

Nemko Korea Co., Ltd.

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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 : June 13, 2013****Test Report No. : NK-13-R-125-2****Test Site : Nemko Korea Co., Ltd.****FCC ID
IC****A3LWIDA10
649E-WIDA10****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 15E and IC RSS-210 Issue 8
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, ANSI C63.10-2009. 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 : Jin-ha Ko
Engineer

Jun. 13, 2013



Reviewed By : Deokha Ryu
Technical Manager

Jun. 13, 2013

Samsung Electronics Co., Ltd.

Page 1 of 59

FCC ID : A3LWIDA10 / IC : 649E-WIDA10

TABLE OF CONTENTS

1. Scope	4
2. Introduction (Site Description)	5
2.1 Test facility	5
2.2 Accreditation and listing	6
3. Test Conditions & EUT Information	7
3.1 Operation During Test	7
3.2 Support Equipment	7
3.3 Setup Drawing	8
3.4 EUT Information	8
4. Summary of Test Results	9
5. Recommendation / Conclusion	10
6. Antenna Requirements	10
7. Description of Test	11
7.1 Conducted Emissions	11
7.2 Radiated Emissions	12
7.3 26 dB Bandwidth and 99% Occupied Bandwidth	13
7.4 Maximum Conducted Output Power	14
7.5 Peak Power Spectral Density	15
7.6 Peak Excursion Measurement	16
7.7 Frequency Stability	17
7.8 Duty Cycle	18
8. Test Data	19
8.1 Conducted Emissions	19
8.2 Radiated Emissions	22
8.3 26 dB Modulated Bandwidth and 99% Occupied Bandwidth	23
8.4 Maximum Conducted Output Power	27

8.5 Power Spectral Density	31
8.6 Peak Excursion	35
8.7 Radiated Spurious Emissions	36
8.8 Radiated Band Edge	39
8.9 Frequency Stability	41
9 Accuracy of Measurement	42
10 Test Equipment	43
Appendix A: Labelling Requirement	45
Appendix B: Photographs of Test Set-up	46
Appendix C: EUT Photographs	48
Appendix D: Maximum Permissible Exposure	58

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 subpart C and IC RSS-210 Issue 8.

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: A3LWIDA10
- IC : 649E-WIDA10
- Model: WIDA10
- 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 C63.10-2009 and FCC guidance of 789033 D01 v01r03
- Dates of Test: May 20, 2013 ~ June 03, 2013
- 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) were used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**

FCC ID : A3LWIDA10 and IC : 649E-WIDA10

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, REPUBLIC OF.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18 miles) 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
	FCC part 15/18 Filing site	Registration No. 97992
	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	-
 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 Laptop and test Jig were used to control the EUT to transmit the wanted TX channel and maximum output power. During the test, the EUT was operating with a duty cycle 100 %.

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

Frequency	5180 MHz ~ 5240 MHz
Power setting level	255

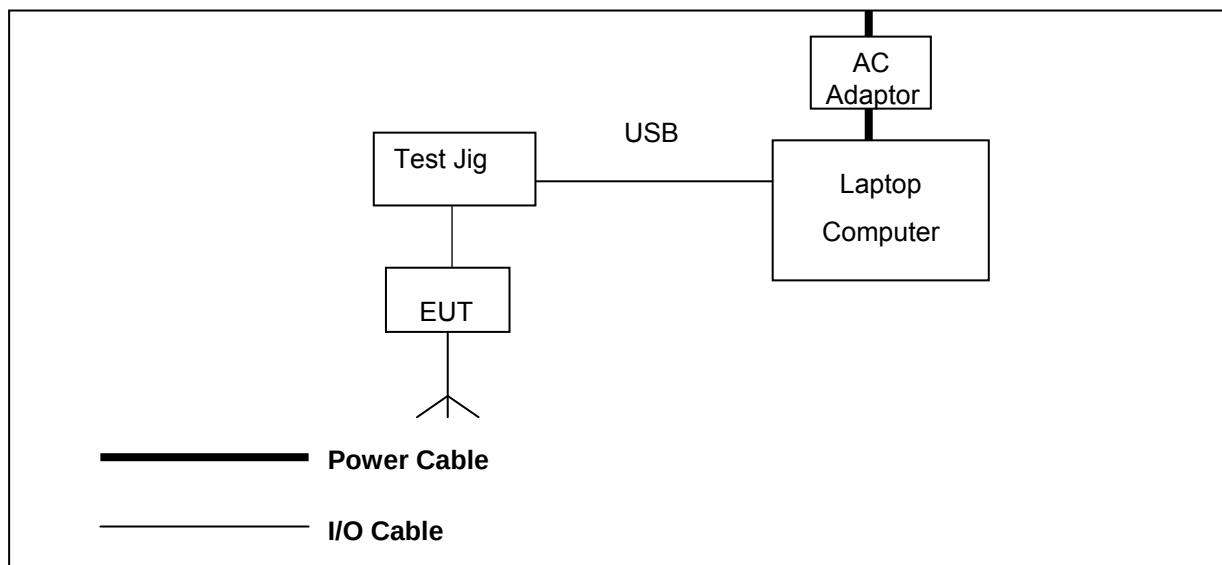
Table of test channels:

Frequency band	Mode	Test Channel	Frequency (MHz)
5.2 GHz	QPSK modulation	Low	5180
		Middle	5210
		High	5240

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. FCC ID: A3LWIDA10	S/N: N/A
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-R520 1.2 m shielded USB cable	FCC DOC S/N : ZK6V93FS800012Y
AC/DC Adapter	Chicony Power Technology Co., Ltd. Model : AD-6019R 1.2 m unshielded power cable	FCC DOC S/N : CNBA440024ADON897I2602
d.c. power supply	UNICORN Co.,LTD Model: UP-100DT 1.5 m unshielded power cable	S/N: 9668IP

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Audio transceiver module FCC ID: A3LWIDA10, IC: 649E-WIDA10.**

Specifications:

Category	Audio transceiver module
Model Name	WIDA10
Brand Name	SAMSUNG
Frequency of Operation	5180 MHz ~ 5240 MHz
Power Output (Conducted)	10.49 dBm
Channels	3 ch
Antenna Gain (peak)	4.92 dBi
Modulations	QPSK
Temperature Range	0 °C ~ +60 °C
Voltage	5.0 Vdc
Dimensions (W x H x D)	43 mm x 80 mm X 11 mm
Weight	27 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 Issue 8 A9.2	Complies	
26 dB / 99 % Bandwidth	15.407(a)	RSS-210 Issue 8 A9.2	Complies	
Maximum Conducted Output Power	15.407(a)	RSS-210 Issue 8 A9.2	Complies	
Power Spectral Density	15.407(a)	RSS-210 Issue 8 A9.2	Complies	
Peak Excursion Measurement	15.407(a)	-	Complies	
Radiated Spurious Emission	15.407(b)	RSS-210 Issue 8 A9.2	Complies	
Frequency Stability	15.407(g)	RSS-210 Issue 8 A9.4	Complies	
Maximum Permissible Exposure	1.1307(b)	RSS-102	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Active 3D glasses FCC ID: A3LWIDA10, IC: 649E-WIDA10** 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 Active 3D glasses FCC ID: A3LWIDA10, IC: 649E-WIDA10** 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 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 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; whichever determined the worst case emission. Each EME reported was calibrated using the R&S signal generator.

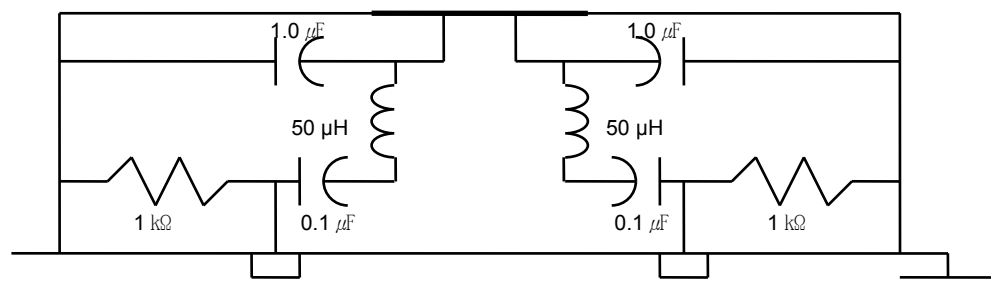


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.4-2003 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 Trilog broadband test antenna(Schwarzbeck, VULB 9168). 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.

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 final maximized level was recorded.

Unwanted emissions in the restricted bands

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 “789033 D01 General UNII Test Procedures v01r03” in section H)5) and H)6). Peak emission levels was measured by setting the analyzer RBW = 1 MHz, VBW $\geq$ 3 MHz, Detector = Peak, Sweep time = auto, Trace mode = max hold. Average emission levels was measured using the “Method VB” by setting the analyzer RBW = 1 MHz, VBW = 10 kHz (VBW $\leq$ RBW/100), Detector = Peak if, if the EUT is configured to transmit with duty cycle $\geq$ 98 percent. When the duty cycle $\leq$ 98 percent, VBW $\geq$ 1/T(T = minimum transmission duration over which the transmitter is on) was used.

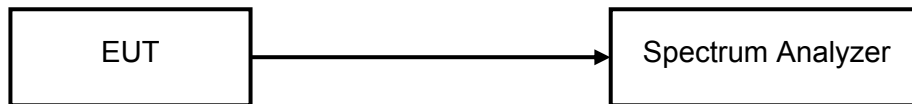
Unwanted emissions outside of the restricted bands

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 “789033 D01 General UNII Test Procedures v01r03” in section H)5). Peak emission levels was measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = auto, Trace mode = max hold.

