

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : OT-20N-RWD-035

Reception No. : 2010003943

Applicant : Samsung Electronics Co Ltd

Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States

Manufacturer : Samsung Electronics Co Ltd

Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea

Type of Equipment : Audio Transceiver

FCC ID : A3LWSA520S

Model Name : WSA520S

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 31 pages (including this page)

Date of Incoming : October 27, 2020

Date of Issuing : November 11, 2020

SUMMARY

The equipment complies with the requirements of **FCC CFR 47 PART 15 SUBPART C Section 15.249**

This test report contains only the result of a single test of the sample supplied for the examination.

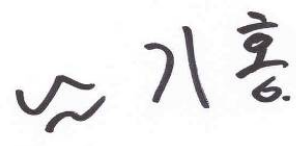
It is not a general valid assessment of the features of the respective products of the mass-production.



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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-20N-RWD-035	November 11, 2020	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd
 Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
 Contact Person : Hansung You / Staff Engineer
 Telephone No. : +82-31-277-2746
 FCC ID : A3LWSA520S
 Model Name : WSA520S
 Brand Name : 
 Serial Number : N/A
 Date : November 11, 2020

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Modular Transmitter, Audio Transceiver
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.249
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.249 (a)	Field Strength of Emission	Met the Limit / PASS
15.249 (c)	Measurement distance	Met the Requirement / PASS
15.249 (d)	Emissions Radiated Outside of the Specified Frequency Band	Met the Limit / PASS
15.249, 15.215	Minimum 20 dB Bandwidth	Met the Limit / PASS
15.249 (e)	Radiated Emissions above 1 000 MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note)
15.203	Antenna Requirement	Met the Requirement / PASS

Note: This test is not performed because the EUT is operated by DC Power.

2.2 Related Submittal(s) / Grant(s)

Original submittal only

2.3 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.5 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The Samsung Electronics Co Ltd, Model WSA520S (referred to as the EUT in this report) is an Audio Transceiver, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Audio Transceiver	
Temperature Range	-5 °C ~ 40 °C	
OPERATING FREQUENCY	5 773.35 MHz ~ 5 871.35 MHz	
MODULATION TYPE	DQPSK	
Field Strength Of Fundamental	96.76 dBμV/m at 3 m	
ANTENNA TYPE	PCB Antenna	
ANTENNA GAIN	Antenna 0	3.10 dBi
	Antenna 1	3.10 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	16 MHz	

Note: This Device works a Diversity Antenna. So, We Tested only Antenna 0.

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	Samsung Electronics Co Ltd	AVM500 REV03	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
WSA520S	Samsung Electronics Co Ltd	Audio Transceiver(EUT)	-
AVM500 ANTEATER REV01	N/A	Jig Board	EUT / Notebook PC
HP Probook	HP	Notebook PC	EUT
PPP009L-E	LIE-ON TECHNOLOGY (CHANGZHOU) CO., LTD.	AC Adapter	

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 5 773.35 MHz, 5 821.35 MHz, and 5 871.35 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis, but the worst data was recorded in this report.

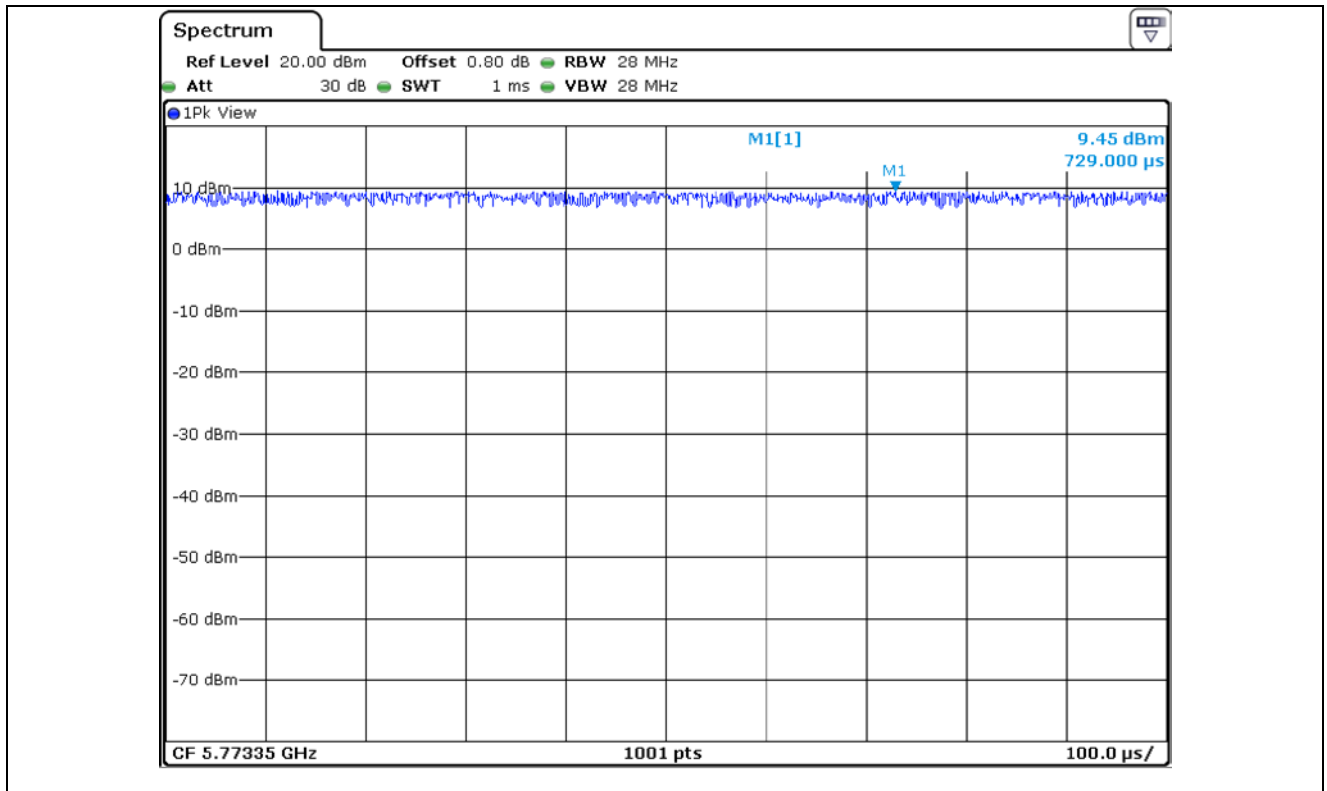
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
-	-	-	100.00	-

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : $10 * \log(1 / (\text{Duty Cycle} / 100))$

-. Test Plot



-. Channel List

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
0	5 773.35	18	5 809.35	36	5 845.35
1	5 775.35	19	5 811.35	37	5 847.35
2	5 777.35	20	5 813.35	38	5 849.35
3	5 779.35	21	5 815.35	39	5 851.35
4	5 781.35	22	5 817.35	40	5 853.35
5	5 783.35	23	5 819.35	41	5 855.35
6	5 785.35	24	5 821.35	42	5 857.35
7	5 787.35	25	5 823.35	43	5 859.35
8	5 789.35	26	5 825.35	44	5 861.35
9	5 791.35	27	5 827.35	45	5 863.35
10	5 793.35	28	5 829.35	46	5 865.35
11	5 795.35	29	5 831.35	47	5 867.35
12	5 797.35	30	5 833.35	48	5 869.35
13	5 799.35	31	5 835.35	49	5 871.35
14	5 801.35	32	5 837.35		
15	5 803.35	33	5 839.35		
16	5 805.35	34	5 841.35		
17	5 807.35	35	5 843.35		

5.4 Configuration of Test System

Line Conducted Test: It is not need to test this requirement, because the EUT shall be operated by DC Power.

Radiated Emission Test : Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber.

For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna.

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

5.5 Antenna Requirement

For intentional device, according to section 15.203, 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.

Antenna Construction:

The antenna of the EUT is PCB Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by DC Power.	

