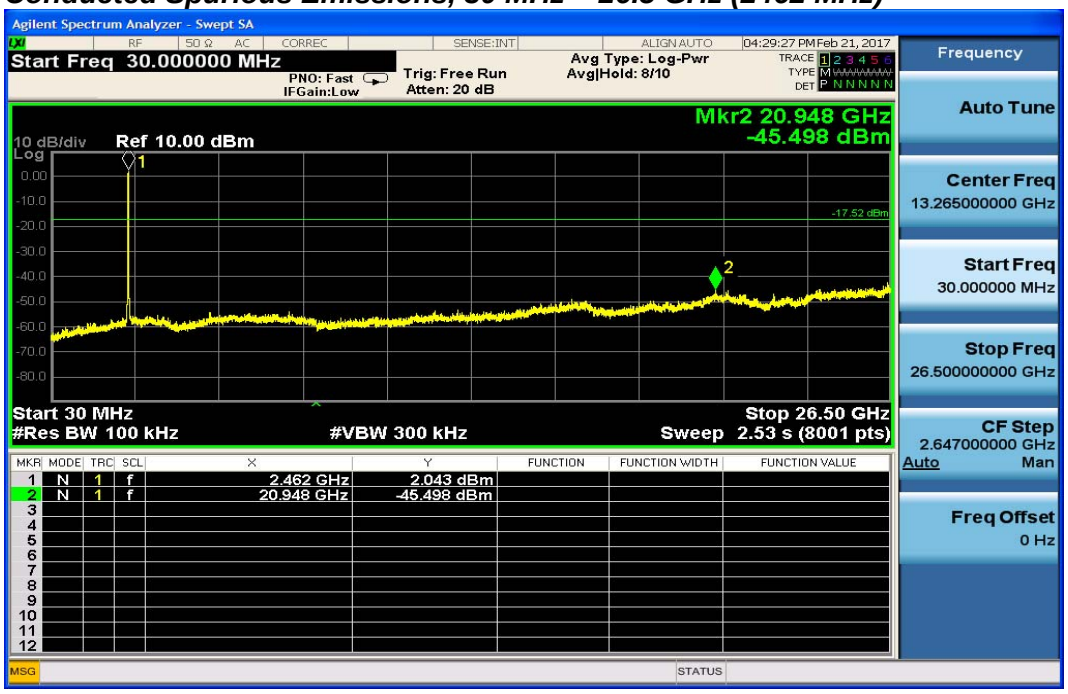
Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2412 MHz)



PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2437 MHz)

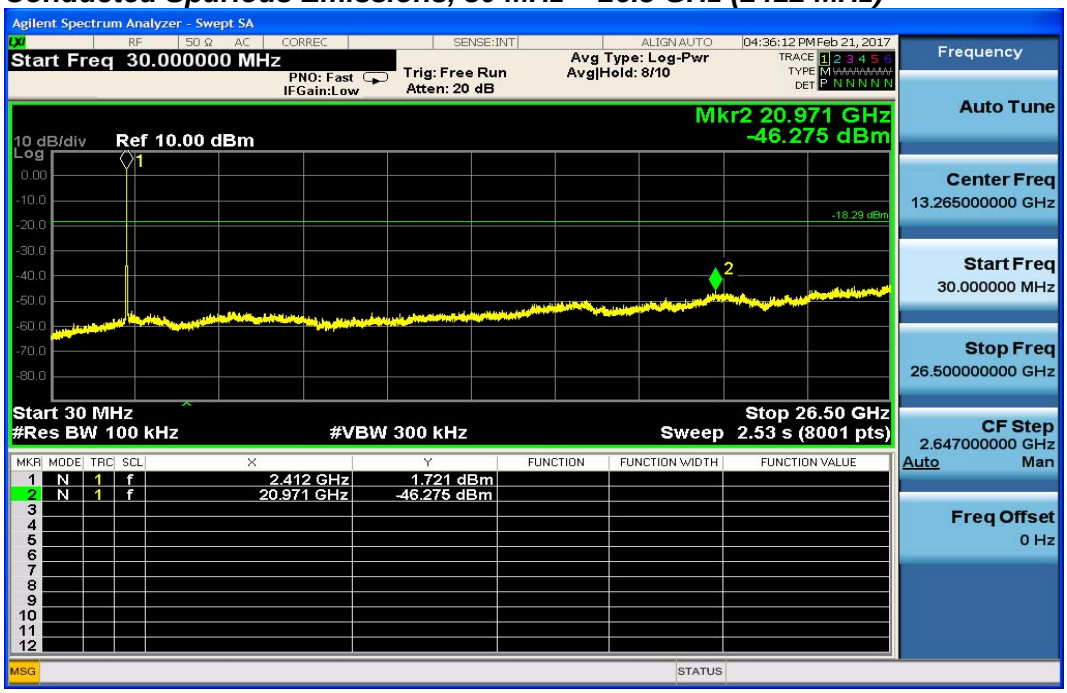
Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2462 MHz)



