Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPUBLIC OF
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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea.
(Post code : 443-742)
Attn. : Mr. Jaywoo. Lee

Dates of Issue : November 15, 2012
Test Report No. : NK-12-R-170-2
Test Site : Nemko Korea Co., Ltd.

FCC ID	**A3LWISP50S**
IC	**649E-WISP50S**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu,** **Suwon-si, Gyeonggi-do, Korea, 443-742.** **Mr. Jaywoo. Lee** **Telephone No. : +82-31-277-2569**

Applied Standard:	FCC 47 CFR Part 15 Subpart E and IC RSS-210
Classification:	Unlicensed National Information Infrastructure (UNII)
EUT Type:	Audio transceiver 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.

Nov. 15, 2012
Tested By : Jin-ha Ko
Engineer

Nov 15. 2012
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 and IC RSS-210.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Jaywoo. Lee
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 443-742

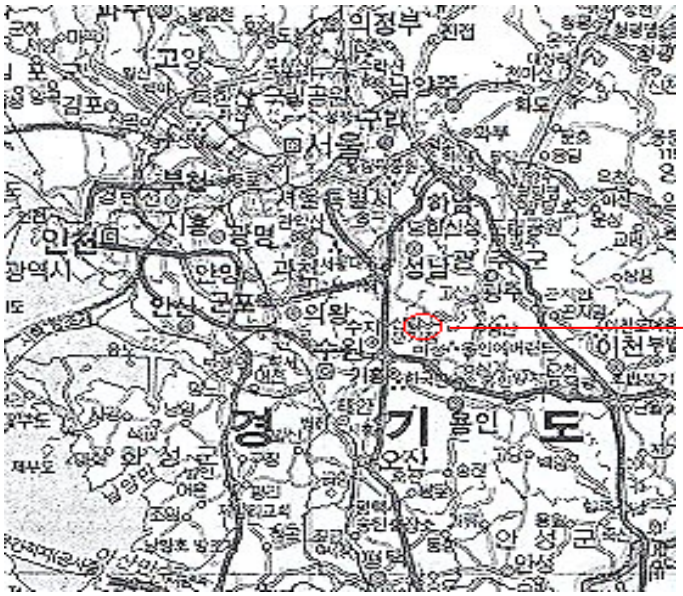
- FCC ID: A3LWISP50S
- IC : 649E-WISP50S
- Model: WISP50S
- Brand Name: SAMSUNG
- EUT Type: Audio transceiver module
- Classification: Unlicensed National Information Infrastructure (UNII)
- Applied Standard: FCC 47 CFR Part 15 subpart E 15.407 and IC RSS-210 Issue 8 Annex 9
- Test Procedure(s): ANSI C63.4-2003, ANSI C63.10 and FCC guidance of 789033 D01 General UNII Test Procedures v01r02 dated September 26, 2012 entitled “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E”
- Dates of Test: October 10, 2012 ~ November 6, 2012
- 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 C63.4-2003), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**
FCC ID : A3LWISP50S and **IC : 649E-WISP50S**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address is 155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPULIC OF.
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 §2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.
EMC Lab.
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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
FC	FCC part 15/18 Filing site	Registration No. 97992
	CAB Accreditation for DOC	Designation No. KR0026
KOLAS	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E
VCCI	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
IECEE CB SCHEME	EMC CBTL	-
방송통신위원회	KCC(RRL)Designated Lab.	Registration No. KR0026
	SASO registered Lab and Certification Body	Registration No. 2008-15

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT was controlled and monitored by testing Jig which manufacturer supported.
The EUT have two antennas which are not working simultaneously. All tests were performed at two antenna paths then the worst case was recorded.

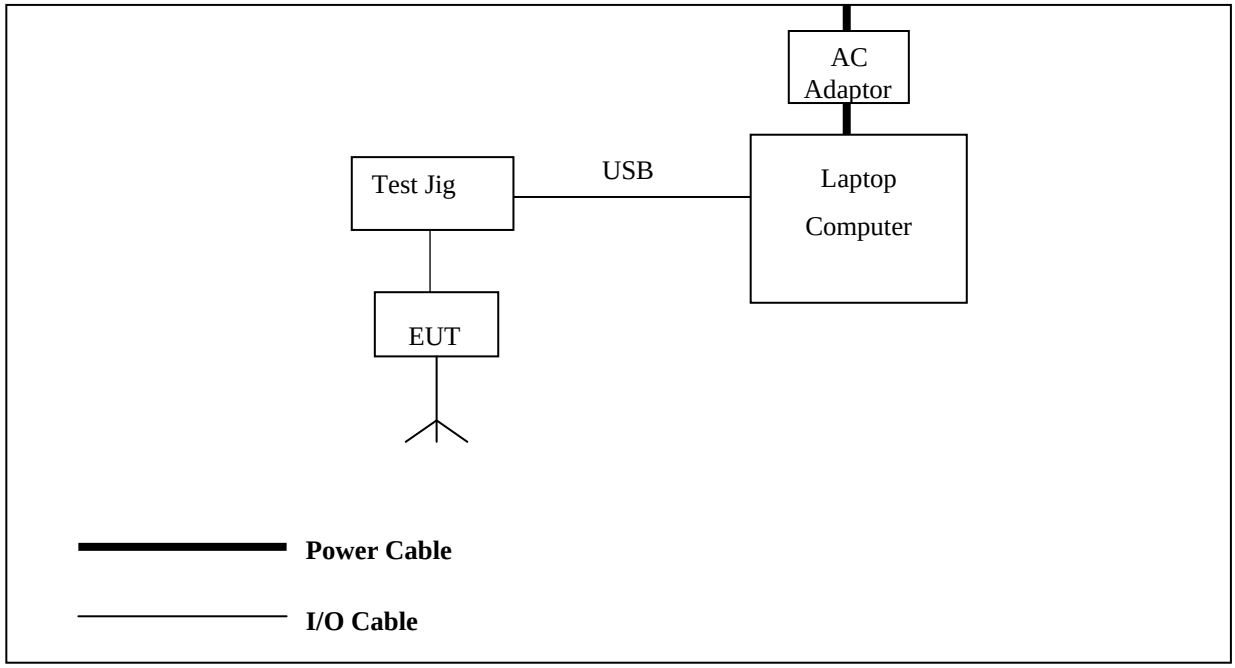
The EUT was programmed with the following power setting that used during the testing:

Frequency	5180 MHz ~ 5240 MHz
Power setting Level	255

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. FCC ID: A3LWISP50S	S/N: N/A
Laptop Computer	HP Model : HSTNN-Q61C 1.2 m shielded USB cable	FCC DOC S/N : CNF0489WDT
AC/DC Adapter	DELTA ELECTRONICS(JIANG SU), LTD Model : PPP009D 1.2 m unshielded power cable	FCC DOC S/N :WBGSV0ACXZH162

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Audio transceiver module FCC ID: A3LWISP50S, IC: 649E-WISP50S.**

Specifications:

Category	Audio transceiver module
Model Name	WISP50S
Brand Name	SAMSUNG
Frequency of Operation	5180 MHz ~ 5240 MHz
Power Output (Conducted)	10.20 dBm
Channels	3 ch
Antenna Gain (peak)	2.8 dBi
Modulations	QPSK
Temperature Range	-10 ℃ ~ +50 ℃
Voltage	5.0 Vdc
Dimensions (D x W x H)	26 mm x 60.2 mm X 3.2 mm
Weight	5 g
Remarks	-

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 A9.2	Complies	
26 dB Spectrum Bandwidth	15.407(a)	RSS-210 A9.2	Complies	
Maximum Conducted Output Power	15.407(a)	RSS-210 A9.2	Complies	
Power Spectral Density	15.407(a)	RSS-210 A9.2	Complies	
Peak Excursion Measurement	15.407(a)	-	Complies	
Radiated Spurious Emission	15.407(b)	RSS-210 A9.2	Complies	
Frequency Stability	15.407(g)	RSS-210 A9.4	Complies	
Maximum Permissible Exposure	1.1307(b)	RSS-102	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Audio transceiver module FCC ID: A3LWISP50S, IC : 649E-WISP50S** is in compliance with Part 15 Subpart C 15.407 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 Audio transceiver module FCC ID: A3LWISP50S, IC: 649E-WISP50S** 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 (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 (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 (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 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.

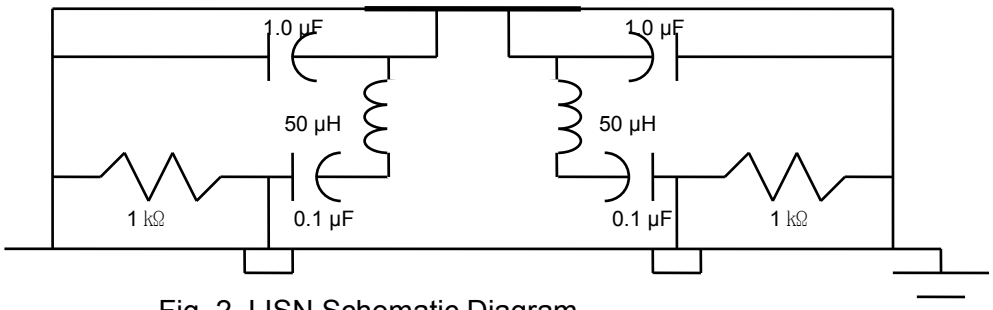


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.4-2003 and ANCI C63.10-2009.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Bi-conical log Antenna(ARA, LPB-2520/A). Above 1 GHz, Horn antenna (Scwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.

The test equipment was placed on turntable with 0.8 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 receiver (ESCS30 & FSP40) bandwidth was set to 120 kHz for measurements below 1 GHz, and 1 MHz for measurements above 1 GHz. A peak detector is used to detect an emission; a quasi-peak detector may be used to record a final measurement below 1 GHz and an average detector may be used above 1 GHz.

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)

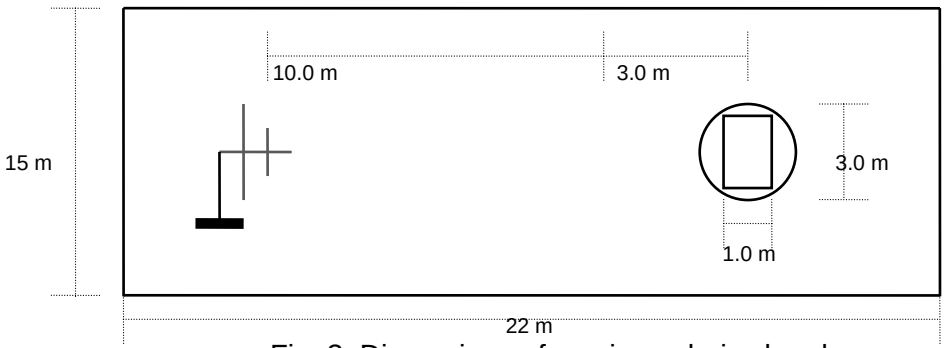
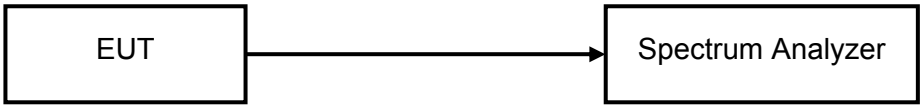


Fig. 3. Dimensions of semi anechoic chamber

7.3 26 dB Bandwidth and 99% Occupied bandwidth

Test Setup

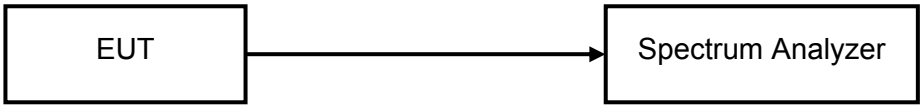


Test Procedure

EUTs 26 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 = approximately 1 % of the emission bandwidth
VBW > RBW
Detector = Peak
Trace mode = max hold
The bandwidth measurement function on the spectrum analyzer is used to measure the 26 dB bandwidth and 99% occupied bandwidth.

7.4 Maximum Conducted Output Power

Test Setup



Test Procedure

EUTs Maximum Conducted Output Power 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 = 1 MHz

VBW ≥ 3 MHz

Number of points in sweep ≥ 2 Span / RBW

Sweep time = auto

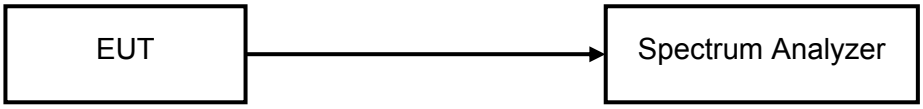
Detector = RMS

Trace average at least 100 traces in power averaging mode

The band power measurement function on the spectrum analyzer is used to measure the Maximum conducted output power.

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.