6.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. MINIMUM 20 dB BANDWIDTH

7.1 Operating environment

Temperature : 23 °C
Relative humidity : 45 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 50 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



7.3 Test Date

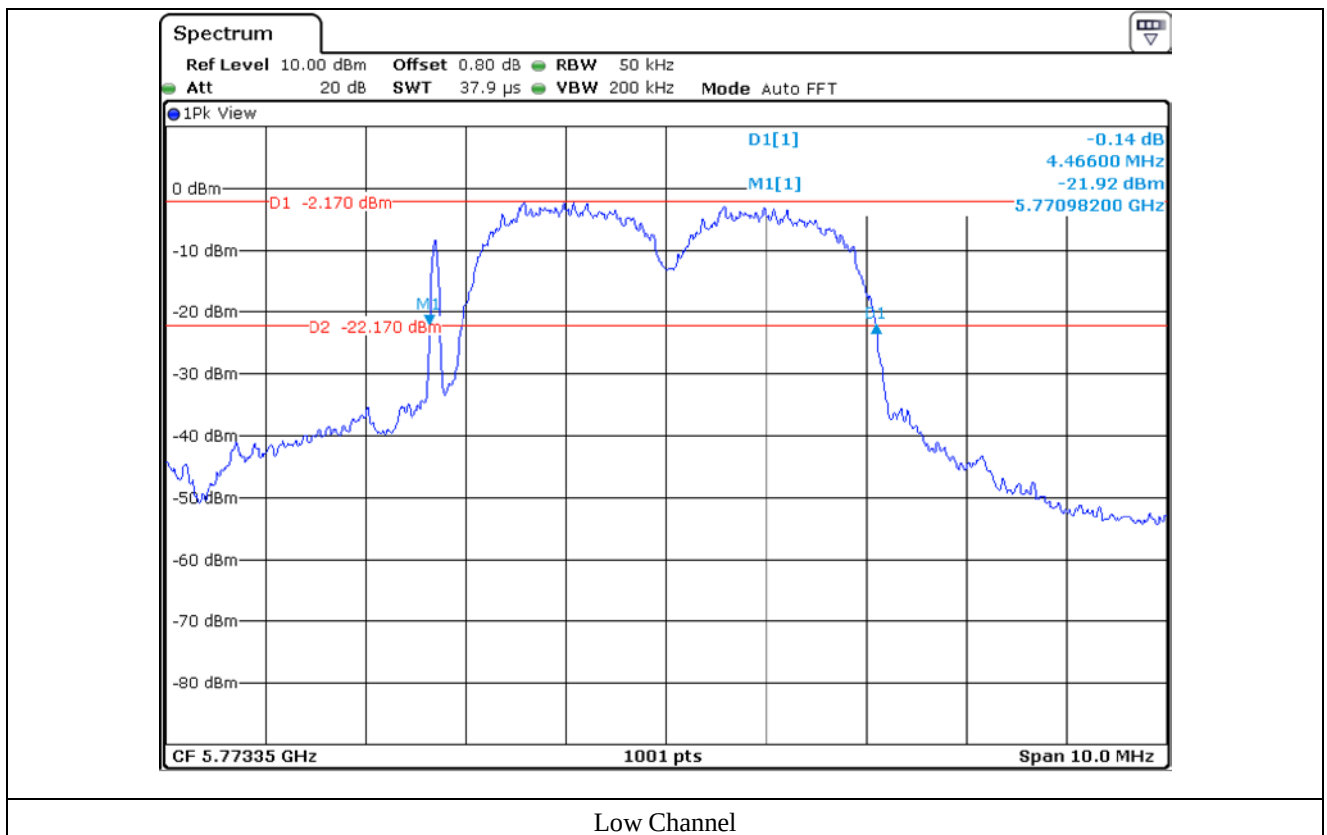
October 27, 2020 ~ November 02, 2020

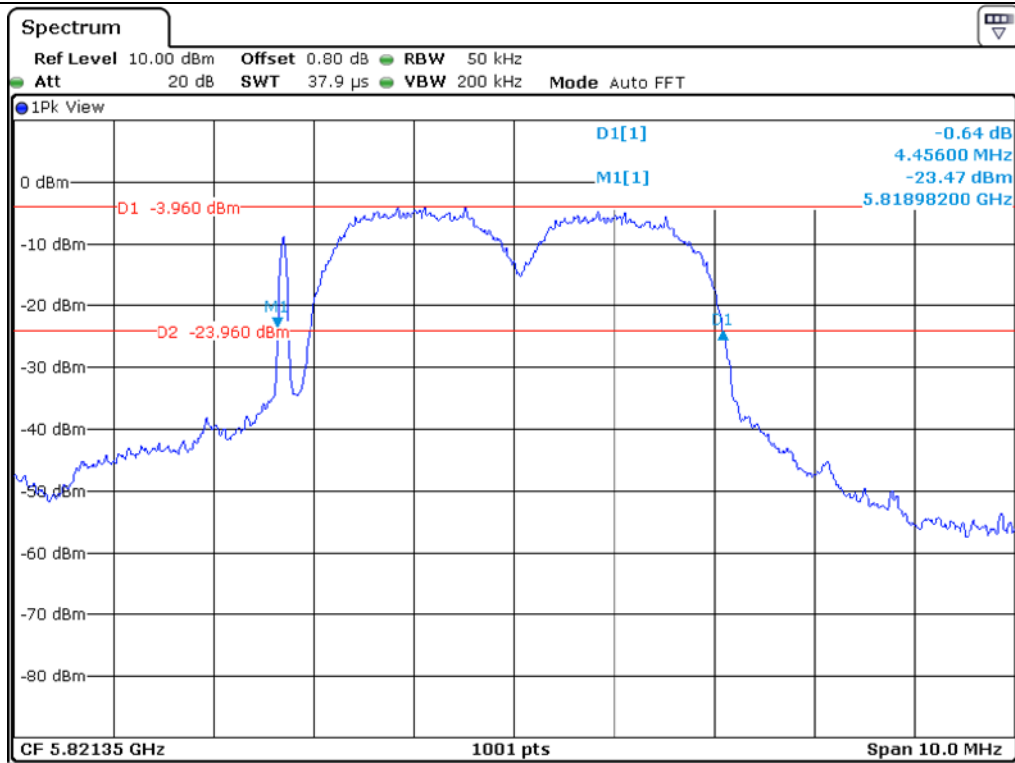
7.4 Test data

-. Test Result : Pass

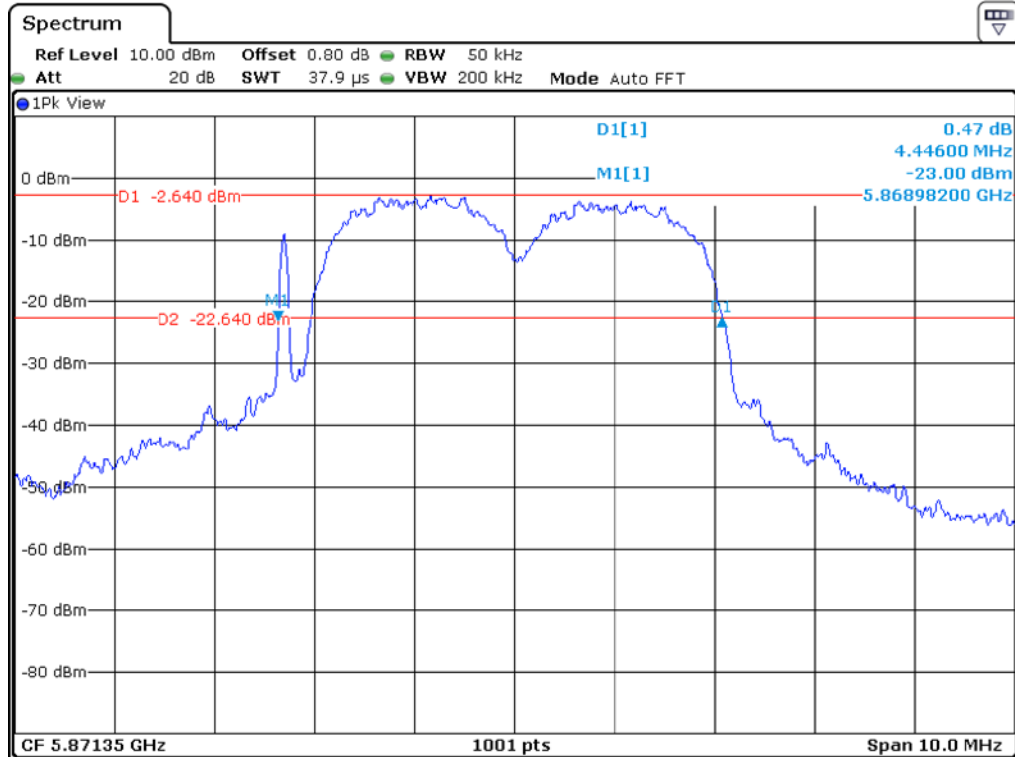
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)
Low	5 773.35	4.47
Middle	5 821.35	4.46
High	5 871.35	4.45

Remark. Margin = Measured Value - Limit





Middle Channel



High Channel

8. RADIATED EMISSION TEST

8.1 Operating environment

Temperature : 23 °C
Relative humidity : 45 % R.H.

8.2 Test set-up

The radiated emissions measurements were on the 3 m, semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from up to 40 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Test set-up photos are included in appendix I.