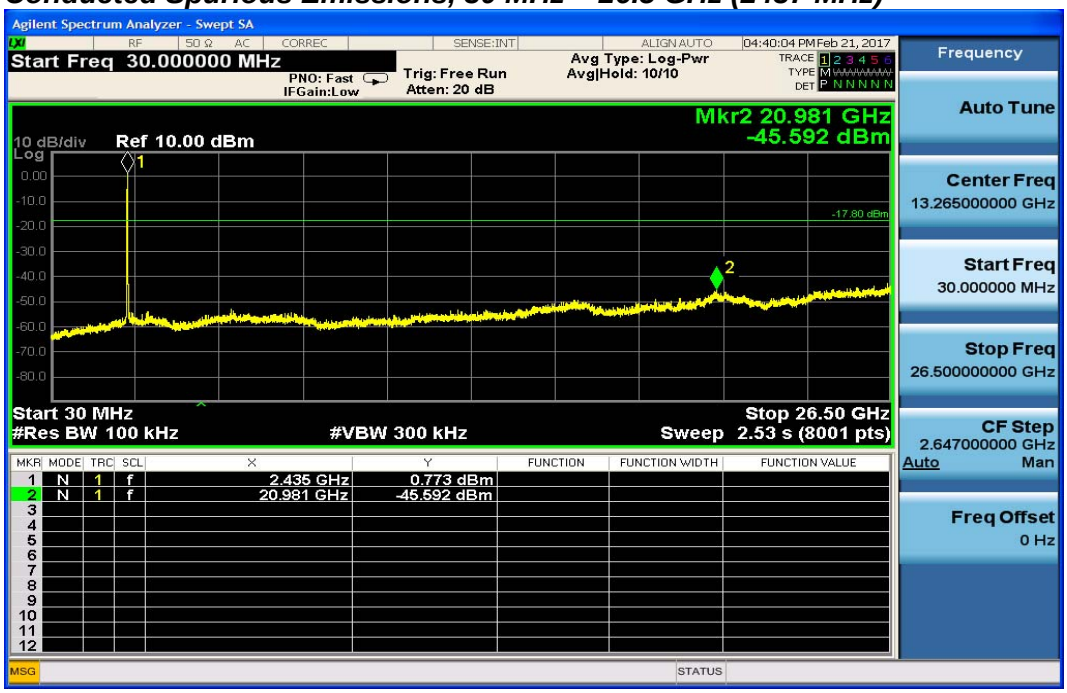
PLOT OF TEST DATA

802.11n mode

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2412 MHz)

