EUROFINS ELECTRICAL TESTING SERVICE (SHENZHEN) CO., LTD.

RADIO TEST - REPORT

FCC Compliance Test Report for

Product name: Mod Dock Circa / Mod Dock Banda

Model name: GS-VSN1/GS-VSN2

FCC ID: 2AXJN-1229020GS

Test Report Number: EFGX20090090-IE-01-E02

The above sample(s) and sample information was/were submitted and identified on behalf of the applicant.
Eurofins assures objectivity and impartiality of the test, and fulfills the obligation of confidentiality for applicant's commercial information and technical documents.

1 General Information

1.1 Notes

The results of this test report relate exclusively to the item tested as specified in chapter “Description of test item” and are not transferable to any other test items.
Eurofins Electrical Testing Service (Shenzhen) Co., Ltd. is not responsible for any generalisations and conclusions drawn from this report. Any modification of the test item can lead to invalidity of test results and this test report may therefore be not applicable to the modified test item.
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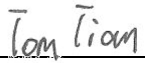
Operator:

2021-03-03		Bruce Zheng / Project Engineer	
Date	Eurofins-Lab.	Name / Title	Signature

Technical responsibility for area of testing:

2021-03-03		Tom Tian / Supervisor	
Date	Eurofins	Name / Title	Signature

1.2 Testing laboratory

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
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Telephone : +86-755-82911867
Fax : +86-755-82910749
The Laboratory has passed the Accreditation by the American Association for Laboratory Accrediation (A2LA). The Accreditation number is 5376.01
The Laboratory has been listed by industry Canada to perform electromagnetic emission measurements, The CAB identifier is CN0088

1.3 Details of applicant

Name	:	Grain Spark LLC
Address	:	421 South Brookhurst Street Suite# 120 Suite #120 Anaheim, CA 92804 United States
Telephone	:	(714) 495-9777
Fax	:	N/A

1.4 Details of manufacturer

Name	:	Shenzhen Form Electronics Co, Ltd
Address	:	F4 BldgE Junfeng Science&Technology Park Le Zhujiao Village,Xixiang Town,Bao'an Dist,Shenzhen,China
Telephone	:	+86 15338707574
Fax	:	N/A

1.5 Application details

Date of receipt of application	:	2020-09-14
Date of receipt of test item	:	2020-09-14
Date of test	:	2020-09-14 to 2020-12-18
Date of issue		2021-03-03

1.6 Test item

Product type	:	Mod Dock Circa / Mod Dock Banda
Model name	:	GS-VSN1/GS-VSN2
Brand	:	Grain Spark
Serial number	:	N/A
Ratings	:	Input: DC 5V / 2A Output:5W Input:120V/60Hz AC adapter
Test voltage	:	Input: DC 5V / 2A Input:120V/60Hz AC adapter
FCC ID	:	2AXJN-1229020GS
Additional information	:	All 2 products (GS-VSN1/GS-VSN2) have the same Wireless charger module, so only needs to be tested once.

RadioTechnical data

Operating Frequency	:	117 ~ 180kHz

1.7 Test standards

Test Standards	
FCC Part 15 Subpart C December 21, 2020	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

Test Method

1: ANSI C63.4-2014, 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.
2: ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices.

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

or

The deviations as specified were ascertained in the course of the tests performed. ☐

2.2 Test environment

Ac line conducted

Enviroment Parameter	Temperature	Relative Humidity
101.2 kPa	24.2℃	57.3%

Radiated

Enviroment Parameter	Temperature	Relative Humidity
101.2 kPa	24.3℃	52.7%

2.3 Measurement uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty in conducted measurements	1.96dB
Uncertainty for Radiated Emission 9KHz-30MHz	4.56dB
Uncertainty for Radiated Emission 30MHz-3000MHz	Horizontal: 4.46dB; Vertical: 4.54dB;

2.4 Test mode

Test item	Operating Mode	Descriptions
Radiated Emissions	Standby	EUT Alone powered by AC/DC adapter
	Operating (With & Without 3mm gap)	EUT and smart phone powered by AC/DC adapter (Phone 5W charging)
AC Power Line Conducted Emission	Standby	EUT Alone powered by AC/DC adapter
	Operating (With & Without 3mm gap)	EUT and smart phone powered by AC/DC adapter (Phone 5W charging)