7.3 26 dB Bandwidth and 99 % Occupied bandwidth

Test Setup



Test Procedure

1) 26 dB bandwidth

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.

2) 99 % Bandwidth

EUTs 99 % 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.

Span = 1.5 times to 5.0 times the OBW

RBW = 1 % to 5 % of the OBW

VBW > 3 x RBW

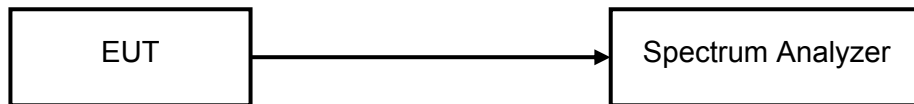
Detector = Peak

Trace mode = max hold

The bandwidth measurement function on the spectrum analyzer is used to measure 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 $\geq$ 3 MHz

Number of points in sweep $\geq$ 2 Span / RBW

Sweep time = auto

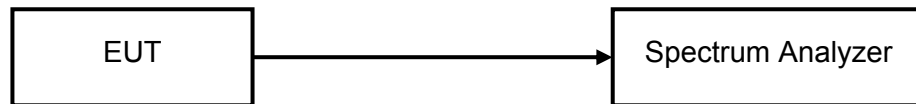
Detector = RMS

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 $\geq$ 3 MHz

Number of points in sweep $\geq$ 2 Span / RBW

Sweep time = auto

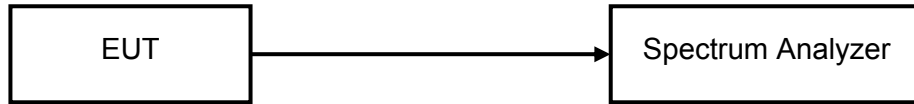
Detector = RMS

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 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.

Trance 1)

RBW = 1 MHz

VBW $\geq$ 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 $\geq$ 3 MHz

Number of points in sweep $\geq$ 2 Span / RBW

Sweep time = auto

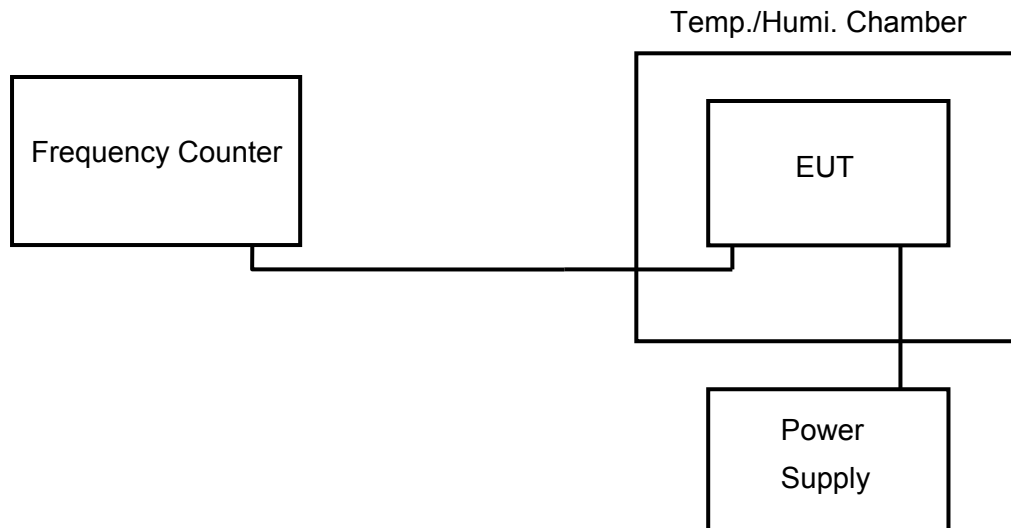
Detector = RMS

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.

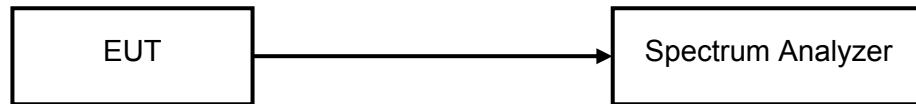
f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f) / f_c \times 10^6$ ppm.

The test extreme voltage is set from 4.7 Vdc to 5.25 Vdc according to manufacturer's specification.

Extreme temperature rule is 0 °C ~ 60 °C.

7.8 Duty Cycle

Test Setup



Test Procedure

EUTs duty cycle are measured at middle 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 = 3 ms

Trace mode = veiw

The marker function on the spectrum analyzer is used to determine the duty cycle.

According to the KDB 789033 v01r03, the zero-span measurement method shall be used while RBW and VBW are $> 50/T$. Since T is fully larger than 50 microseconds, the zero-span measurement method was used.

Following the result of the duty cycle measurement according to the above test procedure, the duty cycle was 100 %.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen

Frequency (MHz)	* Level(dB μ V)		** Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.17	54.9	35.5	L	65.0	55.0	10.1	19.5
0.23	46.7	28.5	L	62.4	52.4	15.7	23.9
0.29	40.9	21.7	L	60.5	50.5	19.6	28.8
0.52	35.2	21.5	N	56.0	46.0	20.8	24.5
12.28	43.3	42.9	N	60.0	50.0	16.7	7.1
15.36	36.7	36.5	N	60.0	50.0	23.3	13.5

Line Conducted Emissions Tabulated Data

Note(s):

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. * Correction factor was included to test level (dB μ V)
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)

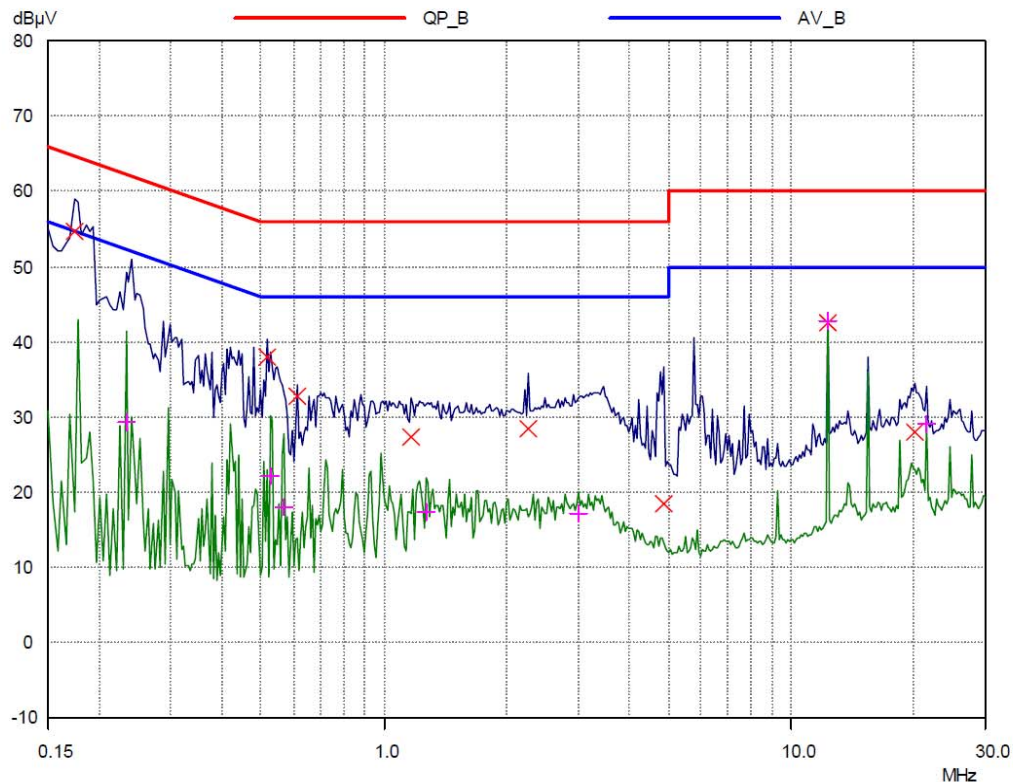
NEMKO KOREA (NK-13-R-125)

31 May 2013 20:49

Conducted Emissions

EUT: Audio transceiver
Manuf: Samsung Electronics
Op Cond: a.c. 120 V / 60 Hz (5210 MHz Audio tx mode)
Operator: Jinha. KO
Test Spec: FCC Part 15.207
Comment: MODEL : WIDA10
LINE : L1

Scan Settings		(1 Range)			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)

