

Nemko Korea CO., Ltd.

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

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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

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

Dates of Issue : January 5, 2011
Test Report No. : NK-10-R-378-1
Test Site : Nemko Korea Co., Ltd.

FCC ID
IC ID

A3LWISP30
649E-WISP30

Brand Name

SAMSUNG

Contact Person

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

Applied Standard: FCC 47 CFR Part 15 Subpart C §15.247 and
IC RSS-210 Annex 8

Classification: Digital modulation Transmitter

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.



Jan 5, 2011

Tested By : Jinha Ko
Engineer



Jan. 05. 2011

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

Samsung Electronics Co., Ltd.

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FCC ID : A3LWISP30 / IC ID : 649E-WISP30

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1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15 and IC RSS-210.

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

- FCC ID: A3LWISP30
- IC ID: 649E-WISP30
- Model: WISP30
- Brand Name: SAMSUNG
- EUT Type: Audio transceiver module
- Classification: Digital modulation Transmitter
- Applied Standard: FCC 47 CFR Part 15 subpart C part 15.247 and IC RSS-210 Annex 8
- Test Procedure(s): ANSI C63.4 (2003)
- Dates of Test: Nov. 23, 2010 ~ Dec. 9, 2010
- 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 9kHz to 40GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**

FCC ID : **A3LWISP30** and IC ID : **649E-WISP30**

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

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

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilo-meters (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.
EMC Lab.
300-2, Osan-Ri, Mohyeon-Myeon,
Cheoin-Gu, Yongin-Si, Gyeonggi-Do,
KOREA 449-852
Tel)+82-31-322-2333

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
	Canada IC Registered site	Site No. 2040E-1
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	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 pathes then the worst case was recorded.

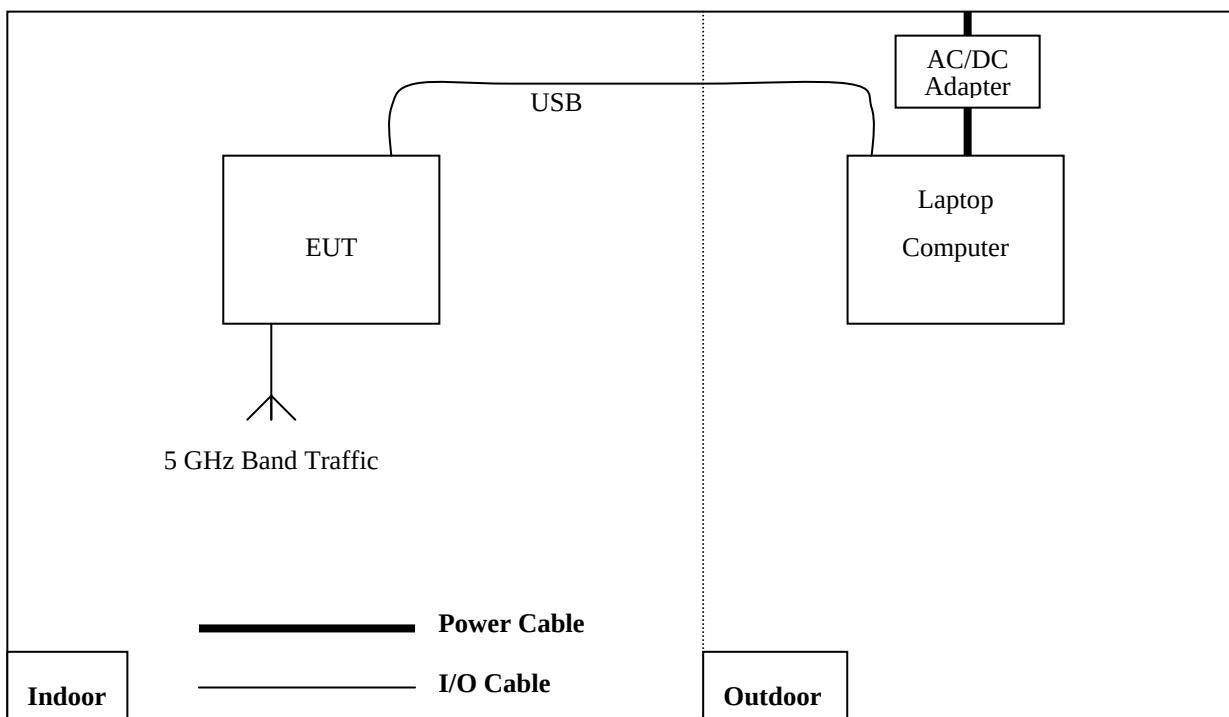
The EUT was programmed with the following power setting that used during the testing:

Frequency	5736 MHz	5762 MHz	5814 MHz
Power Level	10	10	10

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. FCC ID: A3LWISP30	S/N: N/A
Laptop Computer	Dell Inc. Model : PP27L 1.5 m shielded USB cable	FCC DOC S/N : N/A
AC/DC Adapter	Hipro Electronics(Dongguan) Co., Ltd. Model : HA90PE1-00 1.0 m unshielded power cable	FCC DOC S/N : N/A

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Audio transceiver module FCC ID: A3LWISP30, IC ID: 649E-WISP30.**

Specifications:

Category	Audio transceiver module
Model Name	WISP30
Brand Name	SAMSUNG
Frequency of Operation	5736 MHz to 5814 MHz
Power Output (Conducted)	18.35 dBm
Channels	3 ch
Antenna Gain (peak)	3.96 dBi
Modulations	QPSK
Temperature Range	0 °C ~ +55 °C
Voltage	5.0 Vdc
Dimensions (W x H x D)	26 mm x 60 mm X 3 mm
Weight	6 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 A8.5	Complies	
6 dB Bandwidth	15.247(a)(2)	RSS-210 A8.2	Complies	
Peak Power Output	15.247(b)(3)	RSS-210 A8.4	Complies	
Power Spectral Density	15.247(e)	RSS-210 A8.2	Complies	
Conducted Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-210 A8.5	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: A3LWISP30, IC ID: 649E-WISP30** 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 Audio transceiver module FCC ID: A3LWISP30, IC ID: 649E-WISP30** 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 uH 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.

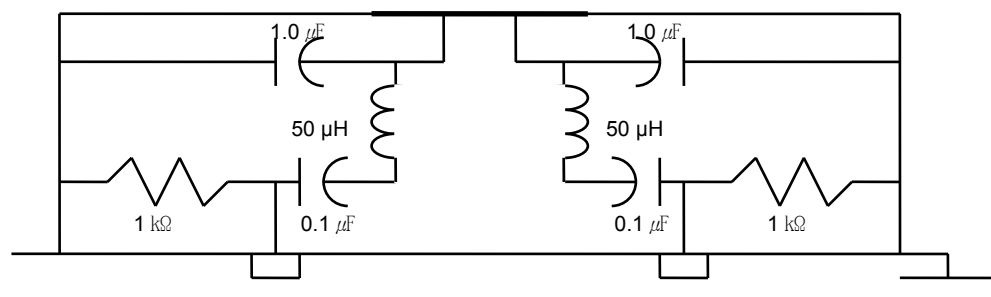


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

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

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

Each frequency found during pre-scan measurements was reexamined and investigated using EMI test receiver (ESCS30) & (FSP40). The detector function was set to CISPR peak mode or quasi-peak mode or average mode and the band-width of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal. The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non- metallic 1.0 x 1.5 meter table. The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turn table containing the Technology was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

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

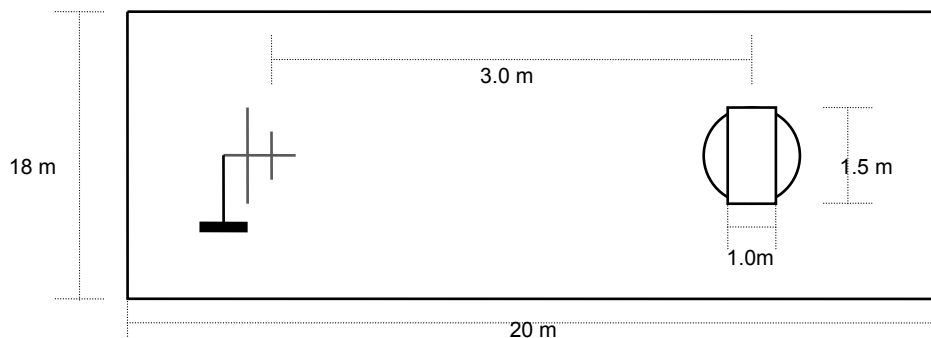
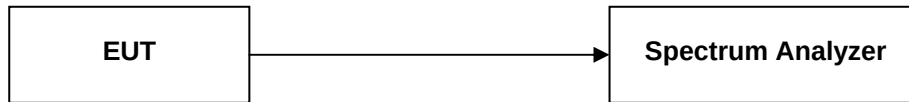


Fig. 3. Dimensions of Outdoor Test Site

7.3 6 dB Bandwidth

Test Setup



Test Procedure

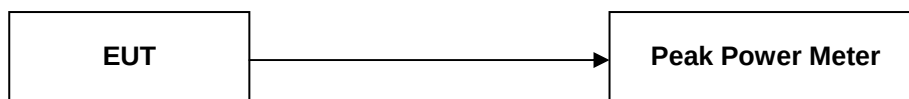
The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer. The RBW and VBW of spectrum analyzer are set to 100 kHz.

The sweep time is coupled.

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

7.4 Maximum Peak Output Power

Test Setup

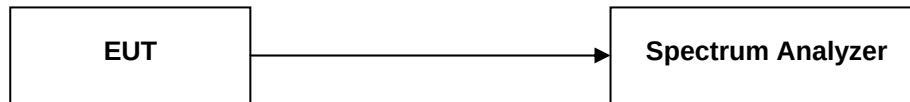


Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the Peak Power Meter.

7.5 Peak Power Spectral Density

Test Setup



Test Procedure

The transmitter is connected to the Spectrum analyzer.

The maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer.

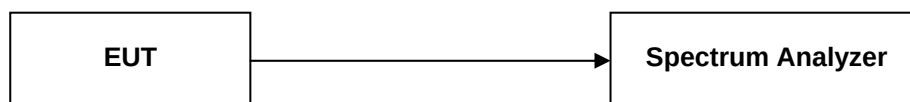
The RBW of spectrum analyzer is set to 3 kHz and VBW is set to 3 kHz.

The sweep time is set to Span/3 kHz and video averaging is turned off.

The PPSD is the highest level found across the emission in any 3 kHz band.

7.6 Conducted Spurious Emissions

Test Setup



Test Procedure

The transmitter is connected to the spectrum analyzer.