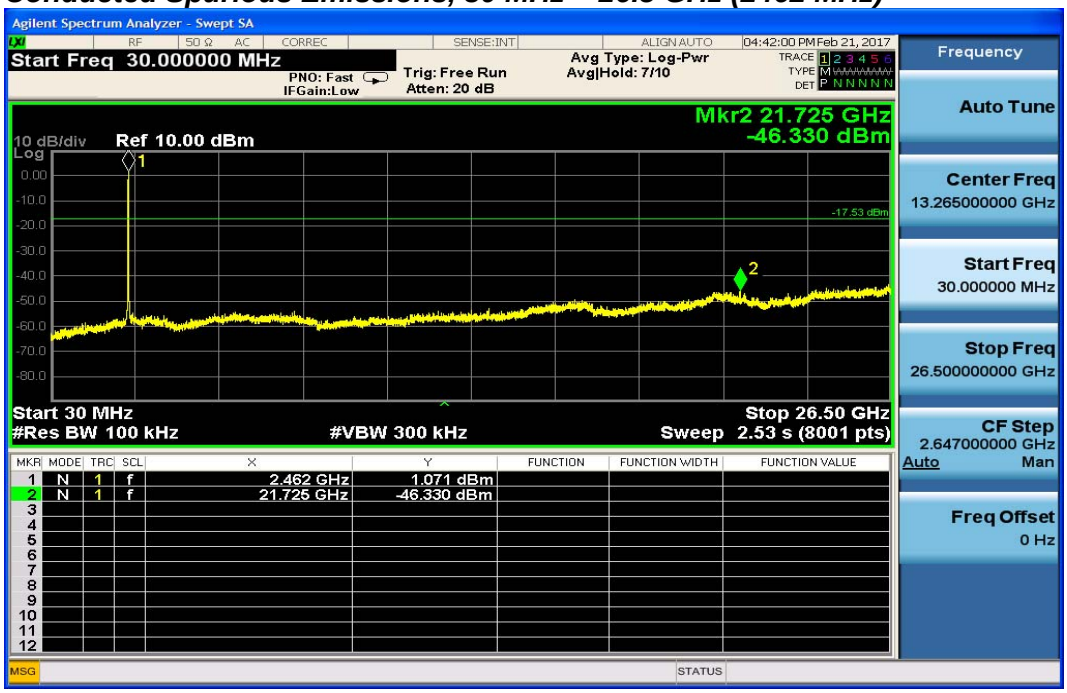


Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2437 MHz)



PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2462 MHz)



PLOT OF TEST DATA

802.11b mode

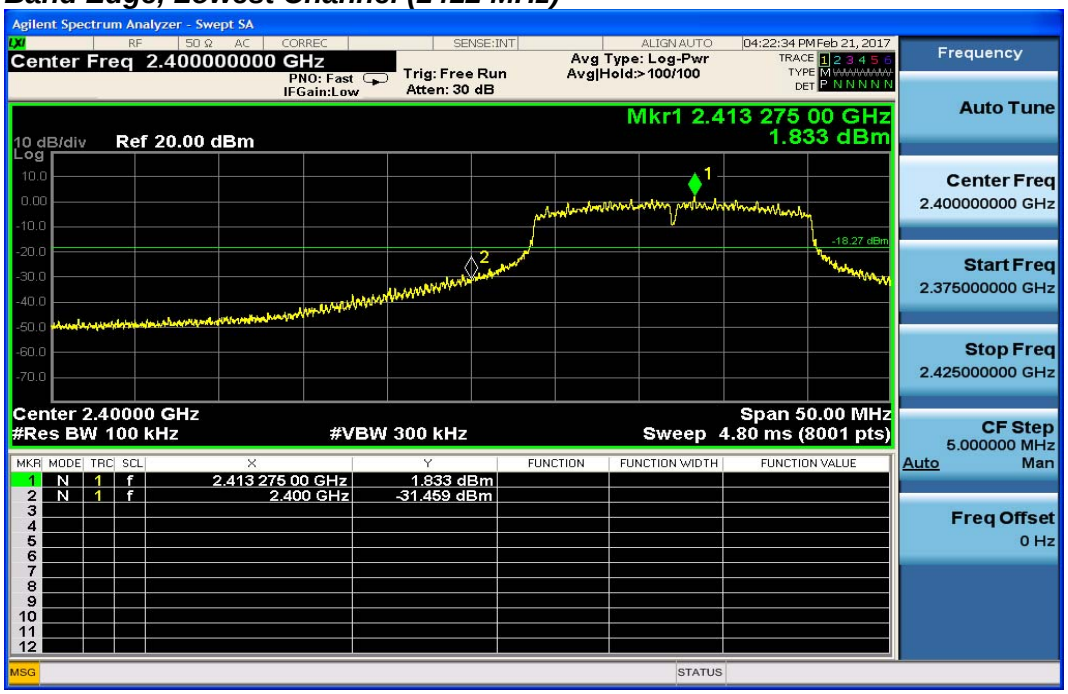
Band Edge, Lowest Channel (2412 MHz)

