TEST REPORT

of

FCC Part 15 Subpart C §15.209
IC RSS-210 Issue 10, RSS-Gen Issue 5

FCC ID: TQ8-BCM-E49
IC Certification: 5074A-BCME49

Equipment Under Test	:	Body Control Module
Model Name	:	BCM-E49
Applicant	:	Hyundai Mobis Co., Ltd.
Manufacturer	:	Hyundai Mobis Co., Ltd.
Date of Receipt	:	2019.12.24
Date of Test(s)	:	2019.12.26 ~ 2020.01.19
Date of Issue	:	2020.01.23

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Murphy Kim** **Date:** **2020.01.23**

Technical Manager: **Jungmin Yang** **Date:** **2020.01.23**

Table of Contents

1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

Phone No. : +82 31 688 0901
Fax No. : +82 31 688 0921

1.2. Details of Applicant

Applicant : Hyundai Mobis Co., Ltd.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 135-977
Contact Person : Choe, Seung-Hoon
Phone No. : +82 31 260 0098

1.3. Details of Manufacturer

Applicant : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product		Body Control Module
Model Name		BCM-E49
Power Supply		DC 12.0 V
Frequency Range		Tx: 125.00 ㎑, Rx: 433.92 ㎒
Antenna Type	**Tx**	Coil antenna
	Rx	PCB pattern antenna

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Spectrum Analyzer	R&S	FSV30	100768	Mar. 08, 2019	Annual	Mar. 08, 2020
Signal Generator	R&S	SMBV100A	259067	Jun. 10, 2019	Annual	Jun. 10, 2020
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 12, 2019	Annual	Mar. 12, 2020
Test Receiver	R&S	ESU26	100109	Jan. 31, 2019	Annual	Jan. 31, 2020
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N. C. R.	N/A	N. C. R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/38330516/L	N. C. R.	N/A	N. C. R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N. C. R.	N/A	N. C. R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jul. 20, 2019	Semi-annual	Jan. 20, 2020
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 20, 2019	Semi-annual	Jan. 20, 2020

1.6. Sample Calculation

Where relevant, the following sample calculation is provided:
Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB)

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

Applied Standard: FCC Part15 subpart C, IC RSS-210 Issue 10, RSS-Gen Issue 5			
Section in FCC	**Section in IC**	**Test Item**	**Result**
15.209	RSS-210 Issue 10, 7.3, RSS-Gen Issue 5, 8.9	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
2.1049	-	20 ㏈ Bandwidth	Complied
-	RSS-Gen Issue 5, 6.7	Occupied Bandwidth	Complied

1.8. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Occupied Bandwidth	± 9.66 ㎑
Radiated Emission, 9 ㎑ to 30 ㎒	± 3.59 ㏈
Radiated Emission, below 1 ㎓	± 5.88 ㏈

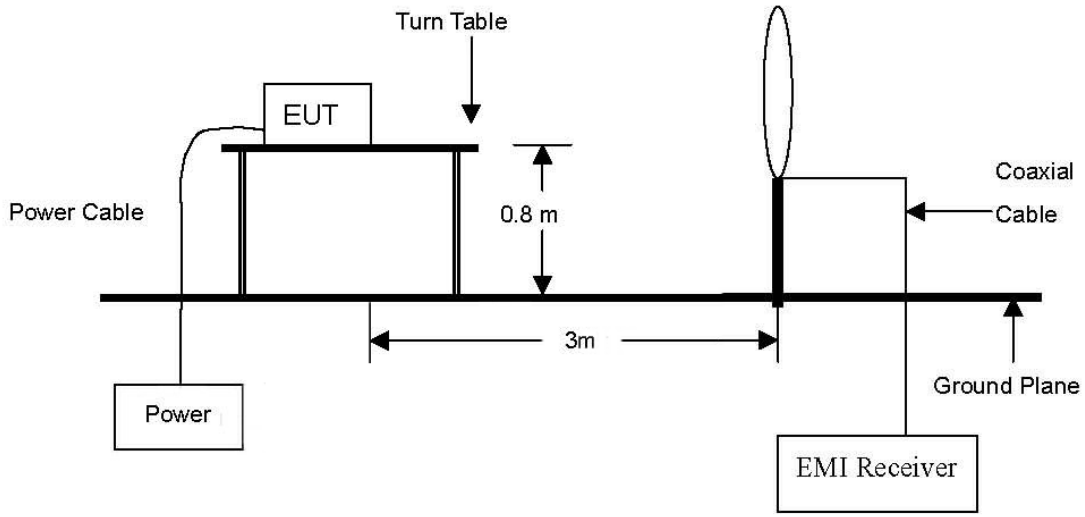
1.9. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000209	2020.01.17	Initial