The RBW of spectrum analyzer is set to 100 kHz and VBW is set to the 300 kHz.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the Lowest, Middle and highest channels.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen

Frequency (MHz)	Level(dB μ V)		*)Factor (dB)	**) Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average			Q-Peak	Average	Q-Peak	Average
0.15	40.5	15.6	0.2	N	66.0	56.0	25.5	40.4
0.23	42.8	22.4	0.2	N	62.4	52.4	19.6	30.0
0.26	43.8	35.7	0.2	L	61.4	51.4	17.6	15.7
0.29	42.4	29.0	0.2	N	60.5	50.5	18.1	21.5
1.07	35.8	33.3	0.2	N	56.0	46.0	20.2	12.7
1.75	37.1	31.4	0.2	N	56.0	46.0	18.9	14.6

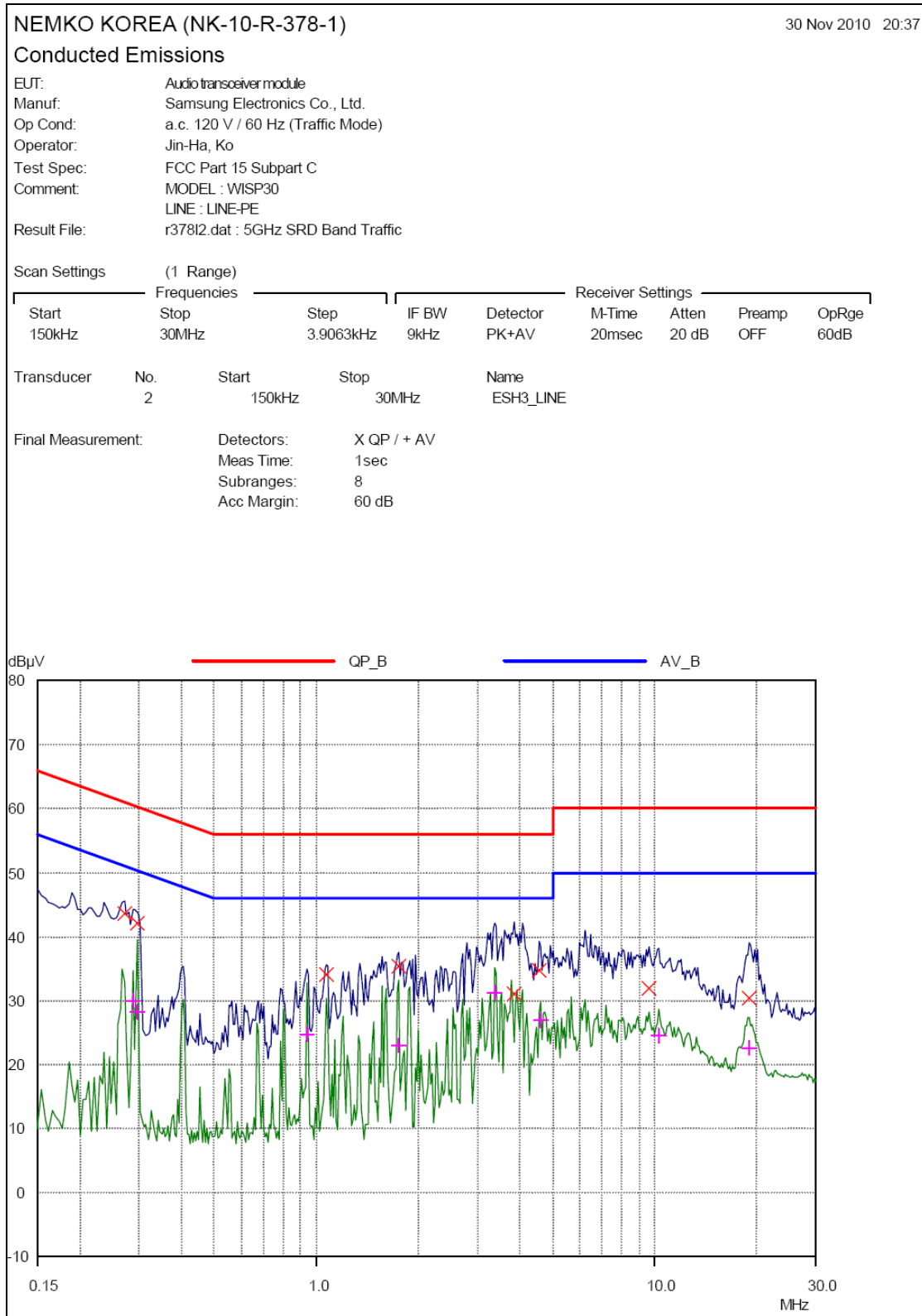
Line Conducted Emissions Tabulated Data

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).

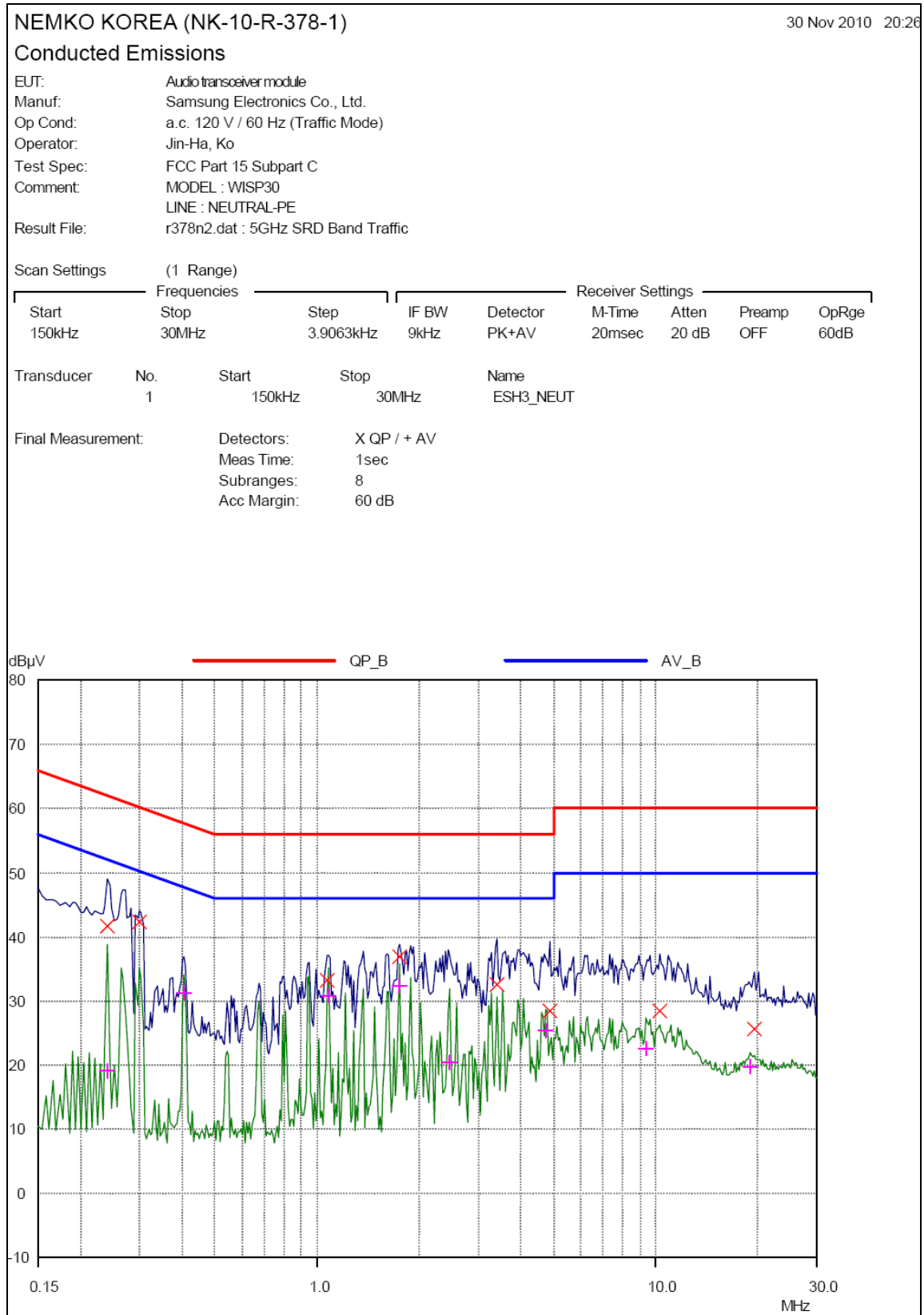
PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Line)



PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Neutral)



TEST DATA

8.2 Radiated Emissions

FCC §15.209, RSS-210 A8.5

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Height (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
195.40	39.3	V	100	311	-16.2	23.1	43.5	20.4
213.82	46.0	H	201	68	-19.1	26.9	43.5	16.6
254.20	29.8	H	167	11	-15.5	14.3	46.0	31.7
285.15	48.6	H	247	201	-15.5	33.1	46.0	12.9
320.75	30.8	H	300	243	-13.6	17.2	46.0	28.8
351.99	48.4	H	100	358	-13.6	34.8	46.0	11.2

Radiated Measurements at 3meters

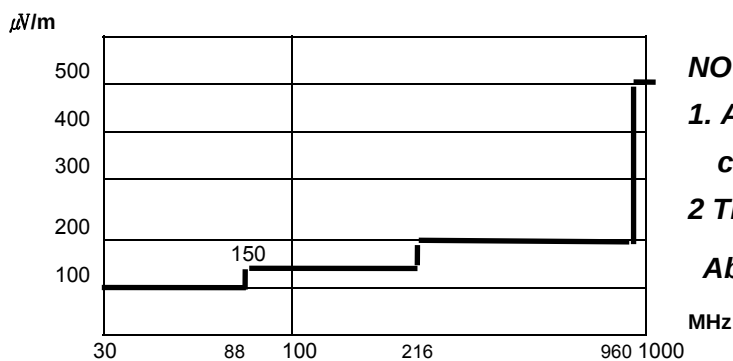


Fig. 4. Limits at 3 meters

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 V/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).

TEST DATA

8.3 6 dB Modulated Bandwidth

FCC §15.247(a)(2), RSS-210 A8.2

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

Result:

Ant A

Channel	Frequency(MHz)	Result(kHz)	Limit(kHz)	Margin(kHz)
Low	5736	9853	500	9353
Middle	5762	9859	500	9359
High	5814	9859	500	9359

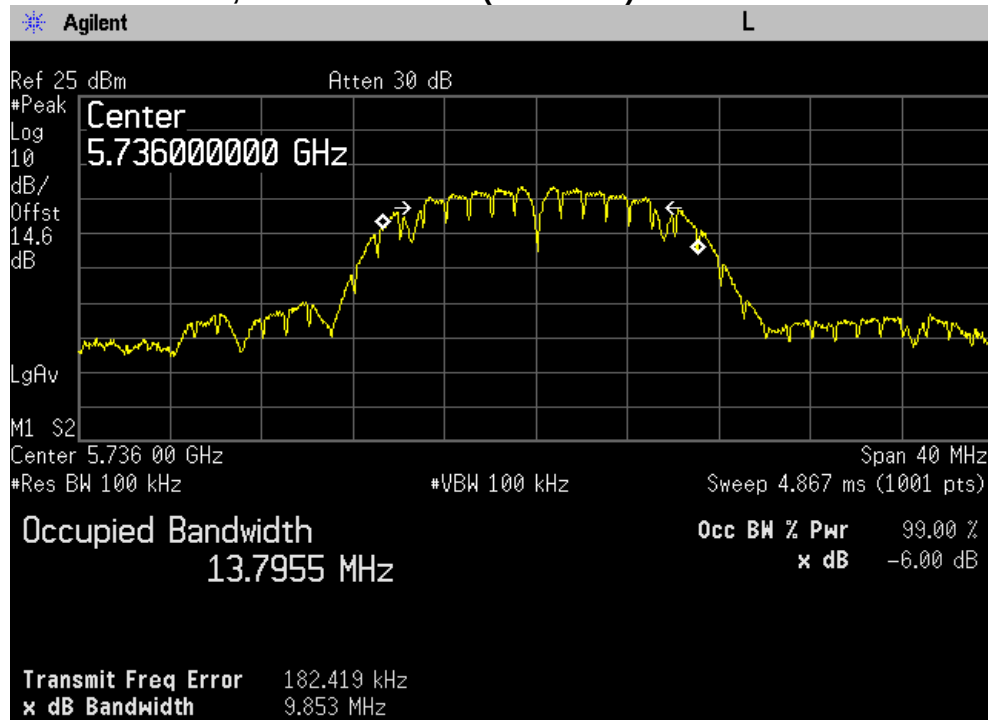
Ant B

Channel	Frequency(MHz)	Result(kHz)	Limit(kHz)	Margin(kHz)
Low	5736	9851	500	9351
Middle	5762	9856	500	9356
High	5814	9853	500	9353