Band Edge, Highest Channel(2462 MHz)

PLOT OF TEST DATA

802.11g mode

Band Edge, Lowest Channel (2412 MHz)

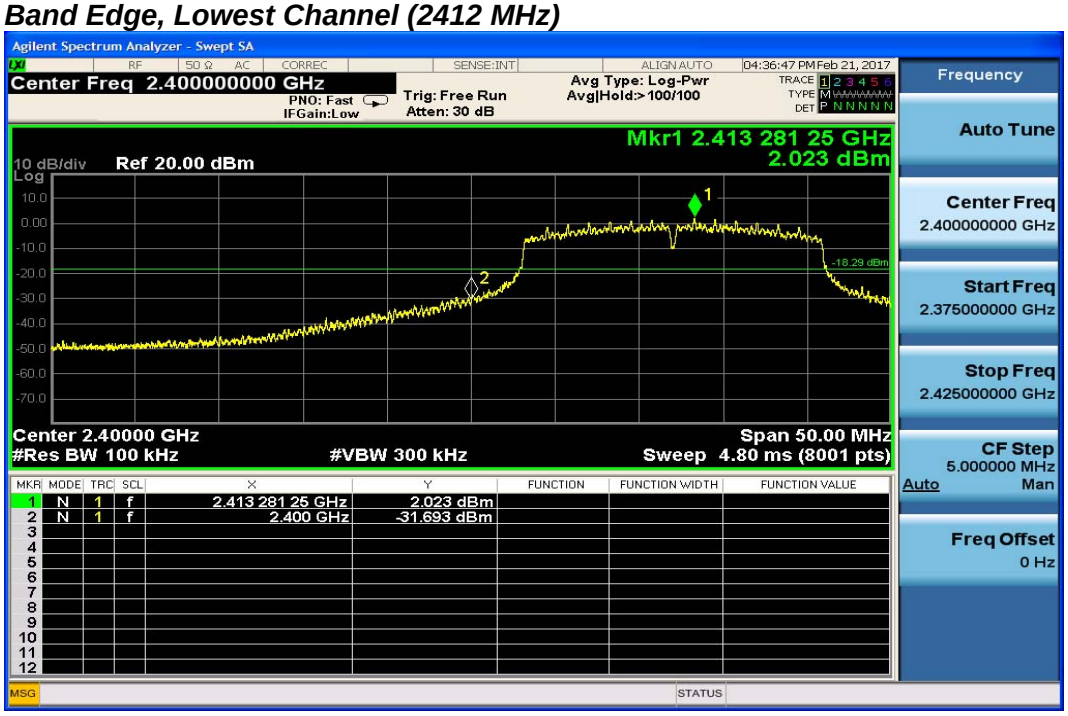


Band Edge, Highest Channel(2462 MHz)

PLOT OF TEST DATA

802.11n (20 MHz) mode

Band Edge, Lowest Channel (2412 MHz)



Band Edge, Highest Channel(2462 MHz)

TEST DATA

8.7 Radiated Spurious Emissions

FCC §15.247(d)

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

802.11b mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1185.00	54.7	V	peak	-9.8	N/A	44.9	74.0
1735.50	54.6	V	peak	-11.1	N/A	43.5	74.0

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1439.50	53.7	H	peak	-10.9	N/A	42.8	74.0

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1209.00	51.6	V	peak	-10.2	N/A	41.4	74.0
1439.50	53.8	H	peak	-10.9	N/A	42.9	74.0