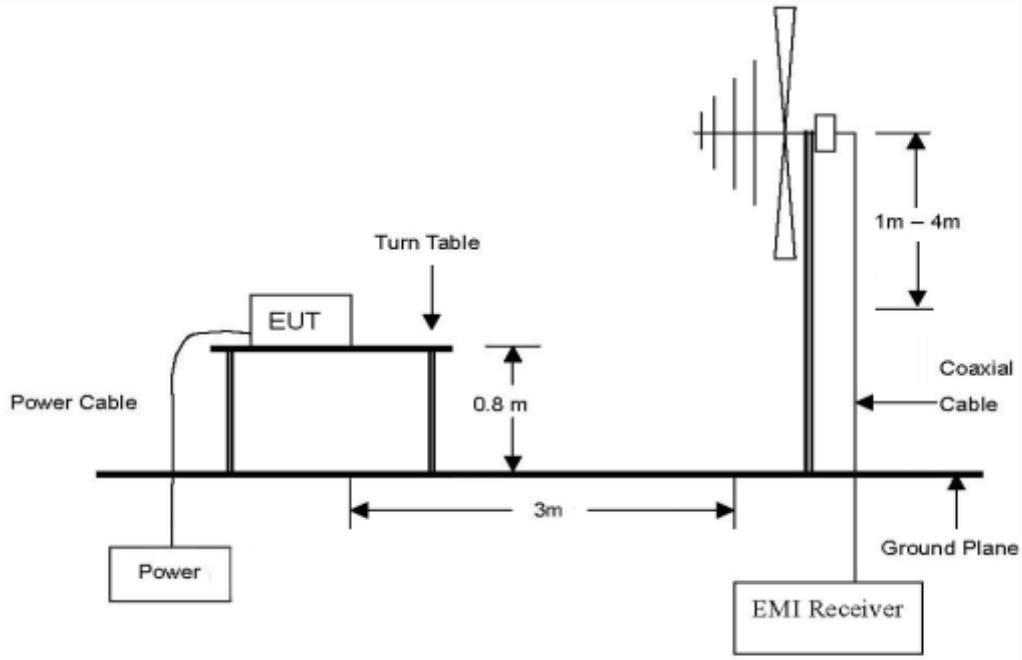
2. Field Strength of Fundamental and Spurious Emission

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission below 30 ㎒.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓.



2.2. Limits

2.2.1. FCC

According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2 400/F(㎑)	300
0.490-1.705	24 000/F(㎑)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

According to §15.209(d), The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 ㎑, 110-490 ㎑ and above 1 000 ㎒. Radiated emission limits in these three bands are based on measurements employing an average detector.

2.2.2. IC

2.2.2.1. Transmitter Emission Limits

According to RSS-Gen Issue 5, 8.9.
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General field strength limits at frequencies above 30 ㎒

Frequency (㎒)	Field Strength (㎶/m at 3 m)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 6 - General field strength limits at frequencies below 30 ㎒

Frequency	Magnetic Field Strength (H-Field) (㎂/m)	Measurement Distance (m)
9-490 ㎑ [1]	6.37/F (F in ㎑)	300
490-1 705 ㎑	63.7/F (F in ㎑)	30
1.705-30 ㎒	0.08	30

Note 1: The emission limits for the ranges 9-90 ㎑ and 110-490 ㎑ are based on measurements employing a linear average detector.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10-2013.

2.3.1. Test Procedures for Emission from 9 ㎑ to 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.
5. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes (X, Y, Z). Worst orthogonal plan of EUT is **X – axis** during radiation test.

2.4. Field Strength of Fundamental Test Result

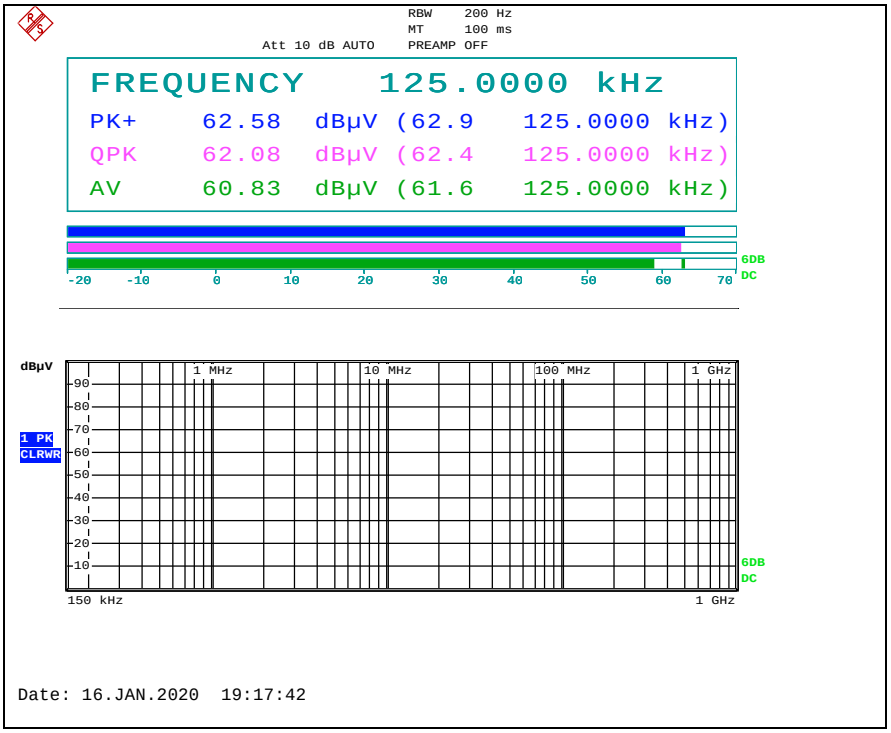
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 300 m	Limit (dB㎶/m) at 300 m	Margin (dB)
0.125	61.60	Average	H	17.80	0.07	**79.47**	-0.53	25.67	26.20

