TEST REPORT

Part 15 Subpart C 15.225

Equipment under test Smart Ashley+F

Model name YDL100FP

FCC ID 2AMALYDL100FP

Applicant Yasuda Co., Ltd.

Manufacturer UNION COMMUNITY Co., Ltd.

Date of test(s) 2019.01.22 ~ 2019.01.30

Date of issue 2019.05.17

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Revision history

Revision	Date of issue	Test report No.	Description
-	2019.05.03	KES-RF-19T0042	Initial
R1	2019.05.17	KES-RF-19T0042-R1	Update of report

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1. General information

Applicant:	Yasuda Co., Ltd.
Applicant address:	Nagahori YASUDA Bldg 7F, 1-11-9, Minamisenba, Chuo-ku, Osaka, 542-0081, Japan
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Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	15.225
FCC ID:	2AMALYDL100FP
Test device serial No.:	☐ Production ☒ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Smart Ashley+F
Frequency range	13.561 ㎒ (NFC)
Model:	YDL100FP
Modulation technique	ASK
Number of channels	13.561 ㎒ (NFC) : 1ch
Antenna specification	Antenna type(NFC) : Pattern antenna
Power source	DC 6.0 V

Note:
Certificated module is mounted in the EUT as following
- Applicant: PROCHILD INC.
- Contains FCC ID : 2AEEY-PBLN51822M
- Model: PBLN51822m

1.2. Test configuration

The **Yasuda Co., Ltd. YDL100FP FCC ID: 2AMALYDL100FP** was tested according to the specification of EUT, the EUT must comply with following standards

FCC Part 15
FCC Part 2
ANSI C63.10-2013

1.3. Accessory information

N/A

1.4. Software and Firmware description

The software and firmware installed in the EUT is V10.

1.5. Measurement results explanation example

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 0.84 + 10 = 10.84 (dB)

1.6 Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.62 dB
Uncertainty for Radiation emission test (include Fundamental emission)	9kHz - 30MHz	4.54 dB
	30MHz - 1GHz	4.36 dB
	Above 1GHz – 25GHz	5.00 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Test frequency/Channel operation

Ch.	Frequency (MHz)
01	13.561

2. Summary of tests

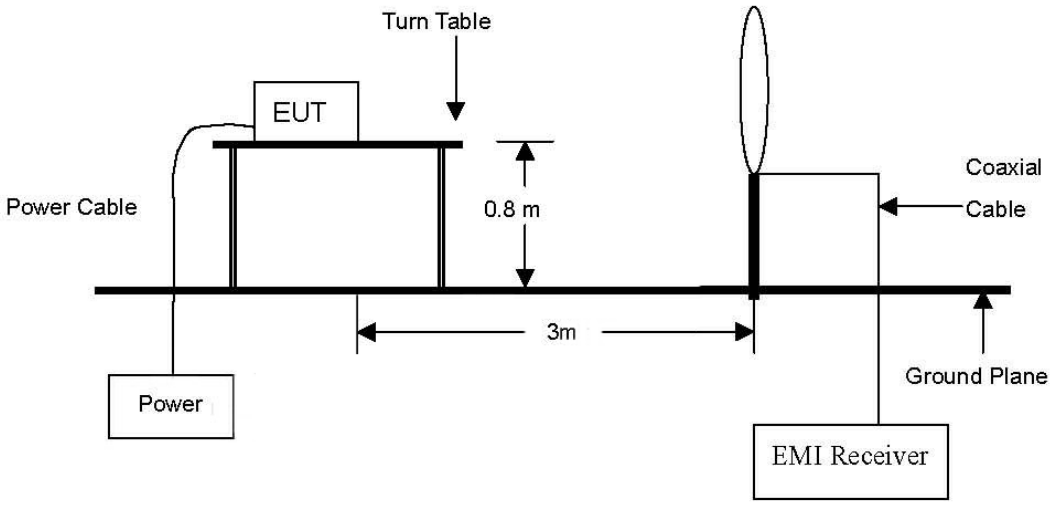
Section in FCC Part 15 & 2	Parameter	Test results
15.225(a)	The field strength of fundamental	Pass
15.225(b)(c)	The field strength of spurious emission(In-band)	Pass
15.225(d) 15.209	The field strength of spurious emission(Out-band)	Pass
2.1049	20 dB bandwidth	Pass
15.225(e)	Frequency stability	Pass