802.11g mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1439.50	53.4	H	peak	-10.9	N/A	42.5	74.0

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1209.50	49.5	H	peak	-10.2	N/A	39.3	74.0
1439.50	52.3	H	peak	-10.9	N/A	41.5	74.0

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1439.50	52.1	H	peak	-10.9	N/A	41.2	74.0

TEST DATA

802.11n (20 MHz) mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1439.50	51.8	H	peak	-10.9	N/A	40.9	74.0

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1209.50	49.4	H	peak	-10.2	N/A	39.2	74.0
1440.00	52.8	H	peak	-10.9	N/A	41.9	74.0

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)
1209.50	49.3	V	peak	-10.2	N/A	39.1	74.0
1440.00	51.8	H	peak	-10.9	N/A	41.0	74.0

TEST DATA

Note(s):

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

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

3. Average emissions on lowest, middle channels were not performed since peak results satisfy the average limit.

4. 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.

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

6. 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 2^{nd} harmonic for this device.

8. b mode, lowest channel was the worst case of b/g/n modes.

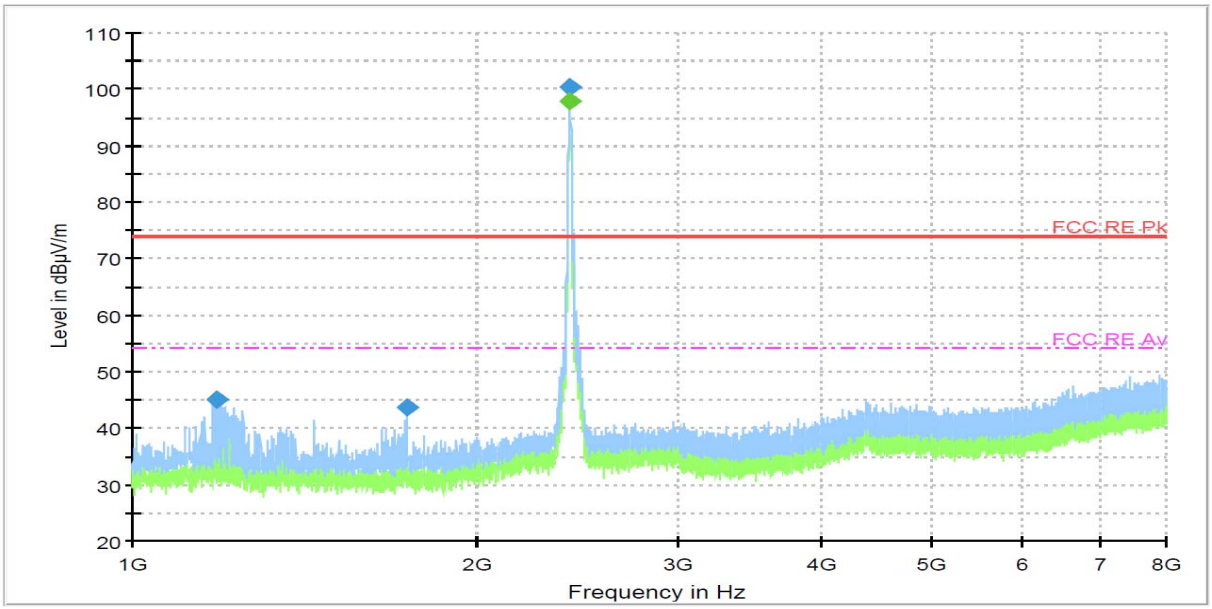
9. At frequencies above 1 GHz, EUT was placed at a height of 1.5m above the floor on a support according to ANSI 63.10-2013.