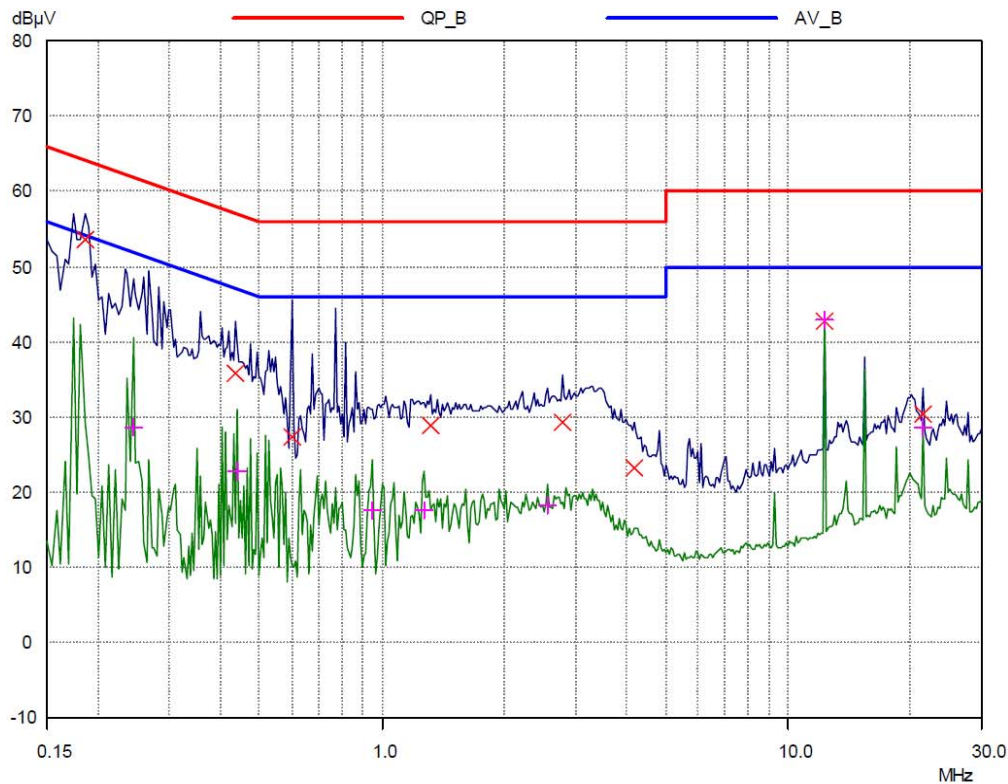
NEMKO KOREA (NK-13-R-125)

31 May 2013 20:58

Conducted Emissions

EUT: Audio transceiver
Manuf: Samsung Electronics
Op Cond: a.c. 120 V / 60 Hz (5210 MHz Audio tx mode)
Operator: Jinha. KO
Test Spec: FCC Part 15.207
Comment: MODEL : WIDA10
LINE : Neutral

Scan Settings		(1 Range)			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					



TEST DATA

8.2 Radiated Emissions

FCC §15.209 / IC RSS-210 Issue 8, A9.2

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
61.44	41.42	V	125	321	-17.1	24.3	40.0	15.7
144.01	42.07	H	120	18	-17.1	25.0	43.5	18.5
228.58	47.11	H	200	310	-19.1	28.0	46.0	18.0
258.05	44.70	H	156	40	-15.5	29.2	46.0	16.8
307.20	44.30	H	122	124	-13.6	30.7	46.0	15.3
847.88	31.47	H	121	339	-3.4	28.1	46.0	17.9

Radiated Measurements at 3meters

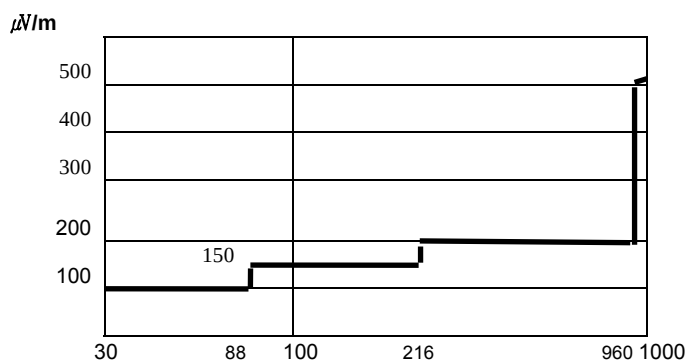


Fig. 4. Limits at 3 meters

Note(s):

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 μ V /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.

TEST DATA

8.3 26 dB Bandwidth and 99 % Occupied bandwidth

FCC §15.407(a) / IC RSS-210 Issue 8, 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	16.22	15.04
Middle	5210	16.22	15.03
High	5240	16.23	15.03

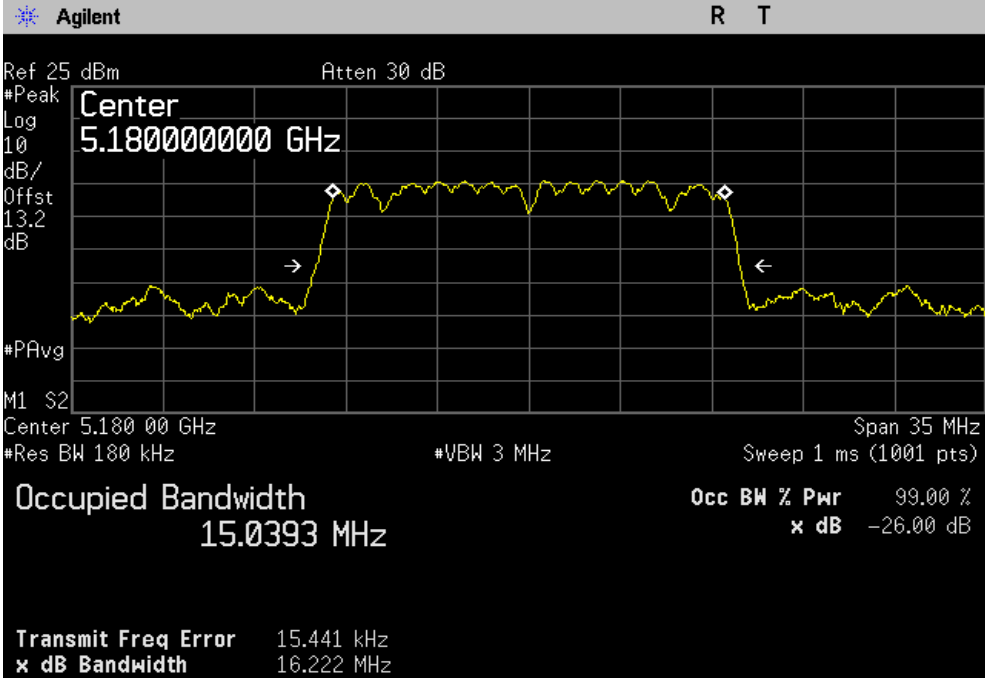
Ant B

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)
Low	5180	16.25	15.04
Middle	5210	16.24	15.03
High	5240	16.24	15.03

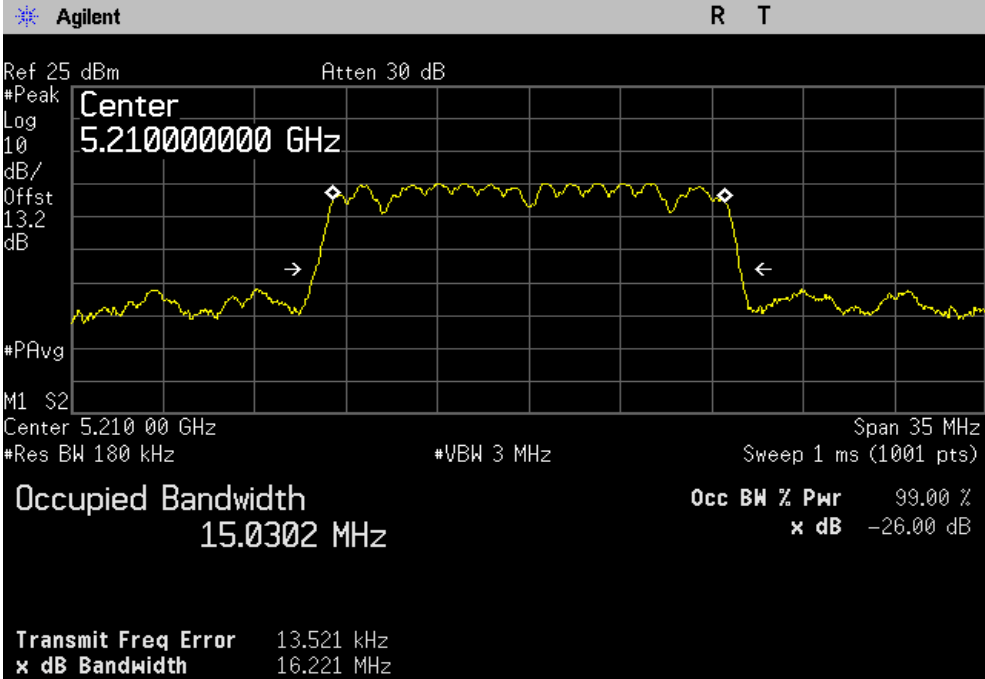
PLOTS OF EMISSIONS

Ant A

Bandwidth, Lowest Channel (5180 MHz)