Remark;

1. According to §15.31(f)(2) 300 m Result (dB㎶/m) = 3 m Result (dB㎶/m) - 40log (300/3) (dB㎶/m).
2. According to §15.209(d), the measurements were tested by using Quasi peak detector except for the frequency bands 9-90 ㎑, 110-490 ㎑ and above 1 000 ㎒ in these three bands on measurements employing an average detector.
3. The limit above was calculated based on table of §15.209(a).
4. According to ANSI C63.10: 2013, For measurement below 30 ㎒.
   conversion factor from E-field to H-field is considered as free-space impedance [1 ㎶/m = (1/377 Ω) × 1 ㎂/m]
   The FCC limits are same to the IC limits.
5. Actual (dB㎶/m) at 3 m = Reading (dB㎶) + AF (dB/m) + CL (dB).

- Test plot



2.5. Spurious Emission Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest level of radiated emissions on between polarizations of horizontal and vertical.

Below 30 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m or 300 m	Limit (dB㎶/m) at 30 m or 300 m	Margin (dB)
0.021	23.70	Average	H	18.17	0.01	41.88	-38.12	41.16	79.28
0.047	15.90	Average	H	17.88	0.02	33.80	-46.20	34.16	80.36
0.068	17.90	Average	H	17.85	0.03	35.78	-44.22	30.95	75.17
0.089	18.60	Average	H	17.82	0.04	36.46	-43.54	28.62	72.16
0.376	25.70	Average	H	17.76	0.24	43.70	-36.30	16.10	52.40
0.625	18.40	Quasi-Peak	H	17.80	0.38	**36.58**	-3.42	31.69	35.11
0.878	12.30	Quasi-Peak	H	18.00	0.51	30.81	-9.19	28.73	37.92
1.122	8.70	Quasi-Peak	H	18.11	0.58	27.39	-12.61	26.60	39.21

Above 30 ㎒

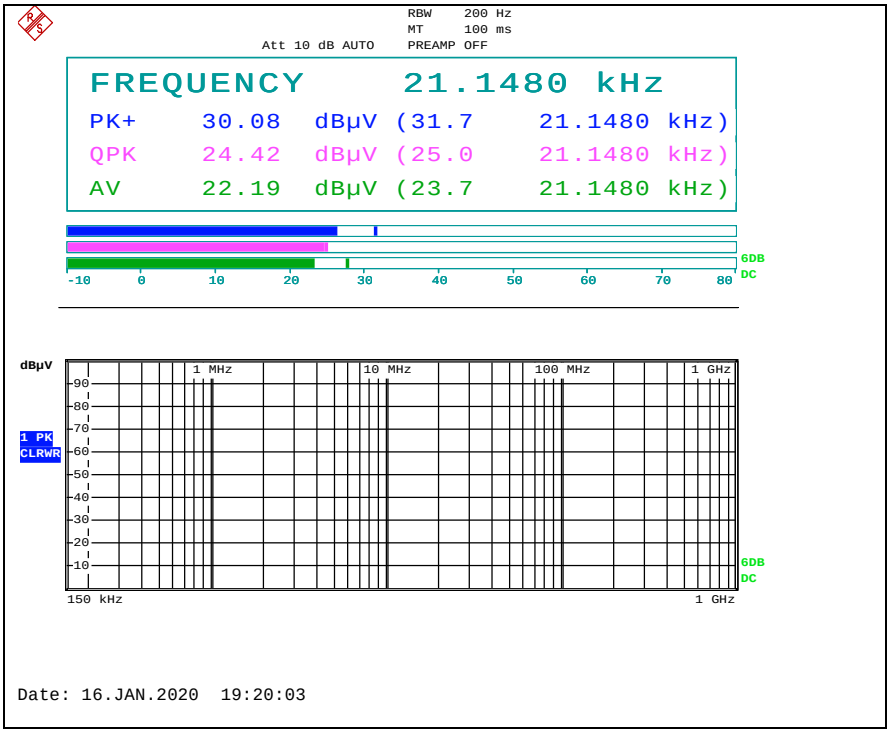
Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
43.82	29.50	Peak	H	20.48	-26.80	23.18	40.00	16.82
95.72	32.70	Peak	V	16.47	-25.56	23.61	43.50	19.89
151.01	37.60	Peak	V	13.90	-25.60	25.90	43.50	17.60
408.30	33.70	Peak	H	21.77	-25.20	30.27	46.00	15.73
460.44	37.10	Peak	V	22.02	-25.06	34.06	46.00	11.94
Above 500.00	Not detected	-	-	-	-	-	-	-