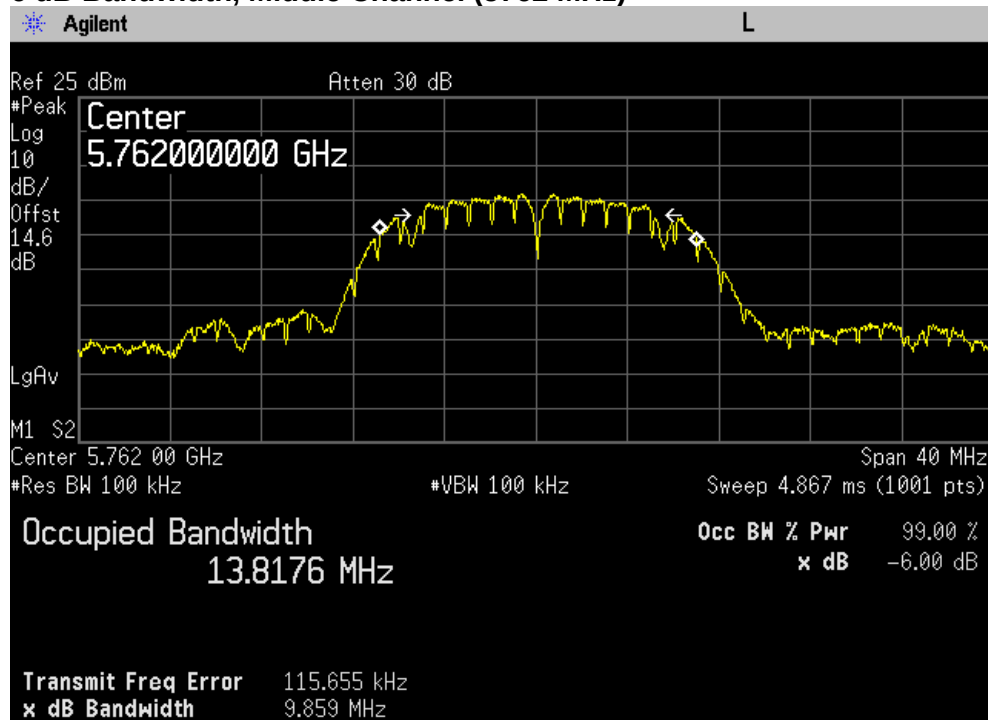
PLOTS OF EMISSIONS

Ant A

6 dB Bandwidth, Lowest Channel (5736 MHz)

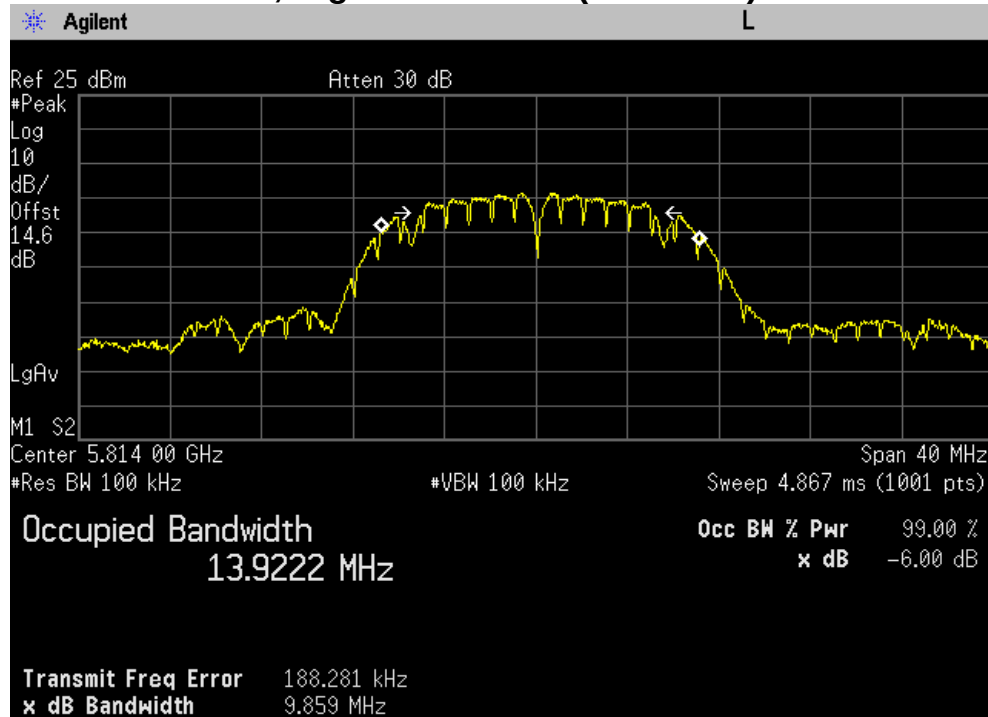


6 dB Bandwidth, Middle Channel (5762 MHz)



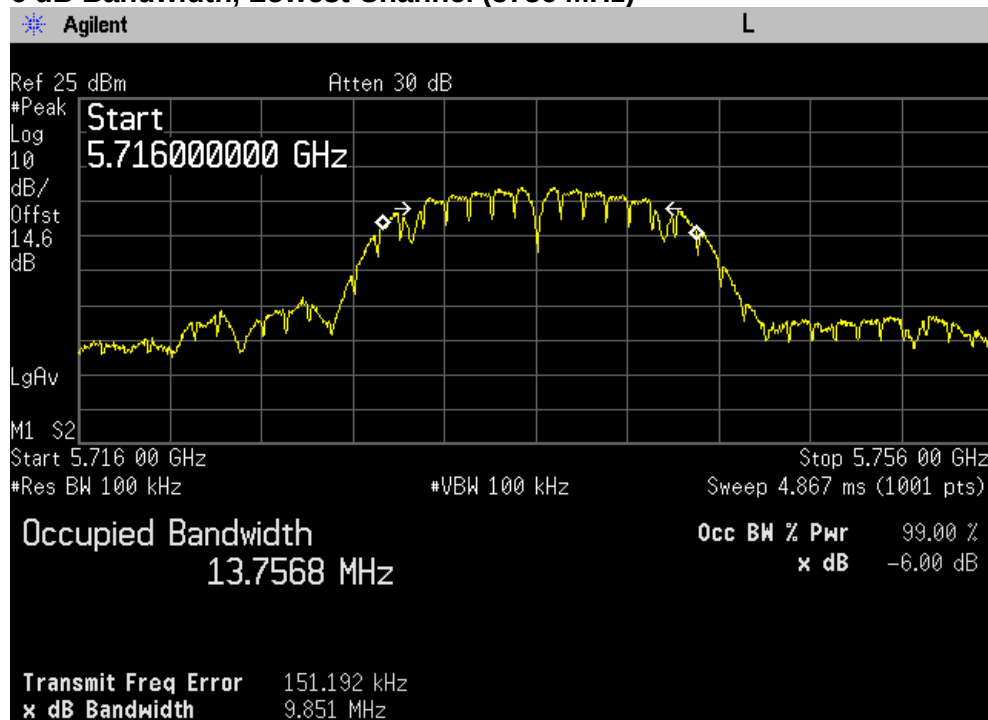
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (5814 MHz)



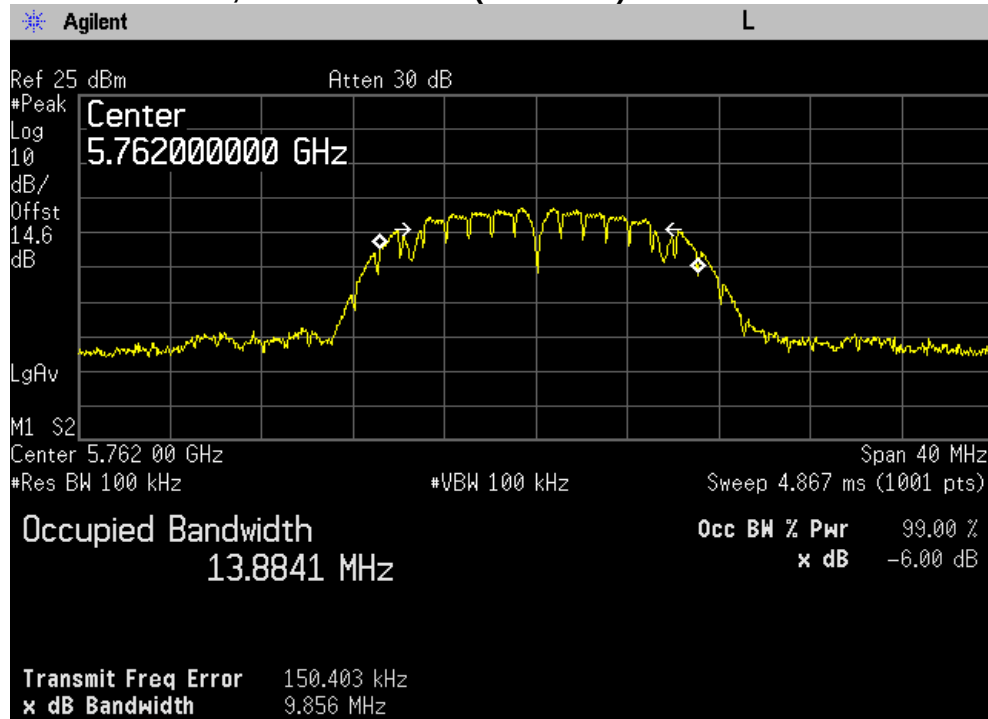
Ant B

6 dB Bandwidth, Lowest Channel (5736 MHz)

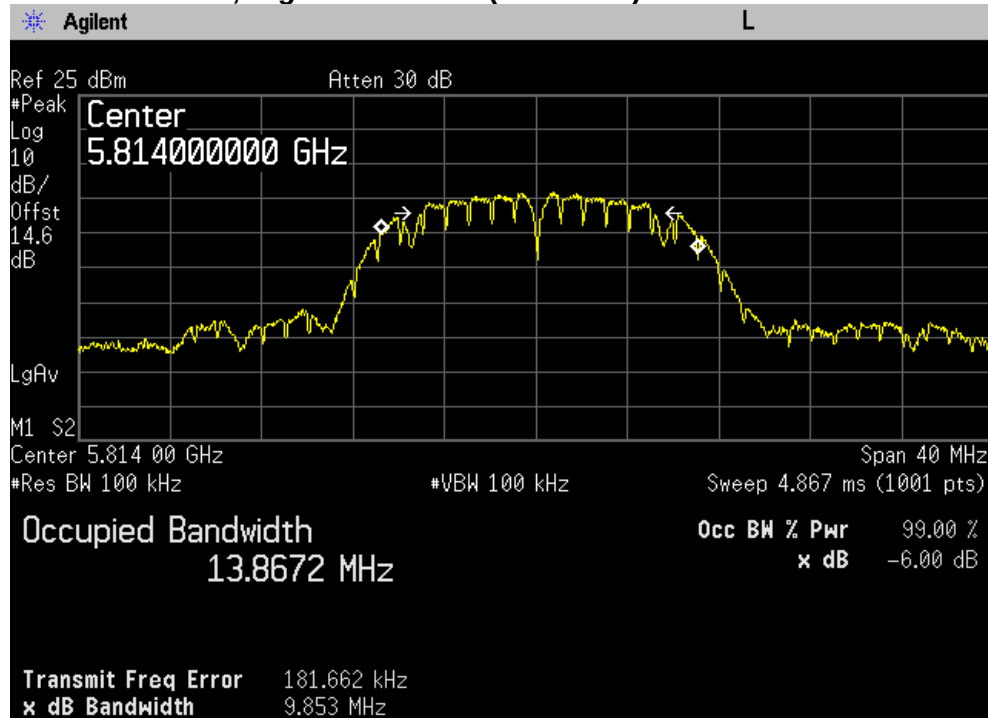


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (5762 MHz)



6 dB Bandwidth, Highest Channel (5814 MHz)



TEST DATA

8.4 Peak Power Output

FCC §15.247(b)(3), RSS-210 A8.4

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

Result:

Ant A

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5736	18.14	30.00	11.86
Middle	5762	16.53	30.00	13.47
High	5814	15.90	30.00	14.10

Ant B

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5736	18.35	30.00	11.65
Middle	5762	16.85	30.00	13.15
High	5814	16.16	30.00	13.84

TEST DATA

8.5 Power Spectral Density

FCC §15.247(e), RSS-210 A8.2

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

Result:

Ant A

Channel	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dB)
Low	5736	-2.68	8	10.68
Middle	5762	-4.13	8	12.13
High	5814	-4.30	8	12.30

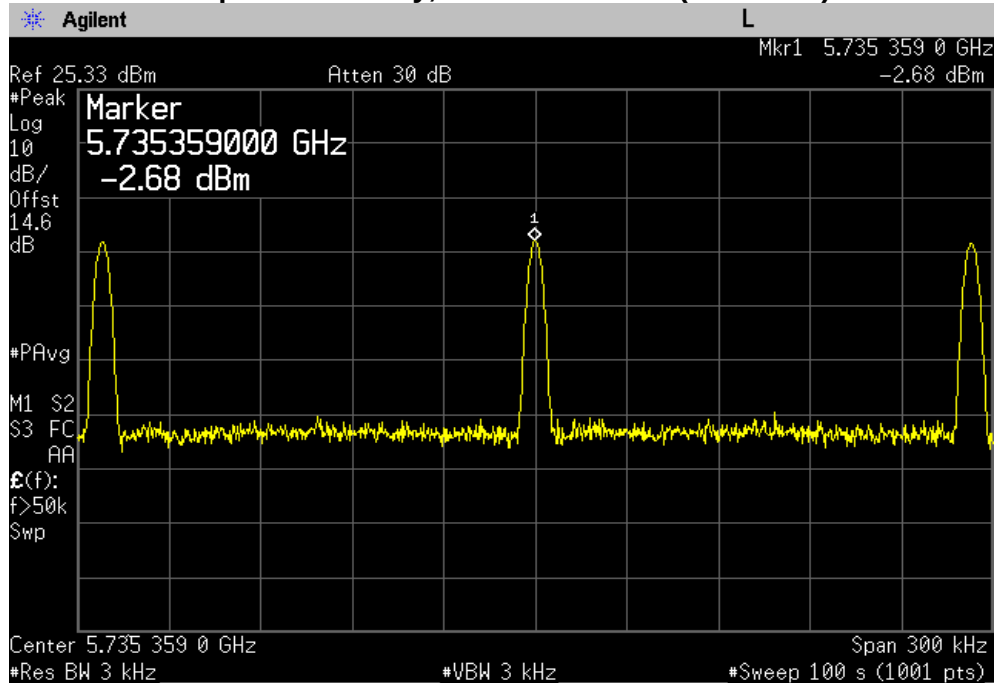
Ant B

Channel	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dB)
Low	5736	-4.13	8	12.13
Middle	5762	-3.33	8	11.33
High	5814	-4.21	8	12.21

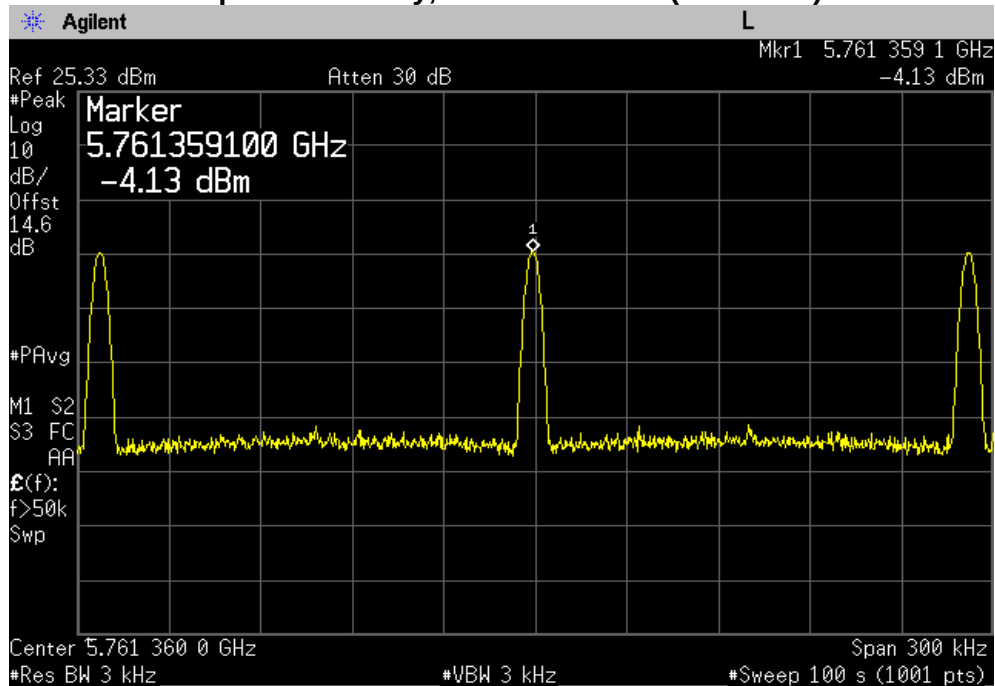
PLOT OF TEST DATA

Ant A

Peak Power Spectral Density, Lowest Channel (5736 MHz)

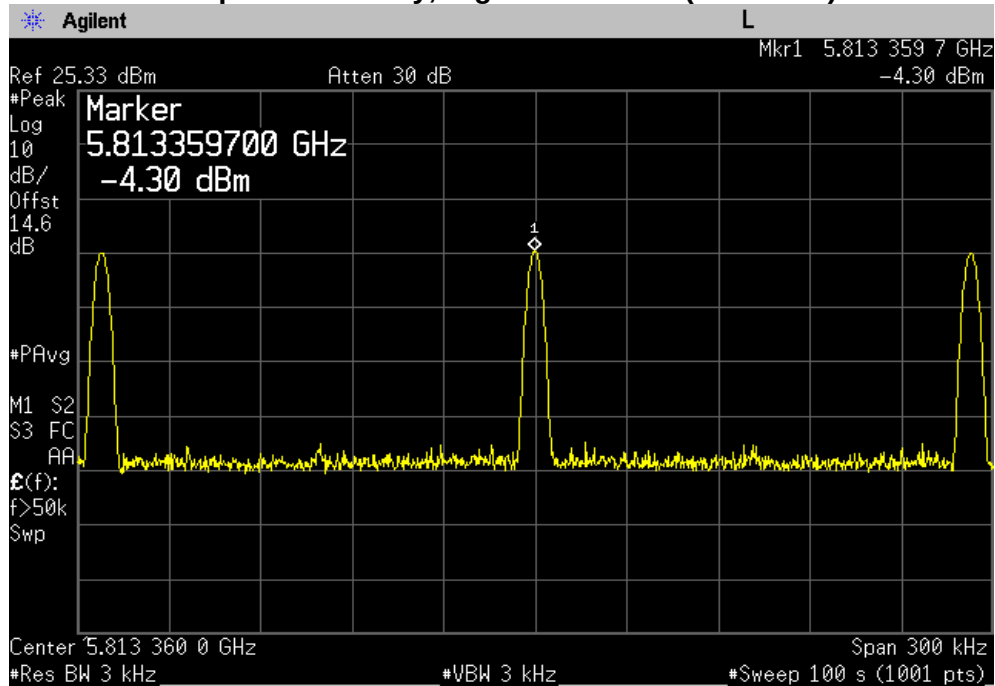


Peak Power Spectral Density, Middle Channel (5762 MHz)



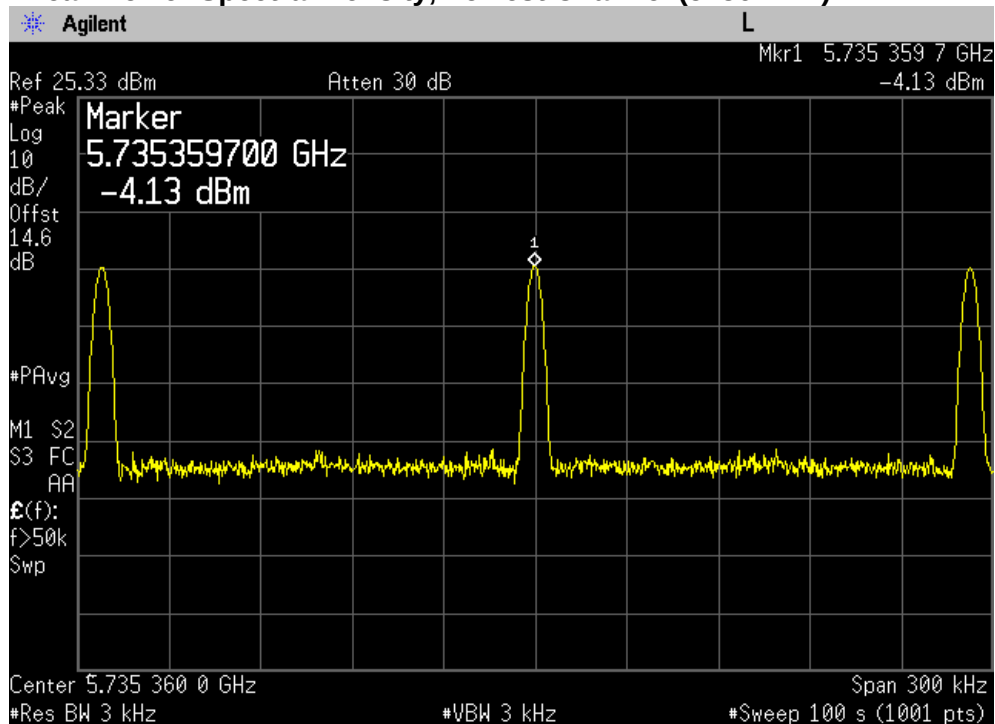
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (5814 MHz)



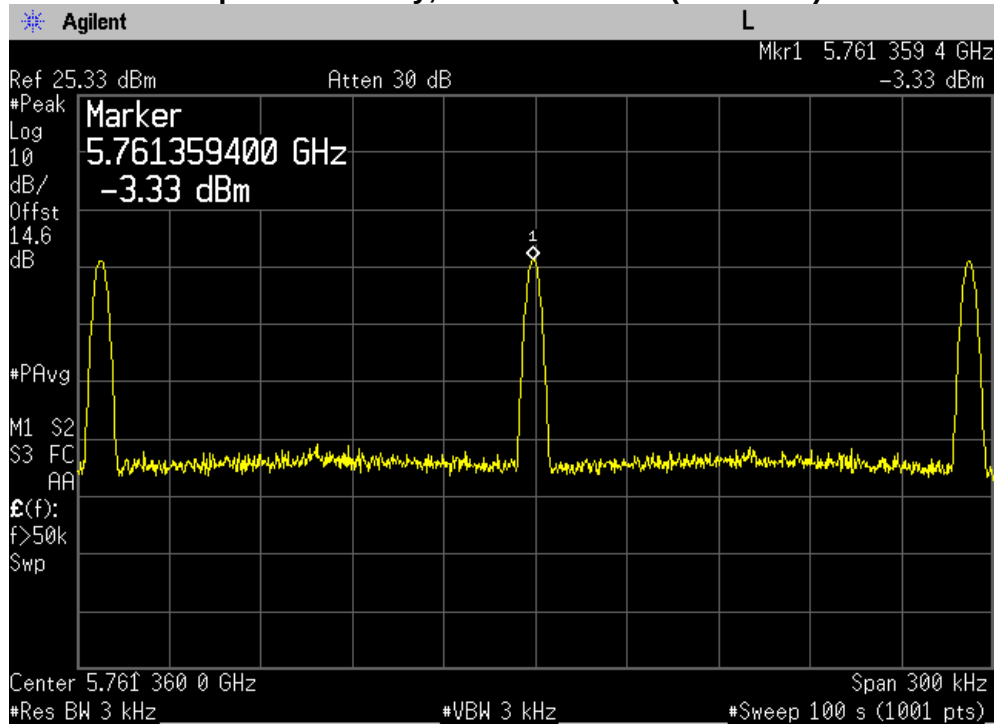
Ant B

Peak Power Spectral Density, Lowest Channel (5736 MHz)