RBW = 1 MHz

VBW ≥ 3 MHz

Number of points in sweep ≥ 2 Span / RBW

Sweep time = auto

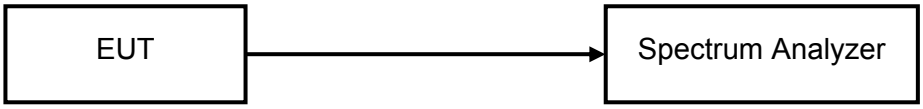
Detector = RMS

Trace average at least 100 traces in power averaging mode

The peak search function on the spectrum analyzer is used to find the peak of the spectrum.

7.6 Peak Excursion Measurement

Test Setup



Test Procedure

EUTs Peak Excursion is 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.

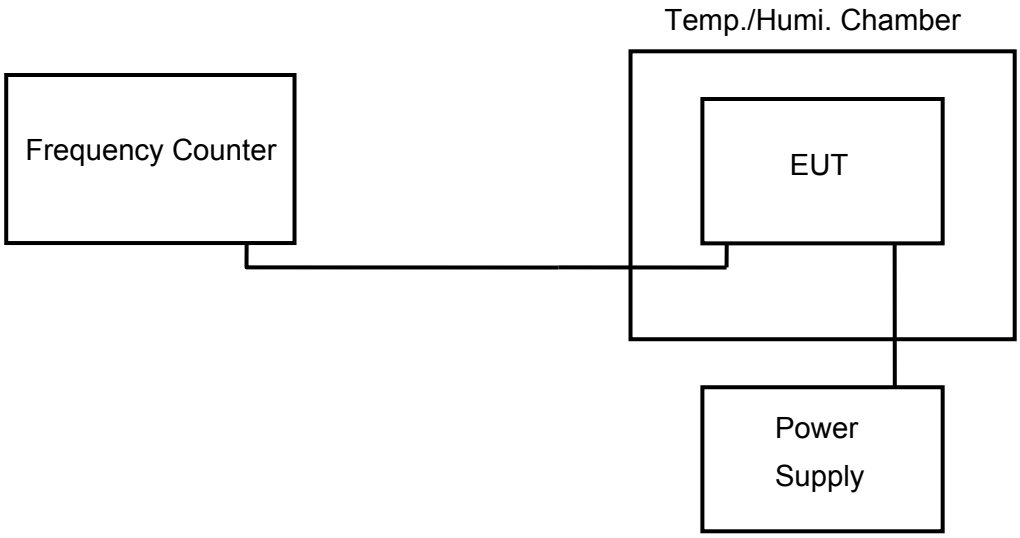
Trace 1)
RBW = 1 MHz
VBW ≥ 3 MHz
Detector = peak
Trace mode = max-hold
The sweeps is set to continue until the trace stabilizes.
The peak search function on the spectrum analyzer is used to find the peak of the spectrum.

Trace 2)
RBW = 1 MHz
VBW ≥ 3 MHz
Number of points in sweep ≥ 2 Span / RBW
Sweep time = auto
Detector = RMS
Trace average at least 100 traces in power averaging mode

The ratio of the maximum of the peak max hold spectrum to the PPSD is computed.

7.7 Frequency Stability

Test Set-up:



Test Procedure

EUTs Frequency Stability is measured at center channel with a Frequency Counter connected to the antenna terminal while the EUTs operating at its non-modulated signal.
fc is declaring of channel frequency. Then the frequency error formula is (fc - f) / fc x 10^6 ppm.
The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value. Extreme temperature rule is - 20 ℃ ~ 50 ℃.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen 7.2.4

Frequency	Level(dBµV)		*)Factor	**) Line	Limit(dBµV)		Margin(dB)	
(MHz)	Q-Peak	Average	(dB)		Q-Peak	Average	Q-Peak	Average
0.15	51.8	43.8	0.2	N	66.0	56.0	14.2	12.2
0.23	45.5	41.6	0.2	N	62.4	52.4	16.9	10.8
0.31	42.2	39.3	0.2	L	60.0	50.0	17.8	10.7
0.39	39.3	37.1	0.2	L	58.1	48.1	18.8	11.0
0.54	39.4	37.4	0.2	N	56.0	46.0	16.6	8.6
27.64	39.6	39.4	1.6	N	60.0	50.0	20.4	10.6

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)***

NEMKO KOREA (NK-12-R-170) 06 Nov 2012 20:52

Conducted Emissions

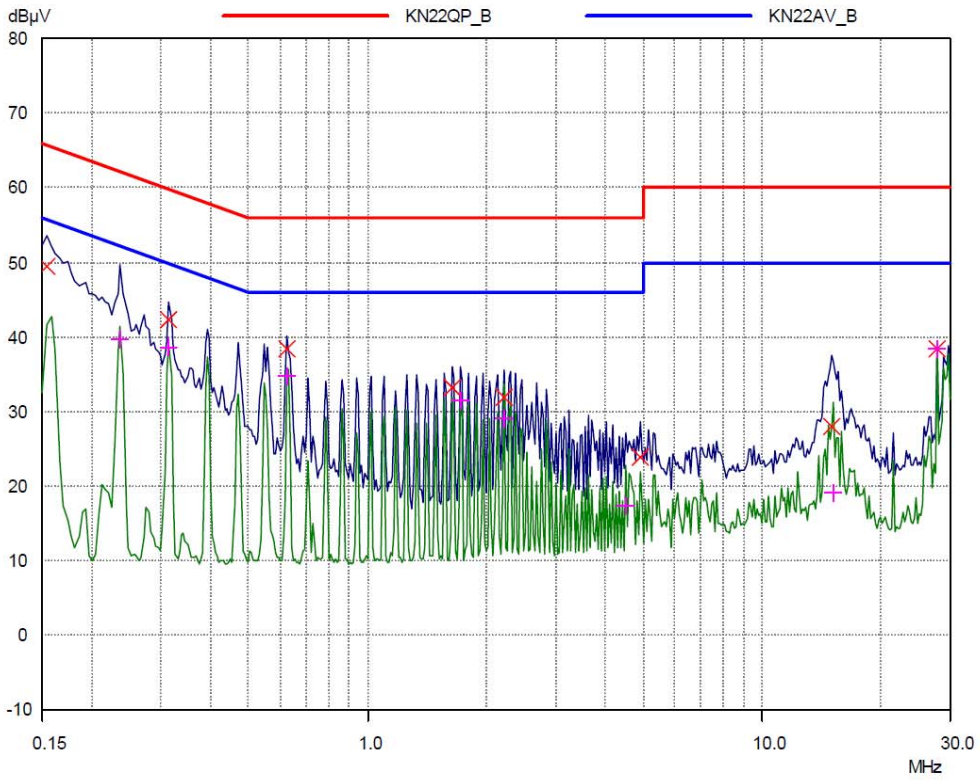
EUT:	Audio transceiver module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz (5.2 GHz Mid ch TX mode)
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : WISP50S LINE : L1

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Line

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***

NEMKO KOREA (NK-12-R-170) 06 Nov 2012 20:42

Conducted Emissions

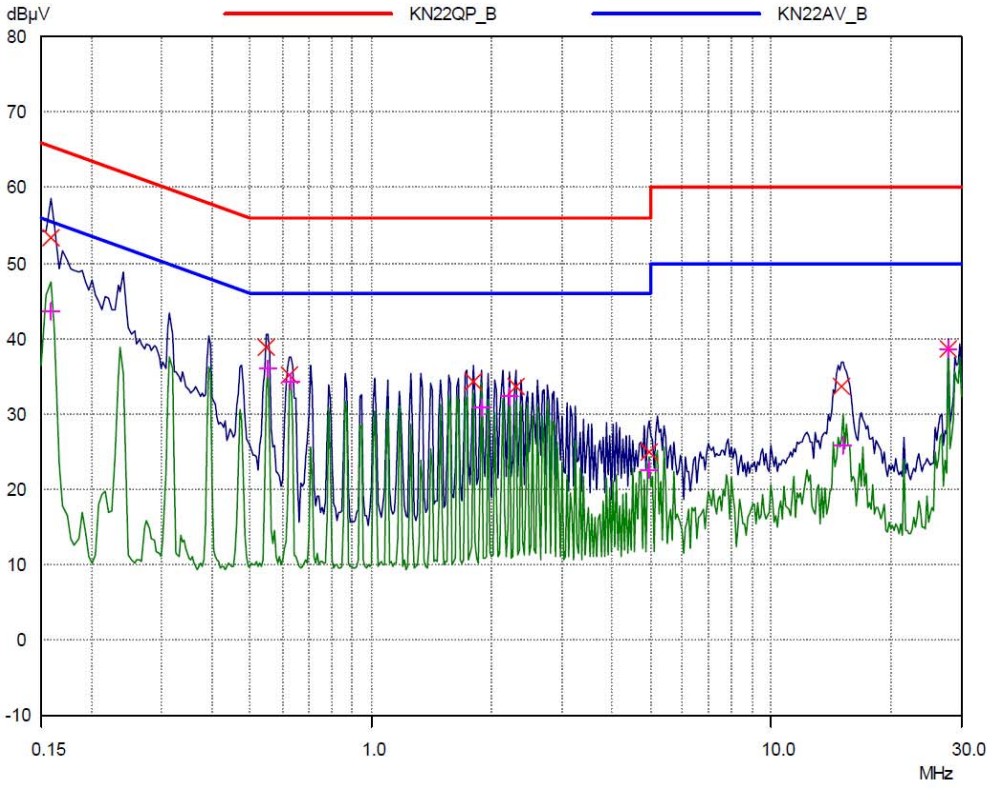
EUT:	Audio transceiver module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz (5.2 GHz Mid ch TX mode)
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : WISP50S
	LINE : Neutral

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Neutral

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



8.2 Radiated Emissions

FCC §15.209, RSS-210 A9.2

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)
36.84	55.4	V	100	246	-21.8	33.6	40.0	6.4
184.33	58.5	H	385	46	-24.8	33.7	43.5	9.8
233.46	60.1	H	385	65	-21.8	38.3	46.0	7.7
258.05	62.8	H	385	70	-20.8	42.0	46.0	4.0
264.01	60.6	H	315	75	-20.6	40.0	46.0	6.0
276.43	57.4	H	302	218	-20.3	37.1	46.0	8.9

Radiated Measurements at 3meters

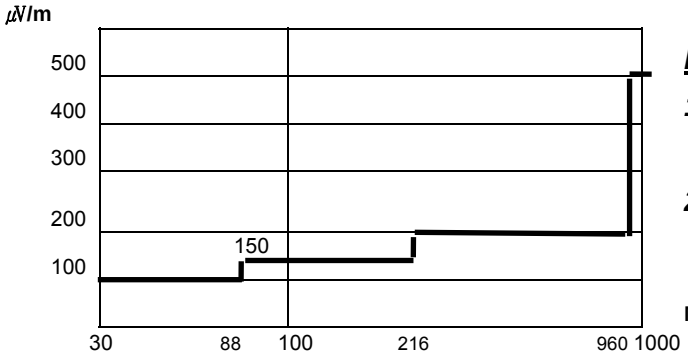


Fig. 4. Limits at 3 meters

Notes:

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

2 The radiated limits are shown on Figure 4.

Above 1 GHz the limit is 500 µ/m.

Notes:

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

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

3. Measurements using CISPR quasi-peak mode.

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).