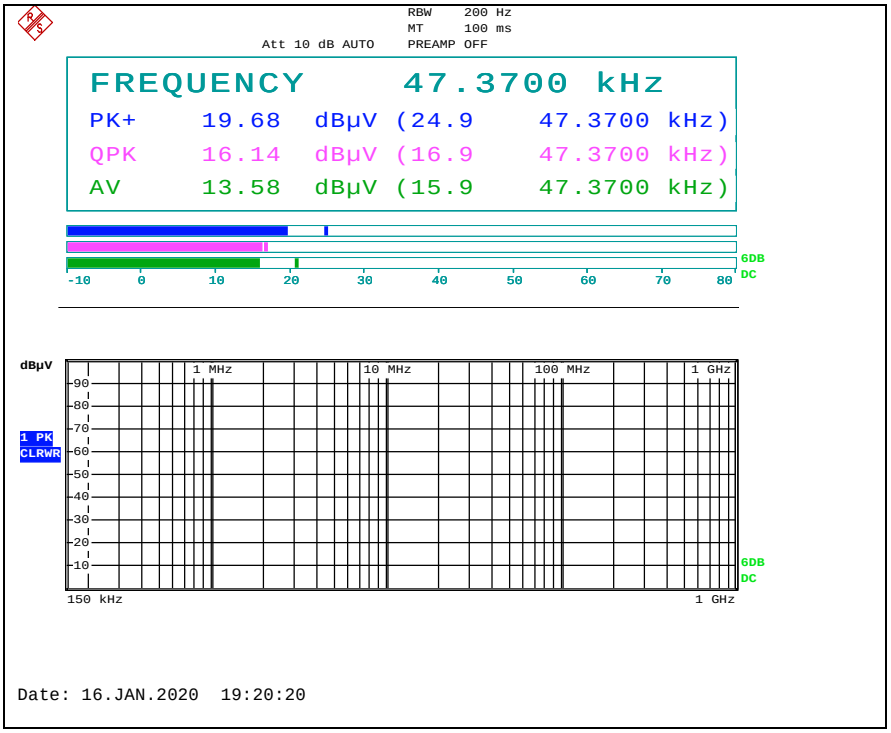
Remark;

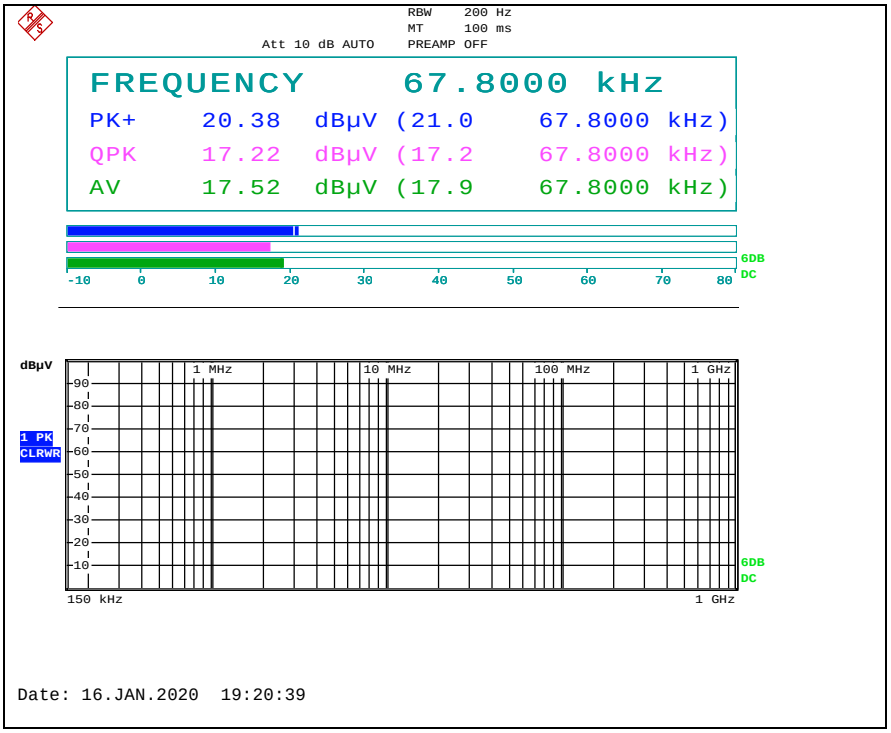
1. According to §15.31(f)(2)
   - 300 m Result (dB㎶/m) = 3 m Result (dB㎶/m) - 40log (300/3) (dB㎶/m)
   - 30 m Result (dB㎶/m) = 3 m Result (dB㎶/m) - 40log (30/3) (dB㎶/m)
2. According to field strength table of general requirement in §15.209(a), field strength limits below 1.705 ㎒ were calculated as below.
   - 9 ㎑ to 490 ㎑: 20log (2 400 / F (㎑)) at 300 m (dB㎶/m)
   - 490 ㎑ to 1 705 ㎑: 20log (24 000 / F (㎑)) at 30 m (dB㎶/m)
3. According to §15.209(d), the measurements were tested by using Quasi peak detector except for the frequency bands 9-90 ㎑, 110-490 ㎑ and above 1 000 ㎒ in these three bands on measurements employing an average detector.
4. According to ANSI C63.10: 2013, For measurement below 30 ㎒.
   conversion factor from E-field to H-field is considered as free-space impedance [1 ㎶/m = (1/377 Ω) × 1 ㎂/m]
   The FCC limits are same to the IC limits.
5. The limit above was calculated based on table of §15.209 (a).
6. Actual (dB㎶/m) at 3 m = Reading (dB㎶) + AF (dB/m) + CL (dB) or
   Reading (dB㎶) + AF (dB/m) + AMP (dB) + CL (dB).