3. Test results

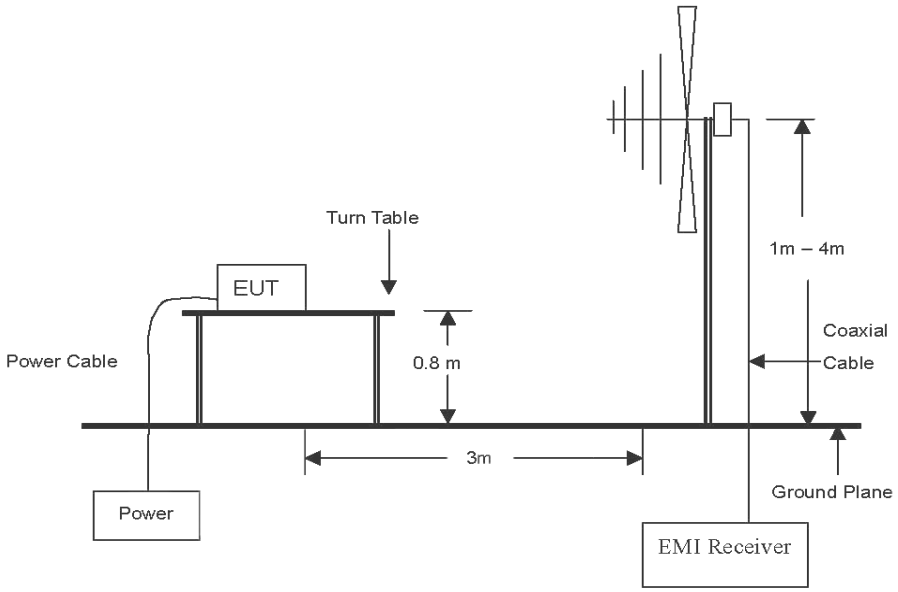
3.1. Radiated spurious emissions

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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



Test procedure

[9 ㎑ to 30 ㎒]

The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. 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. 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. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 ㎐ for Quasi-peak detection (QP) at frequency below 9 ㎑~ 150 ㎑.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 ㎑ for Quasi-peak detection (QP) at frequency below 150 ㎑~ 30 ㎒.

[30 ㎒ to 1 ㎓]

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 ㎓.

Note.

According to exploratory test no any obvious emission except for fundamental 13.56㎒ were detected from 9 ㎑ to 30 ㎒. Although these test were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400/F(㎑)
0.490 ~ 1.705	30	24000/F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**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., Sections 15.231 and 15.241.

In the section 15.225:

(a) The field strength of any emissions within the band 13.553 ~ 13.567 ㎒ shall not exceed 15,848 microvolts/meter (= 84 dB㎶/m) at 30 meters.

(b) Within the bands 13.410 ~ 13.553 ㎒ and 13.567 ~ 13.710 ㎒, the field strength of any emissions shall not exceed 334 microvolts/meter (=50.5 dB㎶/m) at 30 meters.

(c) Within the bands 13.110 ~ 13.410 ㎒ and 13.710 ~ 14.010 ㎒ the field strength of any emissions shall not exceed 106 microvolts/meter (=40.5 dB㎶/m) at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110 ~ 14.010 ㎒ band shall not exceed the general radiated emission limits in § 15.209.

Test results for fundamental

Operating frequency: 13.560 ㎒
Distance of measurement: 3 meter

Radiated emissions		Ant.	Total factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Correction factor (dB/m)	Distance factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
13.560	33.09	H	20.30	40.00	13.39	84.00	70.61
13.560	30.15	V	20.30	40.00	10.45	84.00	73.55

Test results for in-band & out-band(9 ㎑ to 30 ㎒)