8.3 Measurement uncertainty

Radiated emission electric field intensity, 0.15 MHz ~ 30 MHz : ± 2.61 dB

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.40 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

8.4 Test Date

October 27, 2020 ~ November 02, 2020

8.5 Final Result of Measurement

8.5.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : Audio Transceiver

Operating Condition : TX mode

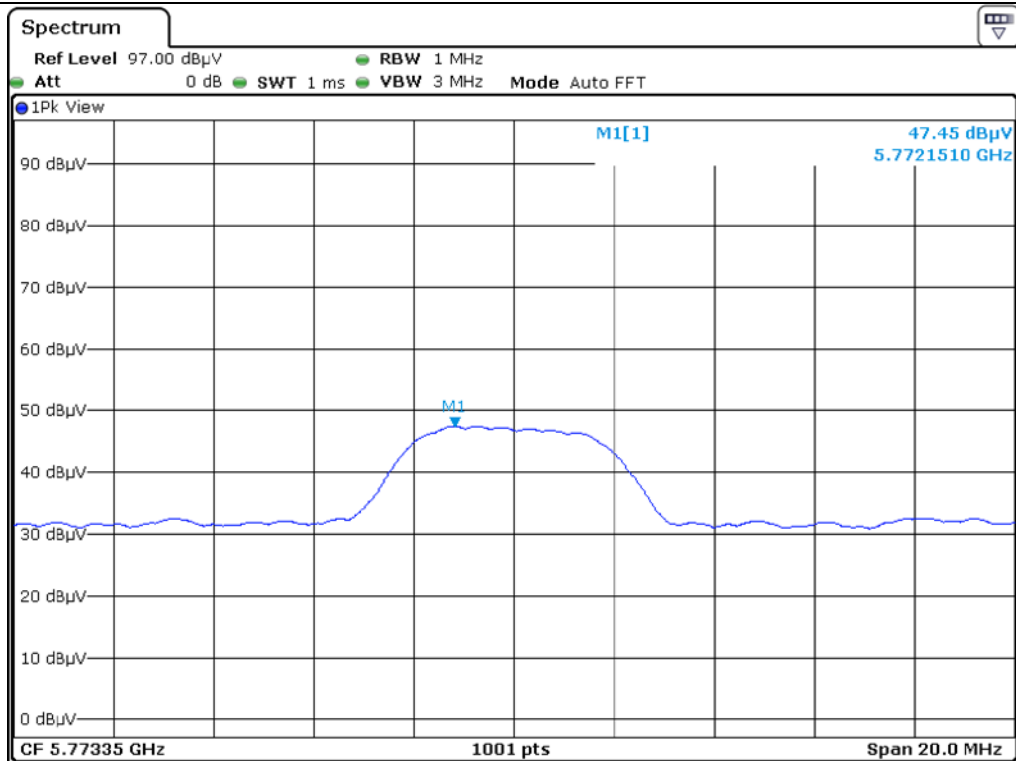
Distance : 3 m

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Carrier Freq. (MHz)	Reading (dBμV)	Detector Mode	Pol.	Antenna (dB/m)	Cable Loss (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Test Data for Low Channel								
5 773.35	47.45	Peak	H	34.50	12.38	94.33	114.00	19.67
	44.47	Average	H			91.35	94.00	2.65
	46.33	Peak	V			93.21	114.00	20.79
	42.45	Average	V			89.33	94.00	4.67
Test Data for Middle Channel								
5 821.35	49.88	Peak	H	34.50	12.38	96.76	114.00	17.24
	45.15	Average	H			92.03	94.00	1.97
	48.70	Peak	V			95.58	114.00	18.42
	44.10	Average	V			90.98	94.00	3.02
Test Data for High Channel								
5 871.35	47.61	Peak	H	34.50	12.38	94.49	114.00	19.51
	43.38	Average	H			90.26	94.00	3.74
	46.19	Peak	V			93.07	114.00	20.93
	42.14	Average	V			89.02	94.00	4.98

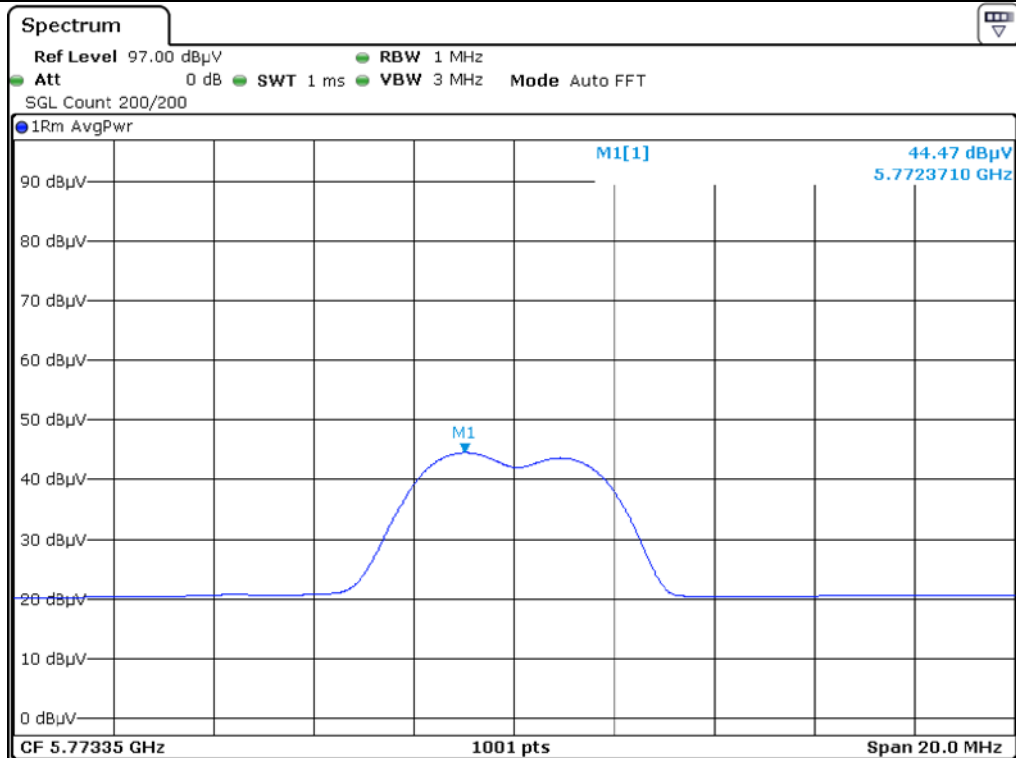
*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes, but the worst plane data were recorded in the report.

Margin (dB) = Limit (dBμV/m) – Total (dBμV/m)

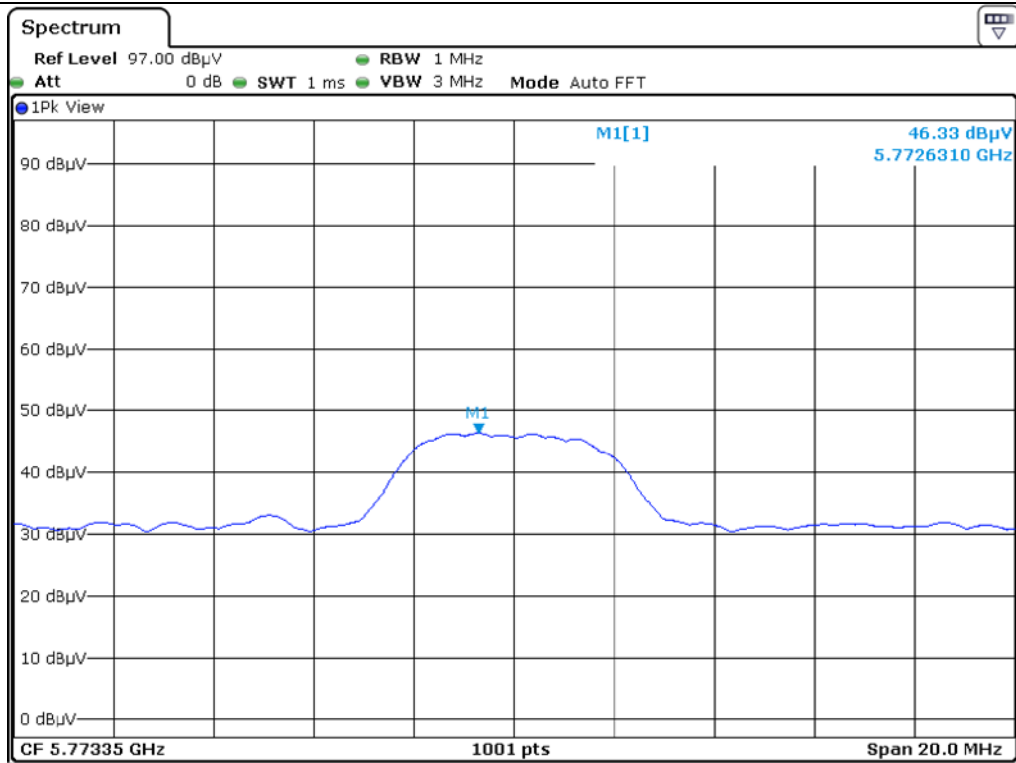
Total = Reading + Antenna Factor + Cable Loss + Duty Cycle Reduction