8.3 26 dB Bandwidth and 99 % Occupied bandwidth

FCC §15.407(a), RSS-210 A9.2

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

Ant A

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)
Low	5180	16.171	15.048
Middle	5210	16.146	15.032
High	5240	16.172	15.033

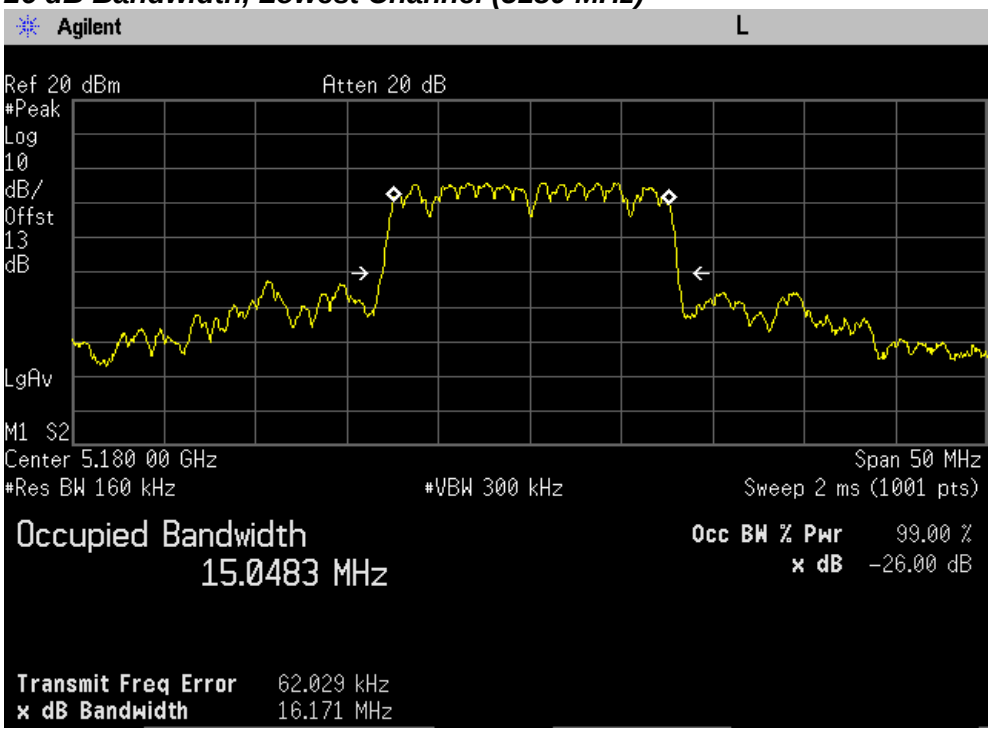
Ant B

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)
Low	5180	16.135	15.035
Middle	5210	16.152	15.045
High	5240	16.162	15.038

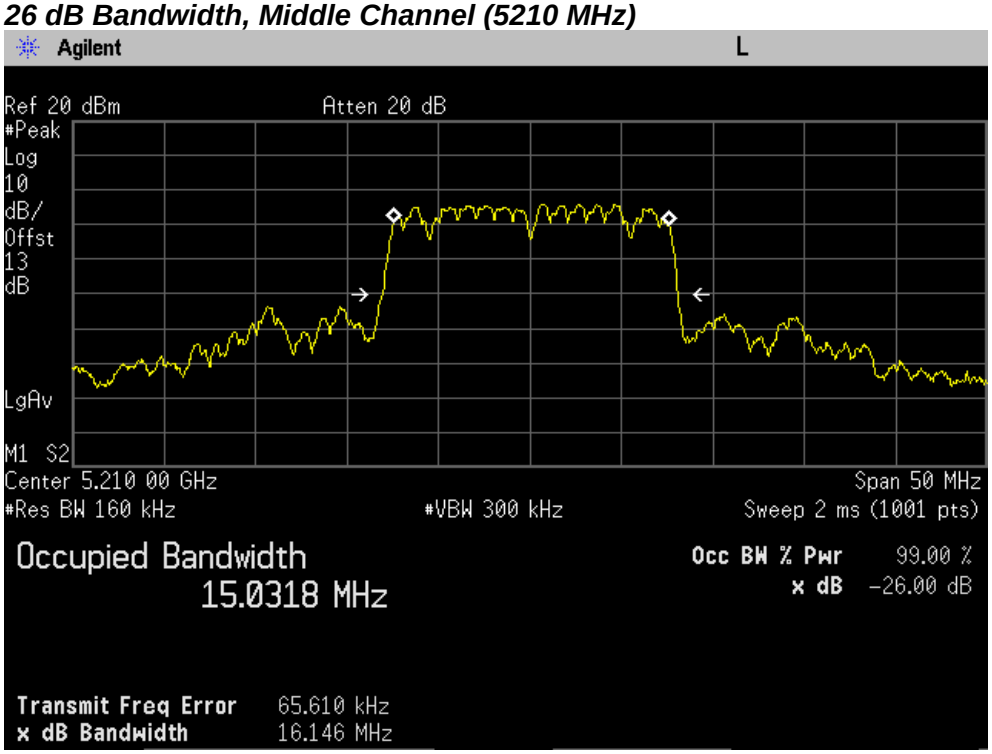
PLOTS OF EMISSIONS

Ant A

26 dB Bandwidth, Lowest Channel (5180 MHz)

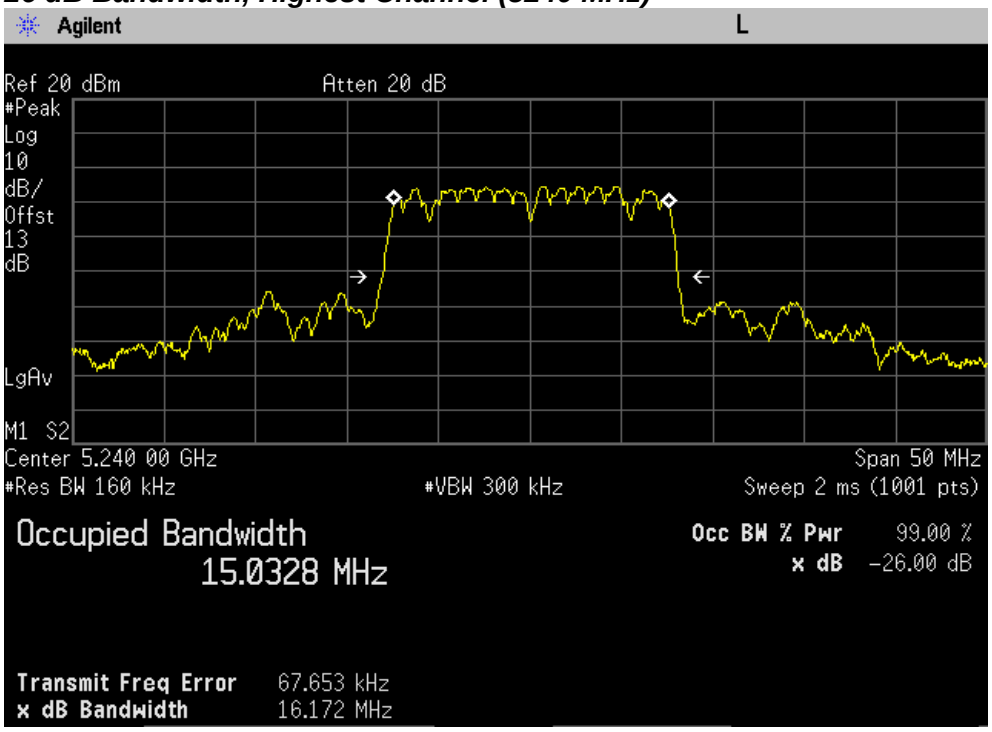


26 dB Bandwidth, Middle Channel (5210 MHz)



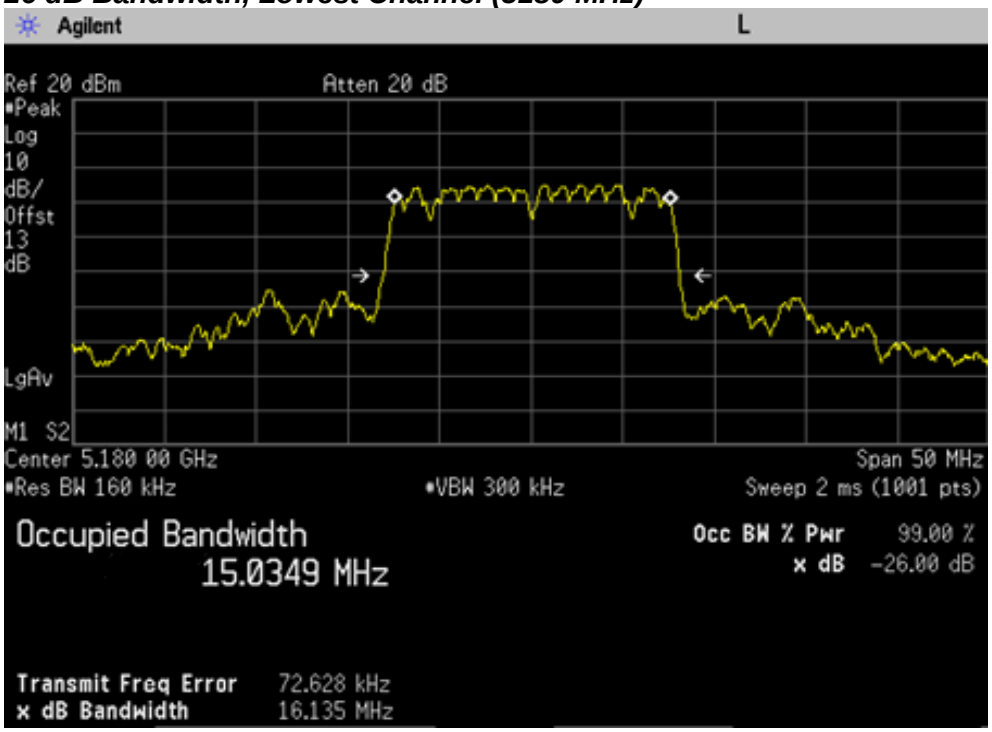
PLOTS OF EMISSIONS

26 dB Bandwidth, Highest Channel (5240 MHz)



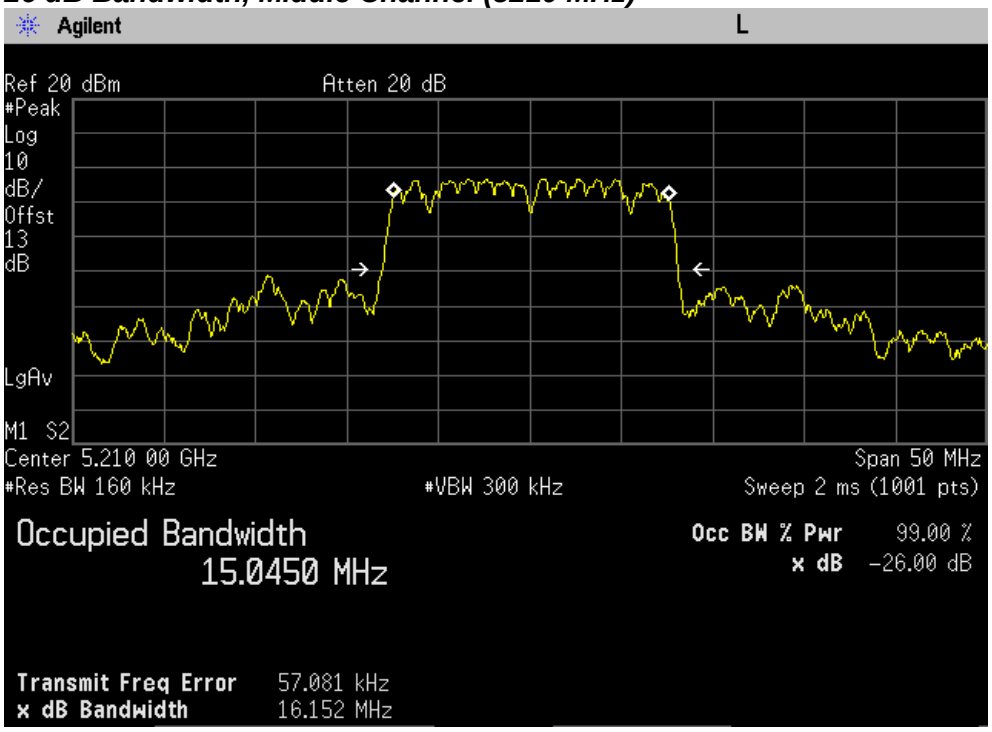
<u>Ant B</u>

26 dB Bandwidth, Lowest Channel (5180 MHz)

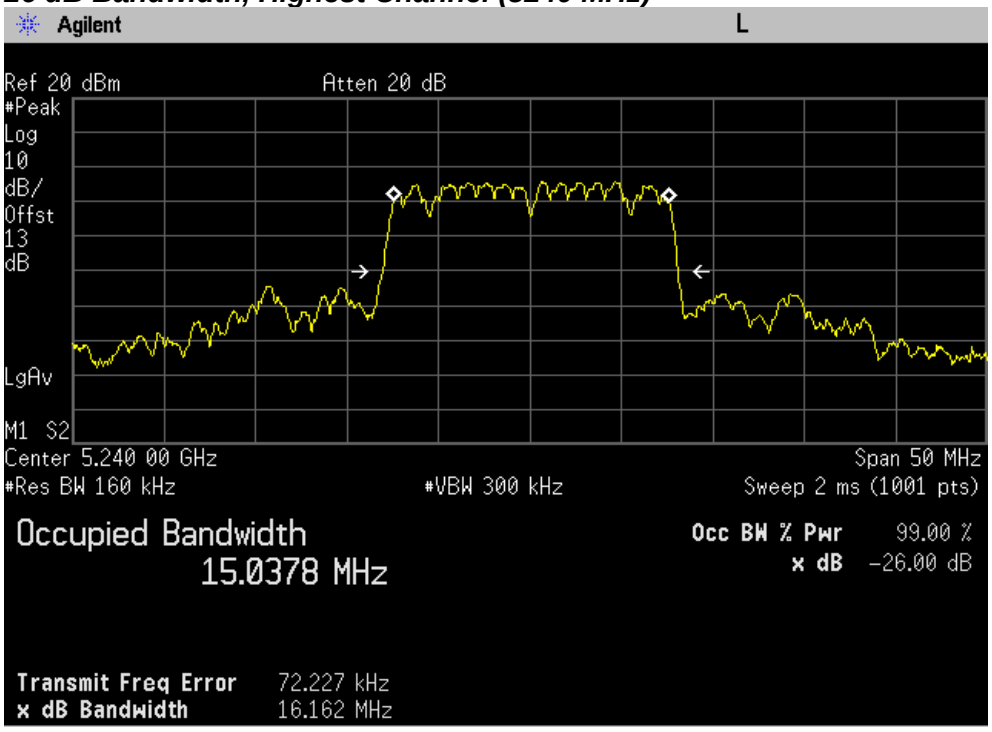


PLOTS OF EMISSIONS

26 dB Bandwidth, Middle Channel (5210 MHz)