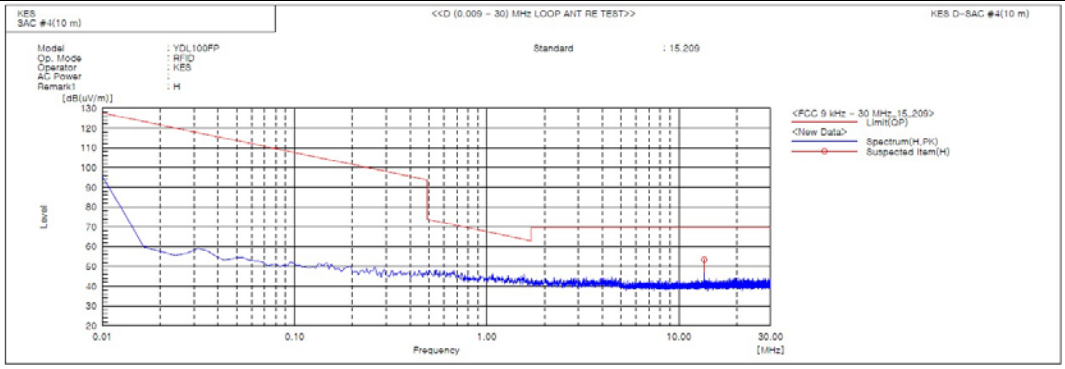
Radiated emissions		Ant.	Total factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Correction factor (dB/m)	Distance factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
12.355	12.80	H	20.56	40.00	-6.64	29.54	36.18
12.860	12.62	H	20.63	40.00	-6.75	29.54	36.29
13.158	12.34	H	20.64	40.00	-7.02	40.50	47.52
13.551	23.81	H	20.62	40.00	4.43	50.50	46.07
13.569	28.81	H	20.62	40.00	9.43	50.50	41.07
13.940	12.73	H	20.60	40.00	-6.67	40.50	47.17
14.044	13.61	H	20.60	40.00	-5.79	29.54	35.33
14.770	13.07	H	20.62	40.00	-6.31	29.54	35.85
12.500	13.51	V	20.58	40.00	-5.91	29.54	35.45
12.698	13.36	V	20.61	40.00	-6.03	29.54	35.57
13.230	13.12	V	20.64	40.00	-6.24	40.50	46.74
13.551	21.03	V	20.62	40.00	1.65	50.50	48.85
13.569	26.29	V	20.62	40.00	6.91	50.50	43.59
13.958	12.50	V	20.60	40.00	-6.90	40.50	47.40
14.044	13.68	V	20.60	40.00	-5.72	29.54	35.26
14.842	13.50	V	20.62	40.00	-5.88	29.54	35.42

Note.

1. All measurements were performed using a loop antenna. The antenna was investigated with three polarizations, and horizontal and vertical polarizations were reported as the worst case.
2. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
3. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 ㏈/decade) as specified in §15.31(f)(2). Extrapolation Factor = 20 log10(30/3)^2 = 40 ㏈.
4. The spectrum was investigated from 9 ㎑ up to 30 ㎒ using the loop antenna. Only the emissions shown in the table above were found to be significant.
5. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
6. Actual = Reading + Correction factors(Ant. factor + Cable loss) - Distance factor
7. Margin [dB] = Limit [㏈㎶//m] - Field Strength Level [㏈㎶//m]
8. All modes (e.g. with and without a tag) were investigated. Only the radiated emissions of the configuration (with a tag) that produced the worst case emissions are reported in this section.

Test results (9 ㎑ to 30 ㎒)

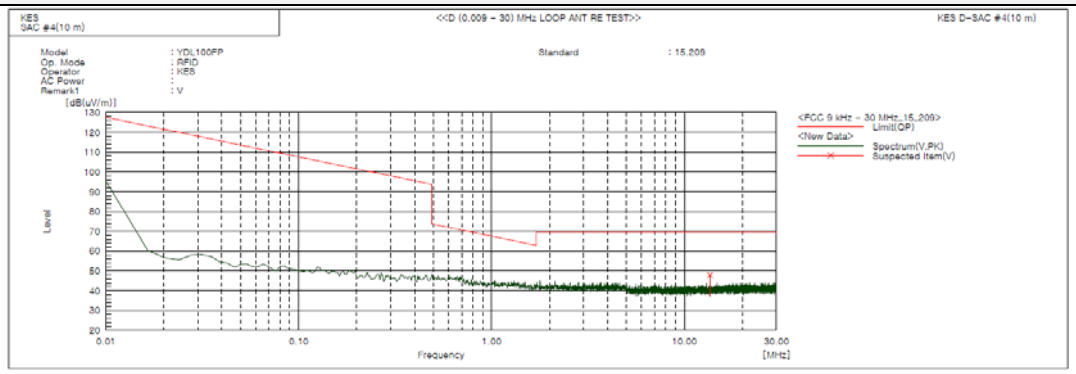
Horizontal



Spectrum Selection

No.	Frequency	(P)	Reading	c.f	Result PK	Limit QP	Margin QP	Height	Angle	Remark
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]	
1	13.561	H	32.9	20.3	53.2	69.5	16.3	100.0	200.0	