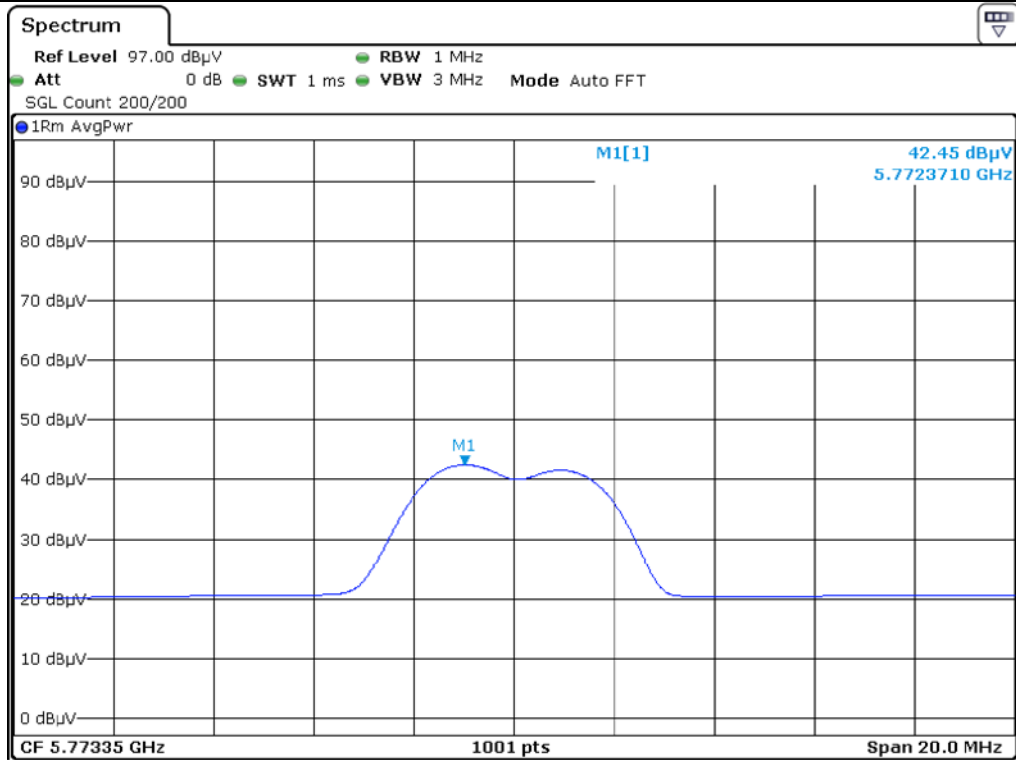
Low Channel_Peak_H



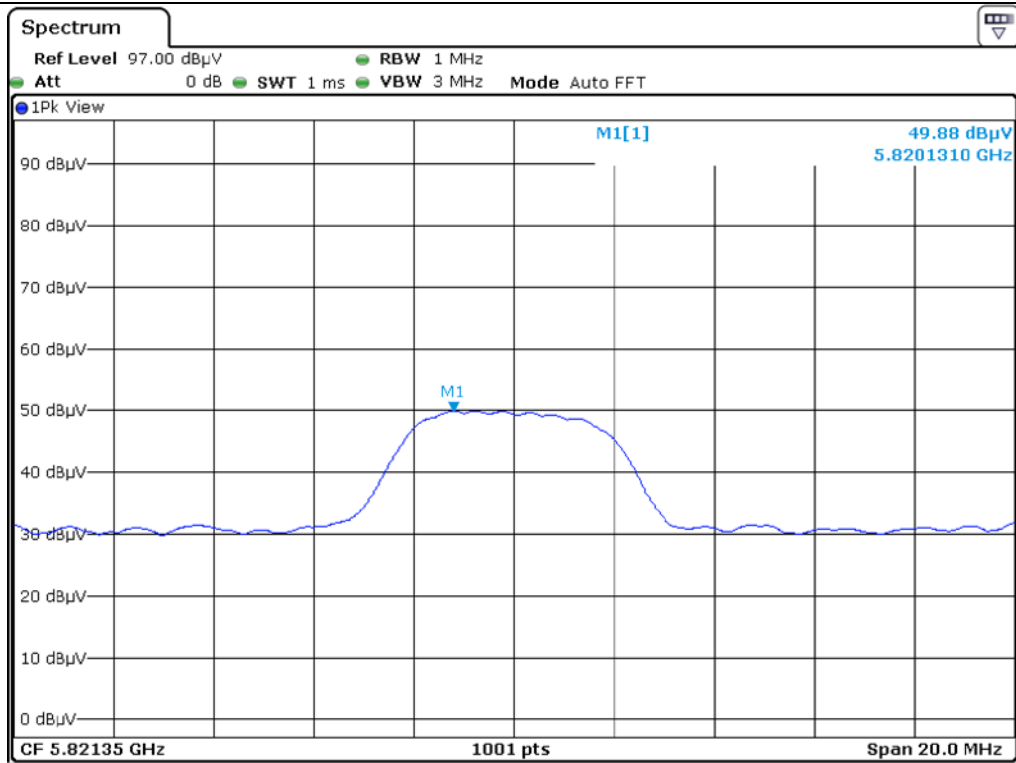
Low Channel_Average_H



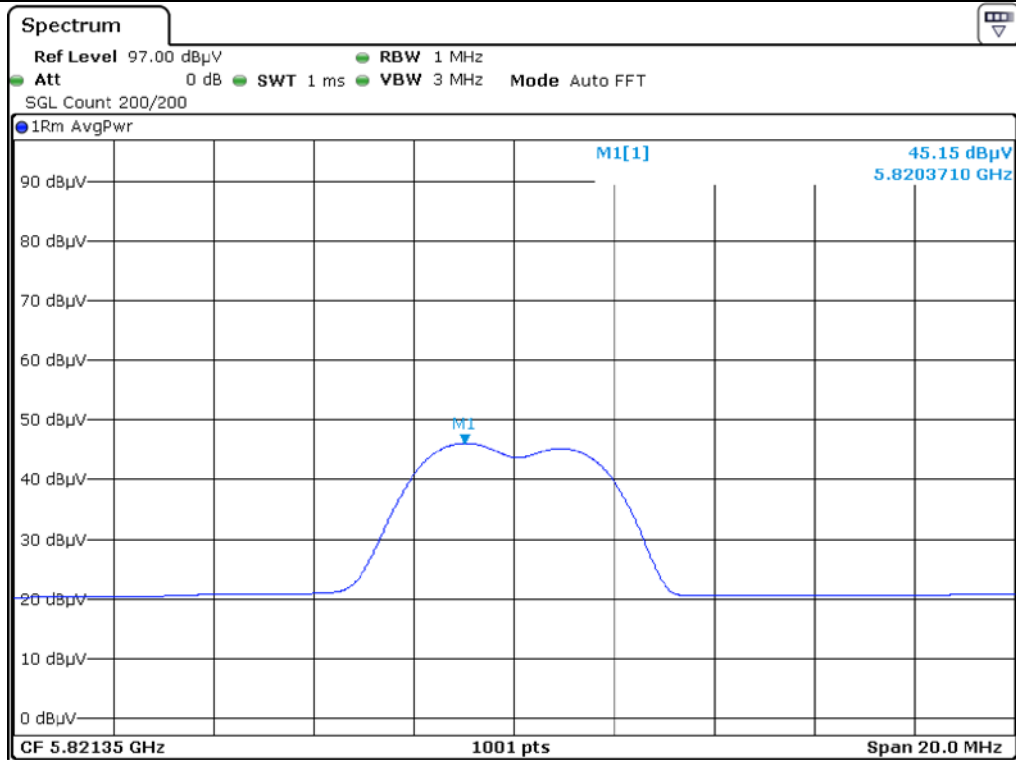
Low Channel_Peak_V



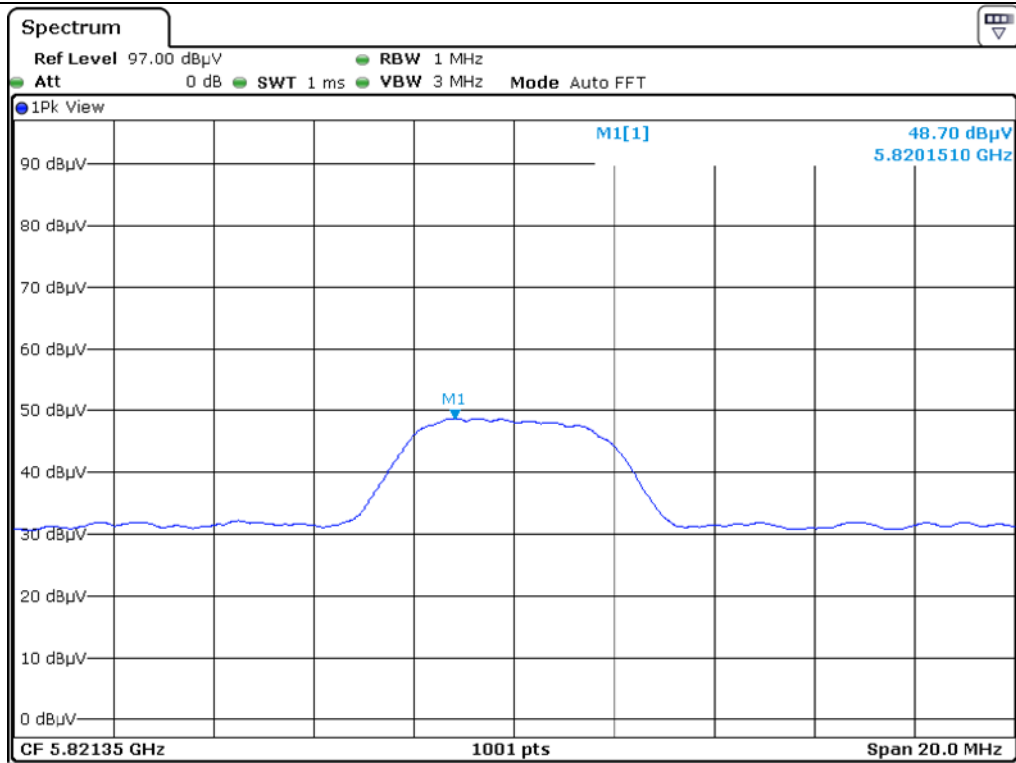
Low Channel_Average_V



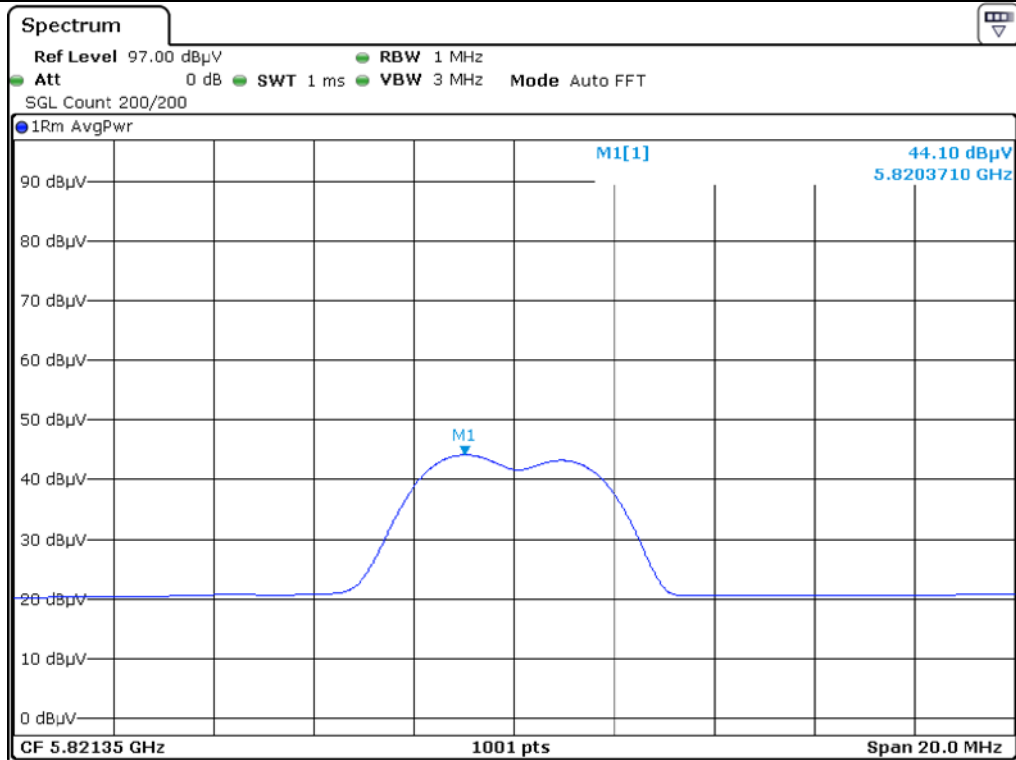
Middle Channel_Peak_H



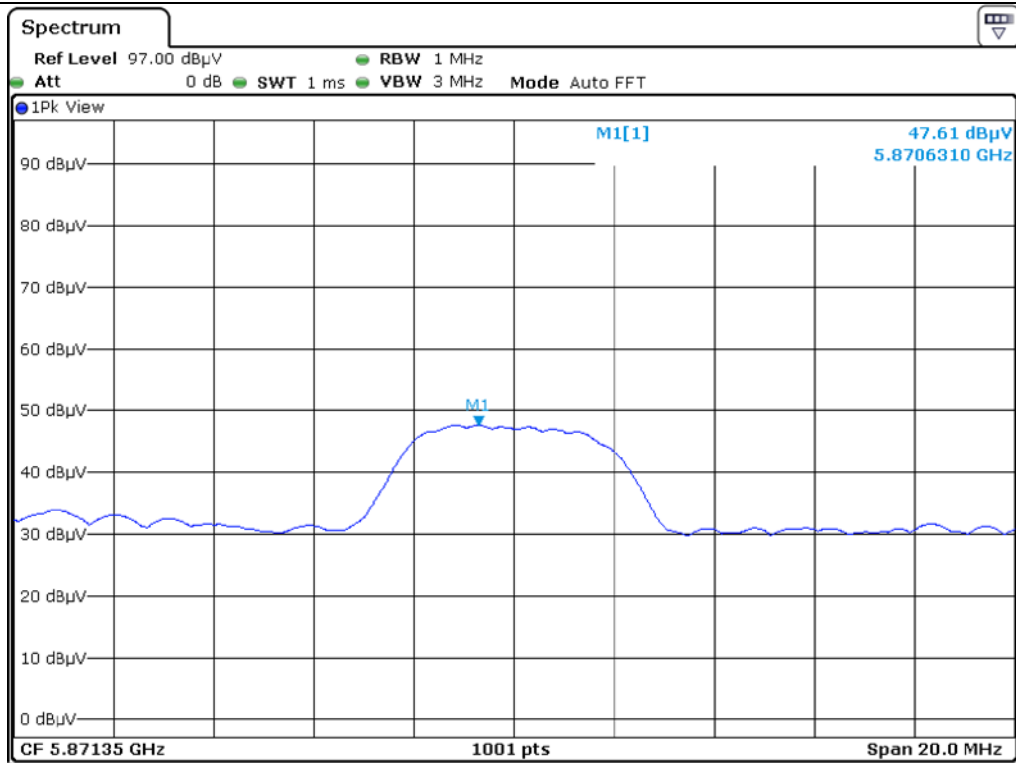
Middle Channel_Average_H



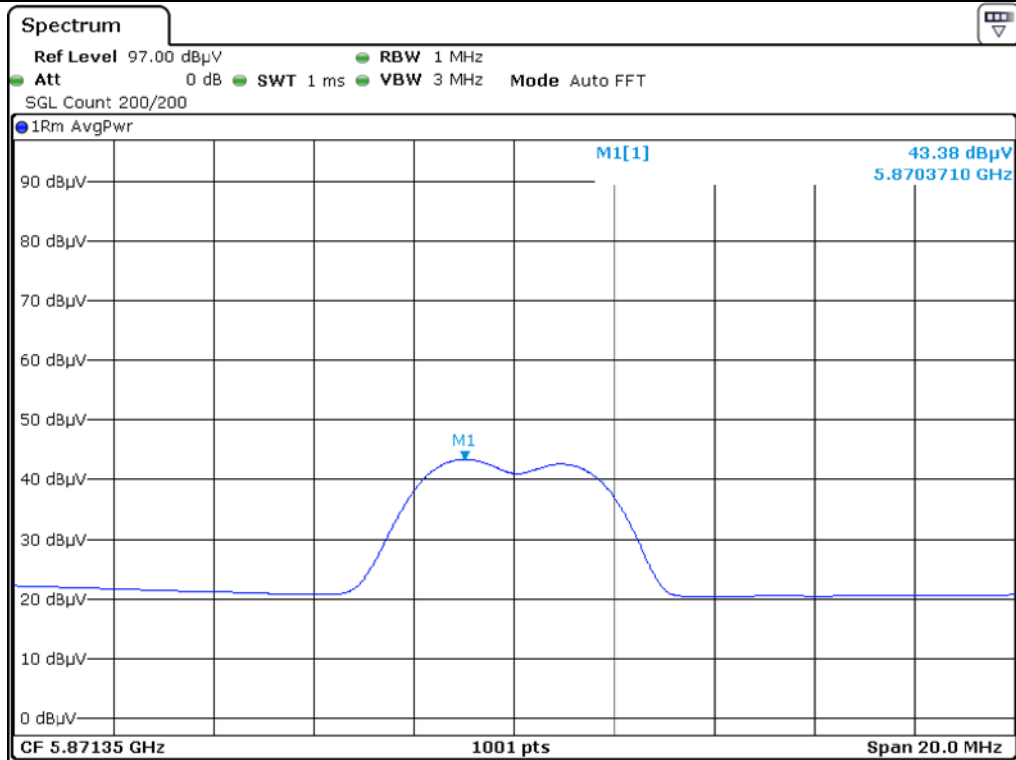
Middle Channel_Peak_V



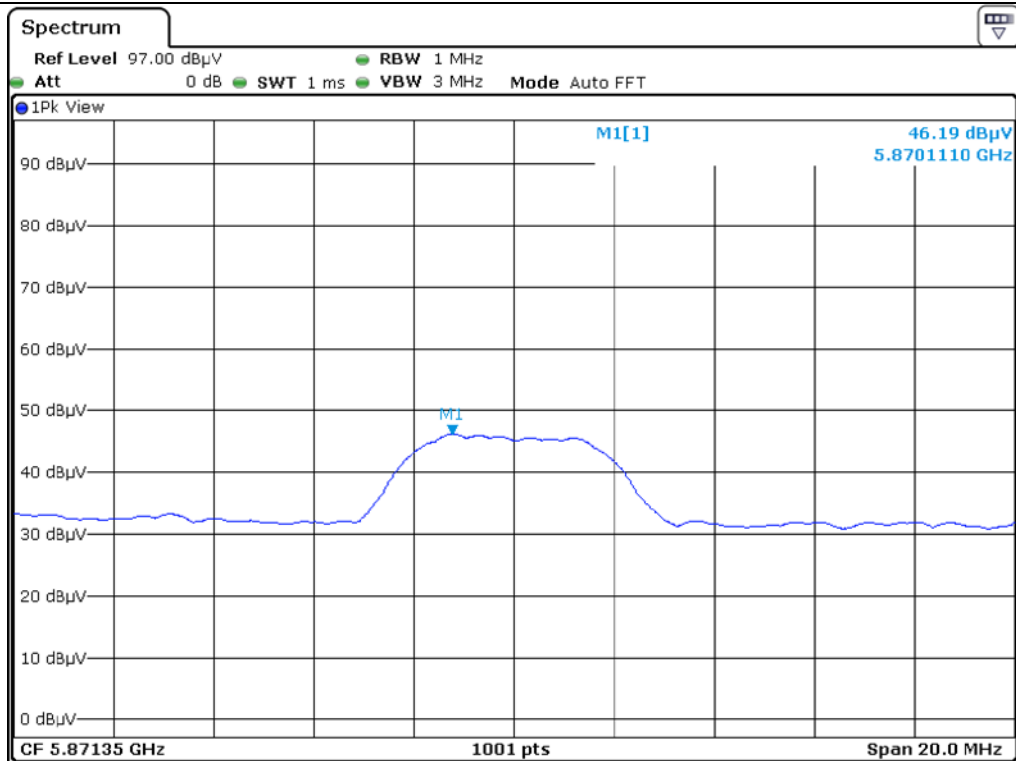
Middle Channel_Average_V



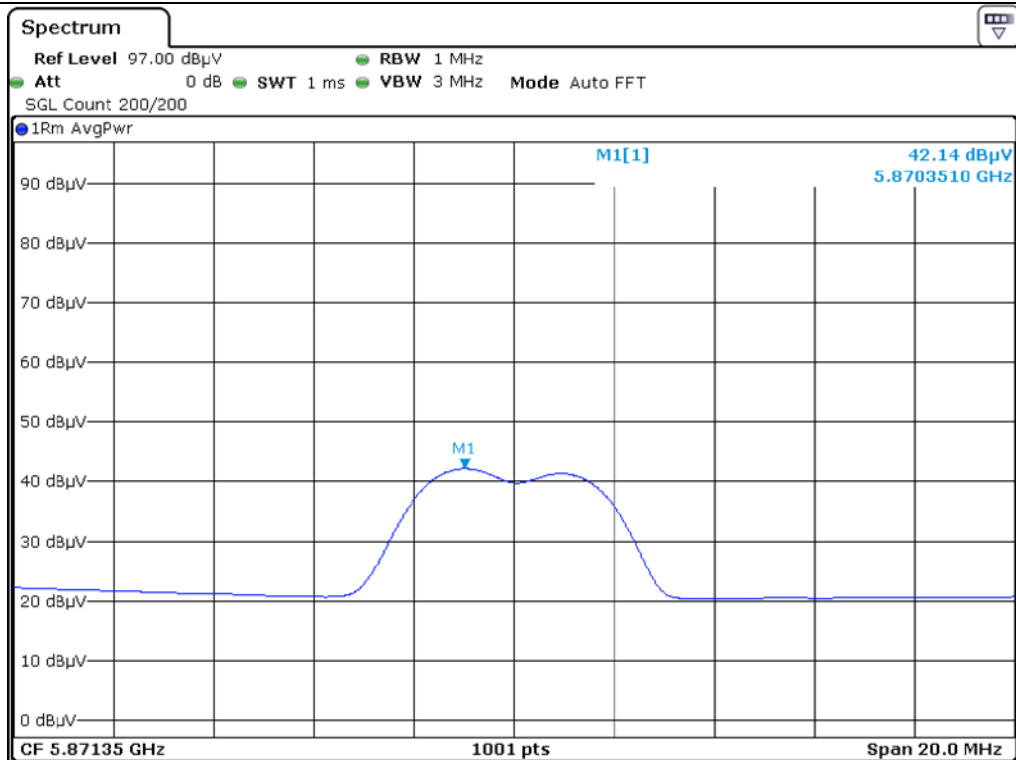
High Channel_Peak_H



High Channel_Average_H



High Channel_Peak_V



High Channel_Average_V

8.5.2 Emissions Radiated Outside of the Specified Frequency Bands_ Harmonic

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : Audio Transceiver

Operating Condition : TX mode

Distance : 3 m

