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TEST REPORT

of

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

FCC ID: CQOEG040
IC Certification: 1551E-EG040

Equipment Under Test	:	IBU
Model Name	:	EG040
Variant Model Name(s)	:	-
Applicant	:	DENSO Korea Corporation
Manufacturer	:	DENSO Korea Corporation
Date of Receipt	:	2021.03.18
Date of Test(s)	:	2021.03.22 ~ 2021.04.17
Date of Issue	:	2021.04.19

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
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Tested by: **Nancy Park**

Technical Manager: **Jinhyoung Cho**

SGS Korea Co., Ltd. Gunpo Laboratory

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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

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1.2. Details of Applicant

Applicant : DENSO Korea Corporation
Address : 3, Cheomdansaneop-ro, Masanhappo-gu, Chang-won-si, Gyeongsangnam-do, Korea, 51176
Contact Person : Ha, Chang-su
Phone No. : +82 55 220 9321

1.3. Details of Manufacturer

Applicant : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product		IBU
Model Name		EG040
Serial Number		95400-L8040
Power Supply		DC 12.0 V
Frequency Range		Tx: 134.00 ㎑, Rx: 433.92 ㎒
Antenna Type	**Tx**	Coil Antenna
	Rx	PCB pattern antenna
Antenna Serial Number		95425-M6000
H/W Version		1.0
S/W Version		1.0

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Spectrum Analyzer	R&S	FSV30	103101	Jun. 01, 2020	Annual	Jun. 01, 2021
Signal Generator	R&S	SMBV100A	255834	Jun. 03, 2020	Annual	Jun. 03, 2021
DC Power Supply	Agilent	U8002A	MY53150029	Jun. 04, 2020	Annual	Jun. 04, 2021
Test Receiver	R&S	ESU26	100109	Feb. 19, 2021	Annual	Feb. 19, 2022
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Dec. 22, 2020	Biennial	Dec. 22, 2022
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	CO3000/963/3 8330516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/3 8330516/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	RFONE	MWX221-NMSNNMS (4 m)	J1023142	Dec. 01, 2020	Semi-annual	Jun. 01, 2021
Coaxial Cable	RFONE	SFX086-NMNM-10M (10 m)	20200324001	Dec. 01, 2020	Semi-annual	Jun. 01, 2021

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(s)**	**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 dB Bandwidth	Complied
-	RSS-Gen Issue 5 6.7	Occupied Bandwidth	Complied
15.207	RSS-Gen Issue 5 8.8	AC Power Line Conducted Emission	N/A[1)]

Note;

1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

1.8. Measurement Uncertainty

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

Parameter		Uncertainty
Radiated Emission, 9 kHz to 30 MHz	H	± 3.66 dB
	V	± 3.66 dB
Radiated Emission, below 1 GHz	H	± 4.90 dB
	V	± 4.82 dB

Uncertainty figures are valid to a confidence level of 95 %.

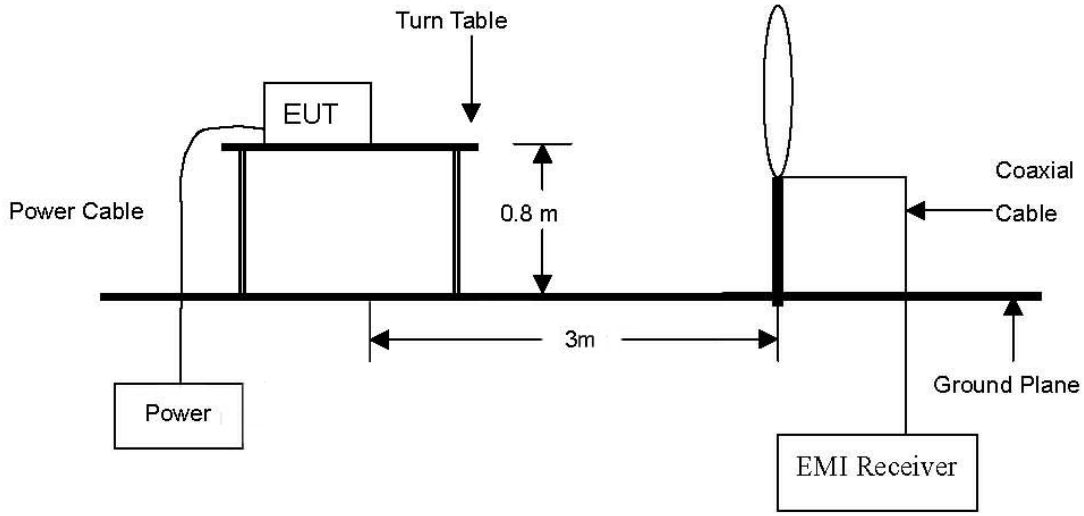
1.9. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL001944	2021.04.19	Initial