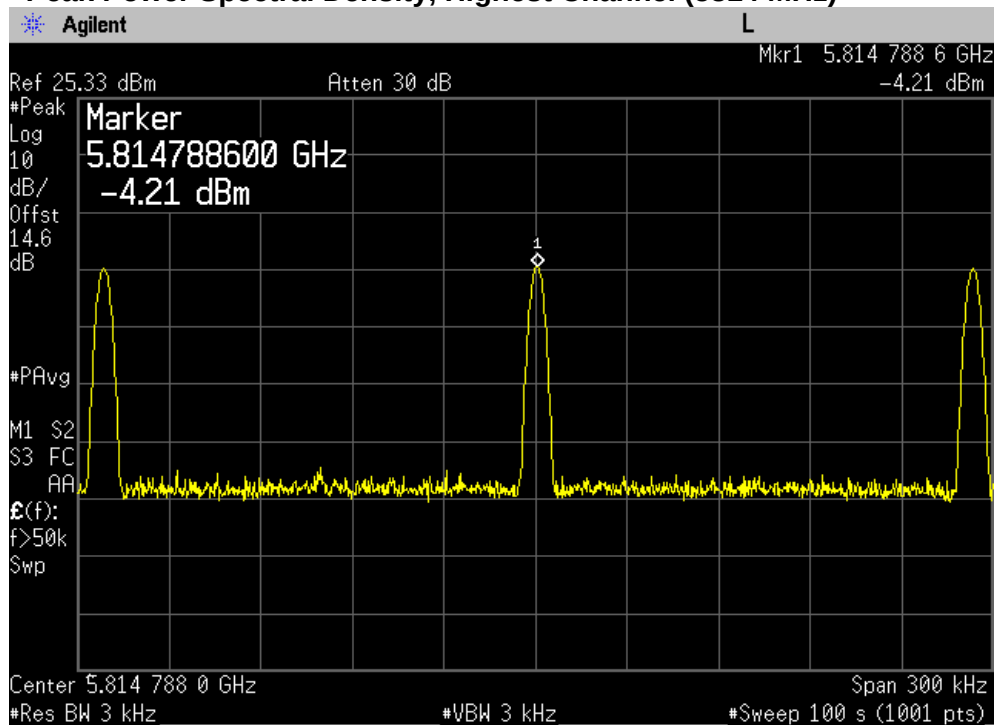


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (5762 MHz)



Peak Power Spectral Density, Highest Channel (5814 MHz)



TEST DATA

8.6 Conducted Spurious Emissions

FCC §15.247(d), RSS-210 A8.5

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

Result:

Ant A

Channel	Frequency(MHz)	Result(dBc)	Limit(dBc)
Low	5736	More than 20 dBc	20
Middle	5762	More than 20 dBc	20
High	5814	More than 20 dBc	20

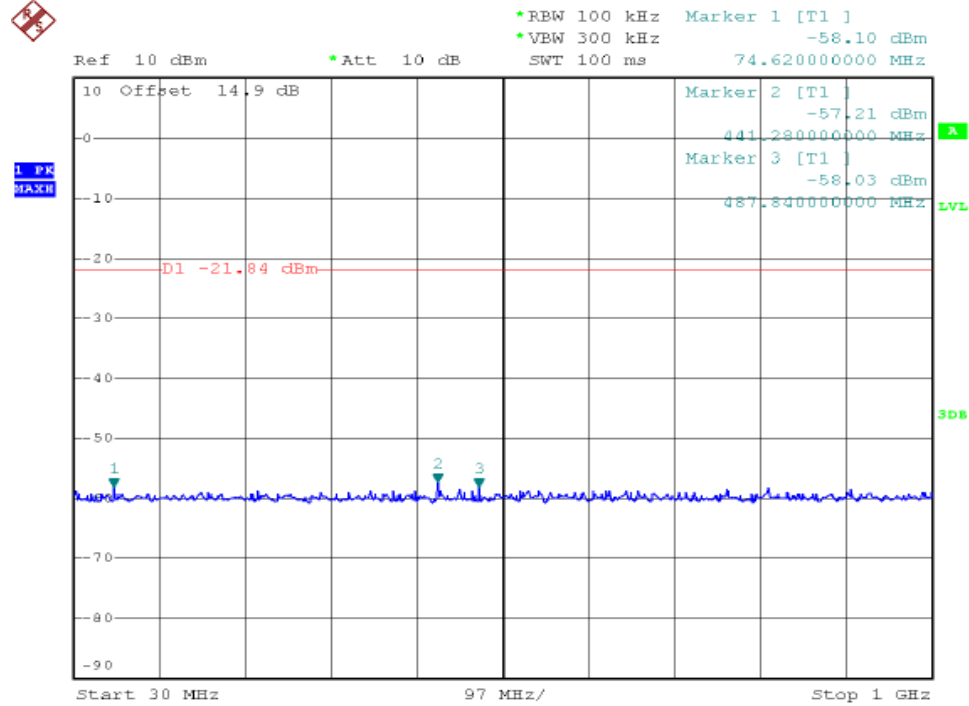
Ant B

Channel	Frequency(MHz)	Result(dBc)	Limit(dBc)
Low	5736	More than 20 dBc	20
Middle	5762	More than 20 dBc	20
High	5814	More than 20 dBc	20

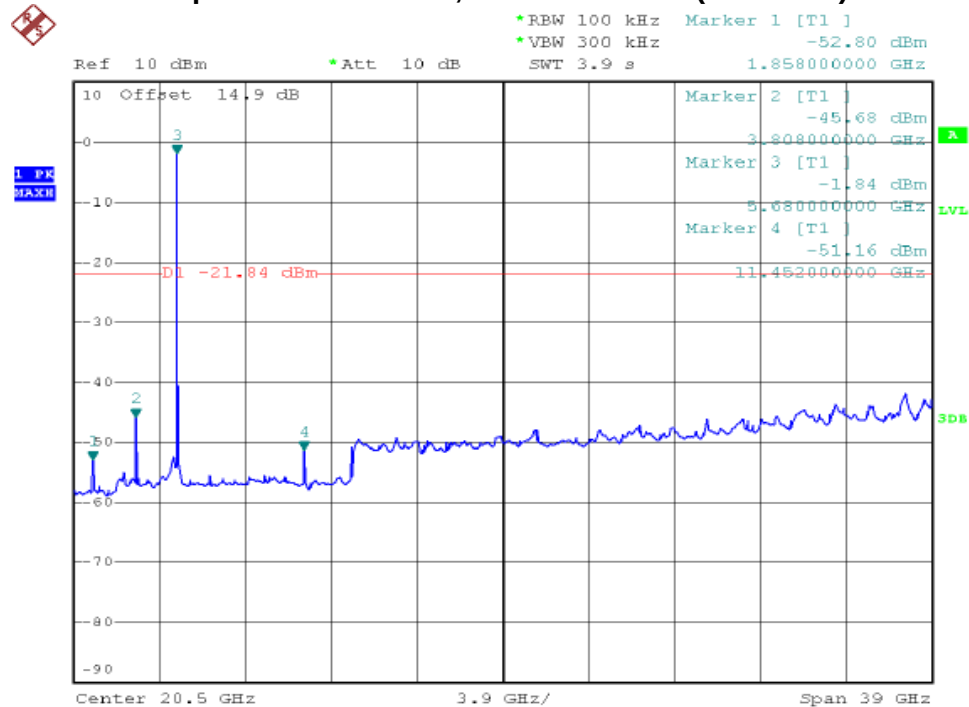
PLOT OF TEST DATA

Ant A

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5736 MHz)

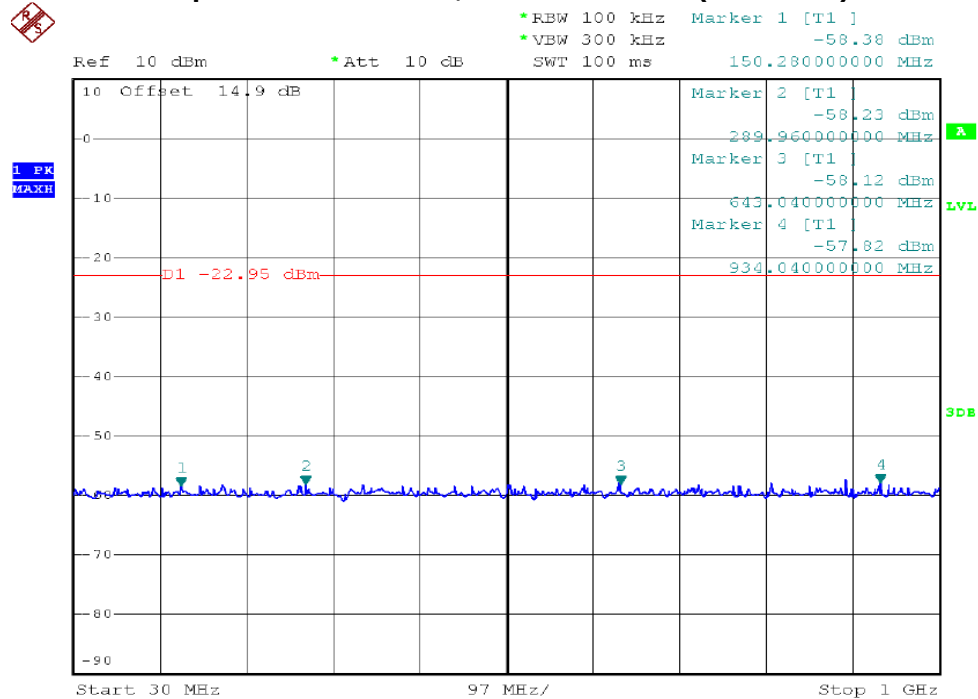


Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5736 MHz)

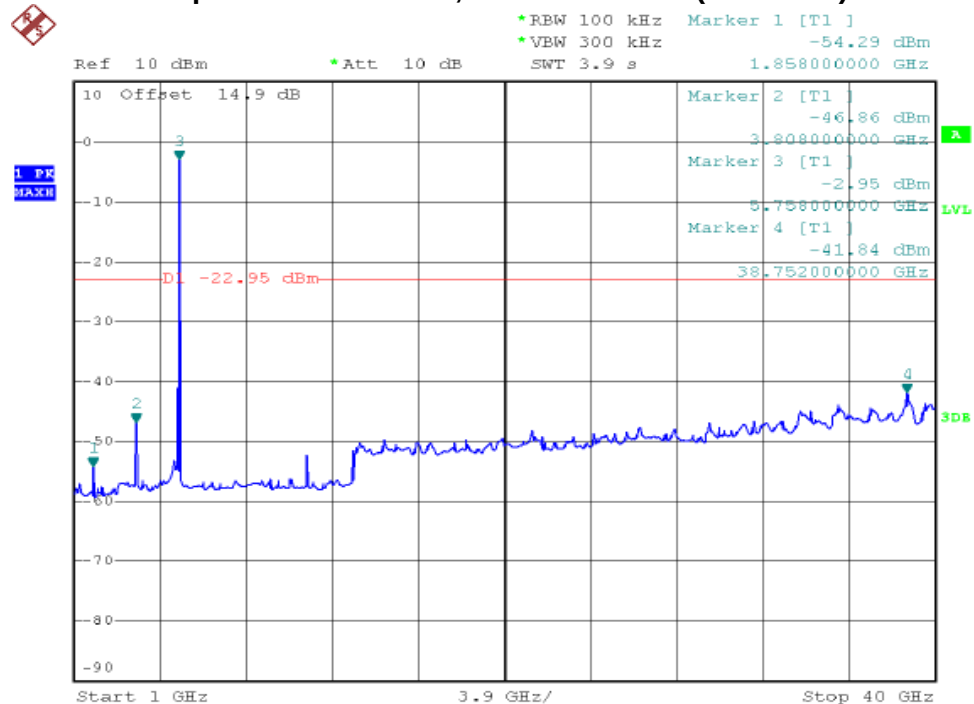


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5762 MHz)