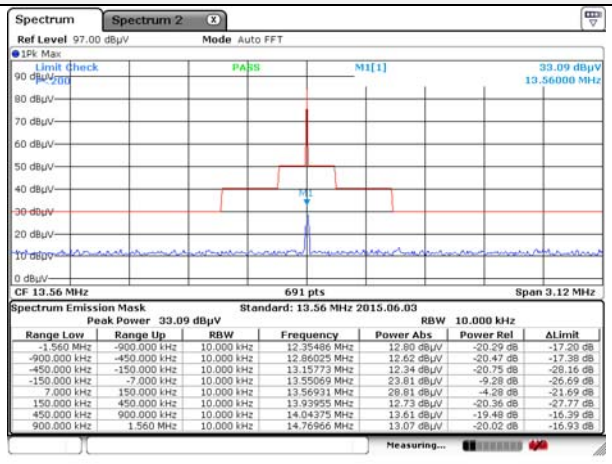
Vertical



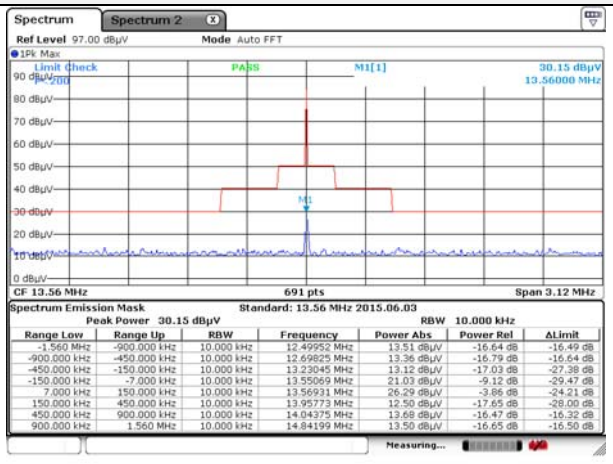
Spectrum Selection

No.	Frequency	(P)	Reading	c.f	Result PK	Limit QP	Margin QP	Height	Angle	Remark
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]	
1	13.561	V	27.7	20.3	48.0	69.5	21.5	100.0	88.0	

Horizontal // in-band & out-band

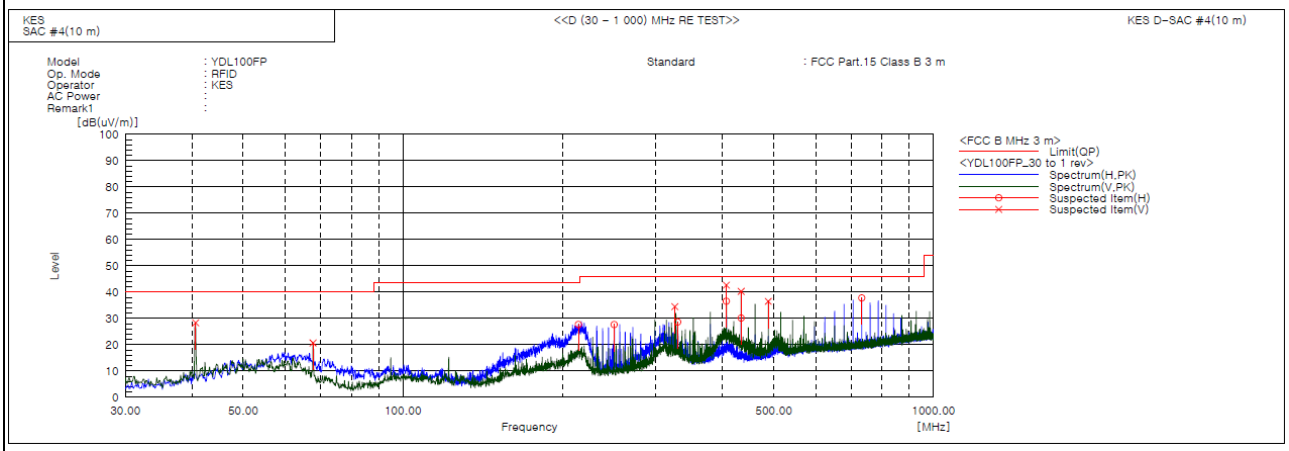


Vertical // in-band & out-band



Test results (Below 1 000 ㎒)