2.5 Test equipment utilized

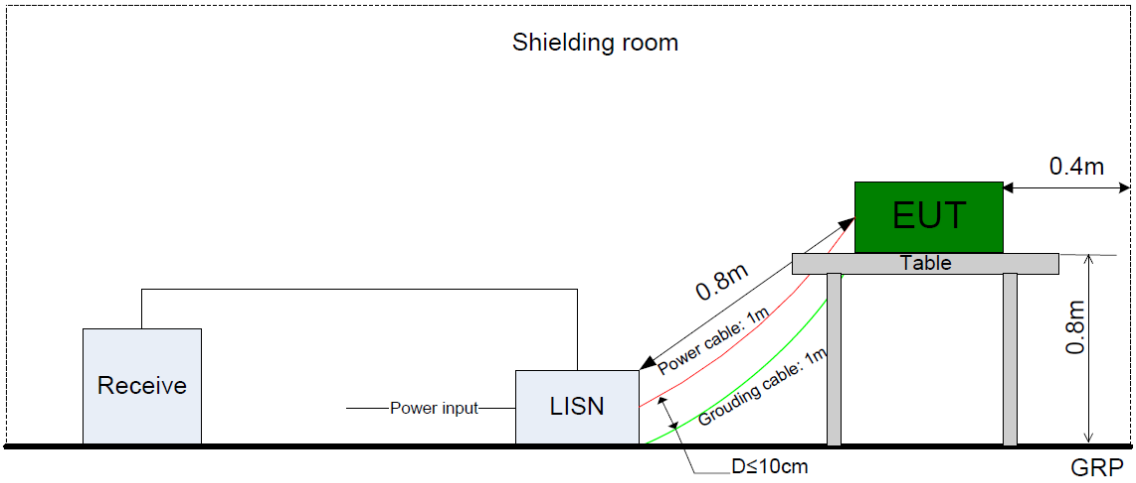
EQUIPMENT ID	EQUIPMENT NAME	MODEL NO.	CAL. DUE DATE
23-2-13-05	EMI Test Receiver	ESR3	2021-04-24
23-2-13-06	LISN	NNLK 8127 RC	2021-04-23
23-2-10-16	Attenuator	VTSD 9561-F	2021-04-24
23-2-10-44	DC power supply	E3642A	2021-06-03
23-2-10-45	temperature test chamber	SG-80-CC-2	2021-04-23
23-2-13-01	EMI Test Receiver	ESR7	2021-04-24
23-2-13-02	Signal Analyzer	N9020B-544	2021-04-24
23-2-12-01	Active Loop Antenna	FMZB 1519B	2021-05-13
23-2-12-02	TRILOG Broadband Antenna	VULB9168	2021-04-27
23-2-12-05	Universal Antenna Stand	CLSA0110	2021-05-11
23-2-10-01	Preamplifier	BBV9745	2021-04-23
23-2-10-14	Switch and Control Unit	ERIT-E-JS0806-SF1	N/A

2.6 Auxiliary Equipment Used during Test:

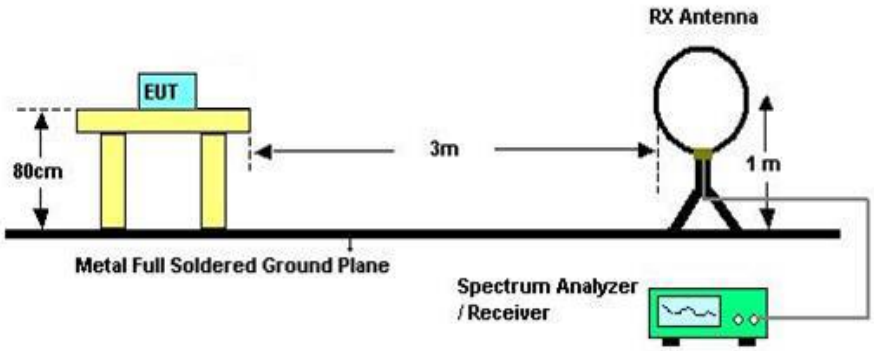
DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Mobile Phone	Apple	A2108XR	---

2.7 Test setup

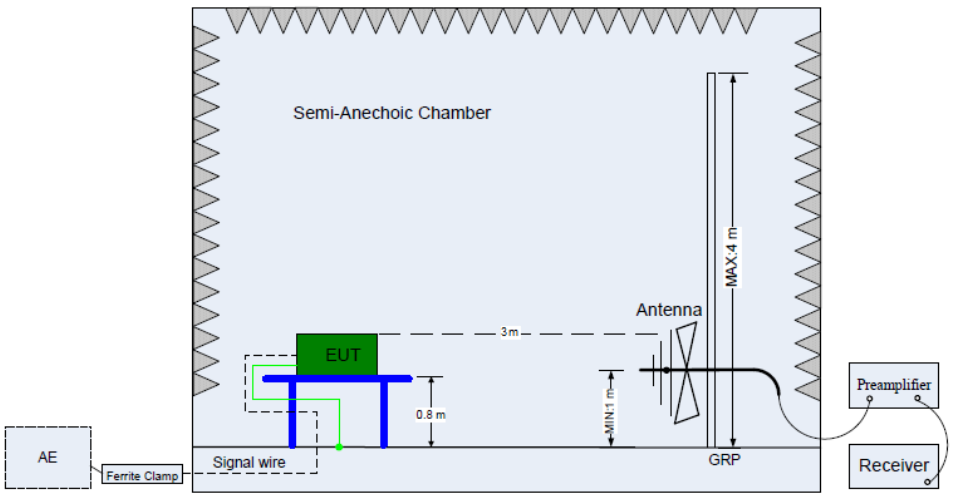
AC line conducted



Radiated tests below 30MHz



Radiated tests below 1GHz



(Below 1 GHz)

2.8 Test results

☒ 1st test ☐ test after modification ☐ production test

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Test Result	Verdict	Test Site
§15.207	Conducted emission AC power port	See Page 11	Pass	Site 1
§15.209	Radiated Emission	See page 17	Pass	Site 1
§15.215 (c)	20dB Occupied bandwidth	See page 26	Pass	Site 1
§15.203	Antenna requirement	See note 1	Pass	--

Note 1: No antenna connector is used.