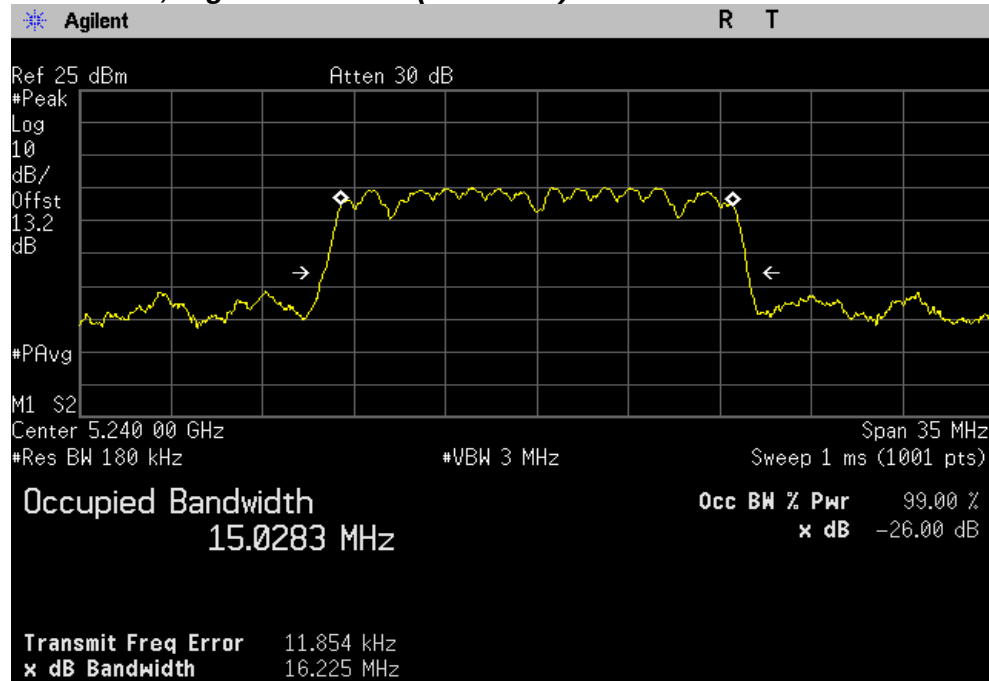


Bandwidth, Middle Channel (5210 MHz)



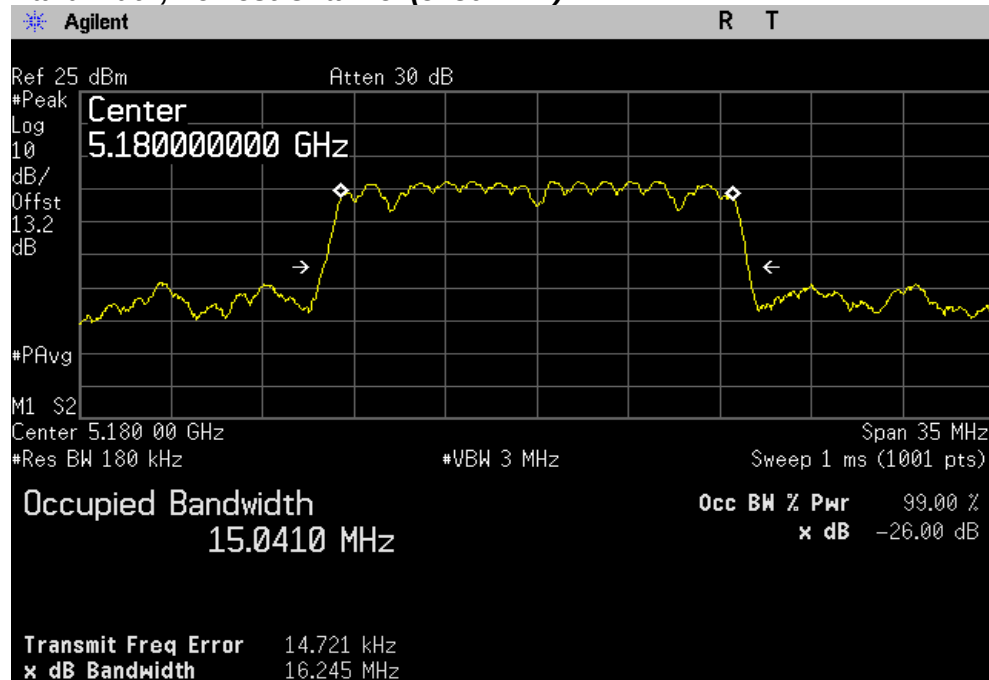
PLOTS OF EMISSIONS

Bandwidth, Highest Channel (5240 MHz)



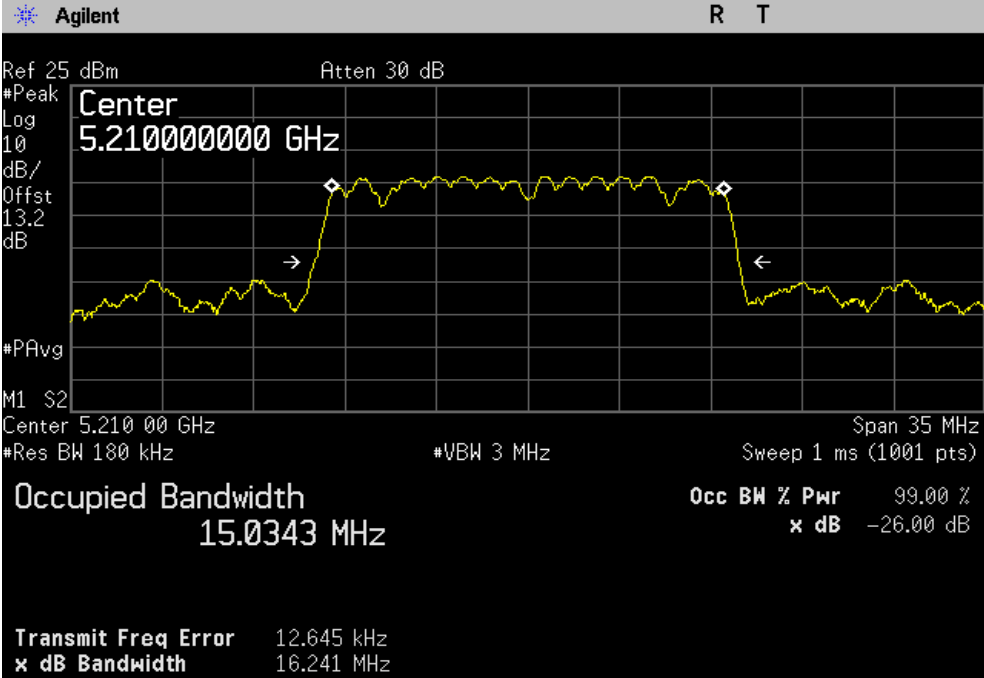
Ant B

Bandwidth, Lowest Channel (5180 MHz)

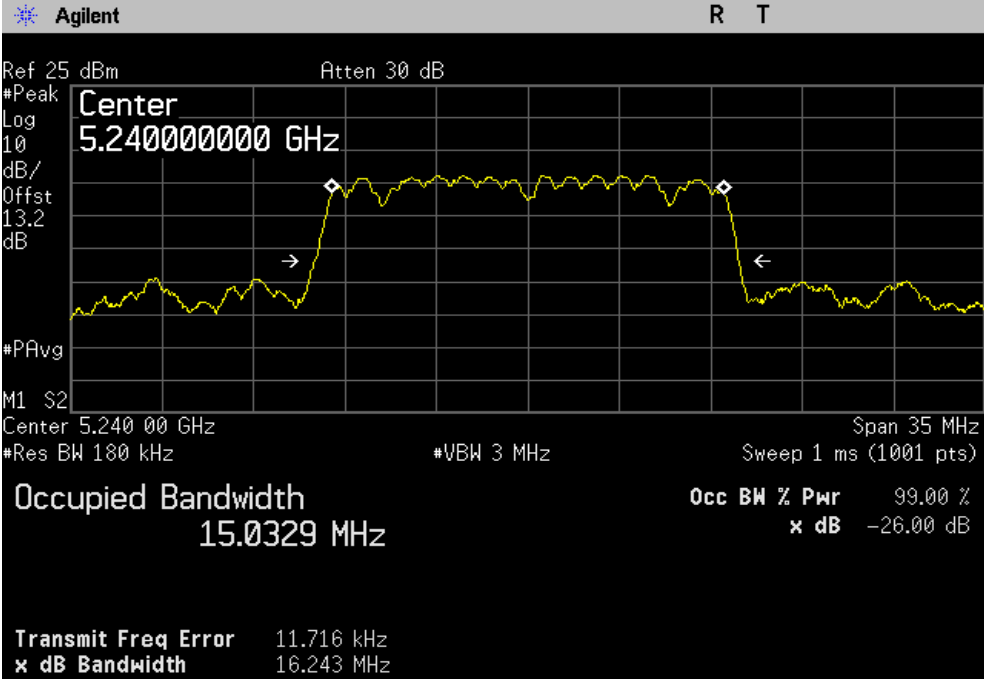


PLOTS OF EMISSIONS

Bandwidth, Middle Channel (5210 MHz)



Bandwidth, Highest Channel (5240 MHz)



TEST DATA

8.4 Maximum Conducted Output Power

FCC §15.407(a) / IC RSS-210 Issue 8, A9.2

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

Ant A

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	8.94	16.11	7.17
Middle	5210	8.33	16.11	7.78
High	5240	8.07	16.11	8.04

Ant B

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.49	16.11	5.62
Middle	5210	9.99	16.11	6.12
High	5240	10.15	16.11	5.96

Note(s):

The following equation was used for spectrum offset:

$\text{Spectrum offset (dB)} = \text{Attenuator (dB)} + \text{Cable Loss (dB)} + \text{SMA Type Connector Loss (dB)}$

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(26 dB Bandwidth)