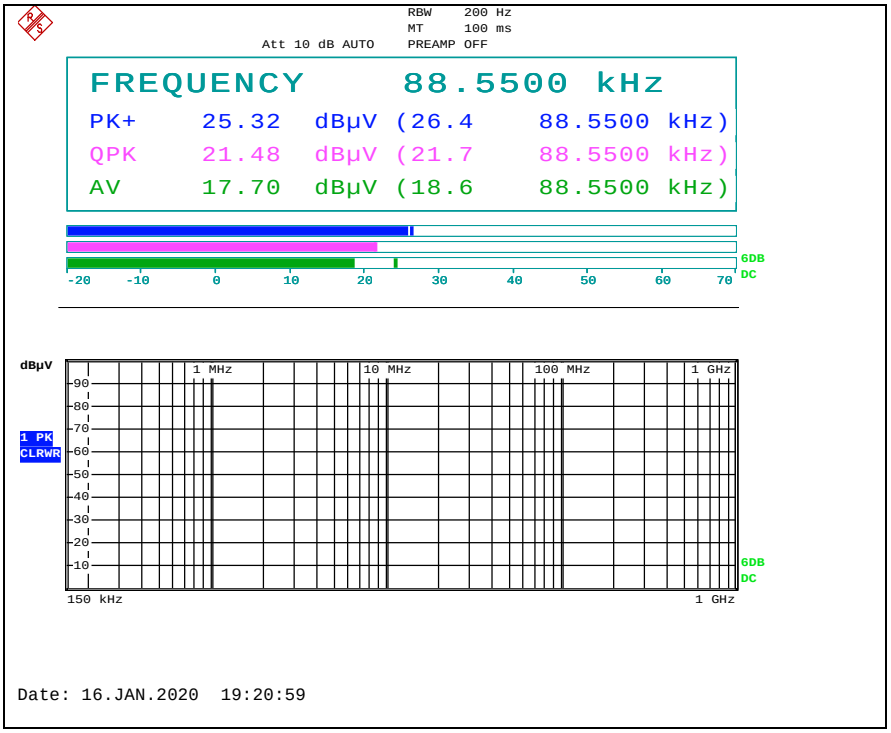
- Test plots

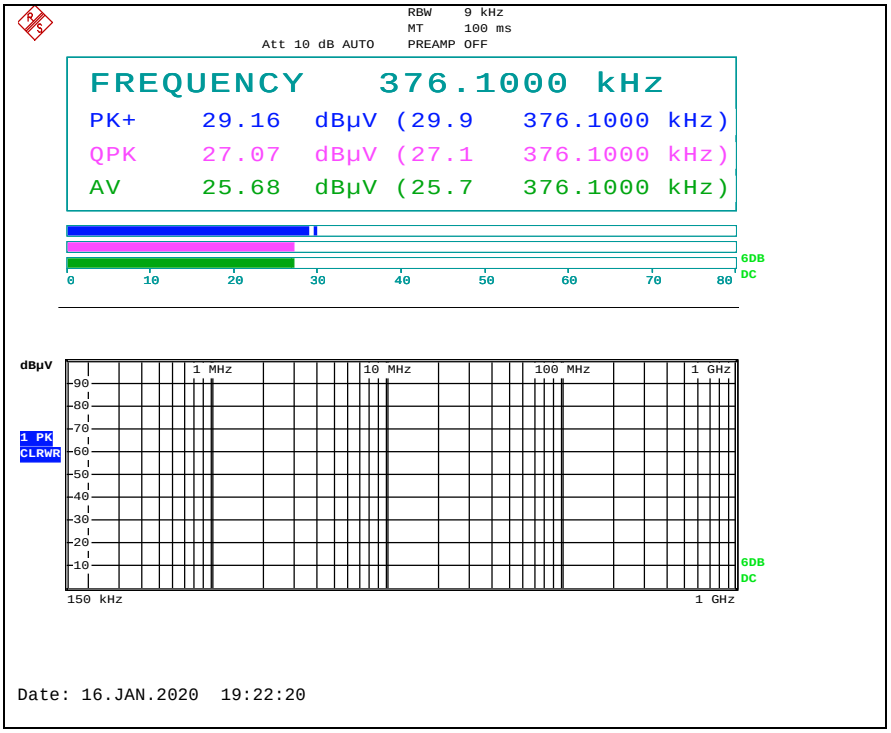
Below 30 ㎒

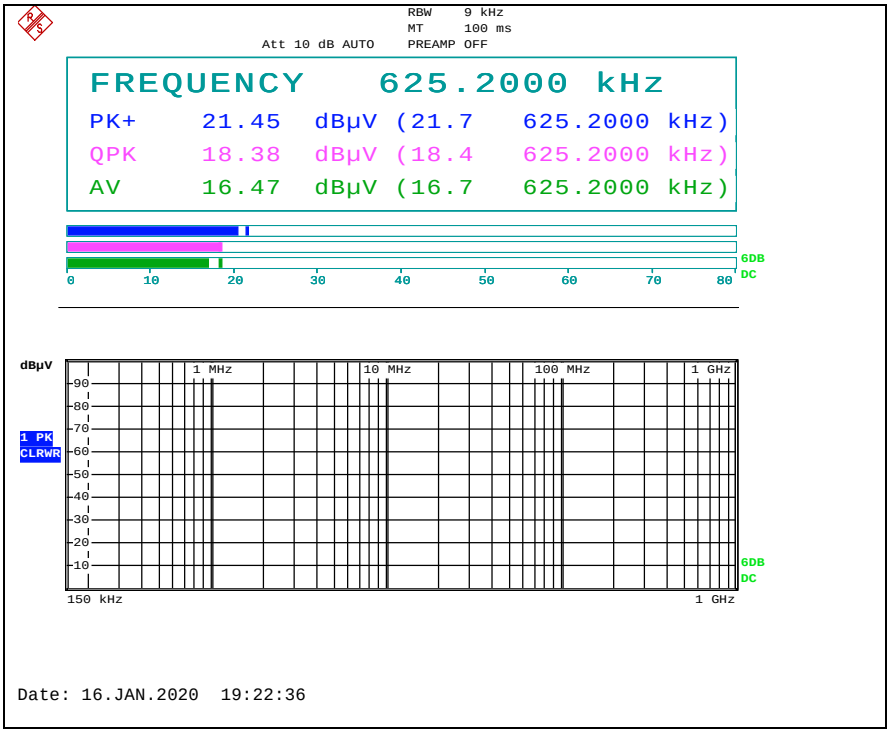


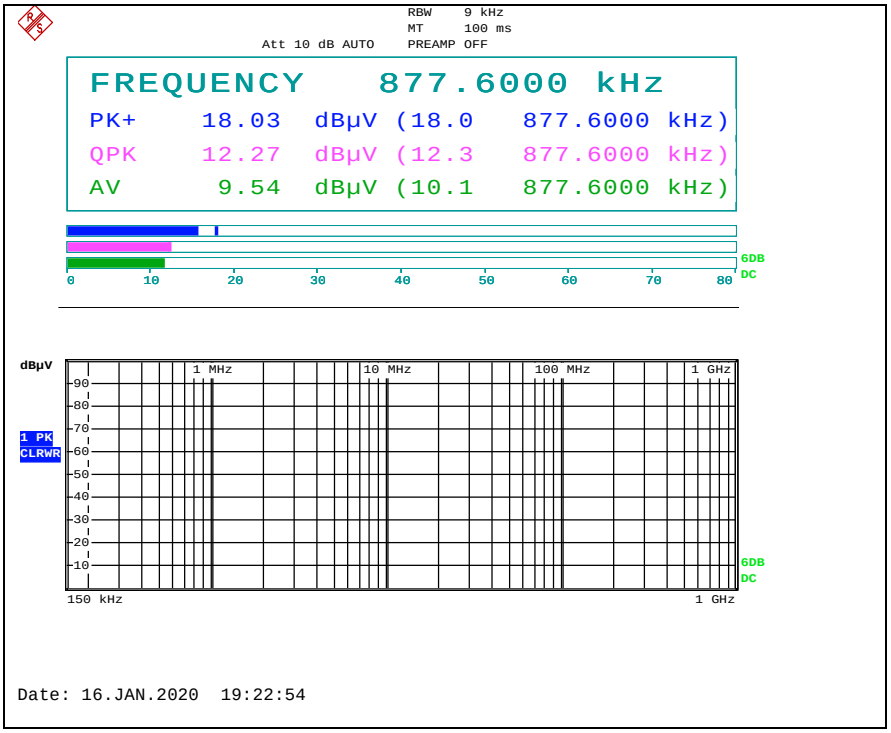


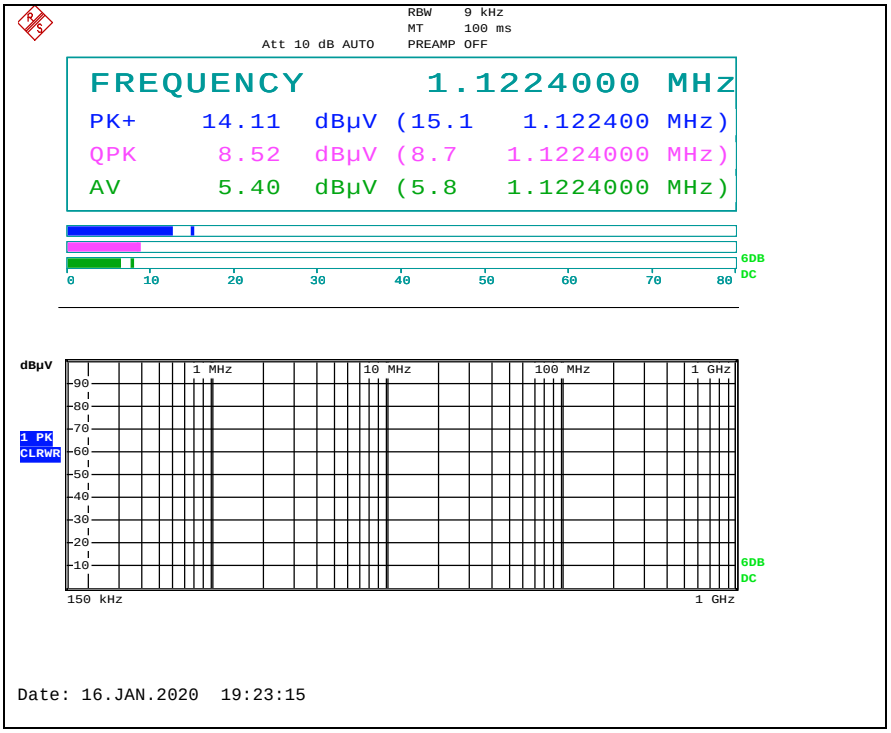




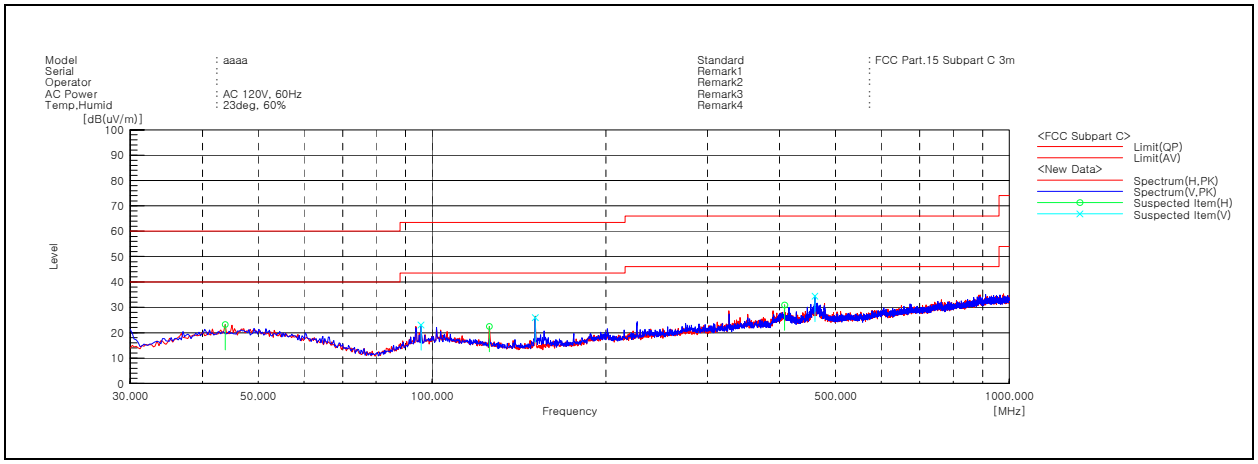








Above 30 ㎒