3 Technical Requirement

3.1 Conducted emission AC power port

Test Method:
The test method was refered to the subclause 6.2 of ANSI C63.10-2013.

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both Neutral and Live lines.

Limit:

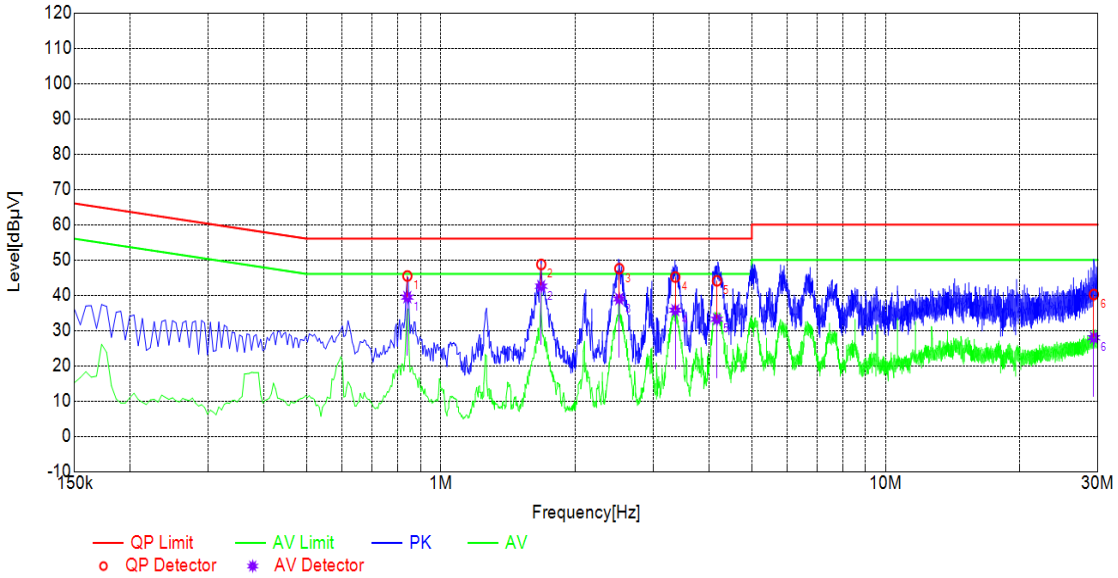
FCC §15.207 (a)

Frequency	QP Limit	AV Limit
MHz	dBµV	dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linear.

Test Result:

Standby L



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.8401	0.22	45.46	56.00	10.54	39.45	46.00	6.55	PASS
1.6800	0.25	48.74	56.00	7.26	42.56	46.00	3.44	PASS
2.5166	0.27	47.52	56.00	8.48	38.96	46.00	7.04	PASS
3.3643	0.27	45.15	56.00	10.85	35.76	46.00	10.24	PASS
4.1733	0.29	44.08	56.00	11.92	33.20	46.00	12.80	PASS
29.3844	0.61	40.20	60.00	19.80	27.97	50.00	22.03	PASS