26 dB Bandwidth, Highest Channel (5240 MHz)



8.4 Peak Power Output

FCC §15.407(a), RSS-210 A9.2

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

Ant A

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	9.08	16.09	7.01
Middle	5210	8.75	16.09	7.34
High	5240	8.57	16.09	7.52

Ant B

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.20	16.09	5.89
Middle	5210	9.93	16.09	6.16
High	5240	9.77	16.09	6.32

Note:

The following equation was used for spectrum offset:

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

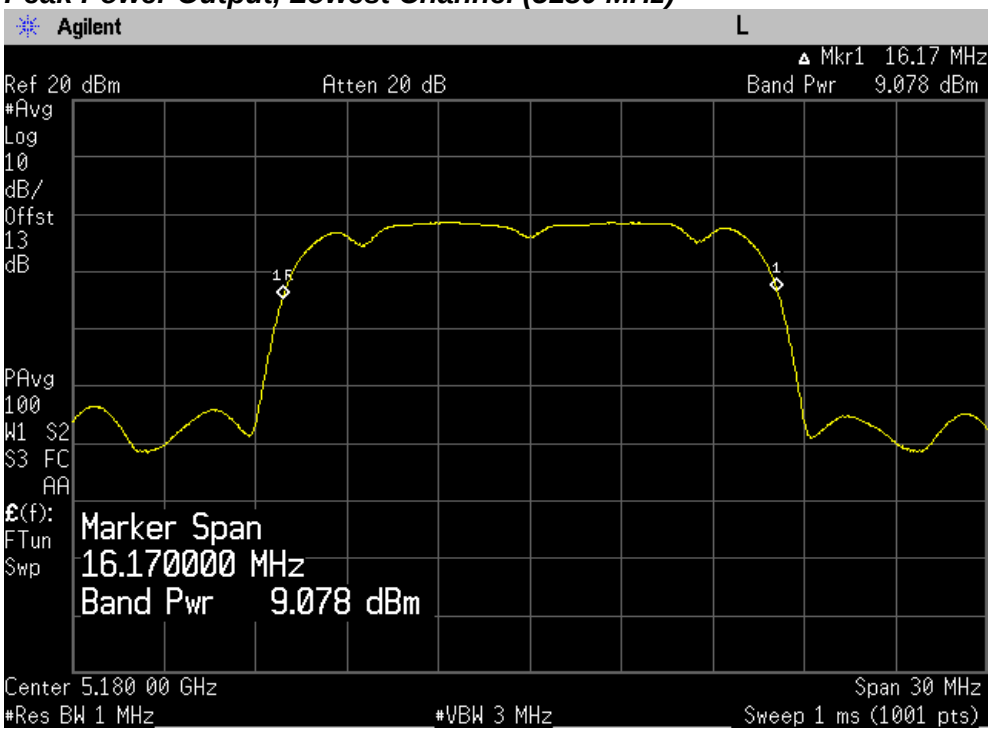
For the band 5.15~5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW(17 dBm) or 4 dBm + 10log B, Where B is the 26 dB emissions bandwidth in MHz.

The maximum conducted output limit = 4 dBm + 10log(16.17) = 16.09 dBm

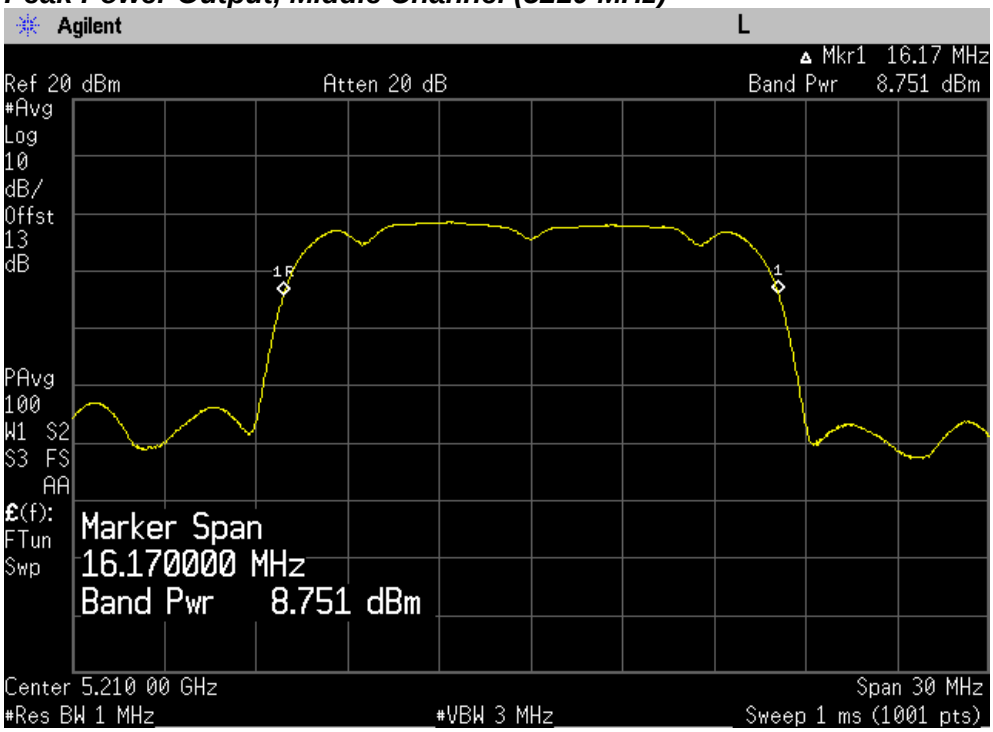
PLOTS OF EMISSIONS

Ant A

Peak Power Output, Lowest Channel (5180 MHz)

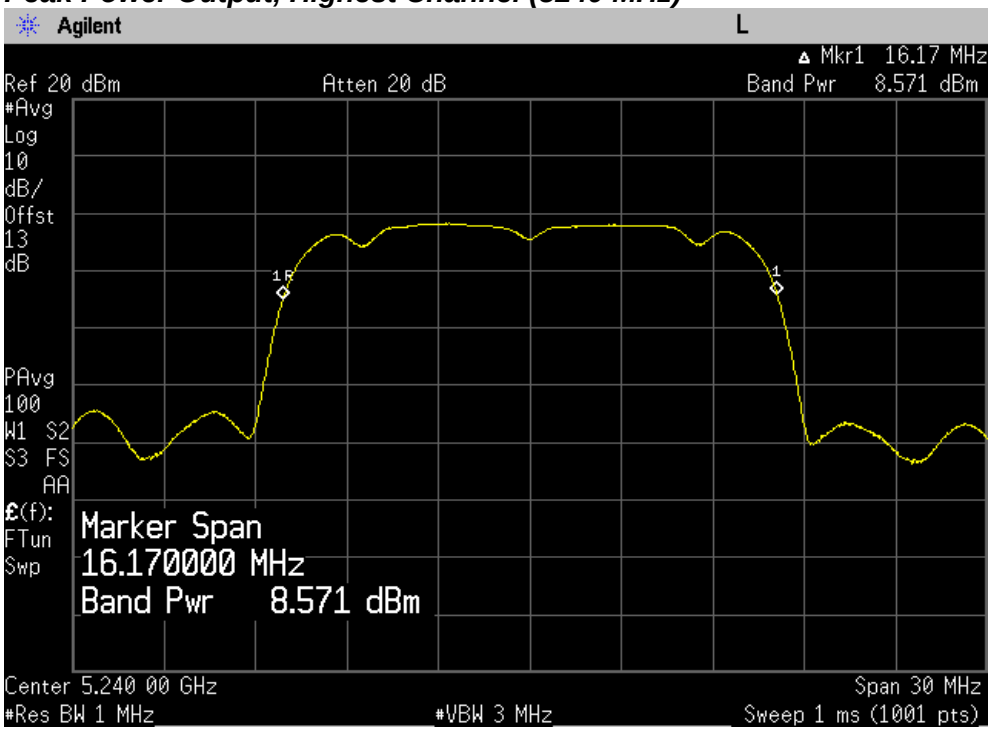


Peak Power Output, Middle Channel (5210 MHz)



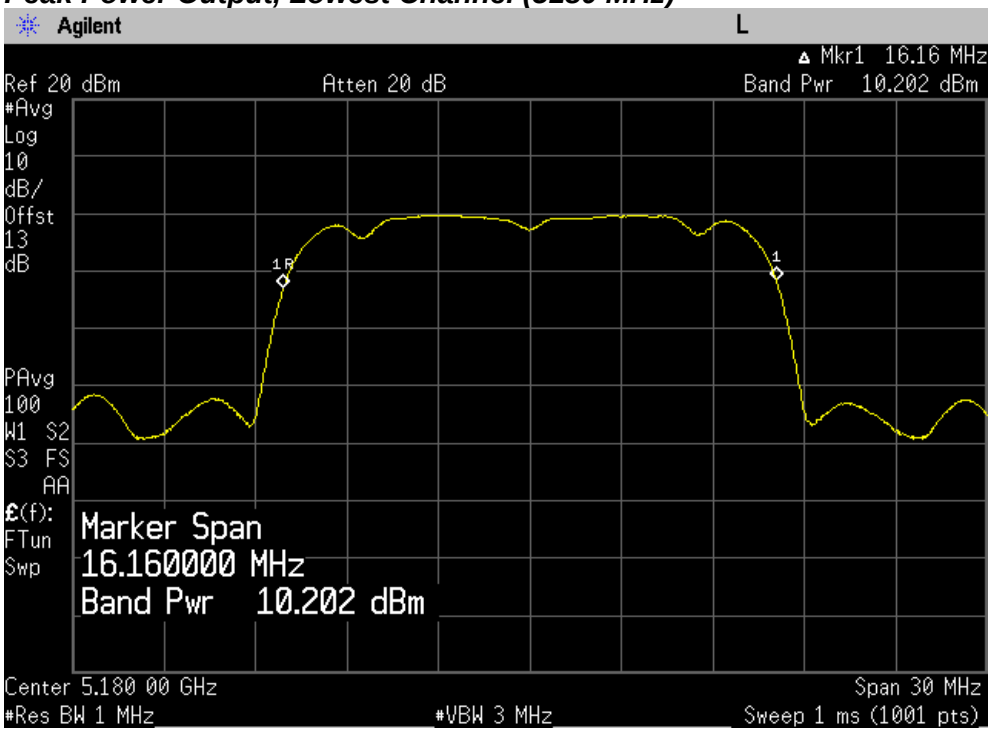
PLOTS OF EMISSIONS

Peak Power Output, Highest Channel (5240 MHz)



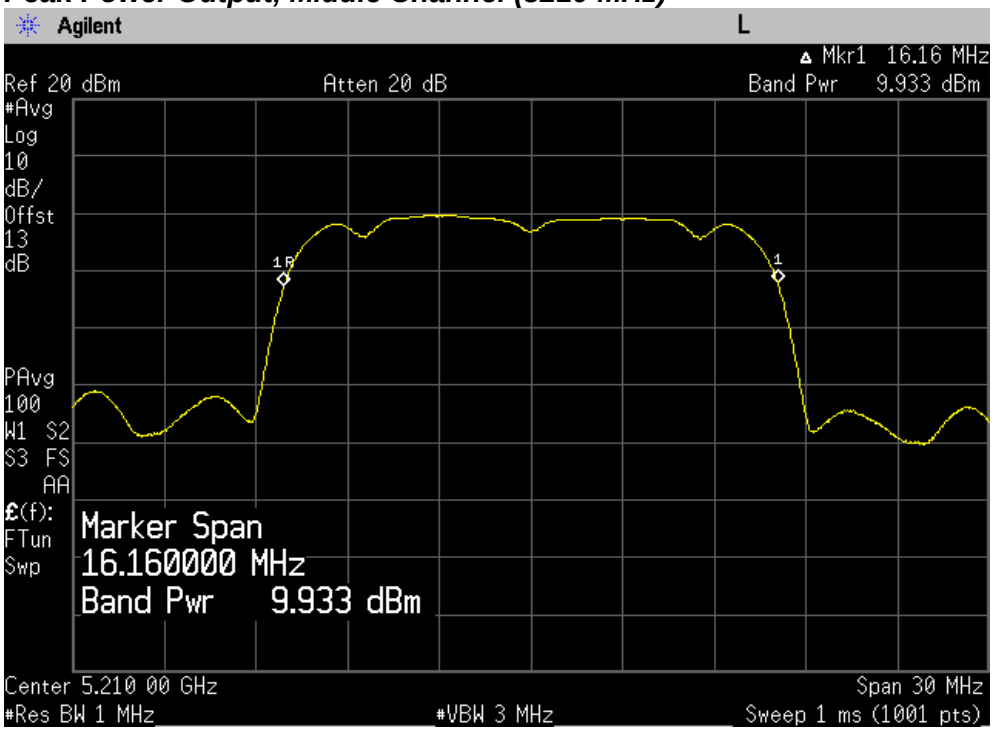
Ant B

Peak Power Output, Lowest Channel (5180 MHz)