PLOTS OF EMISSIONS

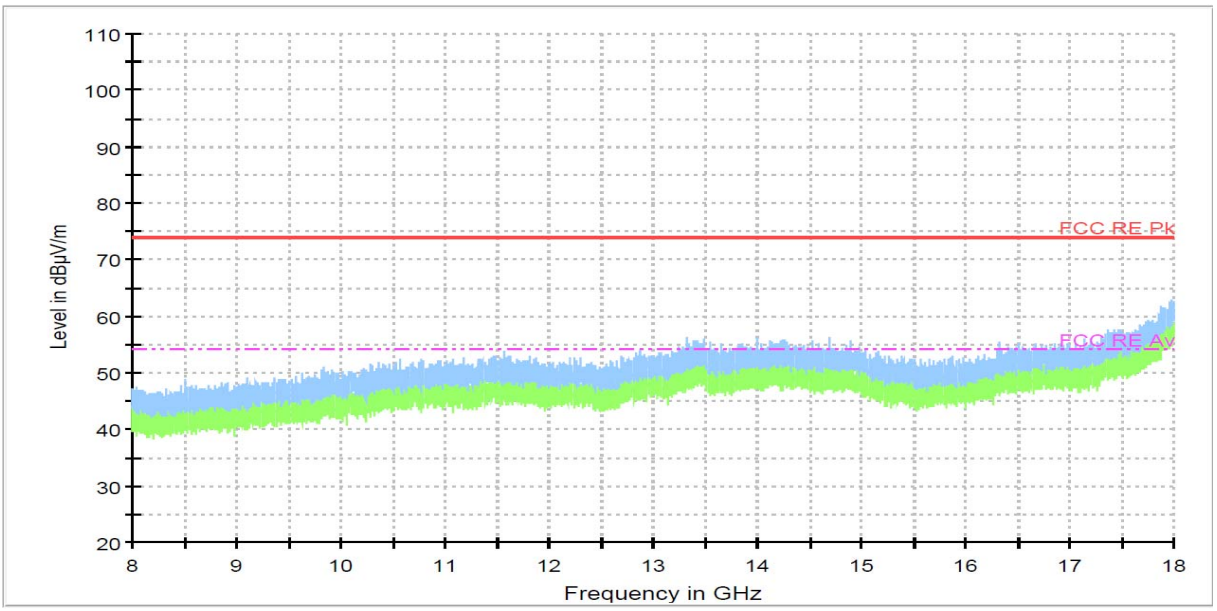
Worst Case

802.11b mode

Lowest channel : 1 GHz to 8 GHz

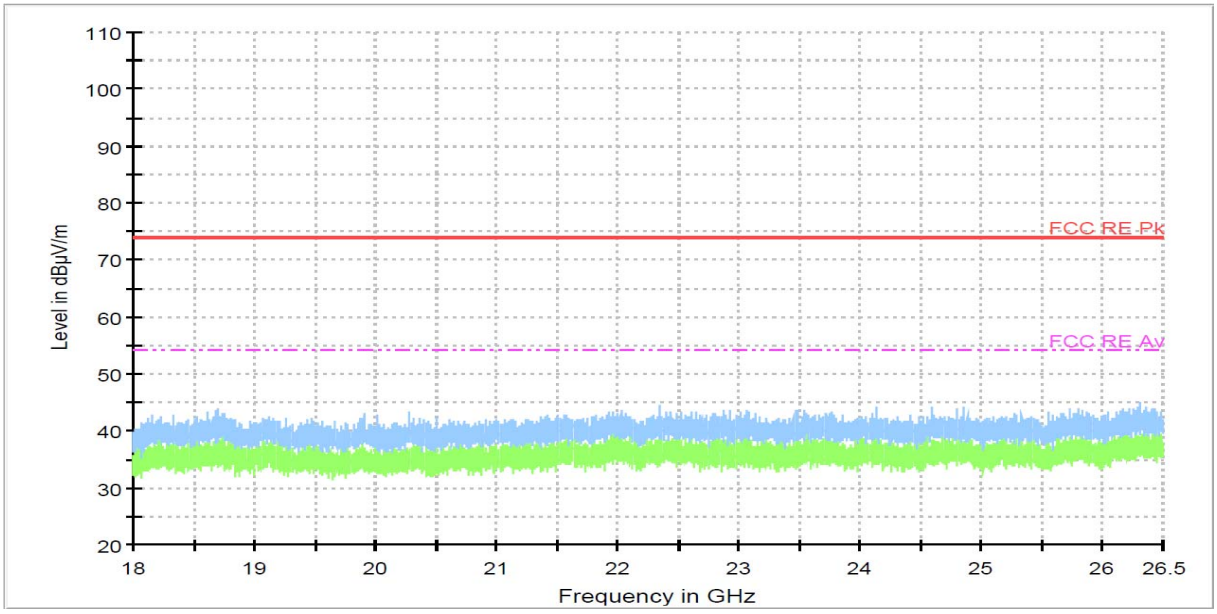


Lowest channel : 8 GHz to 18 GHz



PLOTS OF EMISSIONS

Lowest channel : 18 GHz to 26 GHz



8.8 Radiated Band Edge

FCC §15.247(d)

Test Mode : Set to Lowest channel and Highest channel

802.11b mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2388.25	64.7	H	peak	-7.3	N/A	57.4	74.0
2381.83	59.2	H	average	-7.3	N/A	51.9	54.0

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2487.60	60.3	H	peak	-7.3	N/A	53.0	74.0
2487.63	52.1	H	average	-7.3	N/A	44.8	54.0

802.11g mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2387.60	74.8	H	peak	-7.3	N/A	67.5	74.0
2390.00	59.3	H	average	-7.3	N/A	52.0	54.0

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2483.50	64.9	H	peak	-7.3	N/A	57.6	74.0
2483.50	52.3	H	average	-7.3	N/A	45.3	54.0

802.11n (20 MHz) mode

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2388.58	76.3	H	peak	-7.3	N/A	69.0	74.0
2390.00	57.7	H	average	-7.3	N/A	50.7	54.0

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Duty Factor (dB)***	Result (dBµV/m)	Limit (dBµV/m)
2483.50	64.3	H	peak	-7.3	N/A	57.0	74.0
2483.50	53.5	H	average	-7.3	N/A	46.5	54.0

Note(s):

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

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

*3. *** Duty Factor is not required as specified in clause "12.2.5.3 Average Power Measurement Procedures" at "KDB 558074 D01 DTS Meas Guidance v03r05"*

4. 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.

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

6. For average measurements, "12.2.5.3 Average Power Measurement Procedures" at "558074 D01 DTS Meas Guidance v03r05" was used.

Average emissions were measured using RBW = 1 MHz, VBW = 3 kHz, Detector = Peak

7. At frequencies above 1 GHz, EUT was placed at a height of 1.5m above the floor on a support according to ANSI 63.10-2013.

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	*Wideband Power Sensor	R & S	NRP-Z81	100634	Jul. 15 2016	1 year