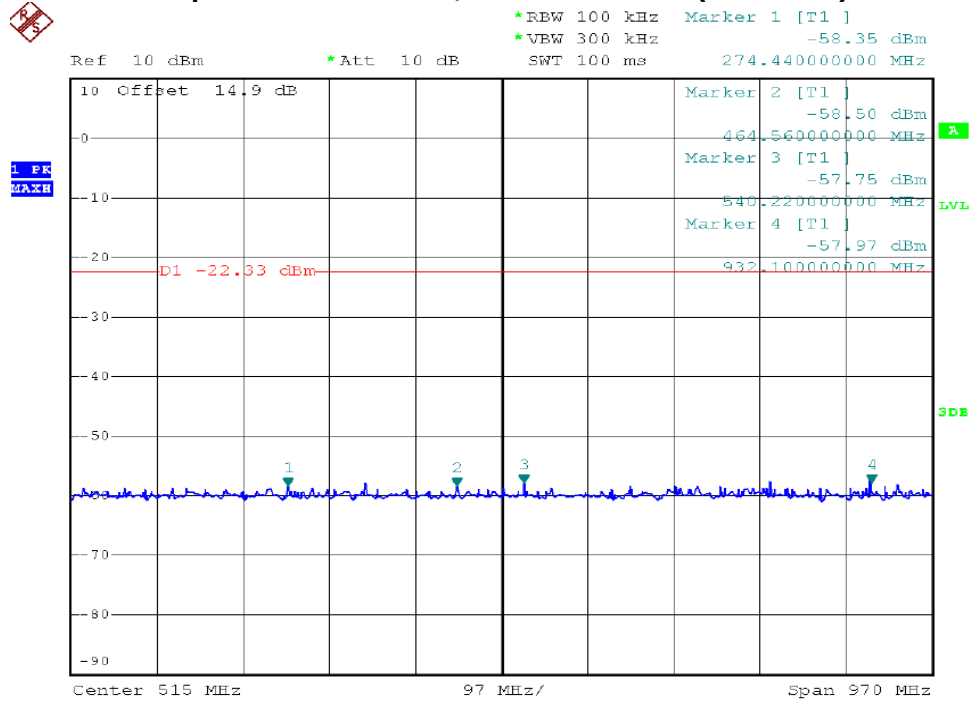


Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5762 MHz)

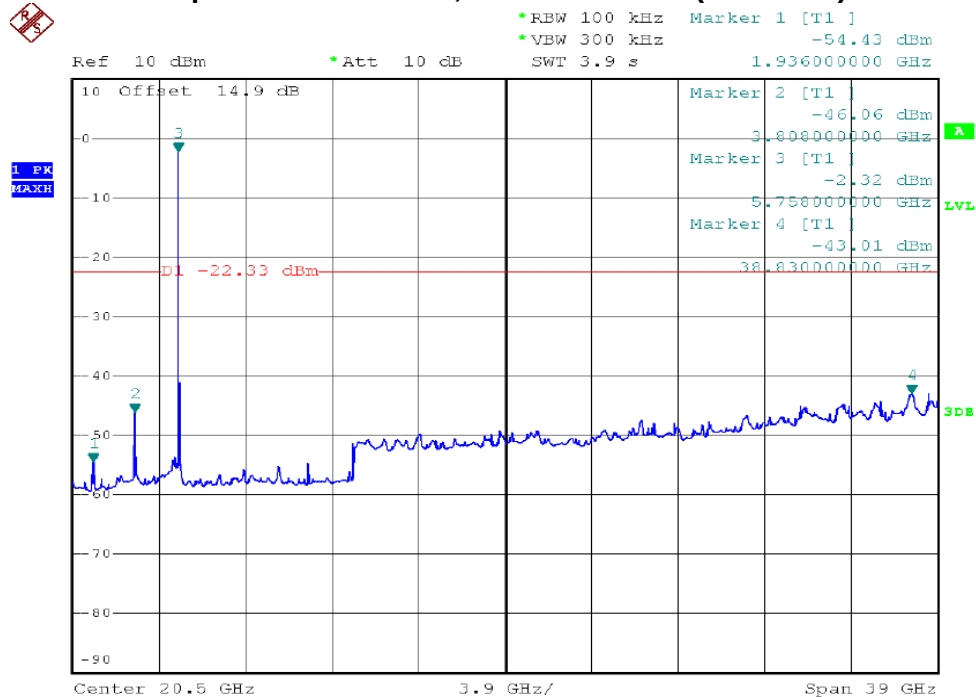


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5814 MHz)



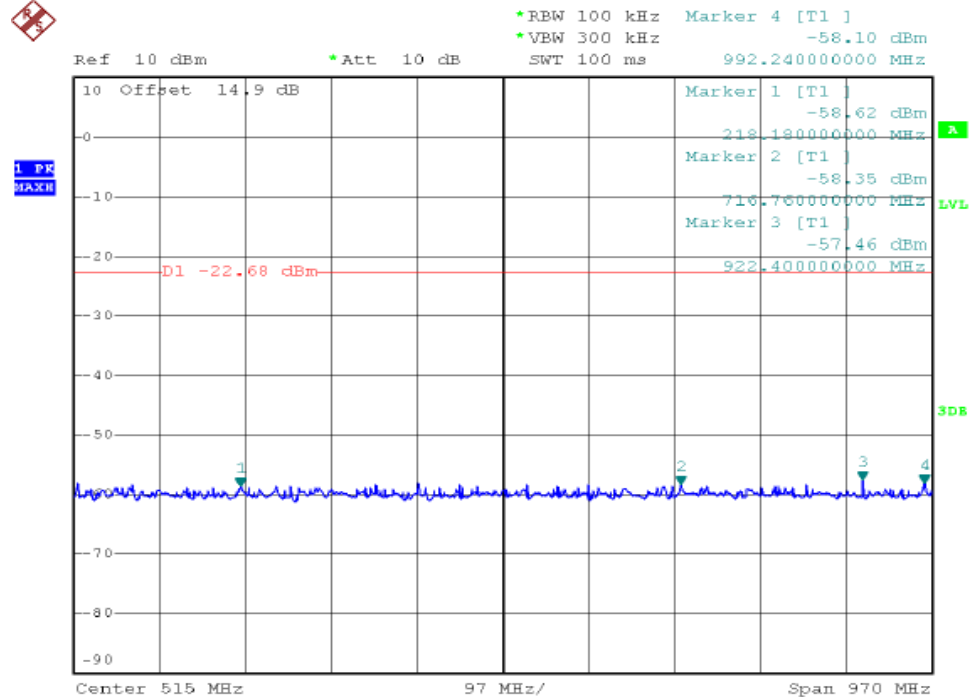
Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5814 MHz)



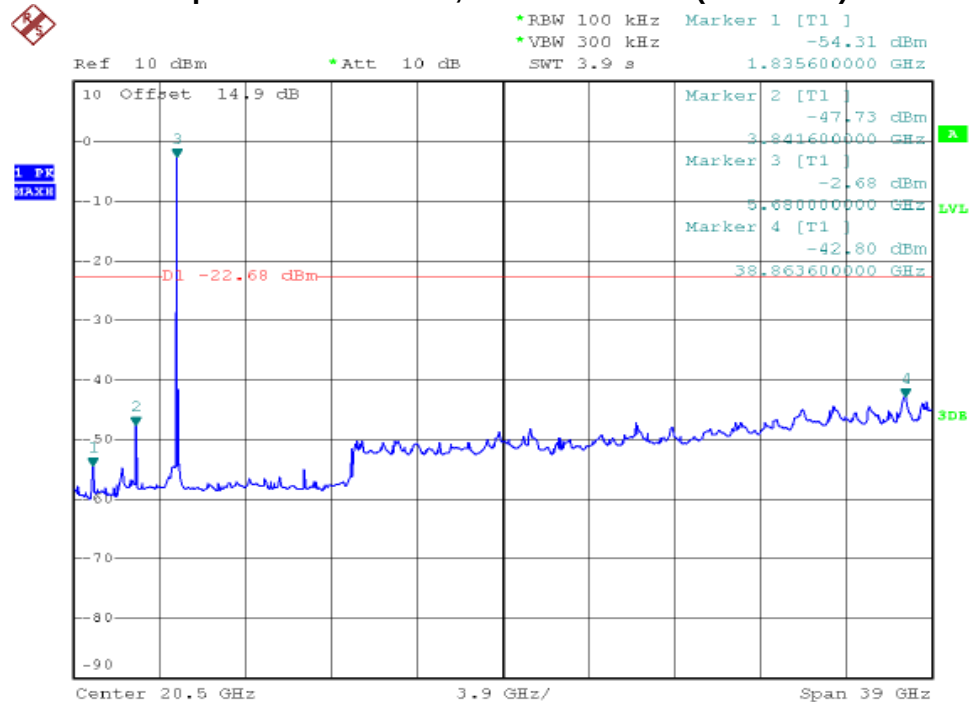
PLOT OF TEST DATA

Ant B

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5736 MHz)

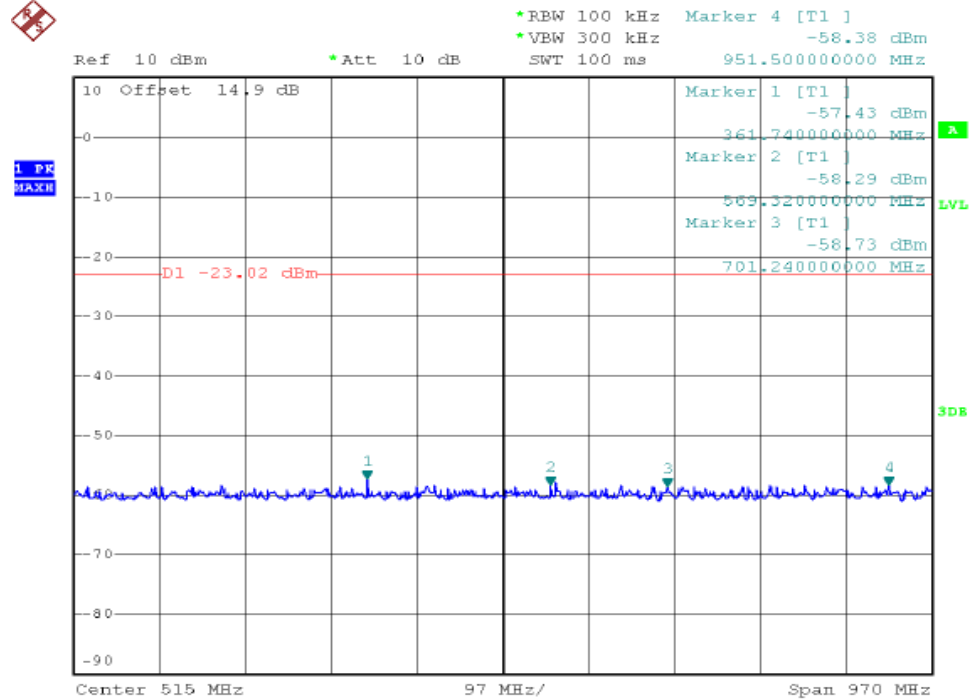


Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5736 MHz)