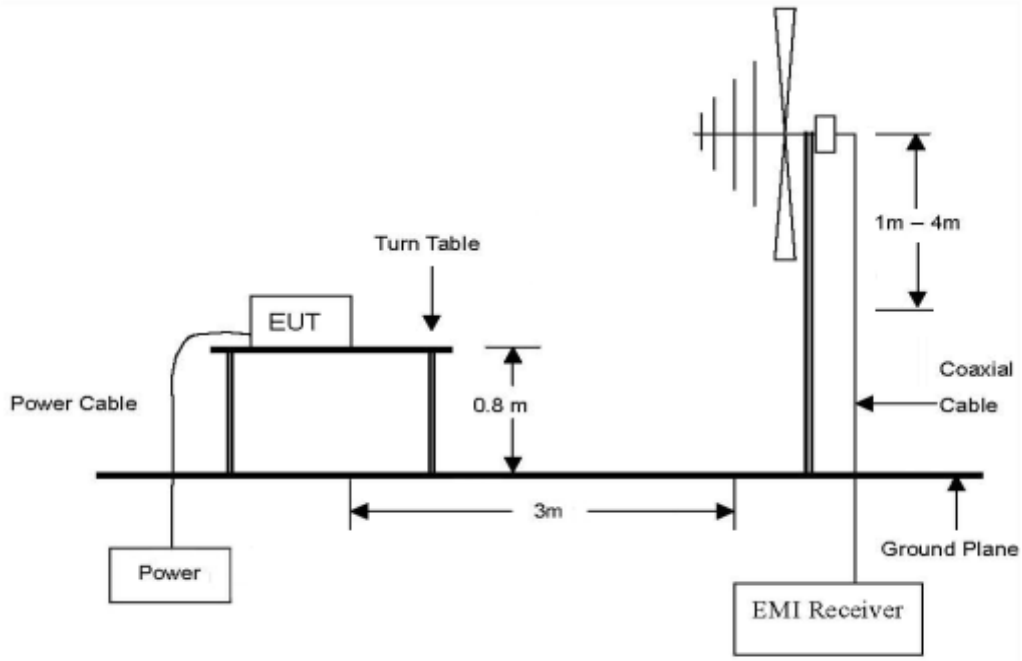
2. Field Strength of Fundamental and Spurious Emission

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

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.

According to RSS-210 Issue 10, 7.3.
Transmitters whose wanted and unwanted emissions fall within the general field strength limits specified in RSS-Gen may operate licence-exempt in any of the frequency bands, other than the restricted frequency bands, other than the restricted frequency bands listed in RSS-Gen and the TV bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ and 470-602 ㎒, and shall be certified under RSS-210. Under no circumstances shall the level of any unwanted emissions exceed the level of the fundamental emissions.

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.

2.3.2. Test Procedures for emission from 30 ㎒ to 1 000 ㎒

a. 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.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.

2.4. Field Strength of Fundamental Test Result

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

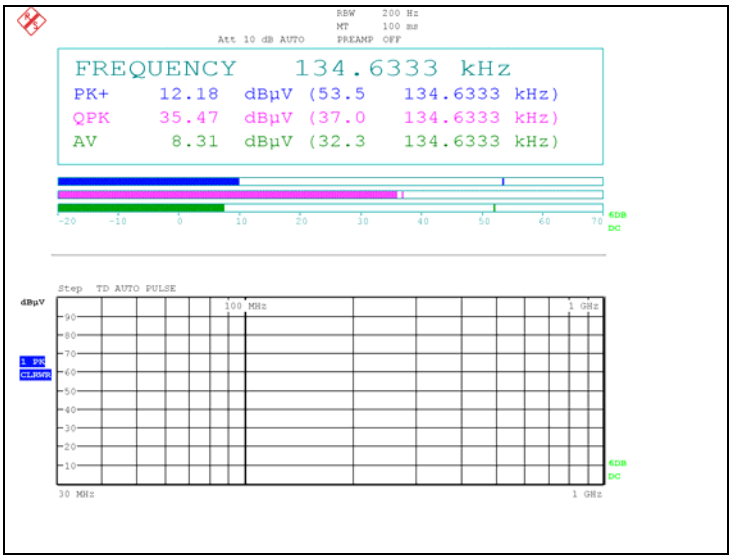
The following table shows the highest level of radiated emissions on between polarizations of horizontal and vertical.