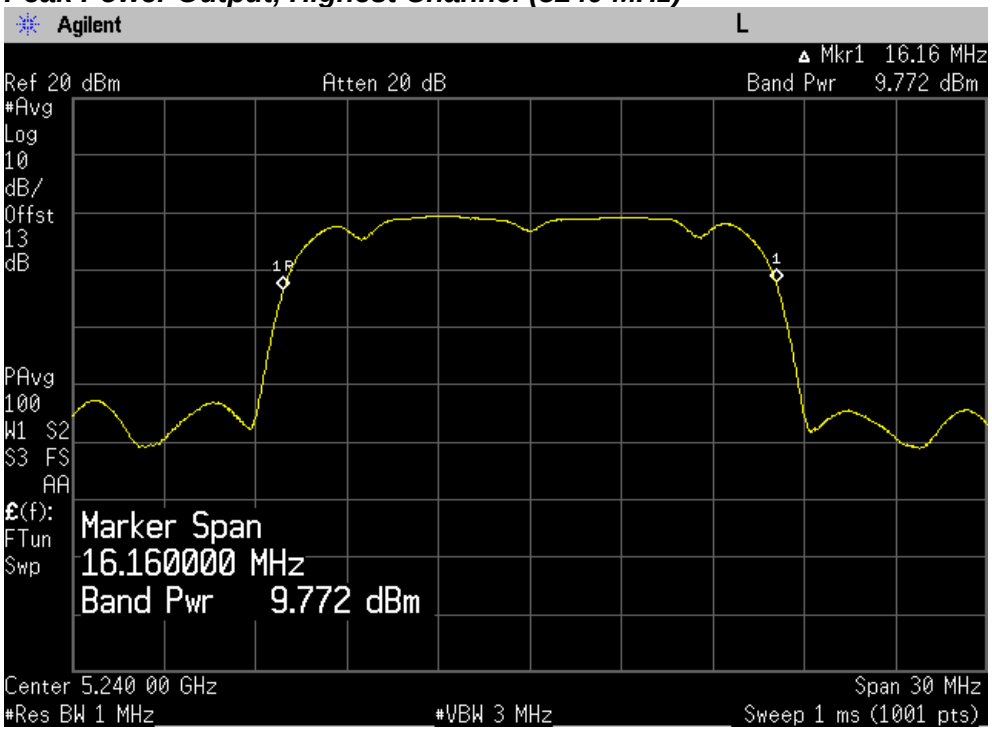


PLOTS OF EMISSIONS

Peak Power Output, Middle Channel (5210 MHz)



Peak Power Output, Highest Channel (5240 MHz)



8.5 Power Spectral Density

FCC §15.407(a), IC RSS-210 A9.2

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

Ant A

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Limit(dBm)	Margin(dB)
Low	5180	-1.22	4	5.22
Middle	5210	-1.41	4	5.41
High	5240	-1.58	4	5.58

Ant B

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Limit(dBm)	Margin(dB)
Low	5180	-0.16	4	4.16
Middle	5210	-0.20	4	4.20
High	5240	-0.50	4	4.50

Note:

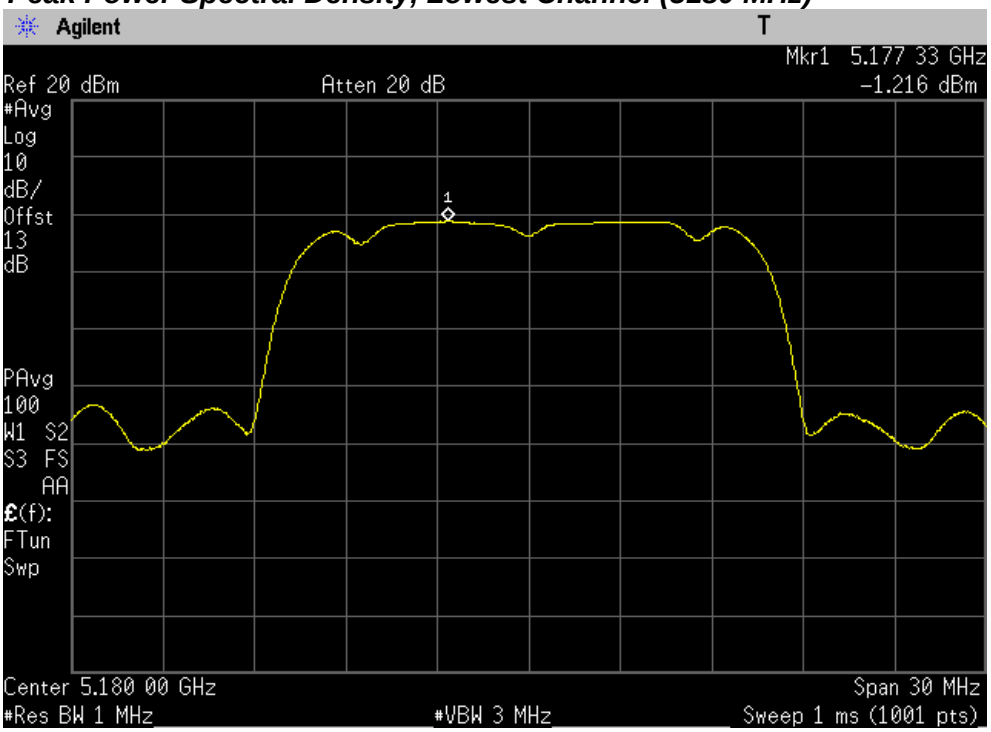
The following equation was used for spectrum offset:

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

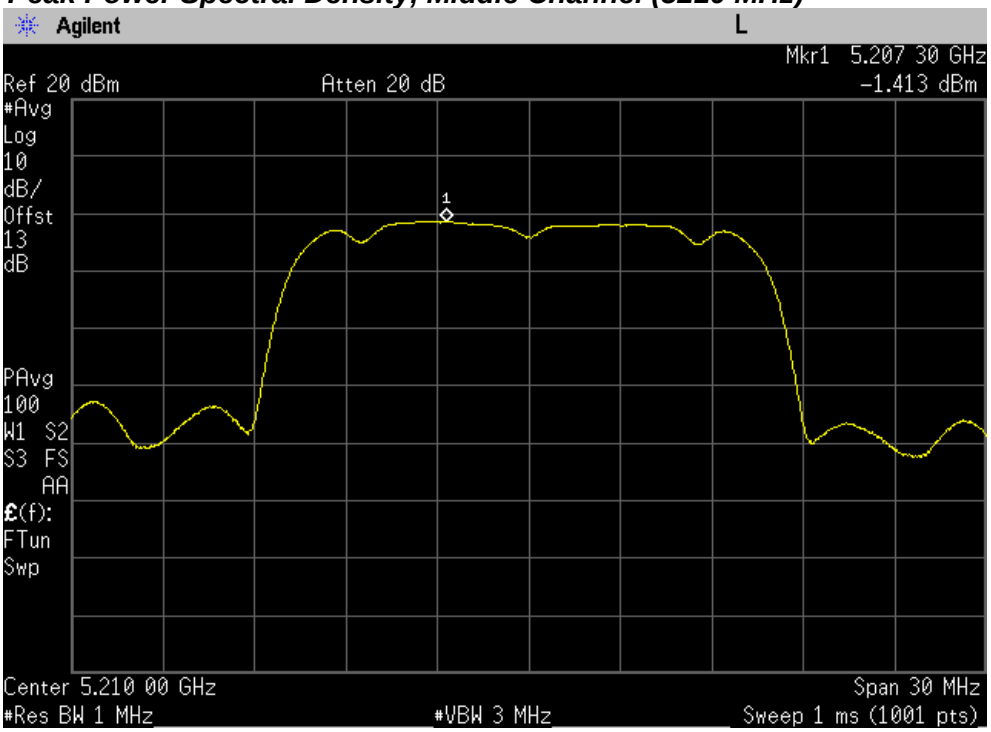
PLOT OF TEST DATA

Ant A

Peak Power Spectral Density, Lowest Channel (5180 MHz)

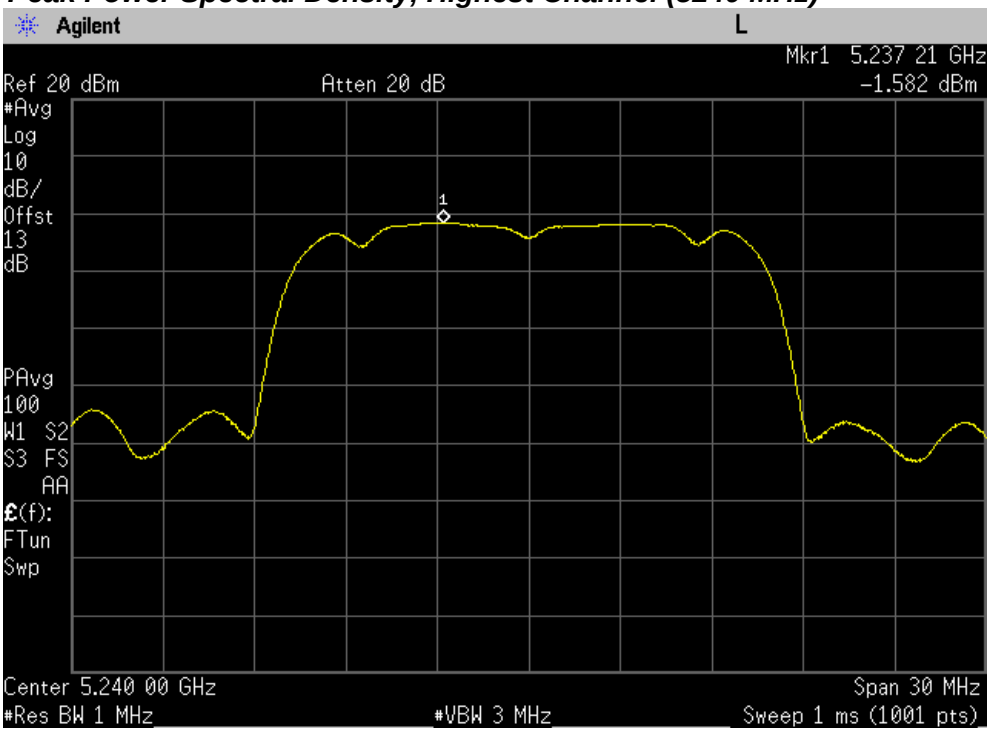


Peak Power Spectral Density, Middle Channel (5210 MHz)



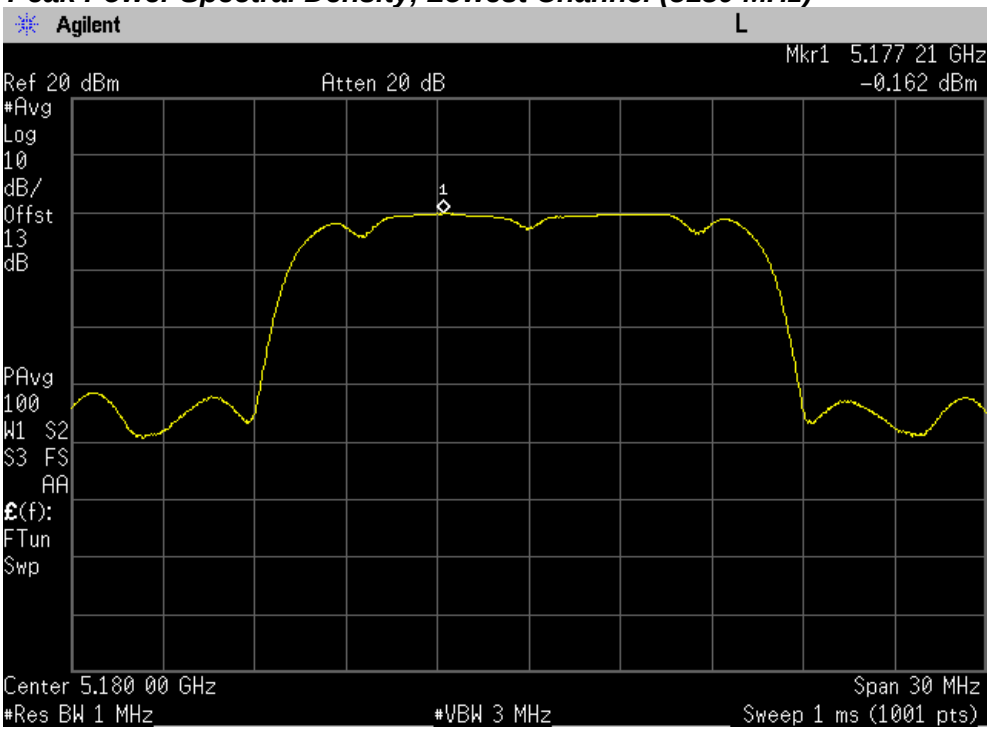
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (5240 MHz)