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Carrier Freq. (MHz)	Reading (dBμV)	Detector Mode	Pol.	Antenna (dB/m)	Cable Loss (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Test Data for Low Channel								
11 546.70	13.78	Peak	H	42.30	4.98	61.06	74.00	12.94
	2.59	Average	H			49.87	54.00	4.13
	13.56	Peak	V			60.84	74.00	13.16
	2.42	Average	V			49.70	54.00	4.30
Test Data for Middle Channel								
11 642.70	13.60	Peak	H	41.80	4.98	60.38	74.00	13.62
	2.55	Average	H			49.33	54.00	4.67
	13.51	Peak	V			60.29	74.00	13.71
	2.49	Average	V			49.27	54.00	4.73
Test Data for High Channel								
11 742.76	13.57	Peak	H	41.30	4.98	59.85	74.00	14.15
	2.53	Average	H			48.81	54.00	5.19
	13.48	Peak	V			59.76	74.00	14.24
	2.56	Average	V			48.84	54.00	5.16
Other frequencies were not found up to 10 GHz.								

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

Margin (dB) = Limit (dBμV/m) – Total (dBμV/m)

Total = Reading + Antenna Factor + Cable Loss + Duty Cycle Reduction

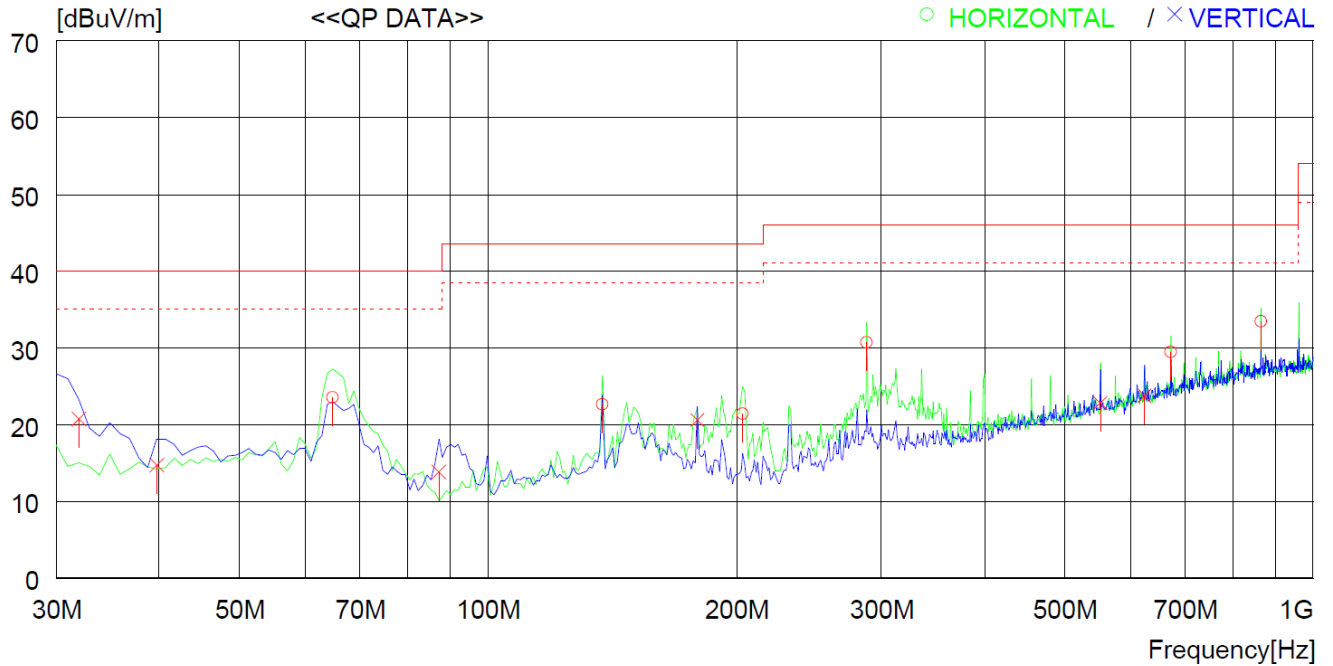
8.5.3 Test Data for Frequency range: 30 MHz ~ 1 000 MHz

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)

Result : PASSED

EUT : Audio Transceiver

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	64.920	36.5	18.4	1.3	32.7	23.5	40.0	16.5	300	359
2	137.670	35.0	18.2	2.0	32.6	22.6	43.5	20.9	200	75
3	203.630	35.7	15.8	2.4	32.5	21.4	43.5	22.1	100	359
4	288.020	41.1	19.1	2.9	32.4	30.7	46.0	15.3	100	100
5	672.136	30.8	26.5	4.5	32.4	29.4	46.0	16.6	100	359
6	864.190	31.7	28.7	5.2	32.2	33.4	46.0	12.6	100	117
----- Vertical -----										
7	31.940	34.5	17.9	0.9	32.6	20.7	40.0	19.3	200	139
8	39.700	27.4	18.9	1.0	32.6	14.7	40.0	25.3	100	0
9	87.230	31.0	13.9	1.5	32.6	13.8	40.0	26.2	100	0
10	179.380	33.2	17.7	2.3	32.6	20.6	43.5	22.9	100	323
11	551.859	26.4	24.6	4.1	32.3	22.8	46.0	23.2	100	166
12	624.607	26.0	25.9	4.3	32.5	23.7	46.0	22.3	100	307