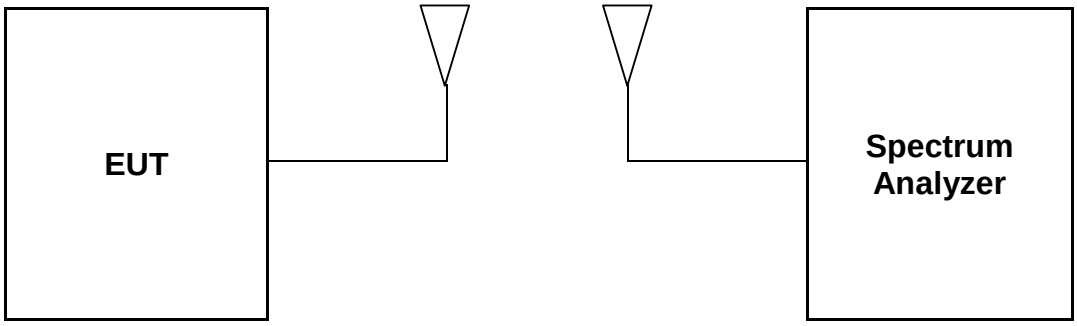


Remark;

- Traces shown in the plot were made by using a peak detector.

3. 20 dB Bandwidth

3.1. Test Setup



3.2. Limits

None; for reporting purposed only

3.3. Test Procedure

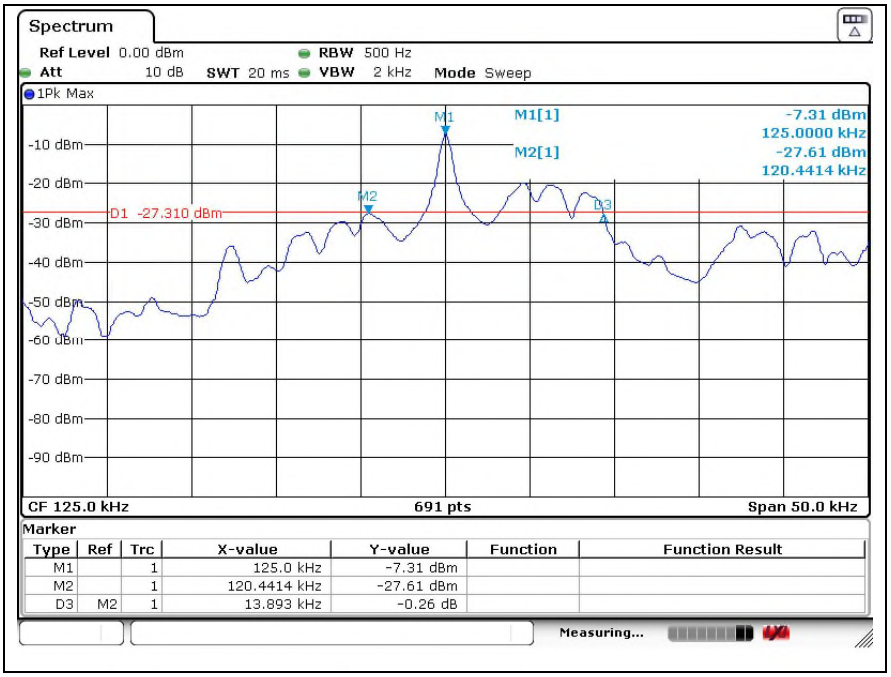
1. Span = the spectrum analyzer shall be between two times and five times the OBW, RBW = 1% to 5% of the OBW, VBW = set approximately 3 x RBW, Sweep = auto, Detector = peak, Trace = max hold.
2. The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level.
   The marker-delta reading at this point is 20 dB bandwidth of the emission