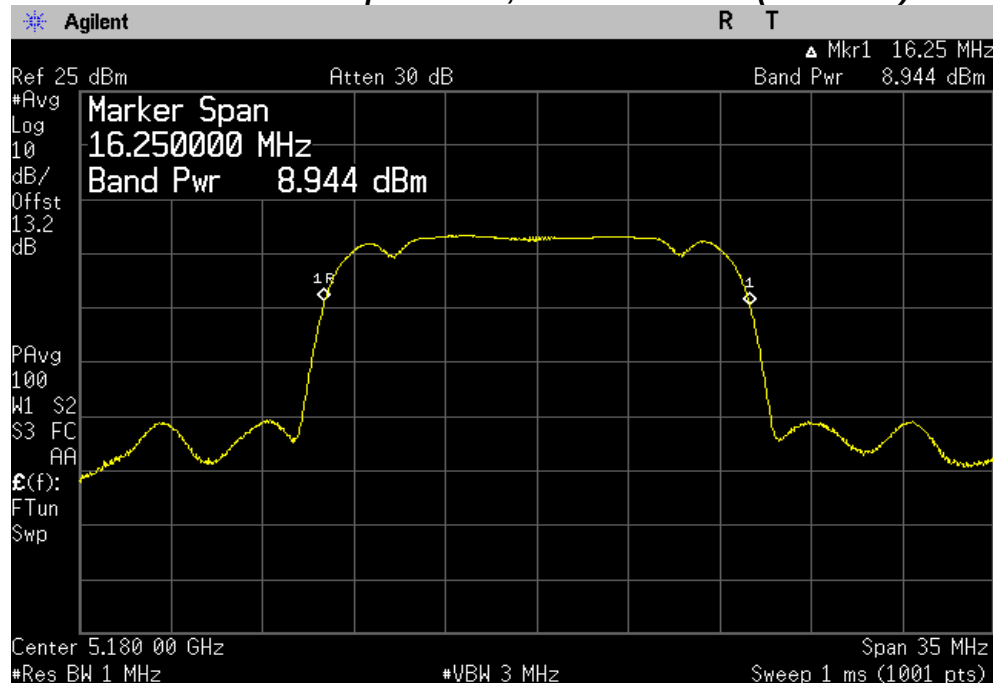
$= 4 \text{ dBm} + 10\log(16.25) = 16.11 \text{ dBm}$

The maximum conducted output limit is 16.11 dBm.

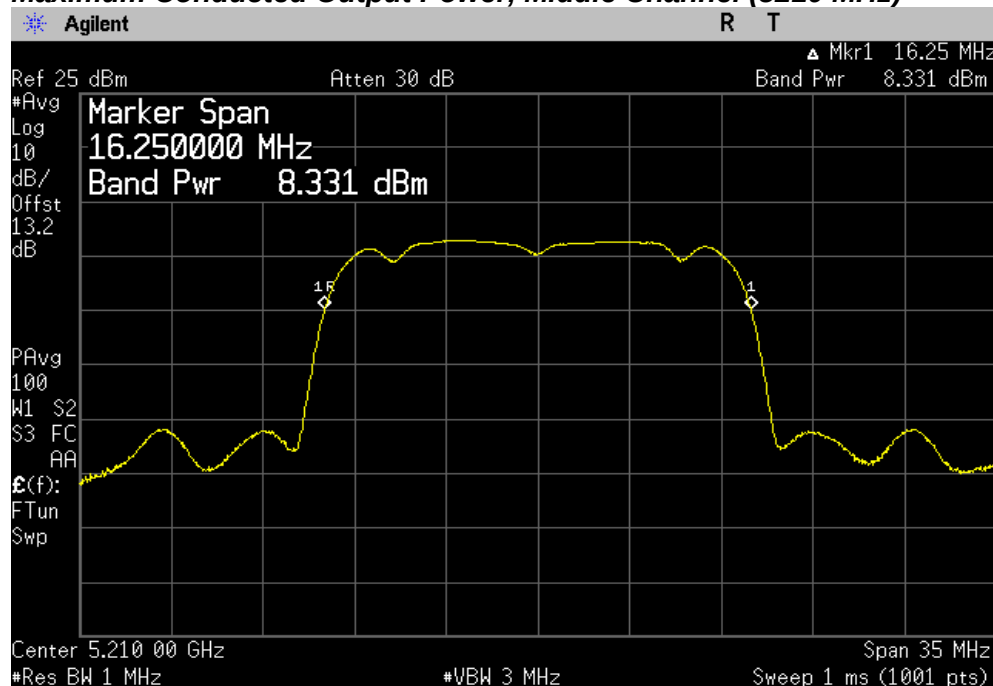
PLOTS OF EMISSIONS

Ant A

Maximum Conducted Output Power, Lowest Channel (5180 MHz)

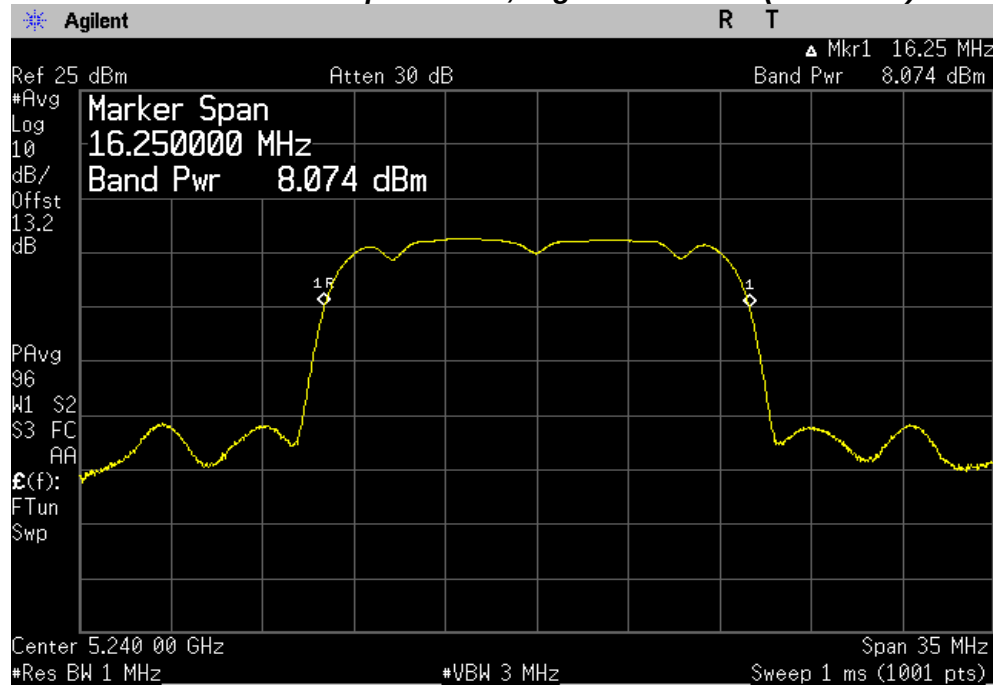


Maximum Conducted Output Power, Middle Channel (5210 MHz)



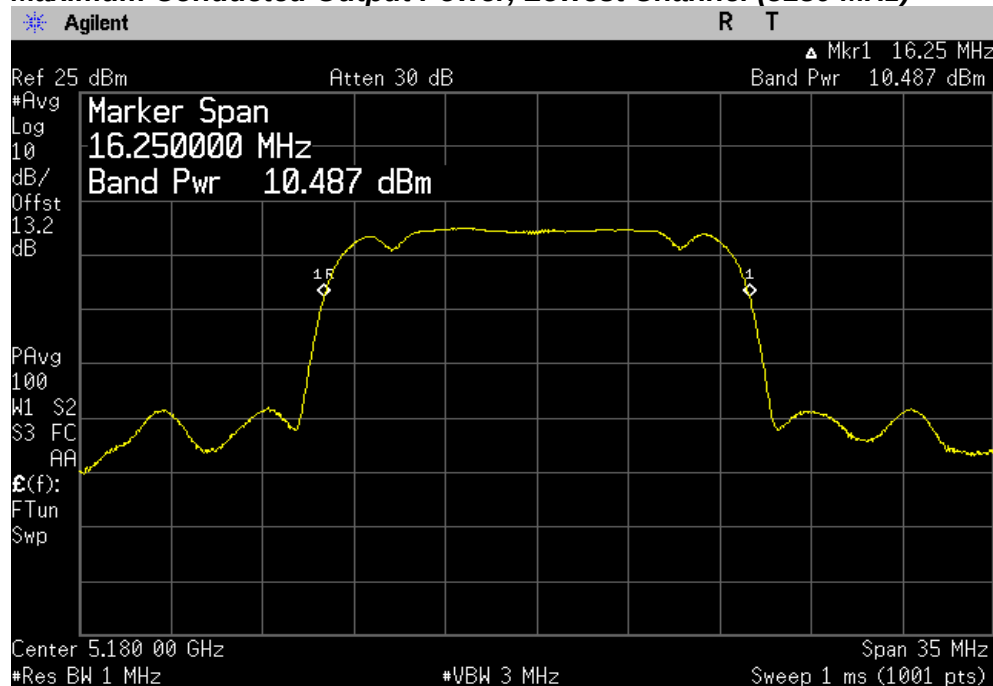
PLOTS OF EMISSIONS

Maximum Conducted Output Power, Highest Channel (5240 MHz)