8.5.4 Test Data for Below 30 MHz

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)

Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

8.5.5 Test Data above 1 GHz except for harmonic

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)

- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

8.5.6 Band Edge

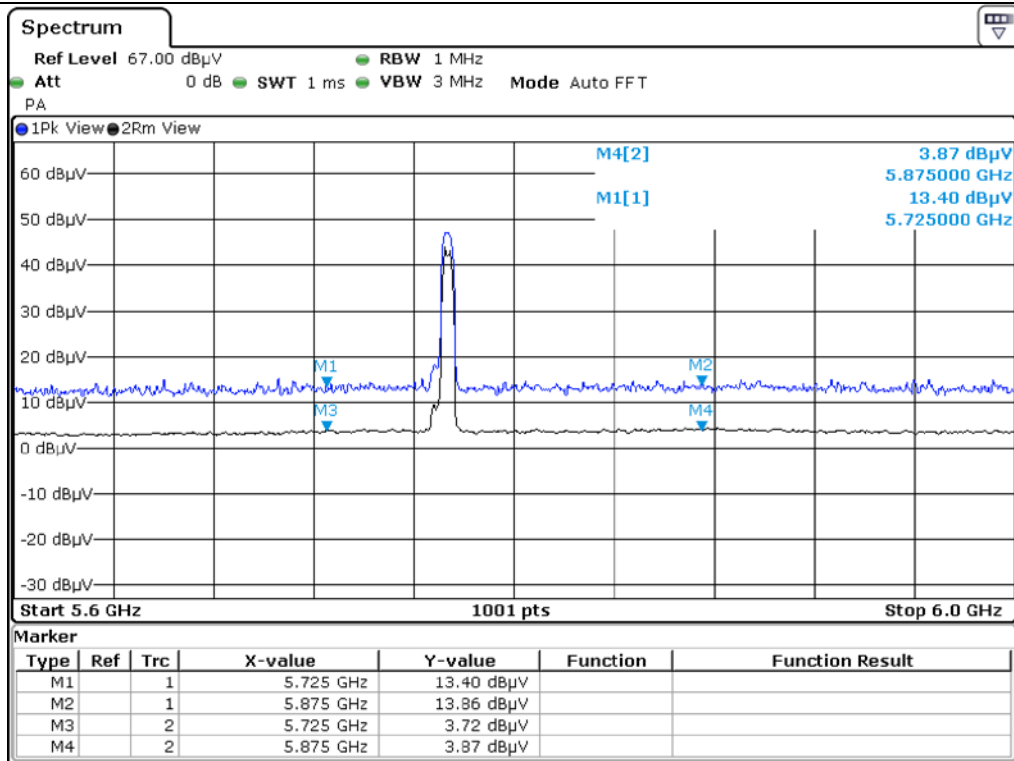
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)
- . Result : PASSED

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel								
5 725.00	13.40	Peak	H	34.50	12.38	60.28	74.00	13.72
	3.72	Average	H			50.60	54.00	3.40
	13.78	Peak	V			60.66	74.00	13.34
	3.75	Average	V			50.63	54.00	3.37
5 875.00	13.86	Peak	H			60.74	74.00	13.26
	3.87	Average	H			50.75	54.00	3.25
	13.17	Peak	V			60.05	74.00	13.95
	3.82	Average	V			50.70	54.00	3.30
Test Data for Middle Channel								
5 725.00	13.28	Peak	H	34.50	12.38	60.16	74.00	13.84
	3.43	Average	H			50.31	54.00	3.69
	11.68	Peak	V			58.56	74.00	15.44
	3.43	Average	V			50.31	54.00	3.69
5 875.00	13.70	Peak	H			60.58	74.00	13.42
	4.19	Average	H			51.07	54.00	2.93
	12.35	Peak	V			59.23	74.00	14.77
	4.06	Average	V			50.94	54.00	3.06

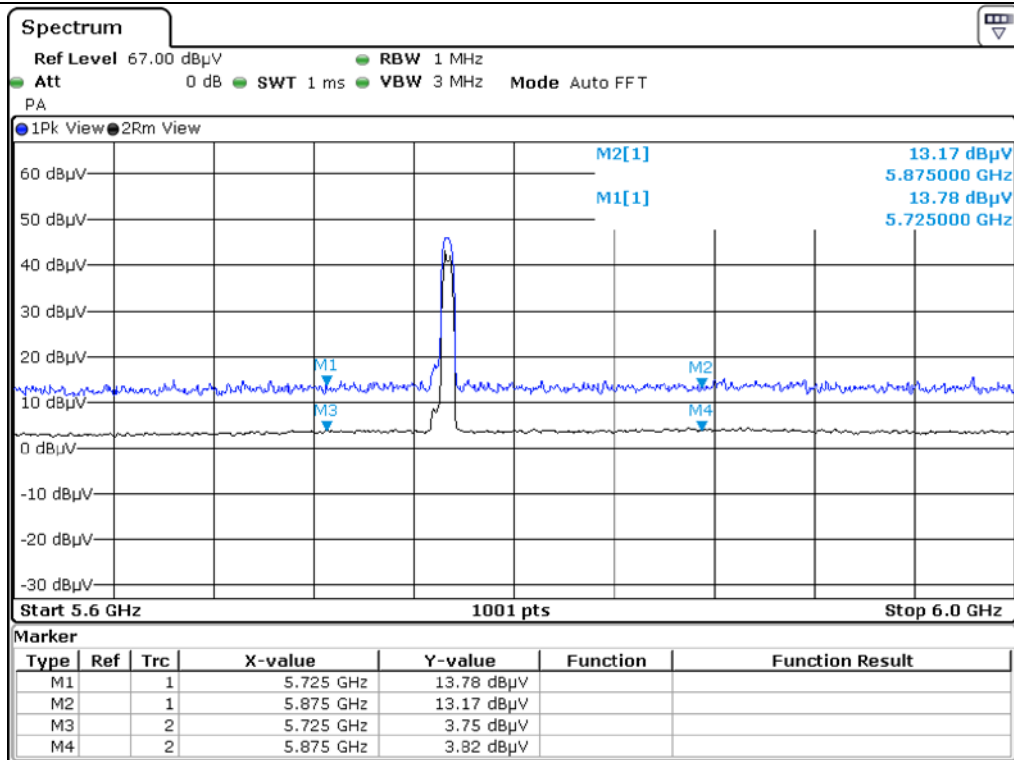
Test Data for High Channel								
5 725.00	12.59	Peak	H	34.50	12.38	59.47	74.00	14.53
	3.56	Average	H			50.44	54.00	3.56
	12.07	Peak	V			58.95	74.00	15.05
	3.69	Average	V			50.57	54.00	3.43
5 875.00	14.07	Peak	H			60.95	74.00	13.05
	4.87	Average	H			51.75	54.00	2.25
	13.31	Peak	V			60.19	74.00	13.81
	4.55	Average	V			51.43	54.00	2.57

Remark. Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

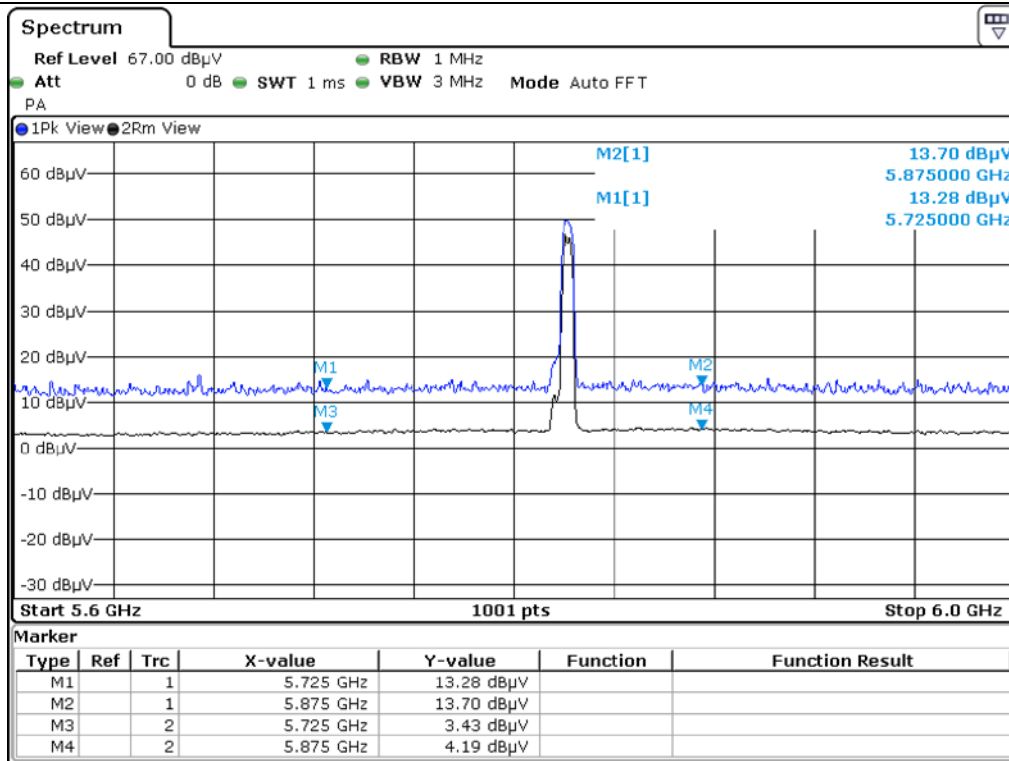
Total = Reading + Antenna Factor + Cable Loss + Duty Cycle Reduction