Note1: Corrector factor = Attenuator loss + Cable Loss

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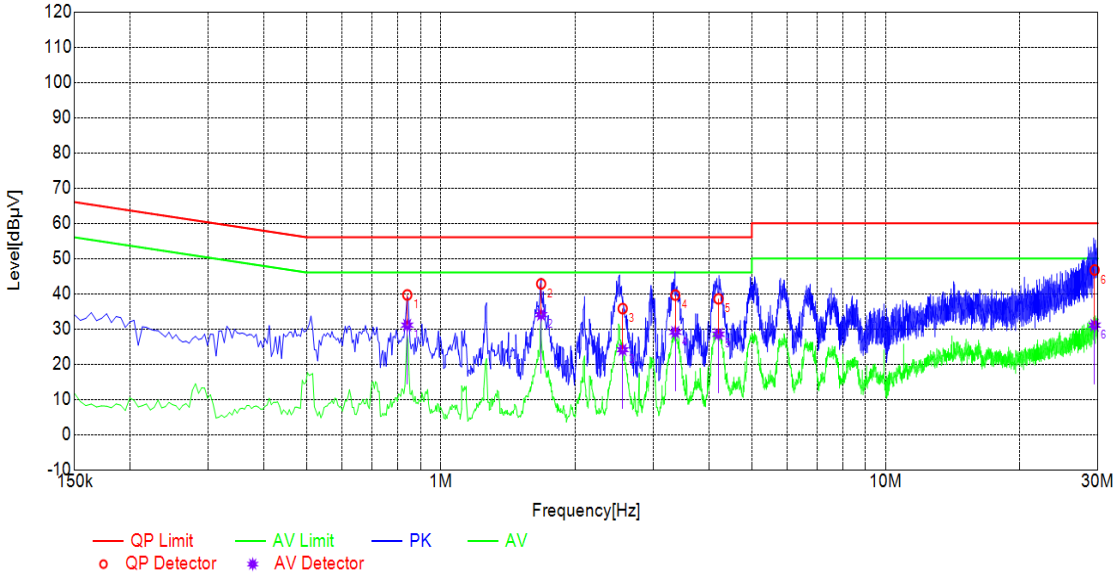
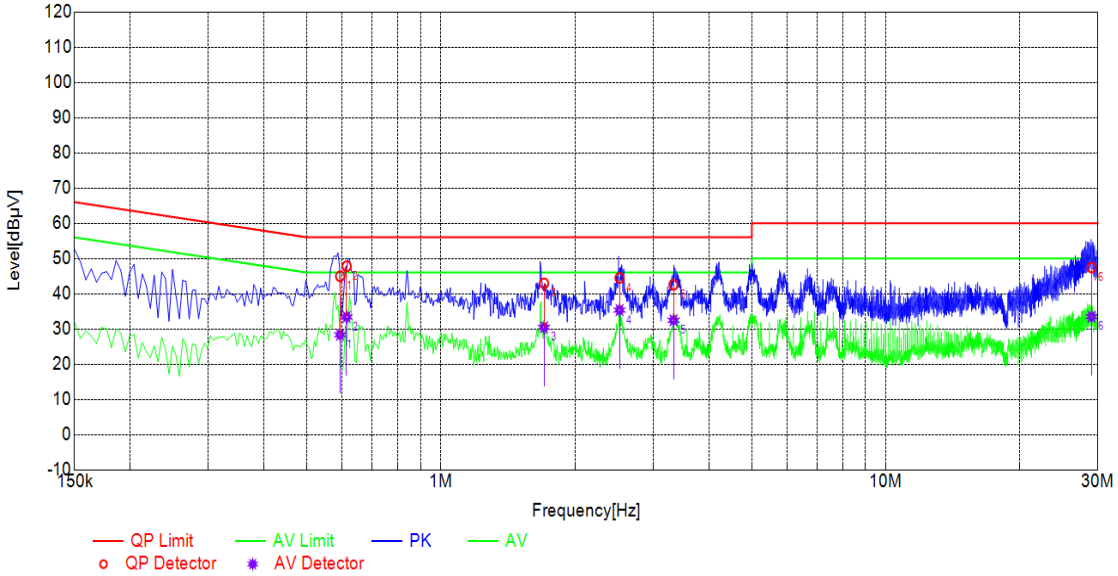
Standby N



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.8395	0.22	39.66	56.00	16.34	31.09	46.00	14.91	PASS
1.6793	0.25	42.81	56.00	13.19	34.07	46.00	11.93	PASS
2.5615	0.27	35.77	56.00	20.23	24.10	46.00	21.90	PASS
3.3641	0.27	39.62	56.00	16.38	29.08	46.00	16.92	PASS
4.2074	0.29	38.54	56.00	17.46	28.52	46.00	17.48	PASS
29.4951	0.65	46.73	60.00	13.27	31.07	50.00	18.93	PASS

Note1: Corrector factor = Attenuator loss + Cable Loss

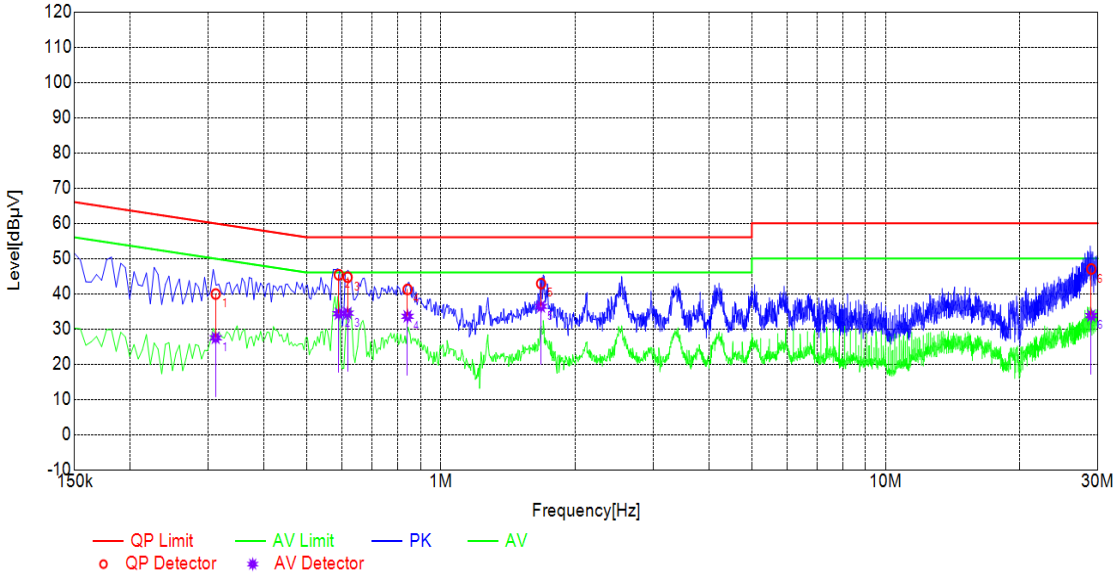
Operating L



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.5930	0.22	44.97	56.00	11.03	28.34	46.00	17.66	PASS
0.6134	0.22	47.82	56.00	8.18	33.40	46.00	12.60	PASS
1.7047	0.25	42.96	56.00	13.04	30.45	46.00	15.55	PASS
2.5207	0.27	44.50	56.00	11.50	35.35	46.00	10.65	PASS
3.3339	0.27	42.56	56.00	13.44	32.45	46.00	13.55	PASS
29.0429	0.61	47.43	60.00	12.57	33.47	50.00	16.53	PASS