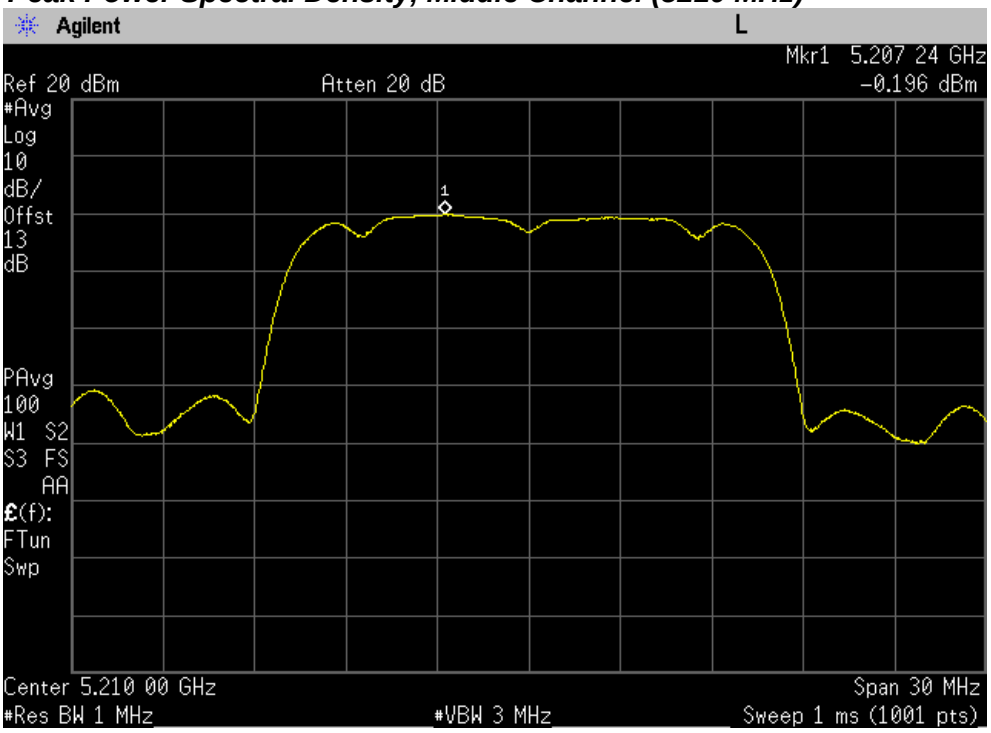
Ant B

Peak Power Spectral Density, Lowest Channel (5180 MHz)

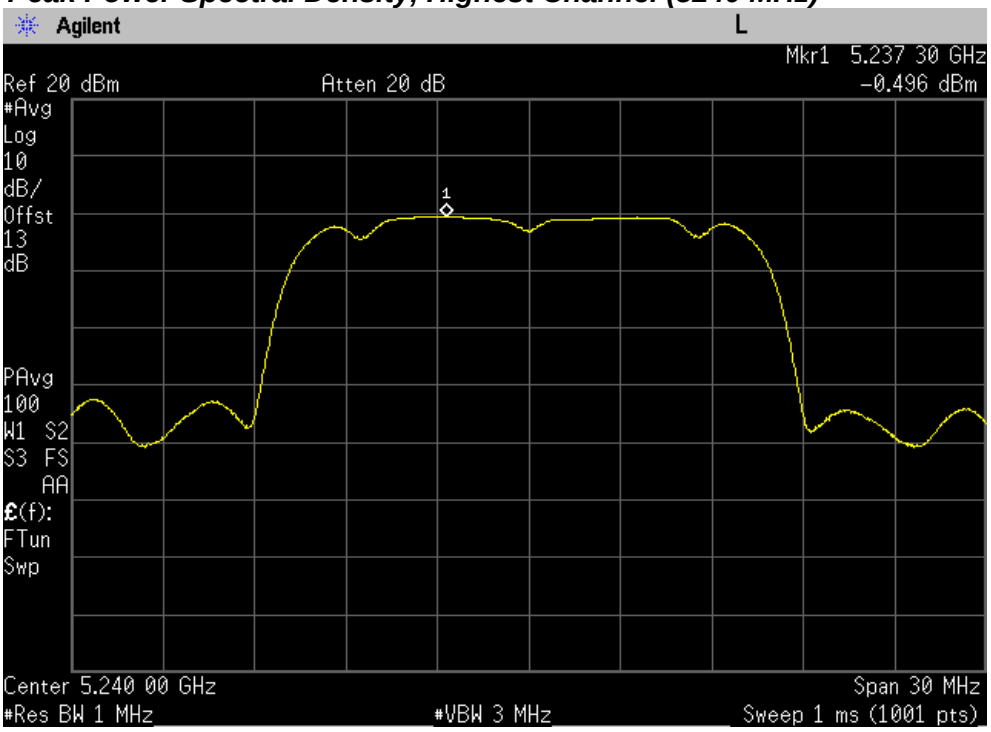


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (5210 MHz)



Peak Power Spectral Density, Highest Channel (5240 MHz)



8.6 Peak Excursion

FCC §15.407(a)

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

Ant A

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin(dB)
Middle	5210	2.74	13	10.26

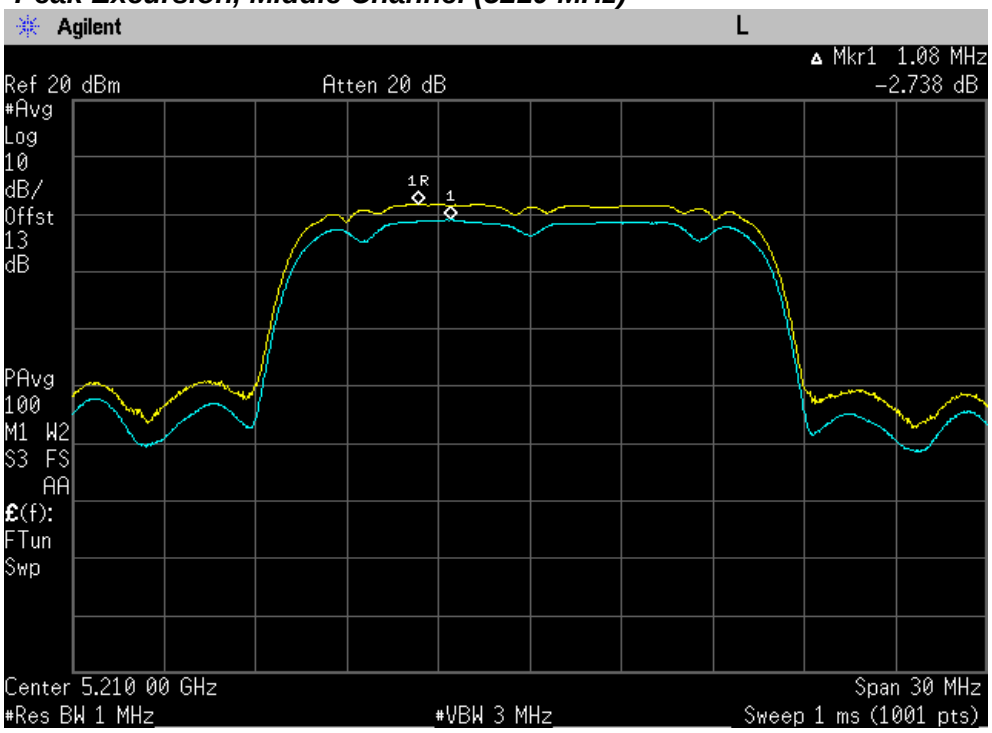
Ant B

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin(dB)
Middle	5210	2.75	13	10.25

PLOT OF TEST DATA

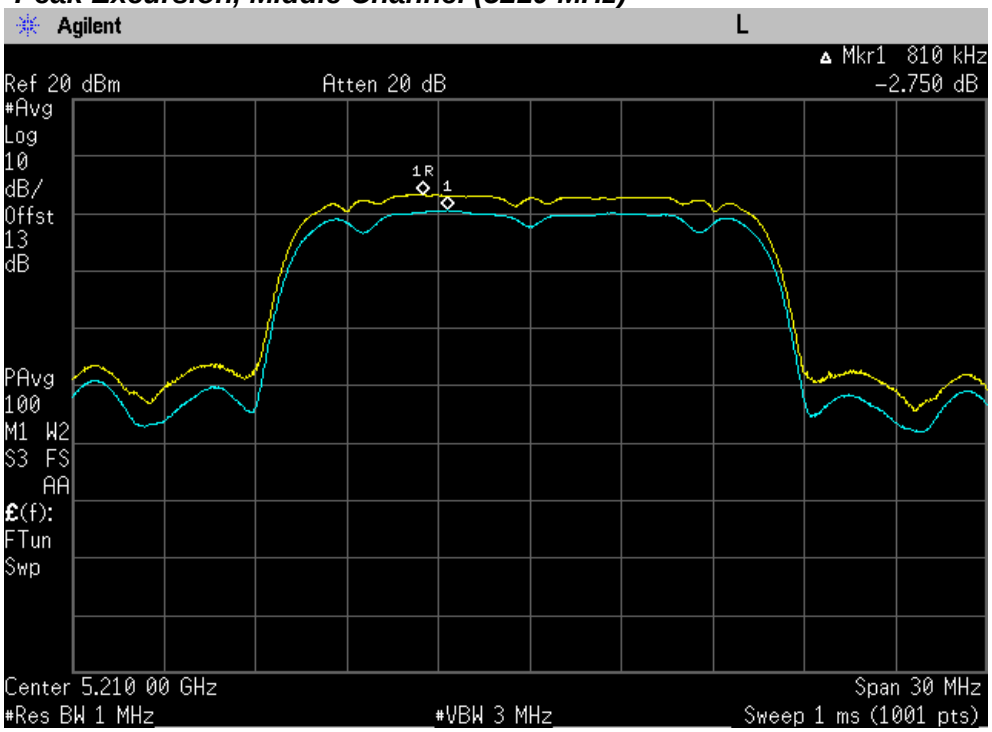
Ant A

Peak Excursion, Middle Channel (5210 MHz)



Ant B

Peak Excursion, Middle Channel (5210 MHz)



8.7 Radiated Spurious Emissions

FCC §15.407(b), RSS-210 A9.2

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

Ant A

Lowest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.36	49.61	H	peak	2.52	-6.02	46.11	68.2	22.09
15.54	49.75	H	peak	3.66	-6.02	47.39	74.0	26.61
15.54	35.74	H	average	3.66	-6.02	33.38	54.0	20.62

Middle Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.42	49.40	V	peak	2.14	-6.02	45.52	68.2	22.68
15.63	49.53	V	peak	3.45	-6.02	46.96	74.0	27.04
15.63	35.42	V	average	3.45	-6.02	32.85	54.0	21.15

Highest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.48	49.20	H	peak	2.89	-6.02	46.07	68.2	22.13
15.72	48.65	H	peak	4.68	-6.02	47.31	74.0	26.69
15.72	34.48	H	average	4.68	-6.02	33.14	54.0	20.86

Ant B

Lowest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.36	50.71	V	peak	2.52	-6.02	47.21	68.2	20.99
15.54	50.03	V	peak	3.66	-6.02	47.67	74.0	26.33
15.54	36.22	V	average	3.66	-6.02	33.86	54.0	20.14

Middle Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.42	48.46	V	peak	2.14	-6.02	44.58	68.2	23.62
15.63	49.98	H	peak	3.45	-6.02	47.41	74.0	26.59
15.63	35.47	H	average	3.45	-6.02	32.90	54.0	21.10

Highest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10.48	49.52	H	peak	2.89	-6.02	46.39	68.2	21.81
15.72	48.69	H	peak	4.68	-6.02	47.35	74.0	26.65
15.72	34.46	H	average	4.68	-6.02	33.12	54.0	20.88

Note:

1. *Pol. H = Horizontal V = Vertical

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

3. ***Distance factor = 20 log (test distance/specific distance) = 20 log (1.5 / 3)

4. Other spurious are under 20 dB below Fundamental.

5. The radiated emissions testing were made by rotating through three orthogonal axes. The worst date was recorded.

6. For peak measurements, the resolution bandwidth is set to 1 MHz and then the video bandwidth is set to 3 MHz.

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

8. 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.