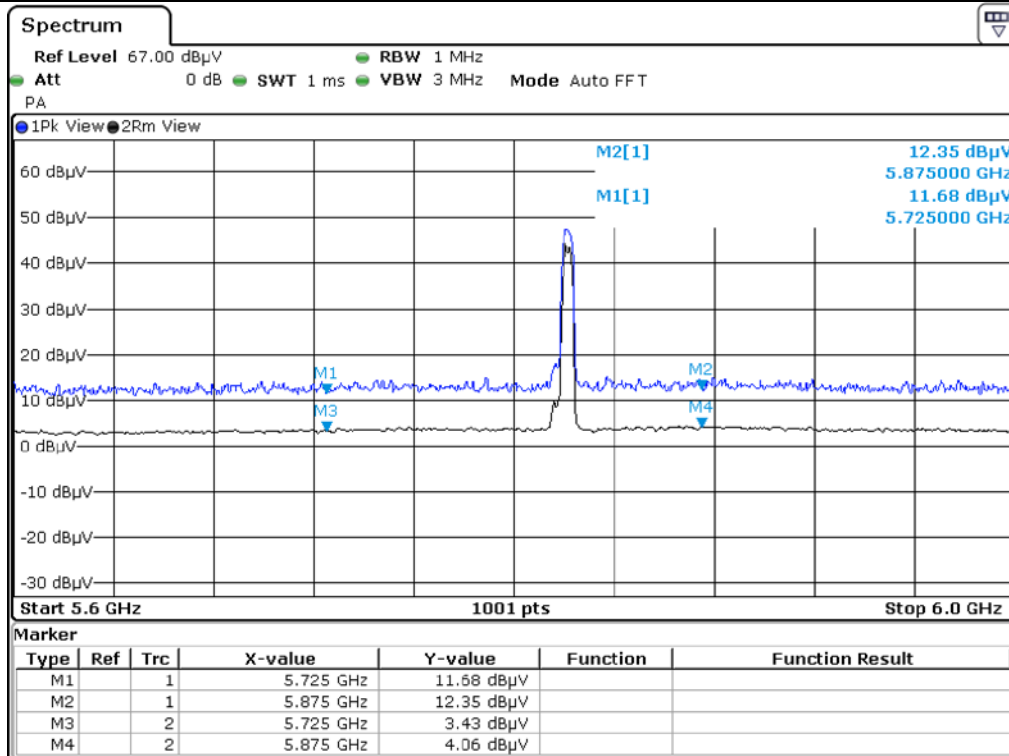
Low Channel_H



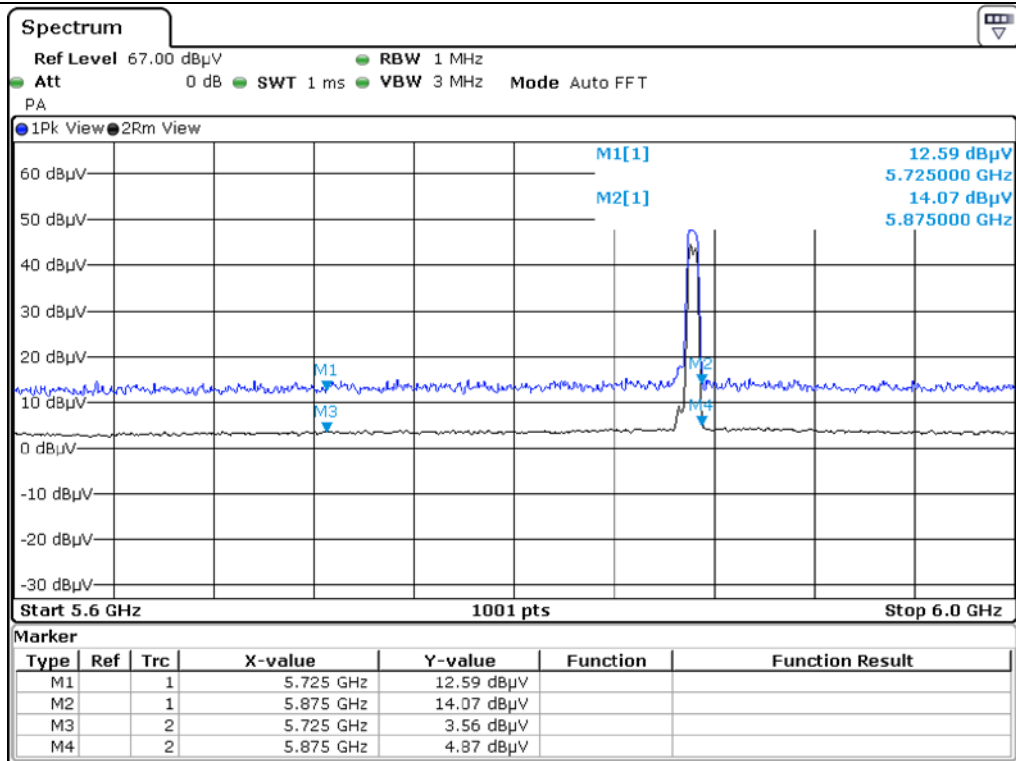
Low Channel_V



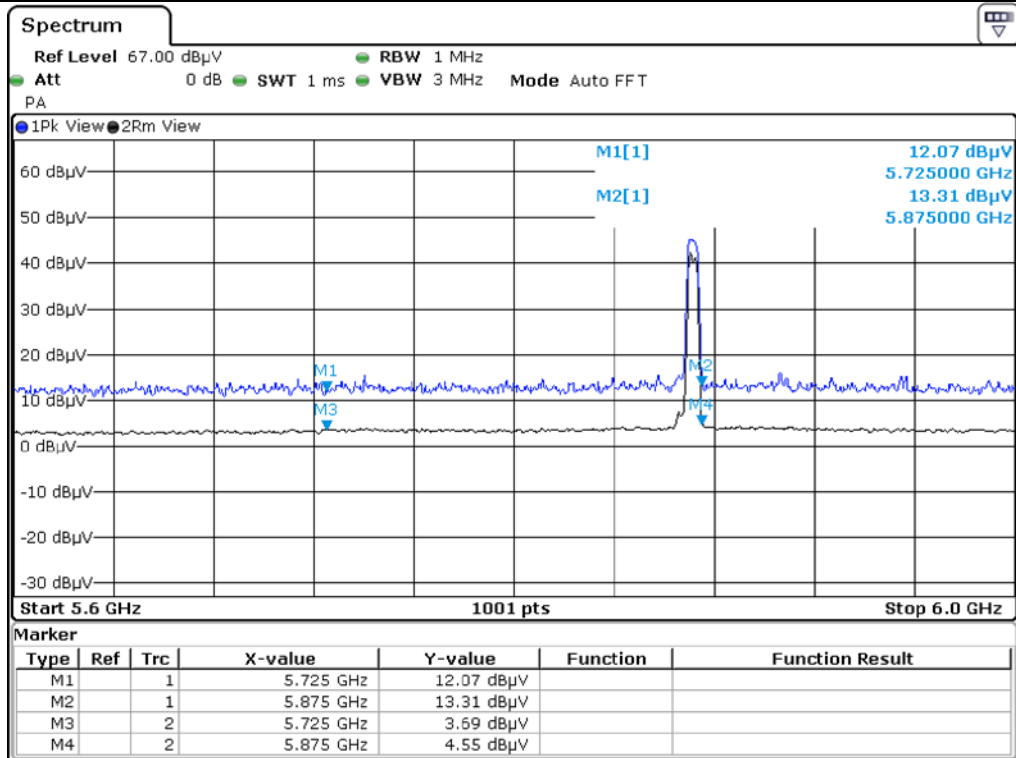
Middle Channel_H



Middle Channel_V



High Channel_H



High Channel_V

9. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSV40-N	Rohde & Schwarz	Signal Analyzer	102177	Apr. 21, 2020 (1Y)
ESW	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 27, 2020 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 16, 2020 (1Y)
BBV 9718 B	Schwarzbeck	Broadband Preamplifier	00009	Mar. 16, 2020 (1Y)
SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Feb. 20, 2020 (1Y)
SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 15, 2020 (1Y)
DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 08, 2020 (2Y)
BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 23, 2020 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020(1Y)
FMZB1513	Schwarzbeck	Active Loop Antenna	1513-235	Oct.28.2020(2Y)