Note1: Corrector factor = Attenuator loss + Cable Loss

Operating N



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.3114	0.22	39.91	59.93	20.02	27.47	49.93	22.46	PASS
0.5889	0.21	45.39	56.00	10.61	34.34	46.00	11.66	PASS
0.6165	0.22	44.68	56.00	11.32	34.48	46.00	11.52	PASS
0.8409	0.22	41.24	56.00	14.76	33.58	46.00	12.42	PASS
1.6788	0.25	42.88	56.00	13.12	36.40	46.00	9.60	PASS
28.9899	0.65	47.03	60.00	12.97	33.78	50.00	16.22	PASS

Note1: Corrector factor = Attenuator loss + Cable Loss

3.2 Radiated emissions

Test Method:
Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4
Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

[For 9 kHz ~ 30 MHz]
a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range.Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]
a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range.Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
Note:
a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
b. All modes of operation were investigated and the worst-case emissions are reported.

Limit:

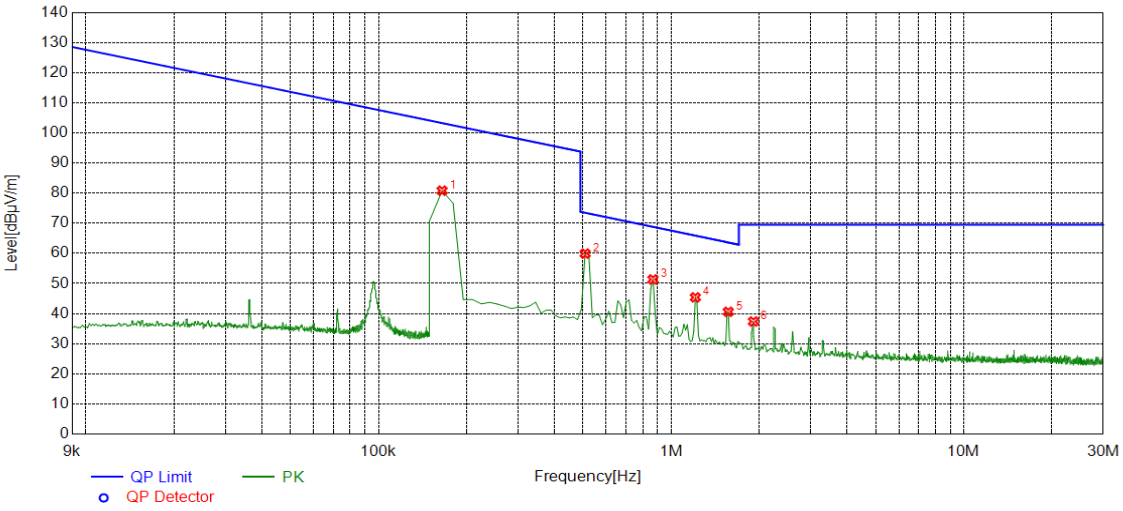
FCC §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

Test Result:
After pre-scan, the worst emission data was recorded.

Standby

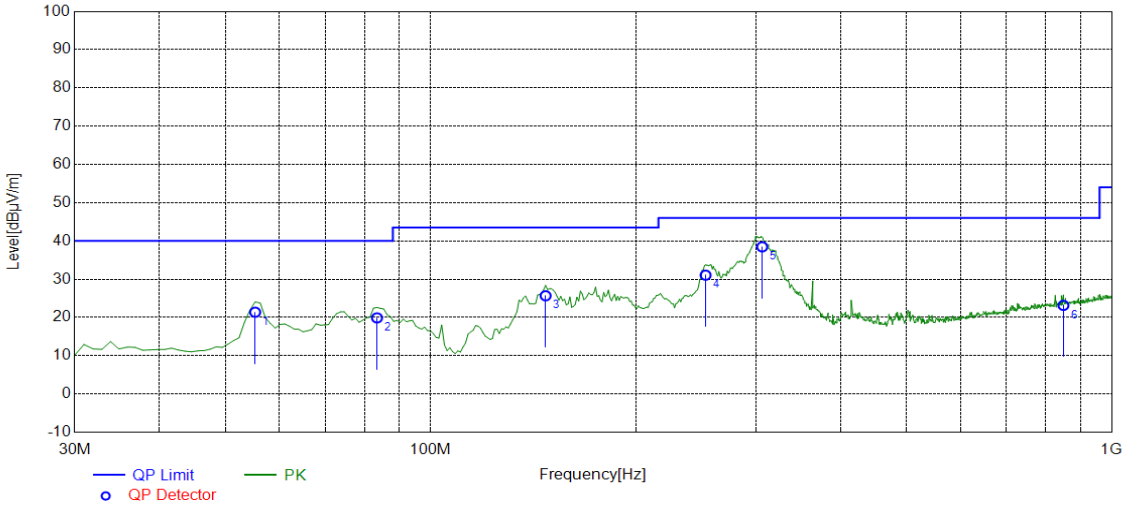
0.009-30MHz
Parallel



Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
*0.1649	80.81	-11.81	103.11	22.30	100	349	Parallel
0.5084	59.93	-11.79	73.38	13.45	100	352	Parallel
0.8668	51.34	-11.66	68.69	17.35	100	352	Parallel
1.2102	45.39	-11.61	65.83	20.44	100	349	Parallel
1.5686	40.59	-11.53	63.61	23.02	100	352	Parallel
1.9120	37.39	-11.45	69.50	32.11	100	337	Parallel