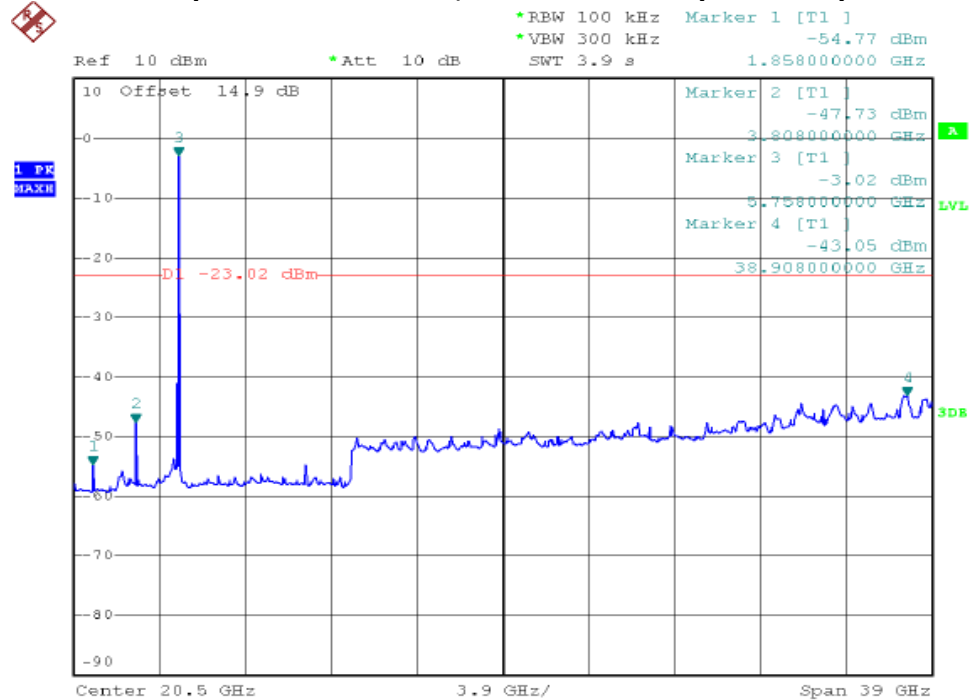


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5762 MHz)

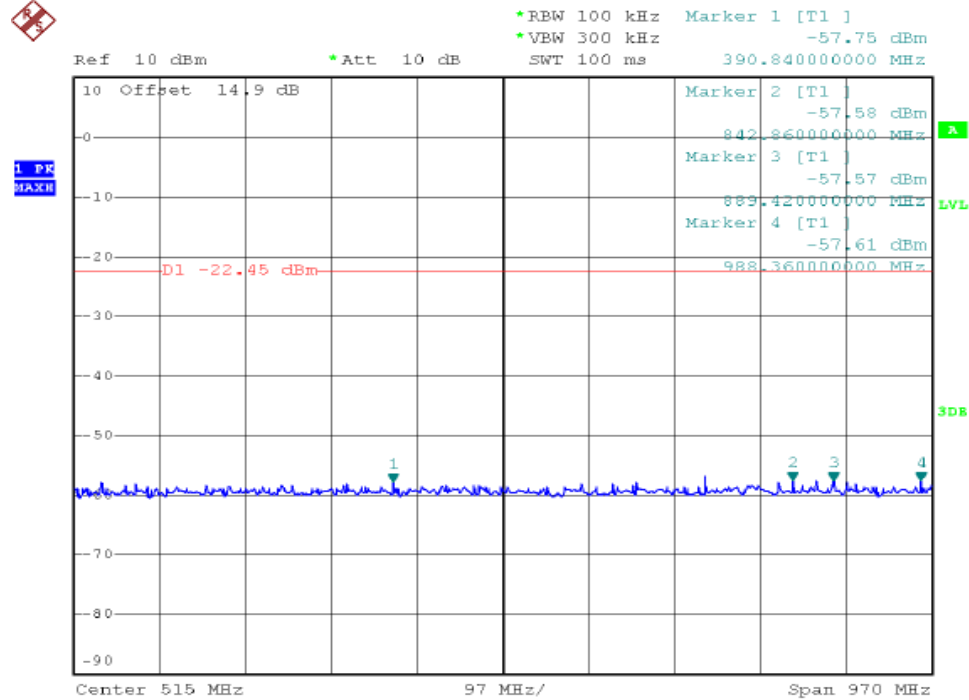


Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5762 MHz)

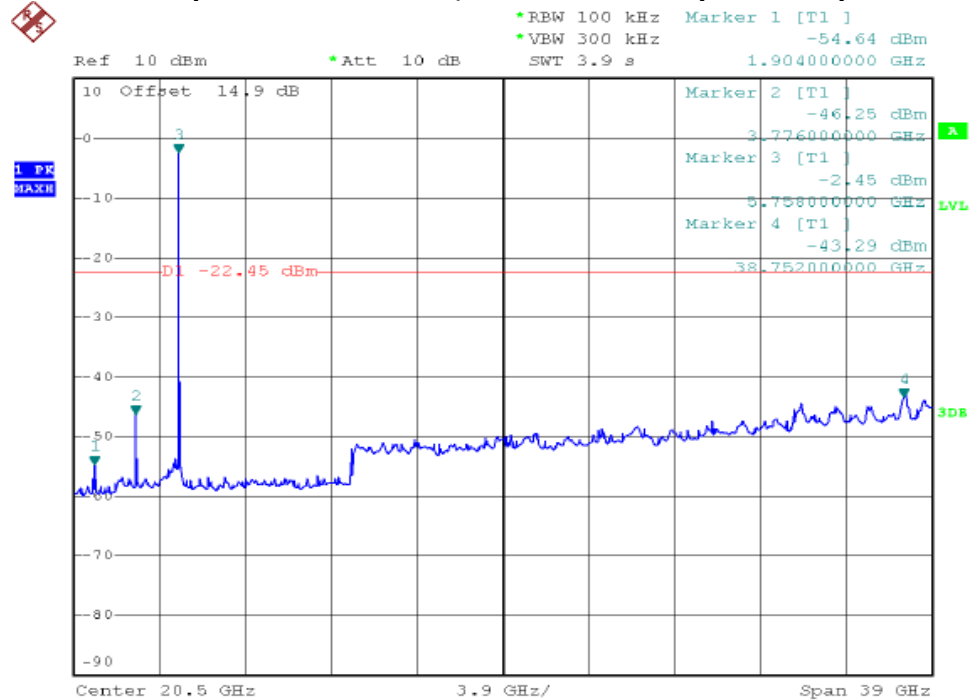


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 1 GHz (5814 MHz)



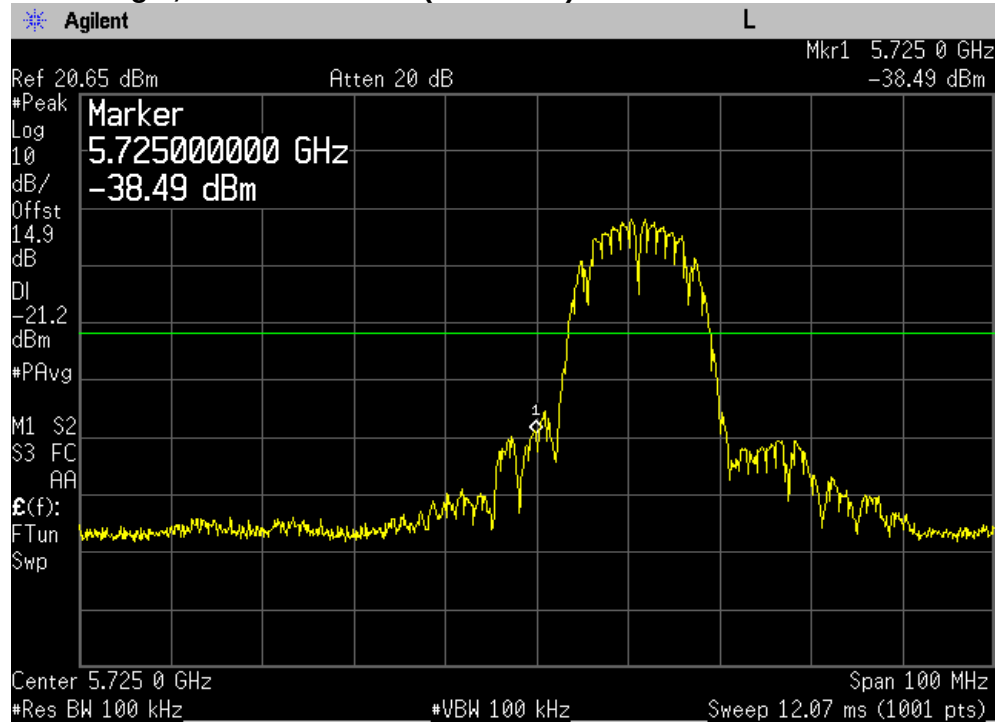
Conducted Spurious Emissions, 1 GHz ~ 40 GHz (5814 MHz)



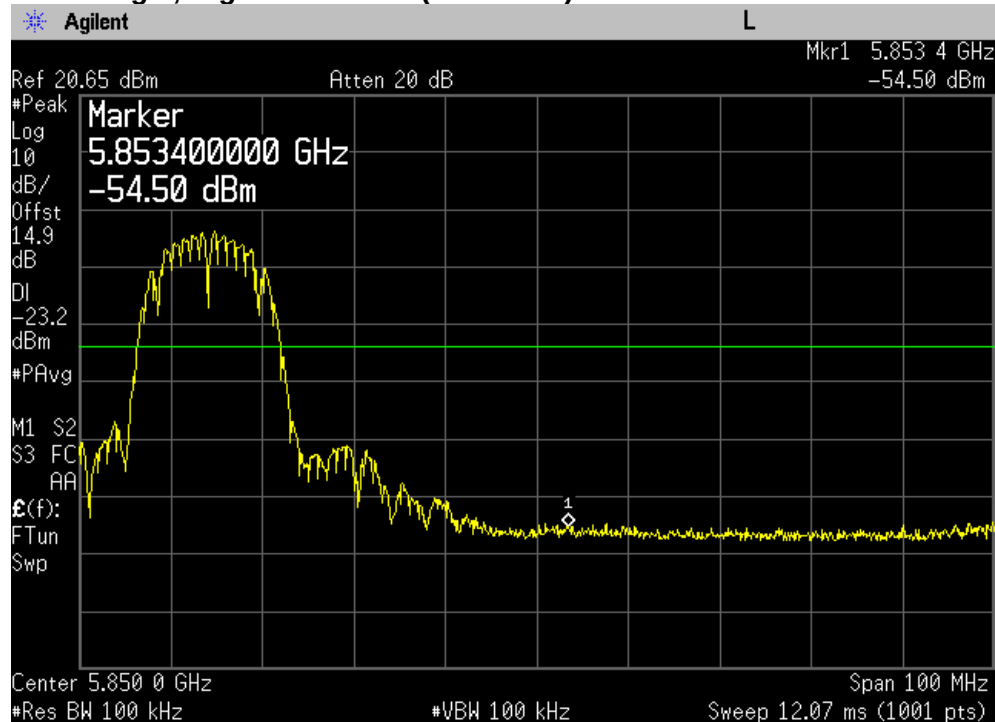
PLOT OF TEST DATA

Ant A

Band Edge , Lowest Channel (5736 MHz)