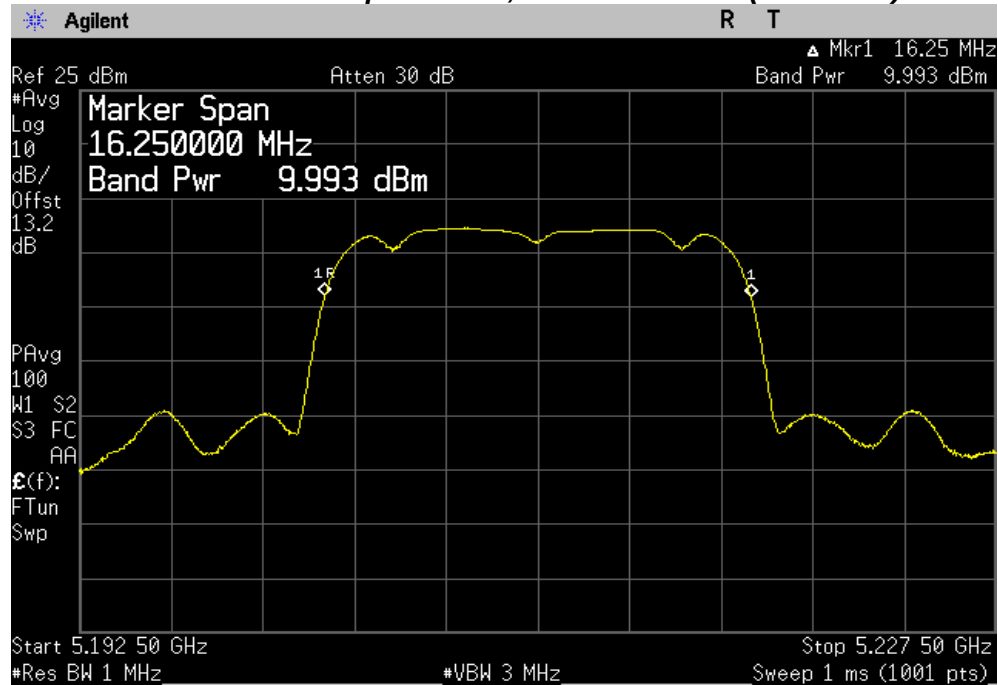
Ant B

Maximum Conducted Output Power, Lowest Channel (5180 MHz)

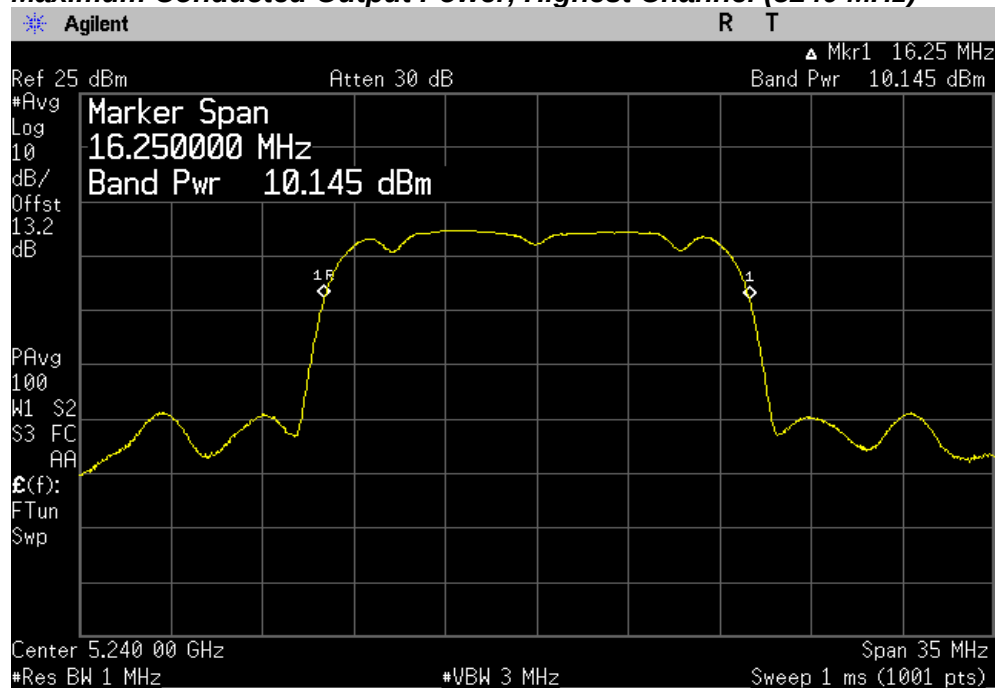


PLOTS OF EMISSIONS

Maximum Conducted Output Power, Middle Channel (5210 MHz)



Maximum Conducted Output Power, Highest Channel (5240 MHz)



TEST DATA

8.5 Power Spectral Density

FCC §15.407(a) / IC RSS-210 Issue 8, 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	-1.88	4	5.88
Middle	5210	-2.32	4	6.32
High	5240	-2.52	4	6.52

Ant B

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Limit(dBm)	Margin(dB)
Low	5180	-1.04	4	5.04
Middle	5210	-0.72	4	4.72
High	5240	-1.20	4	5.20

Note(s):

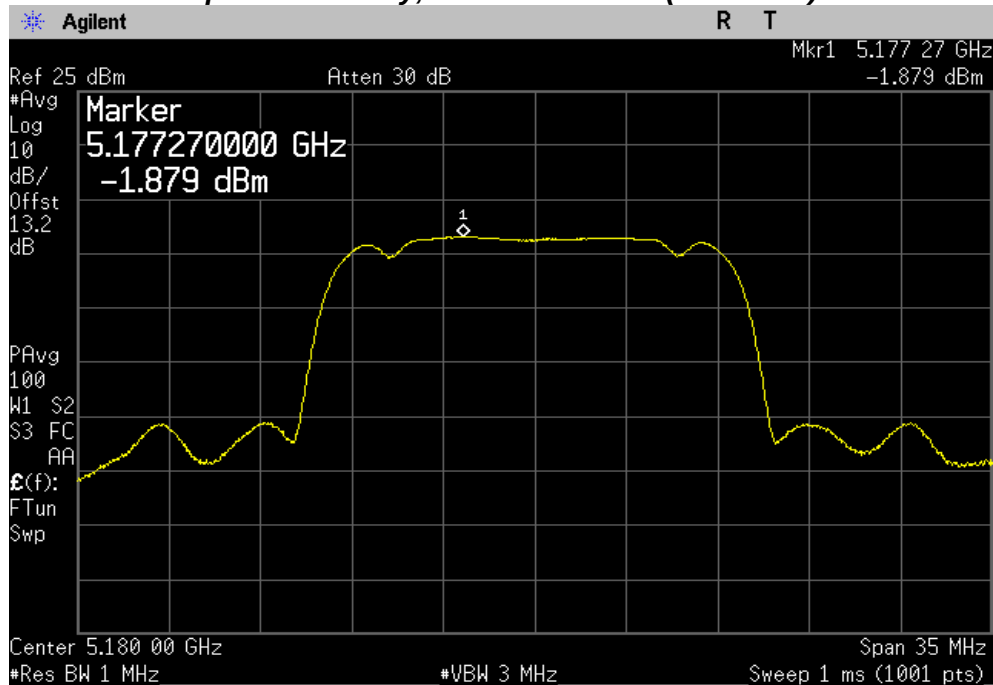
The following equation was used for spectrum offset:

$\text{Spectrum offset (dB)} = \text{Attenuator (dB)} + \text{Cable Loss (dB)} + \text{SMA Type Connector Loss (dB)}$

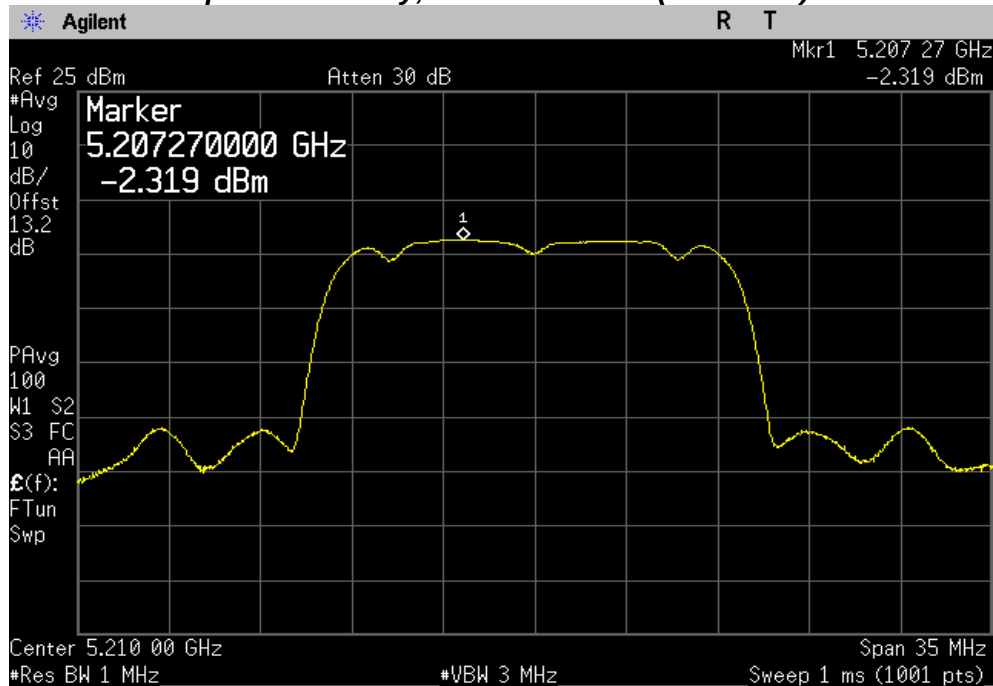
PLOT OF TEST DATA

Ant A

Peak Power Spectral Density, Lowest Channel (5180 MHz)