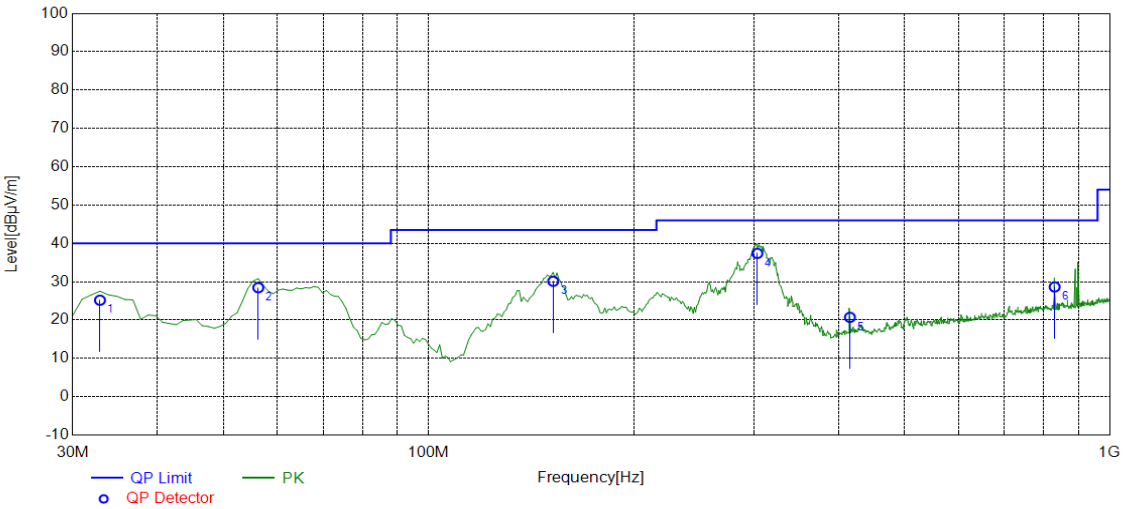
Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The other emission levels were very low against the limit.
5. “*” : Fundamental Frequency.

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	21.38	40.00	18.62	200	235	Horizontal
83.4034	-19.90	19.90	40.00	20.10	200	237	Horizontal
147.4875	-14.90	25.68	43.50	17.82	200	121	Horizontal
253.3233	-16.95	31.06	46.00	14.94	100	282	Horizontal
306.7267	-15.19	38.47	46.00	7.53	100	198	Horizontal
849.4995	-6.07	23.16	46.00	22.84	200	160	Horizontal

Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).

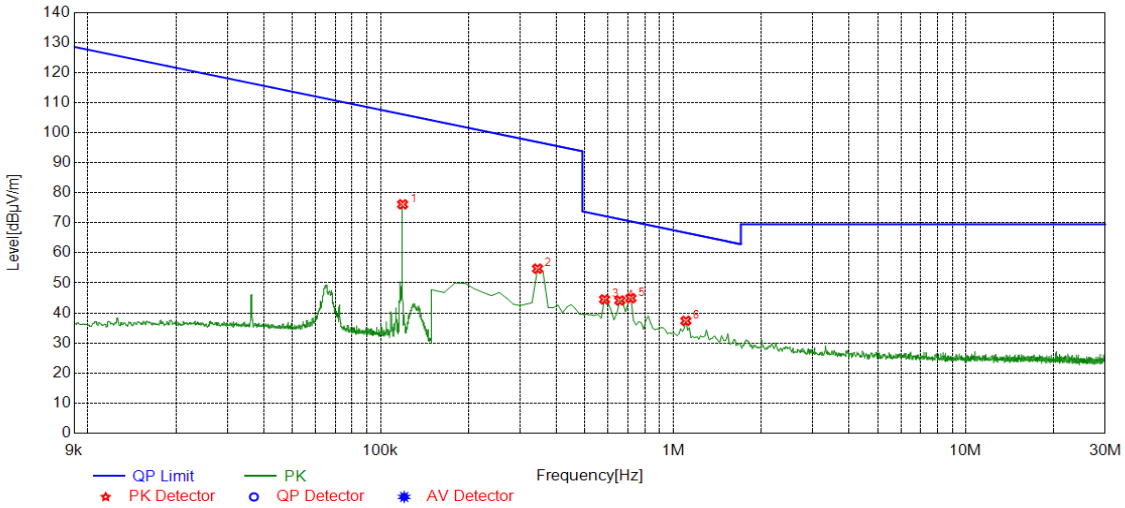


Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
32.9129	-17.94	25.19	40.00	14.81	100	73	Vertical
56.2162	-16.14	28.46	40.00	11.54	100	134	Vertical
152.3423	-14.81	30.12	43.50	13.38	100	27	Vertical
303.8138	-15.22	37.40	46.00	8.60	100	347	Vertical
415.4755	-13.24	20.72	46.00	25.28	100	312	Vertical
830.0801	-6.19	28.66	46.00	17.34	100	234	Vertical

Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).