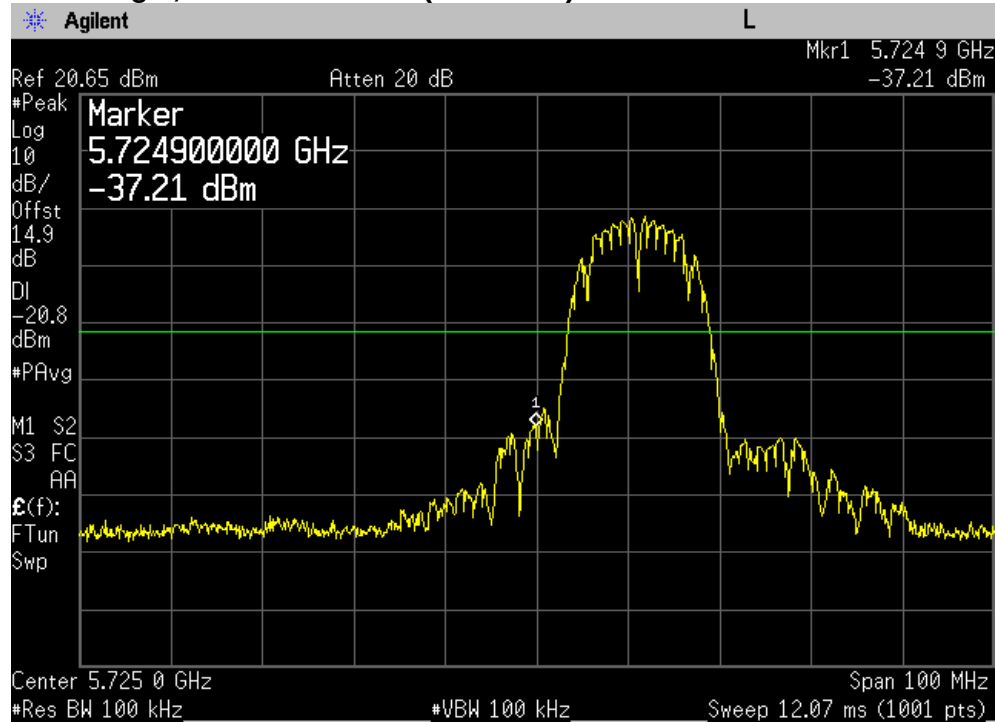
Band Edge , Highest Channel(5814 MHz)



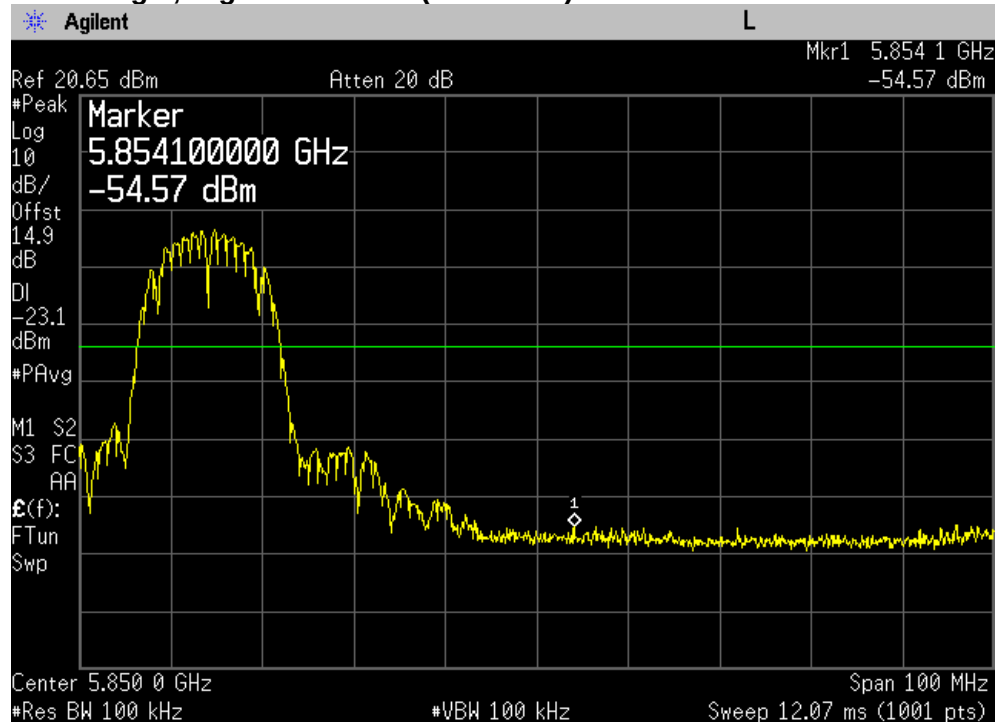
PLOT OF TEST DATA

Ant B

Band Edge , Lowest Channel (5736 MHz)



Band Edge , Highest Channel(5814 MHz)



TEST DATA

8.7 Radiated Spurious Emissions

FCC §15.247(d), RSS-210 A8.5

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

Result:

Ant A

Lowest Channel

Frequency (GHz)	Reading (dB μ V)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
11.472	55.29	H	peak	0.70	-9.54	46.45	74.0	27.55
11.472	50.36	H	average	0.70	-9.54	41.52	54.0	12.48
17.207	50.28	H	peak	7.56	-9.54	48.30	74.0	25.70
17.207	38.49	H	average	7.56	-9.54	36.51	54.0	17.49

Middle Channel

Frequency (GHz)	Reading (dB μ V)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
11.524	55.22	H	peak	1.42	-9.54	47.10	74.0	26.90
11.524	51.19	H	average	1.42	-9.54	43.07	54.0	10.93
17.286	49.61	H	peak	11.39	-9.54	51.46	74.0	22.54
17.286	36.93	H	average	11.39	-9.54	38.78	54.0	15.22

TEST DATA

Highest Channel

Frequency (GHz)	Reading (dB μ N)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dB μ N /m)	Limit (dB μ N /m)	Margin (dB)
11.628	56.79	H	peak	0.85	-9.54	48.10	74.0	25.90
11.628	53.13	H	average	0.85	-9.54	44.44	54.0	9.56
17.442	51.22	H	peak	11.28	-9.54	52.96	74.0	21.04
17.442	43.82	H	average	11.28	-9.54	45.56	54.0	8.44

Ant B

Lowest Channel

Frequency (GHz)	Reading (dB μ N)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dB μ N /m)	Limit (dB μ N /m)	Margin (dB)
11.472	59.63	H	peak	0.70	-9.54	50.79	74.0	23.21
11.472	57.37	H	average	0.70	-9.54	48.53	54.0	5.47
17.207	52.75	H	peak	7.56	-9.54	50.77	74.0	23.23
17.207	45.04	H	average	7.56	-9.54	43.06	54.0	10.94

Middle Channel

Frequency (GHz)	Reading (dB μ N)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dB μ N /m)	Limit (dB μ N /m)	Margin (dB)
11.524	60.07	H	peak	1.42	-9.54	51.95	74.0	22.05
11.524	56.89	H	average	1.42	-9.54	48.77	54.0	5.23
17.286	50.61	H	peak	11.39	-9.54	52.46	74.0	21.54
17.286	41.43	H	average	11.39	-9.54	43.28	54.0	10.72

TEST DATA

Highest Channel

Frequency (GHz)	Reading (dB μ V)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)**	Result (dB μ V / m)	Limit (dB μ V / m)	Margin (dB)
11.628	59.26	H	peak	0.85	-9.54	50.57	74.0	23.43
11.628	56.41	H	average	0.85	-9.54	47.72	54.0	6.28
17.442	51.62	H	peak	11.28	-9.54	53.36	74.0	20.64
17.442	43.57	H	average	11.28	-9.54	45.31	54.0	8.69

Note:

- *Pol. H = Horizontal V = Vertical
- **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- ***Distance = $20\log(1/3)$, Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3 m to 1 m.
- Other spurious are under 20 dB below Fundamental.
- The radiated emissions testing were made by rotating through three orthogonal axes.
The worst date was recorded.
- For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.
- 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.

TEST DATA

8.8 Receiver Spurious Emissions

IC RSS-GEN 7.2.5

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Height (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
195.40	39.0	V	100	309	-16.2	22.8	43.5	20.7
213.82	45.9	H	204	73	-19.1	26.8	43.5	16.7
254.20	29.9	H	167	11	-15.5	14.4	46.0	31.6
285.15	48.1	H	245	196	-15.5	32.6	46.0	13.4
320.75	30.9	H	300	242	-13.6	17.3	46.0	28.7
351.99	48.2	H	100	360	-13.6	34.6	46.0	11.4

Radiated Measurements at 3meters

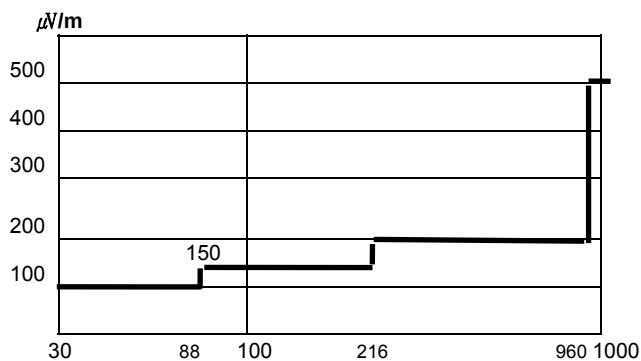


Fig. 5. Limits at 3 meters

NOTES:

1. All modes were measured and the worst-case emission was reported.
 - 2 The radiated limits are shown on Figure 5.
- Above 1GHz the limit is 500 μ V/m.

MHz

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 IC RSS GEN Clause 6.

9. MAXIMUM PERMISSIBLE EXPOSURE

RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the Environmental of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(A) Limits for occupational / Contral Exposure				
30 - 300	61.4	0.163	1	6
300 - 1500	...	...	F/300	6
1500 - 100000	...	...	5	6
(B) Limits for General Population / Uncontrolled Exposure				
30 - 300	27.5	0.073	0.2	30
300 - 1500	...	...	F/1500	30
1500 - 100000	...	...	1	30

F = Frequency (MHz)

Fries formula

Fries transmission formula : $P_d = (P_{out} * G) / (4 * \pi * r^2)$

$$r = \sqrt{((P_{out} * G) / 4 * \pi * P_d)}$$

Where

P_d = Power density in mW/cm²

P_{out} = Output power to antenna in mW

G = Gain of antenna in linear scale

π = 3.1416

r = Distance between observation point center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the Maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the Maximum distance r where the MPE limit is reached and Power density at prediction frequency.

TEST DATA

Test Result :

The maximum antenna gain is **3.96 dBi**.

Maximum peak output power at antenna input terminal:	18.35 (dBm)
Maximum peak output power at antenna input terminal:	68.39 (mW)
Antenna gain(typical):	3.96 (dBi)
Maximum antenna gain:	2.49 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	5762 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)
Maximum allowable antenna gain:	18.66 (dBi)
Maximum Distance:	3.68 (cm)

Power density at prediction frequency : 0.033863 (mW/cm²)

Test result: PASS

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)			

11. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Mar. 24 2010	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Nov. 10 2010	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 20 2010	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 20 2010	1 year
5	*Amplifier	R & S	SCU18	10065	Jun. 11 2010	1 year
6	*Amplifier	R & S	SCU26	10011	Jun. 11 2010	1 year
7	*Amplifier	R & S	SCU40	10011	Jun. 18 2010	1 year
8	*Pre Amplifier	HP	8449B	3008A00107	Feb. 03 2010	1 year
9	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2010	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 20 2010	1 year
11	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Jun. 03 2010	1 year
12	*Spectrum Analyzer	R & S	FSP40	100361	Sep. 02 2010	1 year
13	*Loop Antenna	EMCO	6502	8911-2436	Jan. 11 2009	2 year
14	*Wideband Power Sensor	R & S	NRP-Z81	100634	May. 26 2010	1 year
15	Peak Power Sensor	R & S	NRV-Z32	836019/028	Nov. 10 2010	1 year
16	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 14 2010	2 year
17	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec.24 2010	2 year
18	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Jul. 14 2010	2 year
19	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 12 2010	2 year
20	*Horn Antenna	Q-par Angus	QSH22K20	8180	Apr. 12 2010	2 year
21	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 14 2010	2 year
22	*LISN	R & S	ESH3-Z5	833874/006	Nov. 10 2010	1 year
23	*LISN	R & S	ESH2-Z5	100227	Feb. 03 2010	1 year
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

*) Test equipment used during the test