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)
0.135	32.30	Average	H	17.80	0.15	**50.25**	-29.75	25.00	54.75

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.	AF (dB/m)	CL (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 300 m or 30 m	Limit (dB㎶/m) at 300 m or 30 m	Margin (dB)
0.019	31.40	Average	H	18.23	0.10	49.73	-30.27	42.03	72.30
0.035	30.40	Average	H	17.89	0.11	48.40	-31.60	36.72	68.32
0.198	14.30	Average	H	17.80	0.16	32.26	-47.74	21.67	69.41

Above 30 ㎒

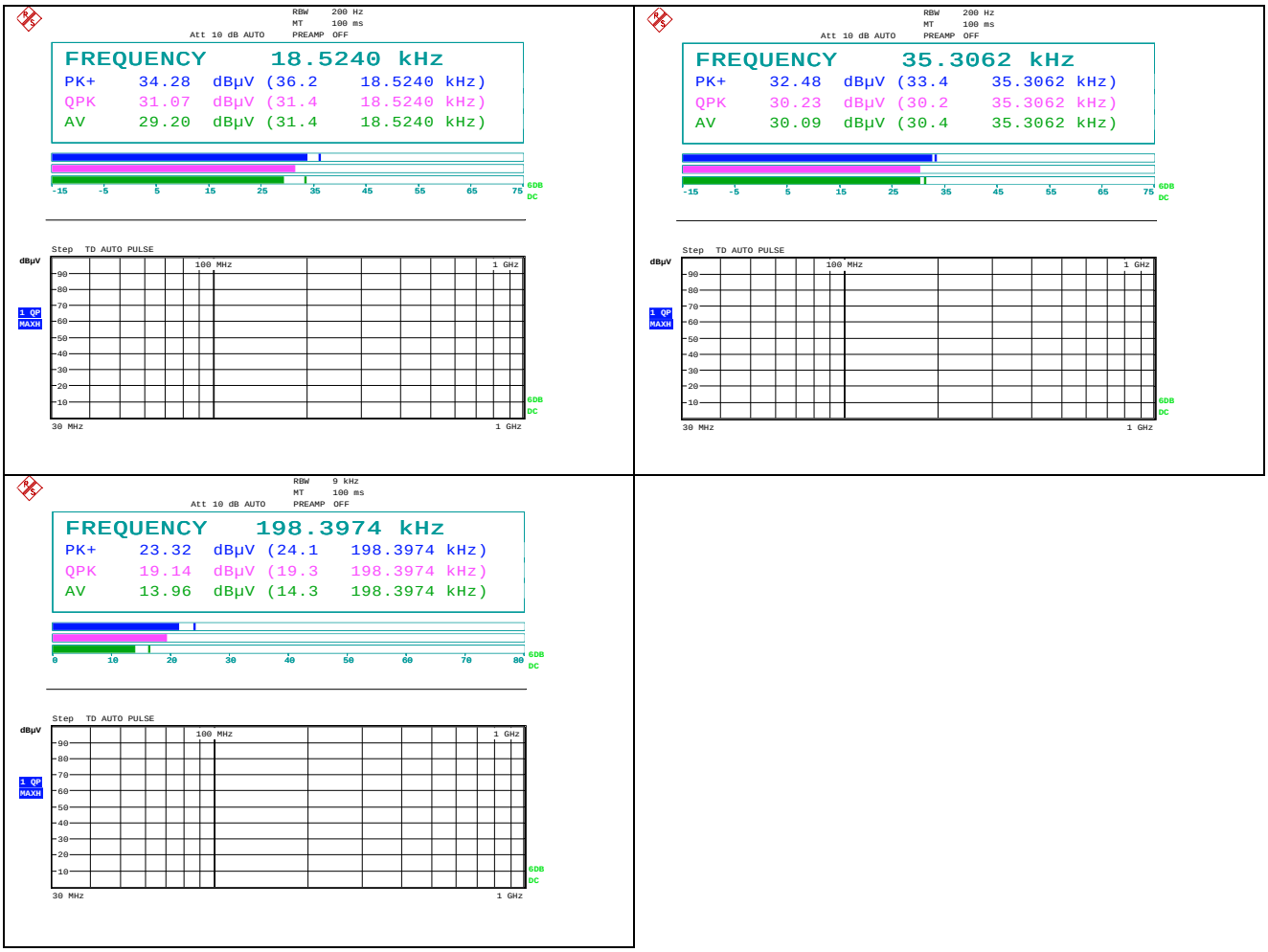
Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
176.23	37.80	Peak	H	14.90	-25.91	26.79	43.50	16.71
208.16	33.10	Peak	H	16.33	-25.62	23.81	43.50	19.69
307.18	37.10	Peak	H	19.04	-25.05	31.09	46.00	14.91
341.90	35.10	Peak	H	20.51	-25.16	30.45	46.00	15.55
418.00	35.70	Peak	H	21.86	-25.56	**32.00**	46.00	14.00
Above 500.00	Not detected	-	-	-	-	-	-	-