Operating

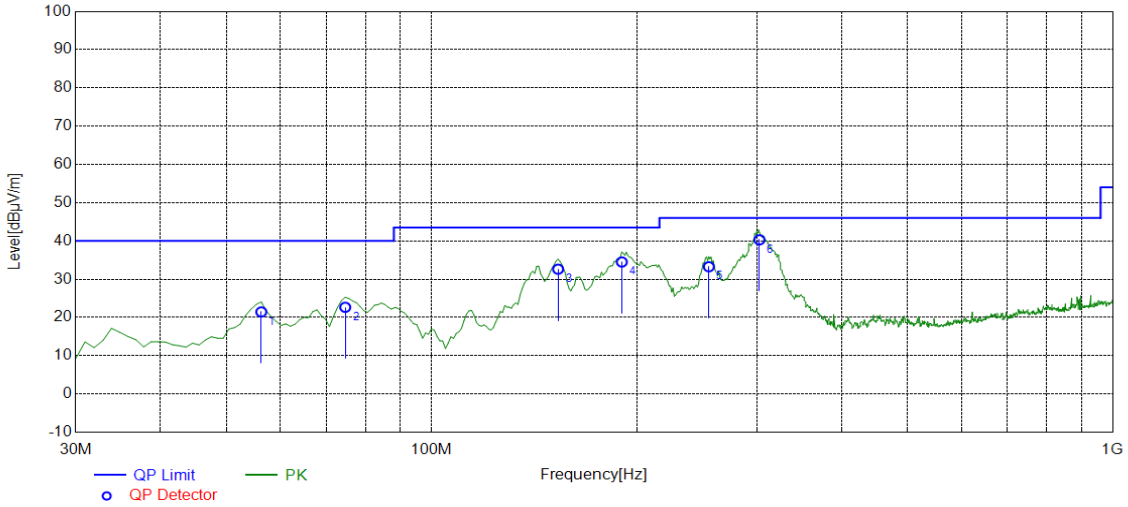
0.009-30MHz
Parallel



Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
*0.1190	76.14	-11.79	106.04	29.90	100	330	Parallel
0.3441	54.74	-11.81	96.83	42.09	100	322	Parallel
0.5830	44.51	-11.75	72.22	27.71	100	329	Parallel
0.6577	44.16	-11.72	71.20	27.04	100	316	Parallel
0.7174	44.93	-11.69	70.43	25.50	100	12	Parallel
1.1057	37.39	-11.64	66.65	29.26	100	141	Parallel

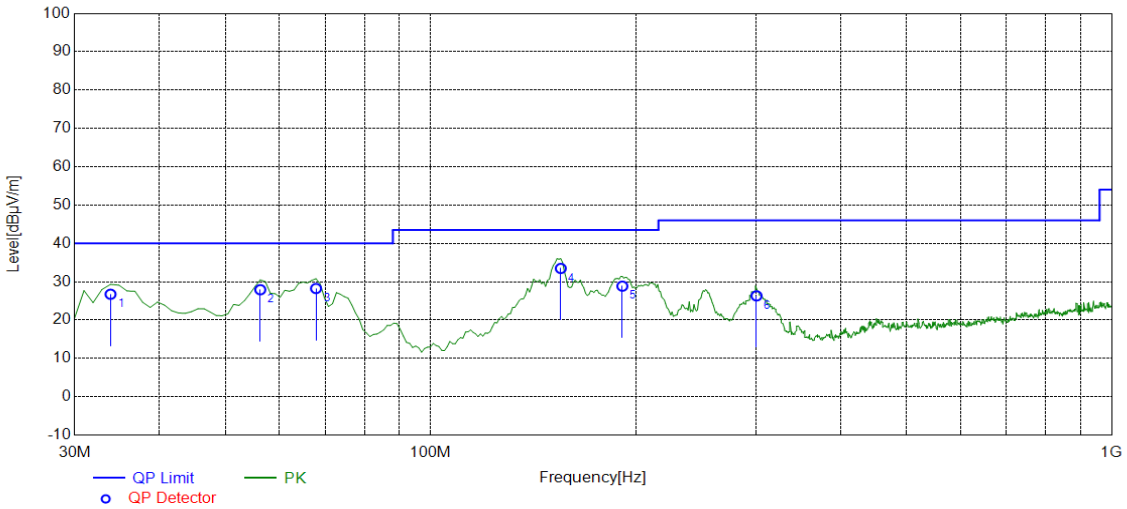
Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The other emission levels were very low against the limit.
5. “*” : Fundamental Frequency.