9. The peak limit of non-restricted band -27 dBm/MHz can be converted 68.2 dBμV/m per KDB789033.

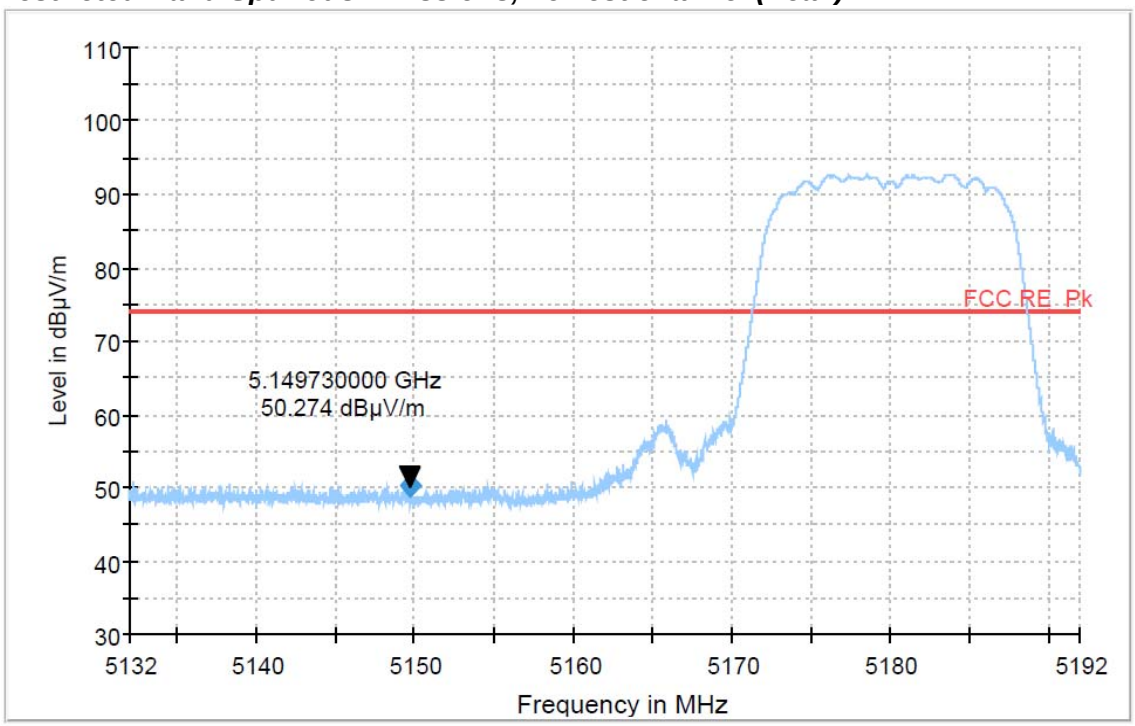
10. For non-restricted band, the peak limit is 68.2 dBμV/m.

11. For restricted band, the peak limit is 74 dBμV/m and the average limit is 54 dBμV/m per § 15.209.

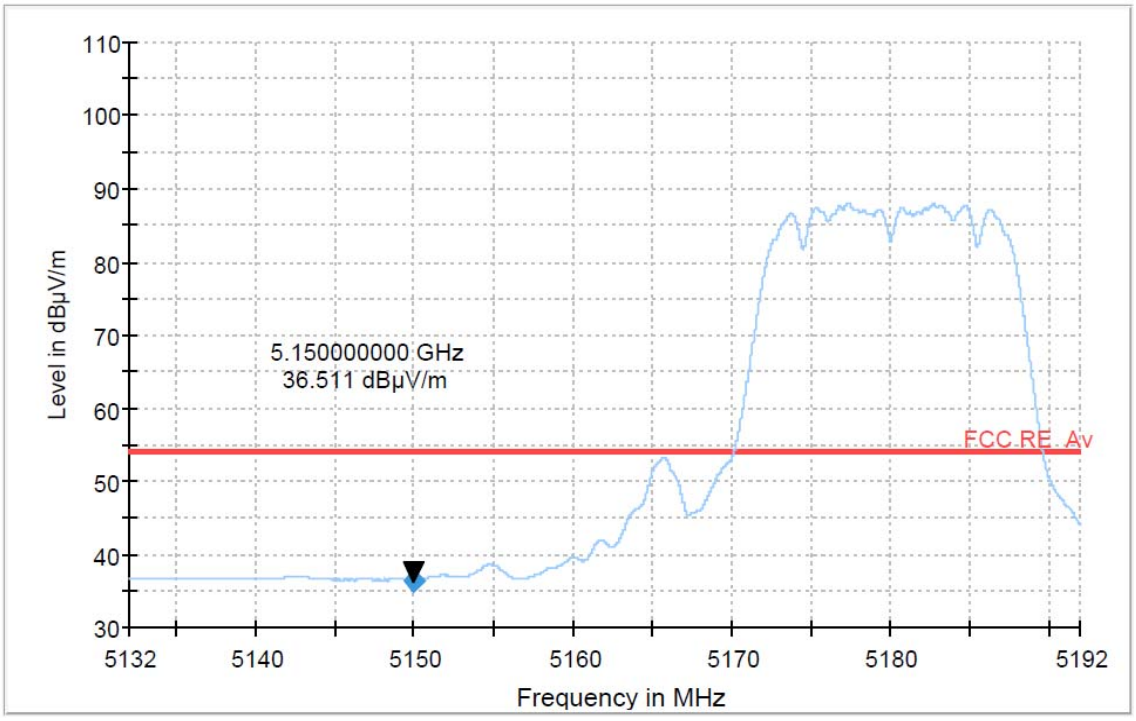
PLOT OF TEST DATA

Ant A

Restricted Band Spurious Emissions, Lowest channel (Peak)

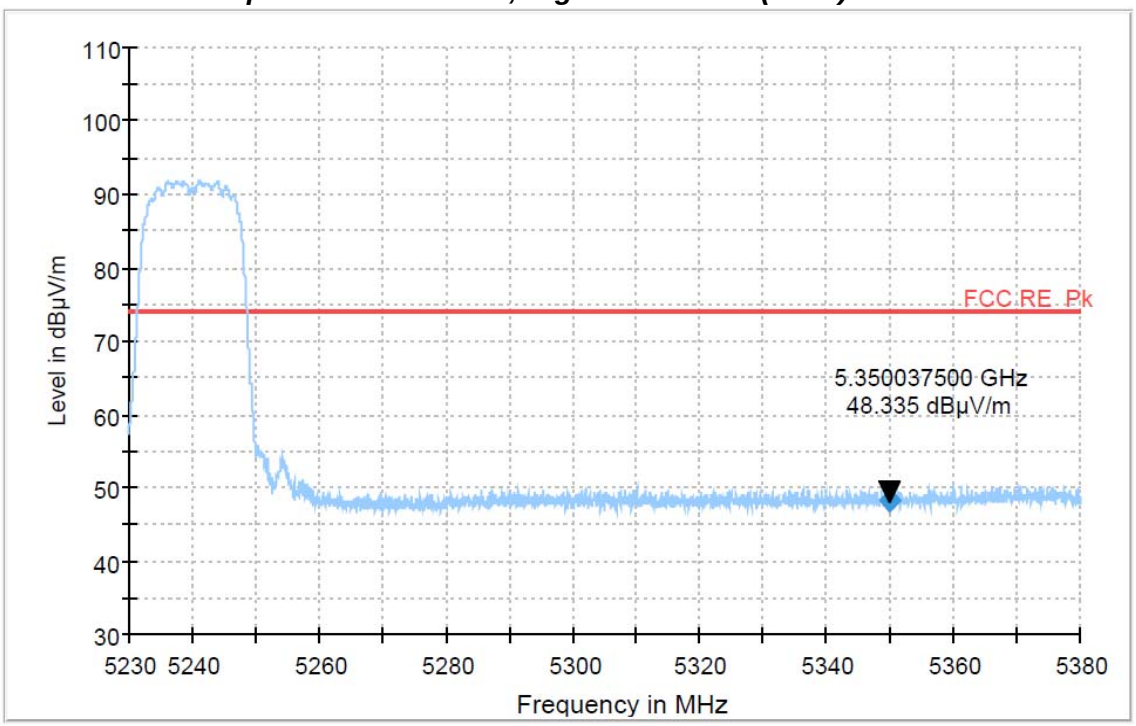


Restricted Band Spurious Emissions, Lowest channel (Average)

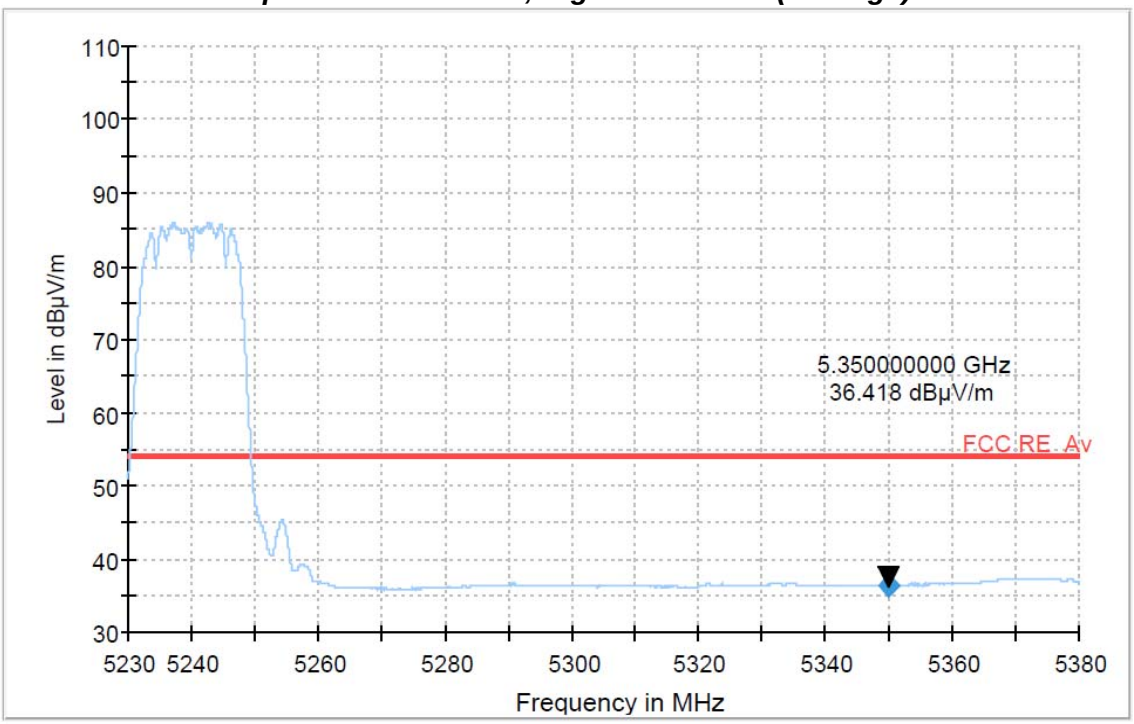


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel (Peak)



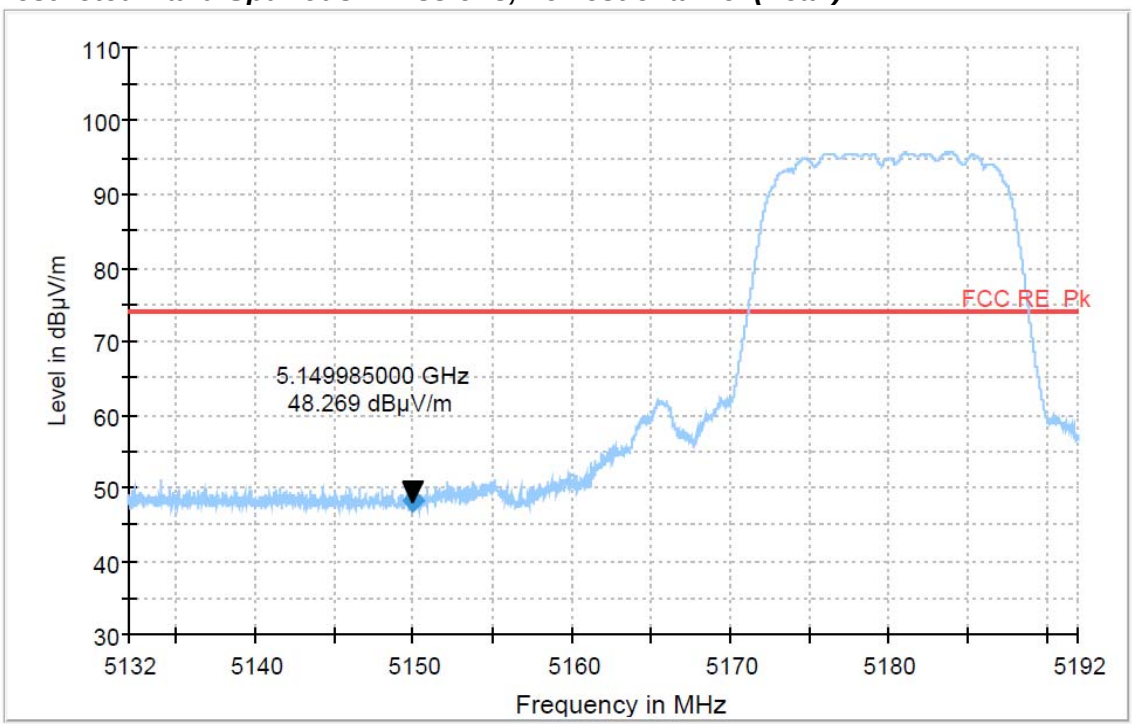
Restricted Band Spurious Emissions, Highest channel (Average)