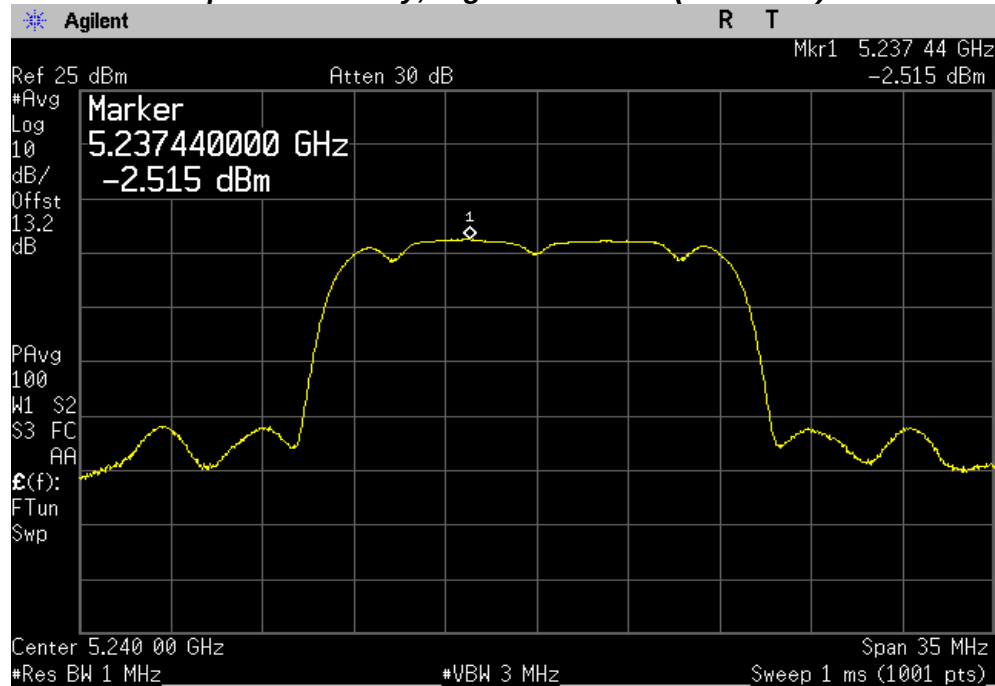


Peak Power Spectral Density, Middle Channel (5210 MHz)



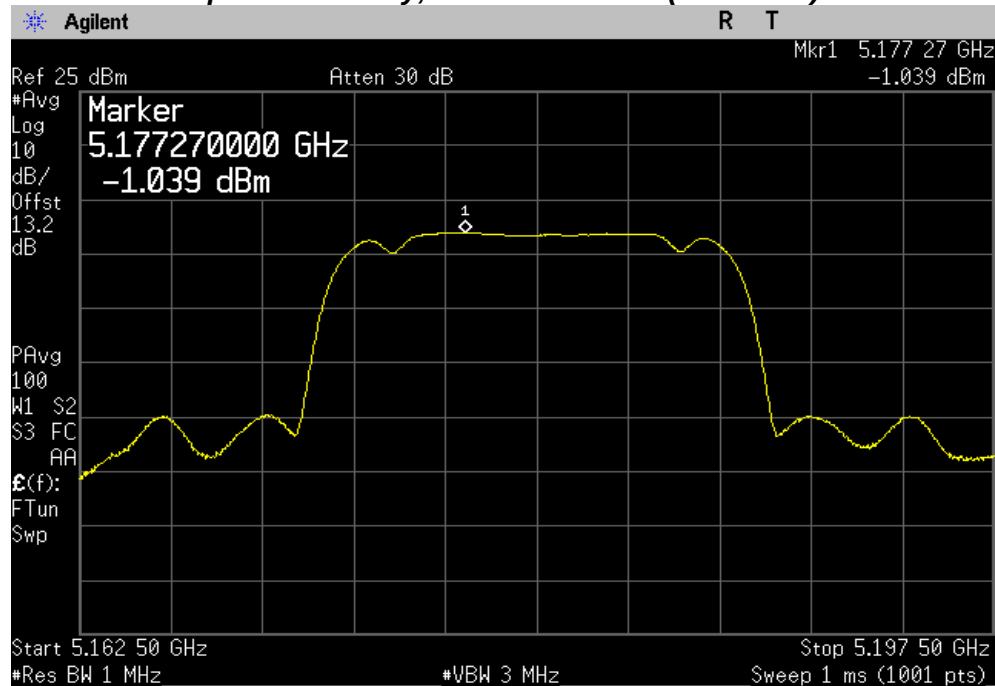
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (5240 MHz)



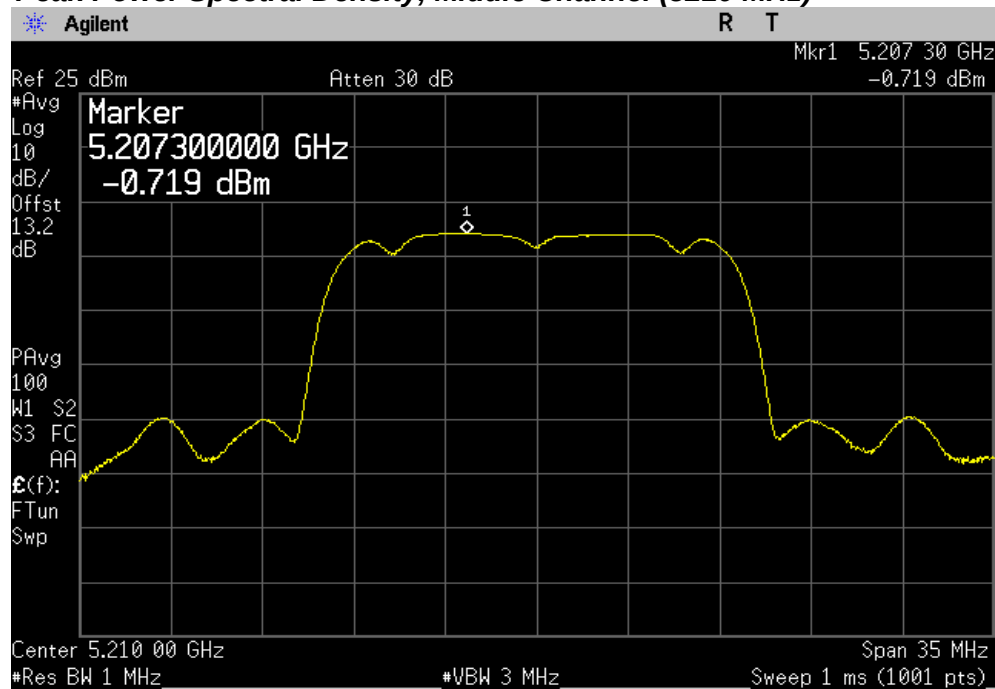
Ant B

Peak Power Spectral Density, Lowest Channel (5180 MHz)

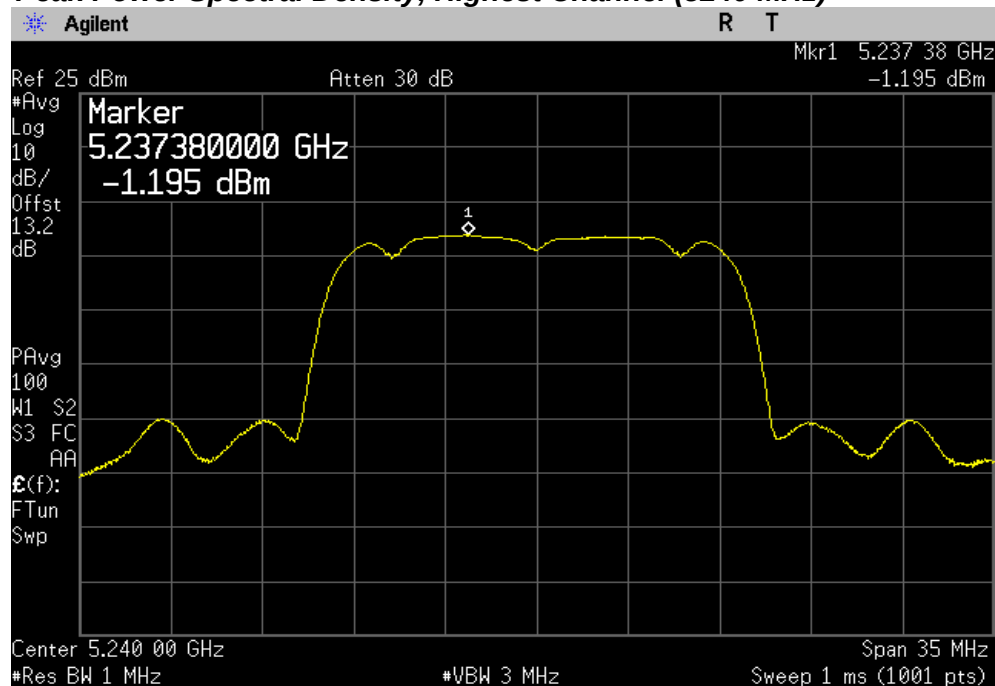


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (5210 MHz)



Peak Power Spectral Density, Highest Channel (5240 MHz)