Remark;

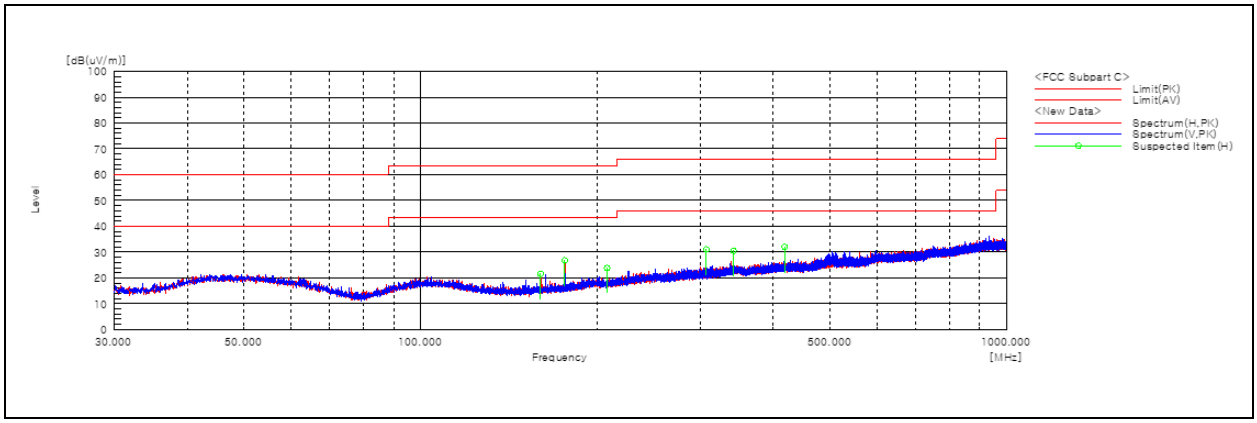
1. According to §15.31(f)(2)
   - 300 m Result (dBμV/m) = 3 m Result (dBμV/m) - 40log (300/3) (dBμV/m)
   - 30 m Result (dBμV/m) = 3 m Result (dBμV/m) - 40log (30/3) (dBμV/m)
2. According to field strength table of general requirement in §15.209(a), field strength limits below 1.705 ㎒ were calculated as below.
   - 9 ㎑ to 490 ㎑: 20log (2 400 / F (㎑)) at 300 m (dBμV/m)
   - 490 ㎑ to 1 705 ㎑: 20log (24 000 / F (㎑)) at 30 m (dBμV/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 μV/m = (1/377 Ω) × 1 μA/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 (dBμV/m) at 3 m = Reading (dBμV) + AF (dB/m) + CL (dB) or
   Reading (dBμV) + AF (dB/m) + AMP (dB) + CL (dB).

- Test plots

Below 30 ㎒



Above 30 ㎒

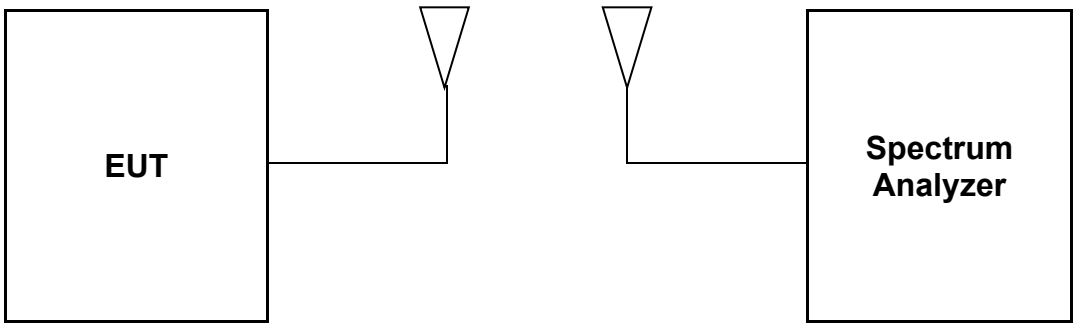


Remark;