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
56.2162	-16.14	21.45	40.00	18.55	200	206	Horizontal
74.6647	-19.09	22.66	40.00	17.34	200	225	Horizontal
153.3133	-14.84	32.62	43.50	10.88	200	103	Horizontal
190.2102	-17.24	34.50	43.50	9.00	200	103	Horizontal
255.2653	-16.88	33.26	46.00	12.74	100	328	Horizontal
302.8428	-15.23	40.30	46.00	5.70	100	195	Horizontal

Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
33.8839	-17.73	26.75	40.00	13.25	100	332	Vertical
56.2162	-16.14	27.93	40.00	12.07	100	109	Vertical
67.8679	-18.27	28.24	40.00	11.76	100	228	Vertical
155.2553	-14.92	33.47	43.50	10.03	100	34	Vertical
191.1812	-17.35	28.85	43.50	14.65	100	155	Vertical
300.9009	-15.25	26.32	46.00	19.68	100	332	Vertical

Remarks:
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).

3.3 20dB Occupied bandwidth

Test Method:
The test method was refered to the subclause 6.9.2 of ANSI C63.10-2013.

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.

c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d) Steps a) through c) might require iteration to adjust within the specified tolerances.

e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.

f) Set detection mode to peak and trace mode to max hold.

g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "íxx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "íxx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

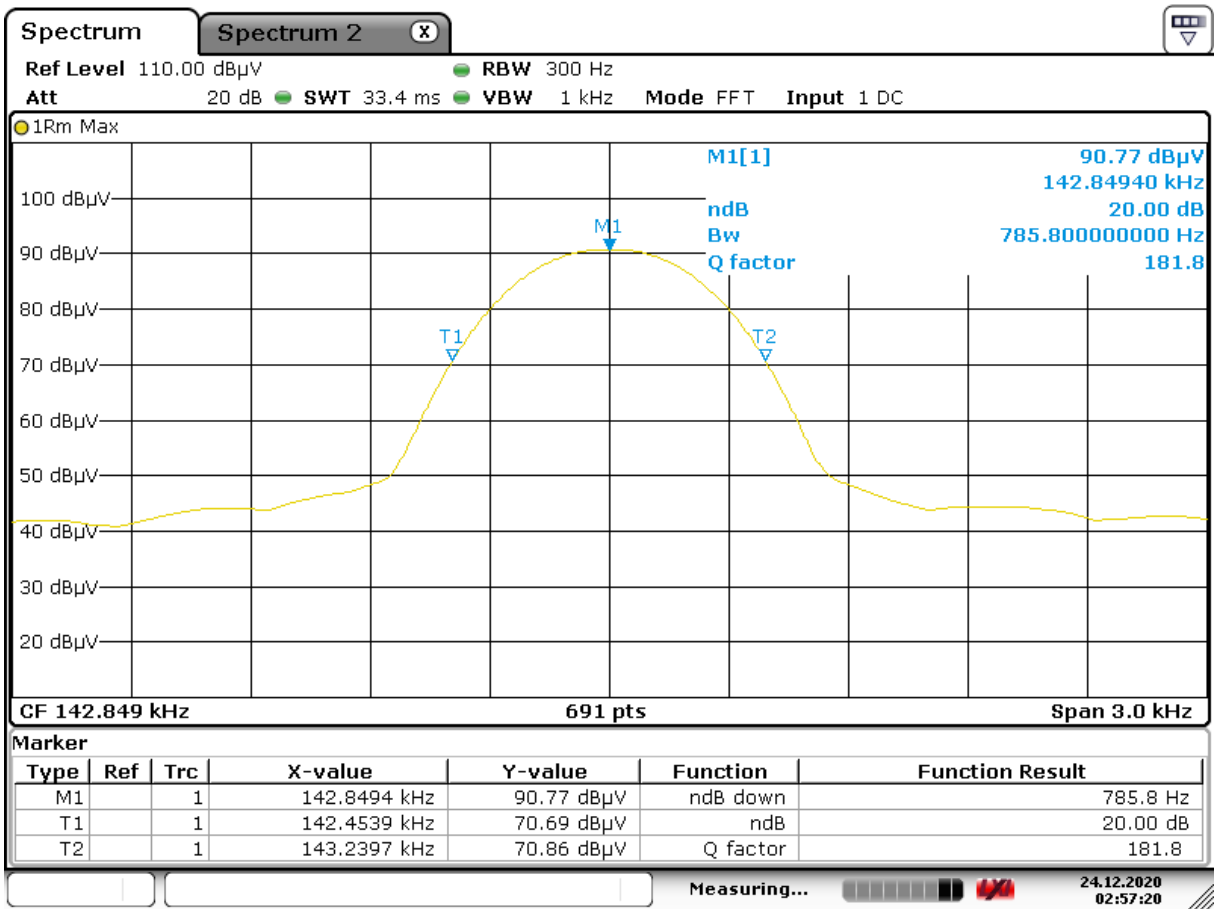
k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Limit:

The field strength of any emissions appearing between the band edges and out of band shall be attenuated at least 20 dB below the level of the unmodulated carrier or to the general limits in Section 15.209.

Test Result:

Frequency (kHz)	20dB Bandwidth (kHz)
142.8	0.785



Date: 24.DEC.2020 02:57:21

-End of report-