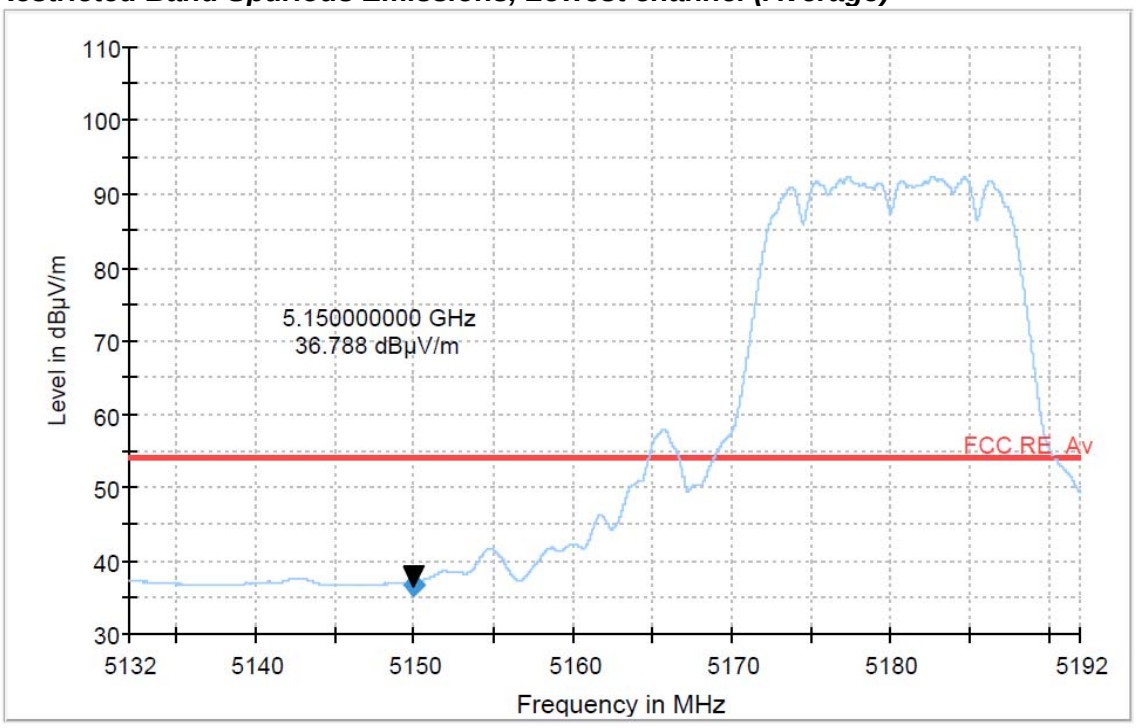
PLOT OF TEST DATA

Ant B

Restricted Band Spurious Emissions, Lowest channel (Peak)

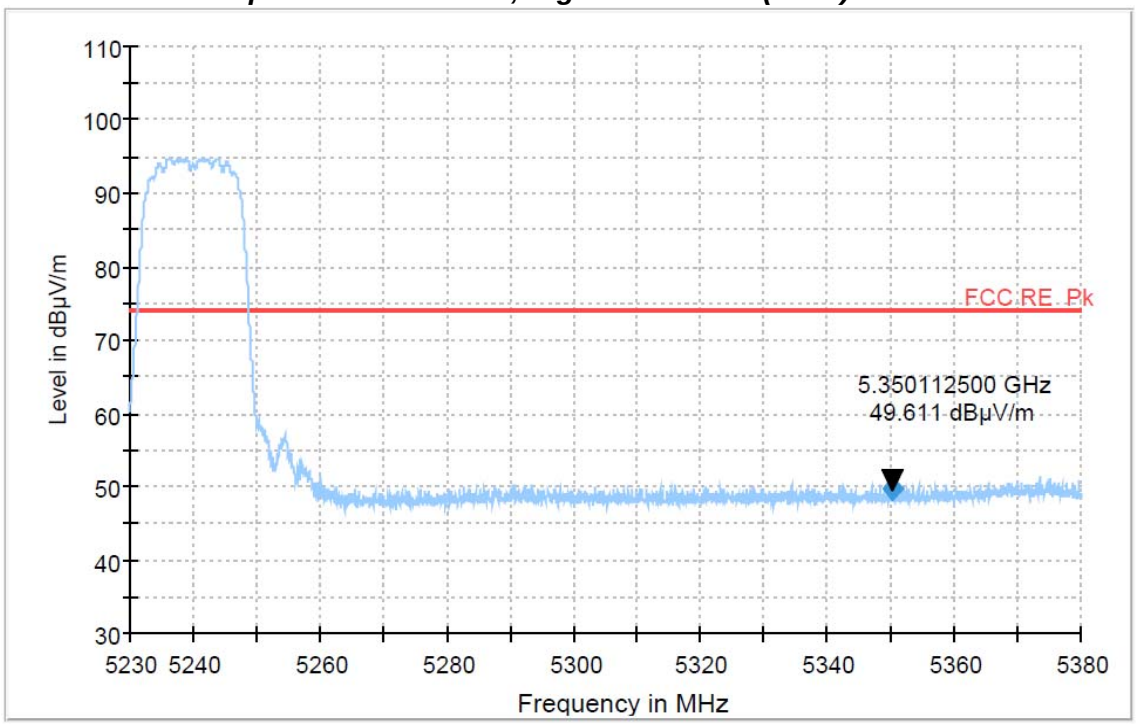


Restricted Band Spurious Emissions, Lowest channel (Average)

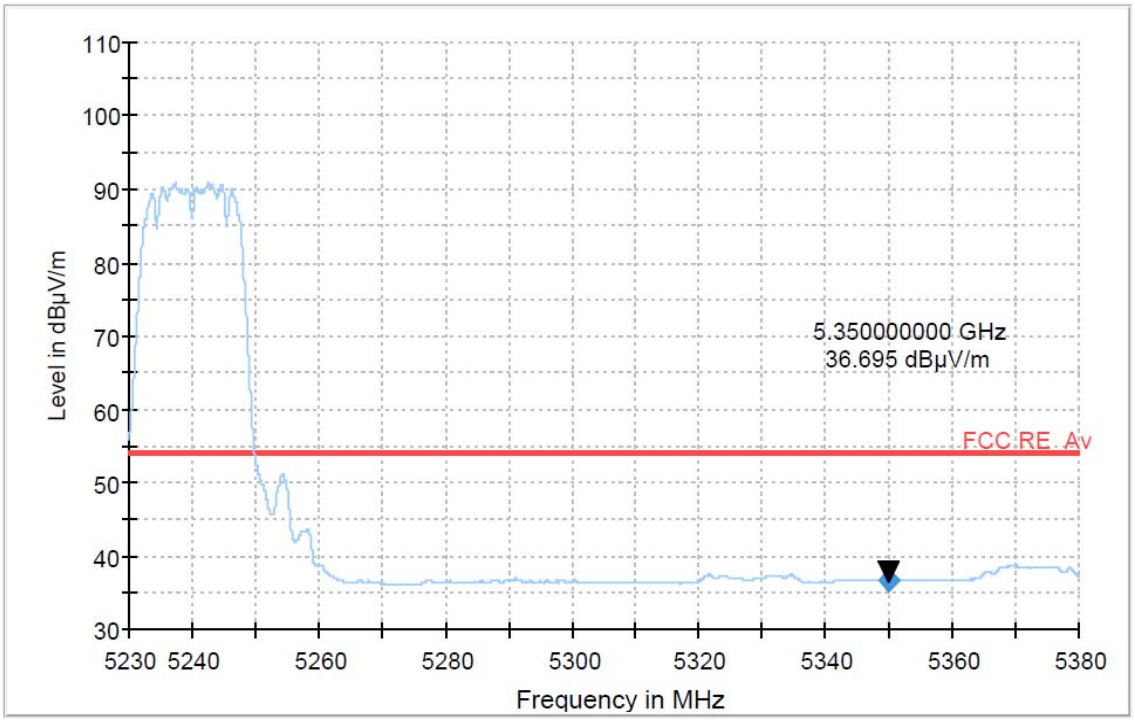


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel (Peak)



Restricted Band Spurious Emissions, Highest channel (Average)



Note: For the radiated emission field strength measurements at the band edges, the resolution bandwidth was set to 1 MHz, and then the video bandwidth was set to 1 MHz for peak measurements and 10 Hz for average measurements.

8.8 Frequency Stability

FCC §15.407(g), IC RSS-210 A9.4

Test channel : Middle channel (5210 MHz)

Standard test voltage : 5 Vdc

Measurement Result :

Voltage (%)	Power (Vdc)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	ppm
100 %	5.00	+ 23(Ref.)	5210044254	44254	8.4940
100 %		- 20	5210059846	59846	11.4868
100 %		- 10	5210067738	67738	13.0015
100 %		0	5210067578	67578	12.9708
100 %		10	5210061982	61982	11.8967
100 %		20	5210054133	54133	10.3902
100 %		30	5210047309	47309	9.0804
100 %		40	5210044144	44144	8.4729
100 %		50	5210047197	47197	9.0589
85 %	4.25	23	5210043653	43653	8.3787
115 %	5.75	23	5210047125	47125	9.0451

Note:
The temperature is varied from –20 °C to +50 °C using an environmental chamber.

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Amplifier	R & S	SCU18	10065	Apr. 05 2012	1 year
2	*Amplifier	R & S	SCU26	10011	Jun. 01 2012	1 year
3	*Amplifier	R & S	SCU40	10008	Jun. 01 2012	1 year
4	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2012	1 year
5	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 16 2012	1 year
6	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 17 2012	1 year
7	*Loop Antenna	R & S	HFH2-Z2	100279	Aug. 31 2011	2 year
8	Wideband Power Sensor	R & S	NRP-Z81	100634	Apr. 05 2012	1 year
9	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
10	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 28 2011	2 year
11	*Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 28 2011	2 year
12	*LISN	R & S	ESH3-Z5	833874/006	Oct. 08 2012	1 year
13	*LISN	R & S	ESH2-Z5	100227	Apr. 04 2012	1 year
14	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
15	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
16	*Position Controller	innco systems GmbH	CO2000	CO2000/329/ 124BD406/L	N/A	N/A
17	*Turn Table	innco systems GmbH	DS1200S	N/A	N/A	N/A
18	*Antenna Mast	innco systems GmbH	MA4000	N/A	N/A	N/A
19	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
20	*EMI test receiver	R & S	ESU 40	100202	Apr. 04 2012	1 year
21	*Trilog broadband test antenna	SCHWARZBECK	VULB 9163	9163-423	Jun. 09 2012	2 year
22	*Attenuator	Fairview	SA3N5W-06	N/A	Apr. 04 2012	
23	*Controller	innco systems GmbH	CO2000-G	N/A	N/A	N/A
24	*Open switch and control unit	R & S	OSP-120	100015	N/A	N/A
25	*Antenna mast	innco systems GmbH	MA4000-EP	N/A	N/A	N/A
26	*Turn table	innco systems GmbH	DT3000-3T	N/A	N/A	N/A
27	*Pre Amplifier	R & S	SCU 01	10030	Apr. 04 2012	1 year

*) 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				
Receiver reading	***RI***	± 0.10	normal 1	1.000	0.10	1	0.10
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***	± 0.50	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 : + (≧ 200 MHz) ⓓ: Log Periodic Antenna-receiver Mismatch : - (≧ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≧200 MHz)			
Expended Uncertainty U	Normal (*k* = 2)			± 5.26 (< 200 MHz) ± 5.48 (≧200 MHz)			