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

3. 20 dB Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purposed only

3.3. Test Procedure

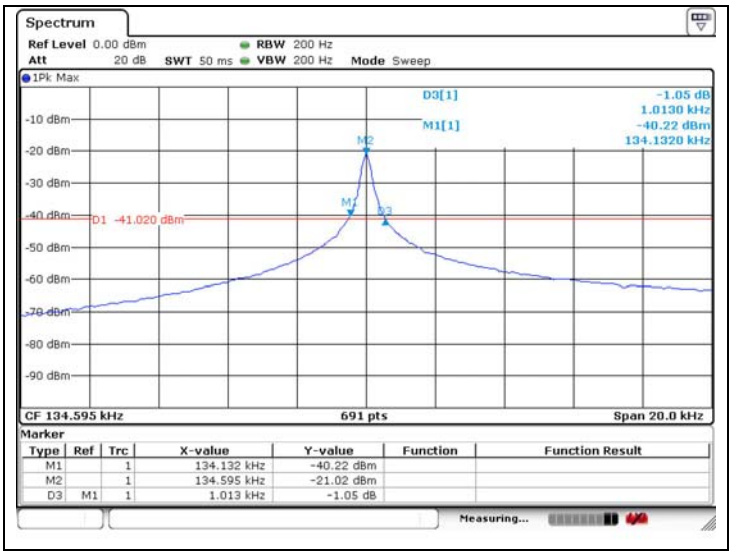
a. Span = set to capture all products of the modulation process, including the emission skirts. RBW = 200 Hz, VBW = 200 Hz, Sweep = auto, Detector = peak, Trace = max hold.
b. The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down 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.

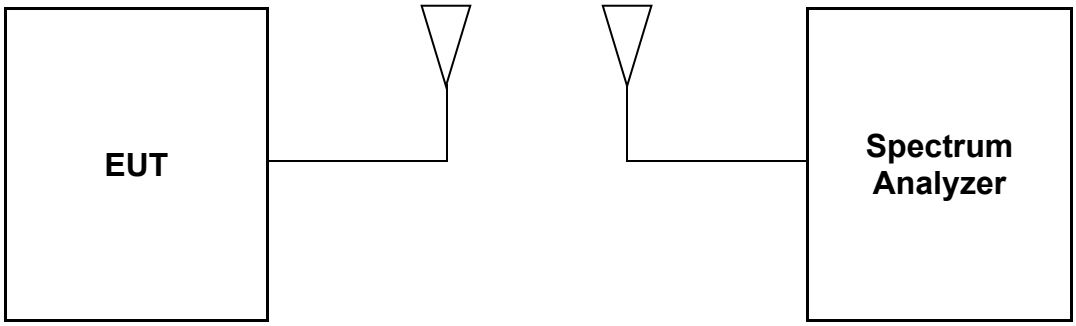
Frequency (㎑)	20 ㏈ Bandwidth (㎑)	Limit
134	1.013	Reporting proposed only

- Test plot



4. Occupied Bandwidth

4.1. Test Setup



4.2. Limit

None; for reporting purposed only

4.3. Test Procedure

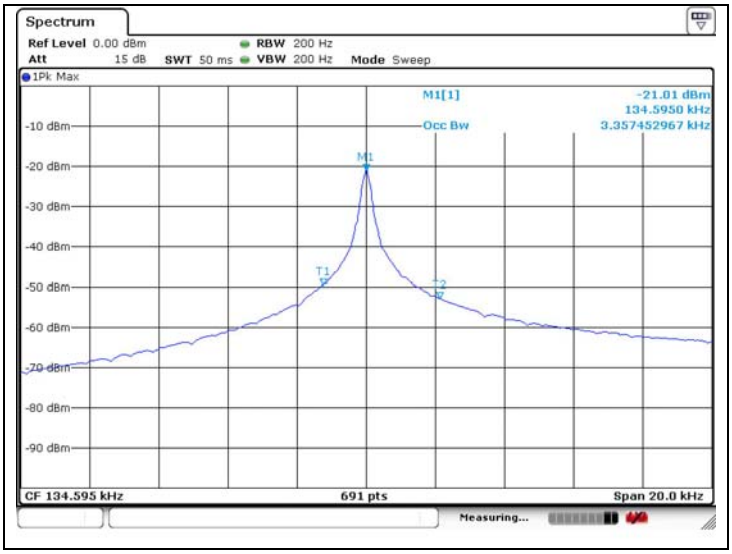
1. Set the spectrum analyzer as Span = set to capture all products of the modulation process, including the emission skirts, RBW = 200 Hz, VBW = 200 Hz, Detector = peak, Trace mode = max hold.
2. Measure lowest and highest frequencies are placed in a running sum until 0.5 % and 99.5 % of the total is 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
134	3.357	Reporting proposed only

- Test plots



- End of the Test Report -