16	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 22 2016	2 year
17	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Sep. 30 2016	2 year
18	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 30 2015	2 year
19	Horn Antenna	Q-par Angus	QSH22K20	8180	Apr. 30 2015	2 year
20	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 11 2016	2 year
21	*Two-Line V-Network	R & S	ENV216	101156	Apr. 04 2016	1 year
22	*Controller	INNCO	CO3000	CO3000/937/38330516/L	N/A	N/A
23	*Turn Table	INNCO	DT3000-3T	N/A	N/A	N/A
24	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
25	*Open Switch And Control Unit	R & S	OSP-120	100015	N/A	N/A
26	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
27	*Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
28	*Turn Table	INNCO	DS1200S	N/A	N/A	N/A
29	*Antenna Mast	INNCO	MA4000	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
32	*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	**RS**	0.34	normal 1	1.00	0.34	1	0.34
Receiver reading	**Ri**	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	**dVsw**	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	**dVpa**	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	**dVpr**	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	**dVnf**	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	**AF**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	**CL**	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	**AD**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	**AH**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	**AP**	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	**Ai**	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	**Si**	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	**DV**	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	**Dbal**	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	**DCross**	± 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	**Vd**	0.33	normal 1	1.00	0.33	1	0.11
Remark							
Combined Standard Uncertainty	Normal						
Expended Uncertainty U	Normal (k = 2)						