TEST DATA

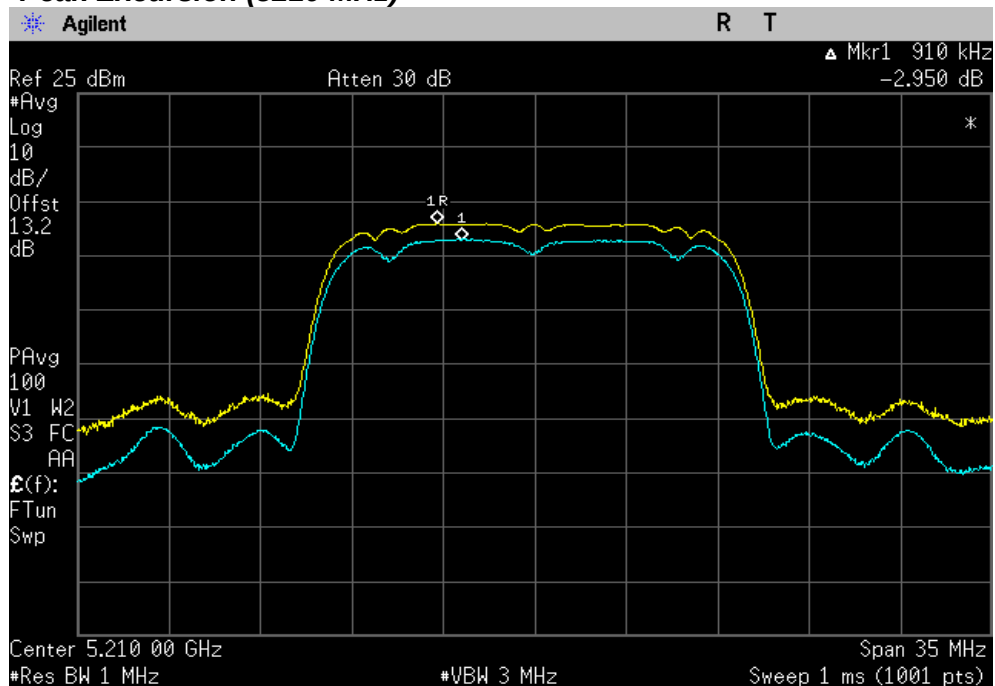
8.6 Peak Excursion

FCC §15.407(a)

Test Mode : Set to Lowest channel

Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin(dB)
5210	2.95	13	10.05

Peak Excursion (5210 MHz)



TEST DATA

8.7 Radiated Spurious Emissions

FCC §15.407(b) / IC RSS-210 Issue 8, A9.2

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

Ant A

Lowest Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.36	47.55	H	peak	5.65	-6.02	47.18	68.2	21.02
15.54	48.43	H	peak	5.96	-6.02	48.37	74.0	25.63
15.54	37.63	H	average	5.96	-6.02	37.57	54.0	16.43
15.54	48.67	V	peak	5.96	-6.02	48.61	74.0	25.39
15.54	36.75	V	average	5.96	-6.02	36.69	54.0	17.31

Middle Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.42	46.69	H	peak	5.62	-6.02	46.29	68.2	21.91
15.63	50.41	H	peak	5.85	-6.02	50.24	74.0	23.76
15.63	37.56	H	average	5.85	-6.02	37.39	54.0	16.61
15.63	48.72	V	peak	5.85	-6.02	48.55	74.0	25.45
15.63	36.94	V	average	5.85	-6.02	36.77	54.0	17.23

Highest Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.48	46.22	H	peak	5.65	-6.02	45.85	68.2	22.35
15.72	47.76	H	peak	5.08	-6.02	46.82	74.0	27.18
15.72	36.22	H	average	5.08	-6.02	35.28	54.0	18.72
15.72	47.82	V	peak	5.08	-6.02	46.88	74.0	27.12
15.72	36.23	V	average	5.08	-6.02	35.29	54.0	18.71

Ant B

Lowest Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.36	47.13	H	peak	5.65	-6.02	46.76	68.2	21.44
15.54	48.17	H	peak	5.96	-6.02	48.11	74.0	25.89
15.54	36.18	H	average	5.96	-6.02	36.12	54.0	17.88
15.54	48.73	V	peak	5.96	-6.02	48.67	74.0	25.33
15.54	36.50	V	average	5.96	-6.02	36.44	54.0	17.56

Middle Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.42	45.86	H	peak	5.62	-6.02	45.46	68.2	22.74
15.63	48.79	H	peak	5.85	-6.02	48.62	74.0	25.38
15.63	37.12	H	average	5.85	-6.02	36.95	54.0	17.05
15.63	49.01	V	peak	5.85	-6.02	48.84	74.0	25.16
15.63	37.24	V	average	5.85	-6.02	37.07	54.0	16.93

Highest Channel

Frequency	Reading	Pol*	mode	AF+CL+Amp	Distance	Result	Limit	Margin
(GHz)	(dBμV)	(H/V)		(dB)**	(dB)***	(dBμV/m)	(dBμV/m)	(dB)
10.48	46.35	V	peak	5.65	-6.02	45.98	68.2	22.22
15.72	47.71	H	peak	5.08	-6.02	46.77	74.0	27.23
15.72	36.02	H	average	5.08	-6.02	35.08	54.0	18.92
15.72	47.52	V	peak	5.08	-6.02	46.58	74.0	27.42
15.72	36.14	V	average	5.08	-6.02	35.20	54.0	18.80

Note(s):

- *Pol. H = Horizontal V = Vertical
- **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- ***Distance factor = $20 \log (\text{test distance/specific distance}) = 20 \log (1.5 / 3)$
- 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.
- At frequencies above 1 GHz, peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
- As the EUT was configured to transmit with duty cycles ≥ 98 percent, at frequencies above 1 GHz, average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 10 kHz ($\text{VBW} \leq \text{RBW}/100$), Detector = Peak.
- The spectrum is measured from 9 kHz to 10^{th} harmonic and the worst-case emissions are reported.
No significant emissions were found beyond the third harmonic for this device.
- The peak limit of non-restricted band is -27 dBm/MHz can be converted 68.2 dBμV/m per KDB789033.
- For restricted band, the peak limit is 74 dBμV/m and the average limit is 54 dBμV/m per § 15.209.

TEST DATA

8.8 Radiated Band Edge

FCC §15.407(b)

Test Mode : Set to Lowest channel and Highest channel

Ant A

Lowest Channel (5180 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5148.74	43.00	V	peak	10.00	53.00	74.0	21.00
5148.73	35.50	V	average	10.00	45.50	54.0	8.50

Highest Channel (5240 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5350.45	41.70	V	peak	10.30	52.00	74.0	22.00
5350.41	33.60	V	average	10.30	43.90	54.0	10.10

Ant B

Lowest Channel (5180 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5148.64	44.90	H	peak	10.00	54.90	74.0	19.10
5148.68	35.80	H	average	10.00	45.80	54.0	8.20

Highest Channel (5240 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5350.26	43.00	V	peak	10.30	53.30	74.0	20.70
5350.26	33.20	V	average	10.30	43.50	54.0	10.50

Note(s):

1. *Pol. H = Horizontal V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. The Band edge 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.
4. The peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
5. As the EUT was configured to transmit with duty cycles ≥ 98 percent, the average emission levels were measured using the "Method VB" by setting the analyzer RBW = 1 MHz, VBW = 10 kHz (VBW $\leq$ RBW/100), Detector = Peak.
6. For restricted band, the peak limit is 74 dB μ V/m and the average limit is 54 dB μ V/m per § 15.209.

TEST DATA

8.9 Frequency Stability

FCC §15.407(g) / IC RSS-210 Issue 8, A9.4

Test channel : Middle channel (5210 MHz)

Standard test voltage : 5.0 Vdc

Measurement Result :

Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100 %	5.00	25(Ref.)	5,209,937,987	-62,013	-11.9027
100 %		0	5,209,963,037	-36,963	-7.0946
100 %		10	5,209,961,311	-38,689	-7.4259
100 %		20	5,209,955,983	-44,017	-8.4486
100 %		30	5,209,946,675	-53,325	-10.2351
100 %		40	5,209,937,448	-62,552	-12.0061
100 %		50	5,209,934,370	-65,630	-12.5969
100 %		60	5,209,938,724	-61,276	-11.7612
Min. voltage	4.70	25	5,209,938,337	-61,663	-11.8355
Max. voltage	5.25	25	5,209,937,862	-62,138	-11.9267

Note(s):

The temperature is varied from 0 °C to +60 °C using an environmental chamber.

According to the results of the frequency stability test, the maximum frequency tolerance was -12.6 PPM at 50 °C. Since it is very small and smaller than the tolerance as specified in the users manual, the device is judged that an emission is maintained within the band of operation under all conditions of normal operation.

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 09 2013	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 08 2012	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 17 2012	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 16 2012	1 year
5	*Amplifier	R & S	SCU18	10065	Apr. 05 2013	1 year
6	*Amplifier	R & S	SCU26	10011	**Jun. 01 2012	1 year
7	*Amplifier	R & S	SCU40	10008	**Jun. 01 2012	1 year
8	*Pre Amplifier	HP	8449B	3008A00107	Jan. 09 2013	1 year
9	*Pre Amplifier	HP	8447F	2805A03351	Jul. 17 2012	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 16 2012	1 year
11	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Apr. 05 2013	1 year
12	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 17 2012	1 year
13	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 21 2012	2 year
14	Wideband Power Sensor	R & S	NRP-Z81	100634	Sep 22 2012	1 year
15	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 26 2012	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Aug. 13 2012	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 20 2013	2 year
18	*Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 20 2013	2 year
19	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 year
20	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 26 2012	2 year
21	*LISN	R & S	ESH3-Z5	833874/006	Oct. 08 2012	1 year
22	LISN	R & S	ESH2-Z5	100227	Apr. 04 2013	1 year
23	*DC Power Supply	UNICORN	UP-100DT	9668IP	Oct. 09 2013	N/A
24	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
25	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
26	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
27	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
28	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
29	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
32	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
33	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

Note(s)

- * Test equipment used during the test
- ** These equipments were not used to test after June 1, 2013.

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	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	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 : + ($\geq$ 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)			