3.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

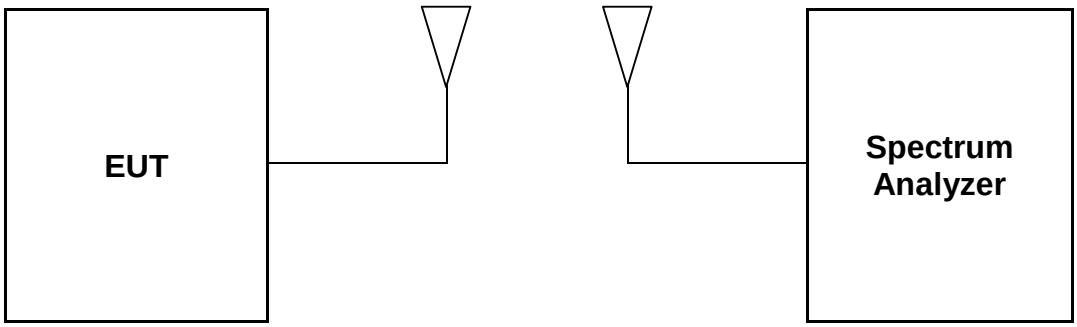
Frequency (㎑)	20 dB Bandwidth (㎑)	Limit
125	13.893	Reporting proposed only

- Test plot



4. Occupied Bandwidth

4.1. Test Setup



4.2. Limit

None; for reporting purposed only

4.3. Test Procedure

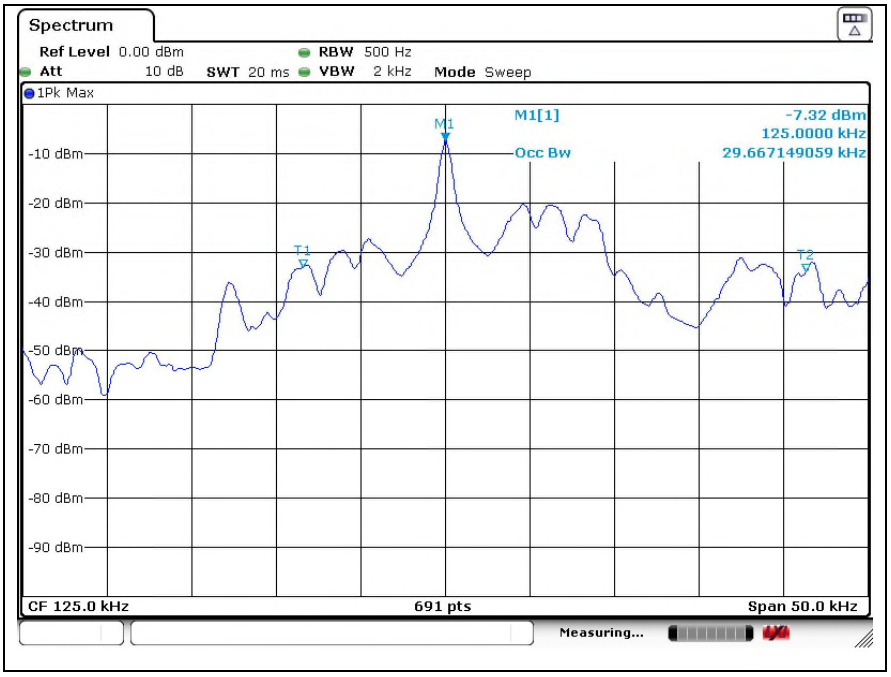
1. Set the spectrum analyzer as SPAN = shall be between 1.5 times and 5.0 times the OBW, RBW = 1% to 5% of the OBW, VBW = set approximately 3 x RBW, Detector = peak, Trace mode = max hold.
2. Measure lowest and highest frequencies are placed in a running sum until 0.5 % and 99.5 % of the total is reached.
3. Record the SPAN between the lowest and the highest frequencies for the 99 % occupied bandwidth.

4.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Frequency (㎑)	Occupied Bandwidth (㎑)	Limit
125	29.667	Reporting proposed only

- Test plot



- End of the Test Report -