Horizontal // Vertical



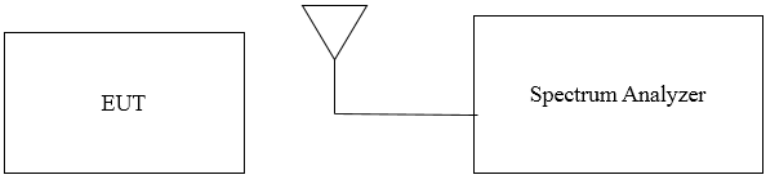
No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]
1	214.179	H	56.0	-28.3	27.7	43.5	15.8
2	250.069	H	54.8	-27.1	27.7	46.0	18.3
3	329.488	H	53.6	-24.9	28.7	46.0	17.3
4	406.845	H	59.0	-22.4	36.6	46.0	9.4
5	434.005	H	51.9	-21.7	30.2	46.0	15.8
6	732.401	H	53.8	-16.0	37.8	46.0	8.2
7	40.670	V	57.8	-29.5	28.3	40.0	11.7
8	67.709	V	51.9	-31.2	20.7	40.0	19.3
9	325.486	V	59.5	-25.0	34.5	46.0	11.5
10	406.845	V	65.1	-22.4	42.7	46.0	3.3
11	434.005	V	62.0	-21.7	40.3	46.0	5.7
12	488.204	V	56.8	-20.3	36.5	46.0	9.5

Note.

1. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector for emissions below 960 ㎒.
2. Below 30 MHz, loop Antenna was investigated with three polarizations, horizontal and vertical polarizations were reported as the worst case.
3. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
4. The spectrum is measured from 9 ㎑ to the 10th harmonic and the worst-case emissions are reported.
5. No spurious emissions levels were found to be greater than the level of the fundamental.

3.2 20 dB bandwidth

Test setup

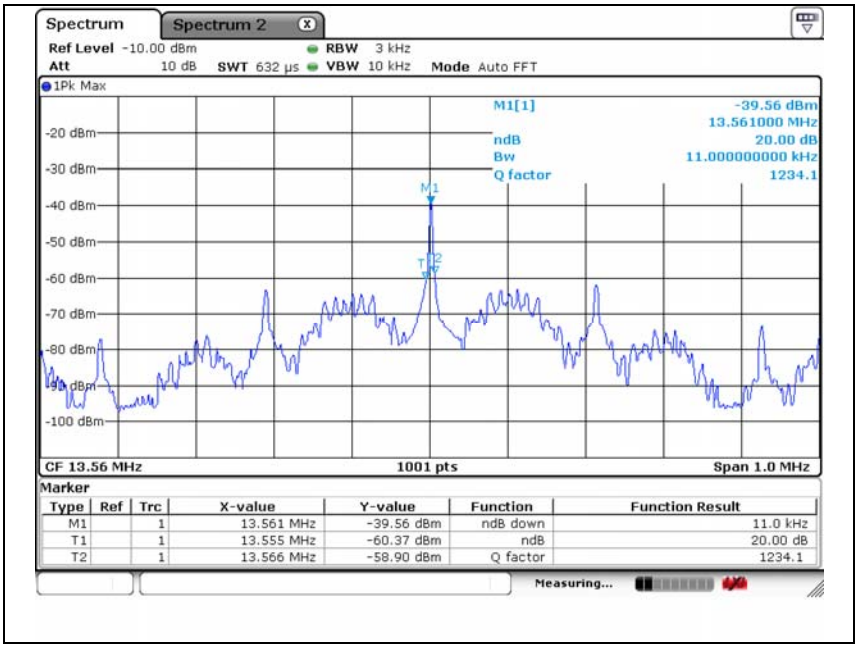


Test procedure

ANSI C63.10-2013 – Section 6.9.2

1. Spectrum analyzer frequency is set to the nominal EUT channel center frequency.
2. RBW = 1~5% OBW
3. VBW ≥ 3 x RBW
4. Reference level set to keep signal from exceeding maximum input mixer for linear operation.
5. Detector = Peak
6. Trace mode = Max hold
7. Sweep = Auto couple
8. The trace was allowed to stabilize
9. Using the marker-delta function, determine the "-20 dB down amplitude" using [(highest in band spectral density) – 20 dB]
10. Set a marker at the lowest frequency of the envelope of the spectral density, such that the marker is at or slightly below the "-20 dB down amplitude" determined in Step 9.
11. Reset Marker-delta function and move the marker to other side of the emission until the delta marker amplitude is the same level as reference amplitude. The marker delta frequency reading at this point is the specified emission bandwidth.

Test results



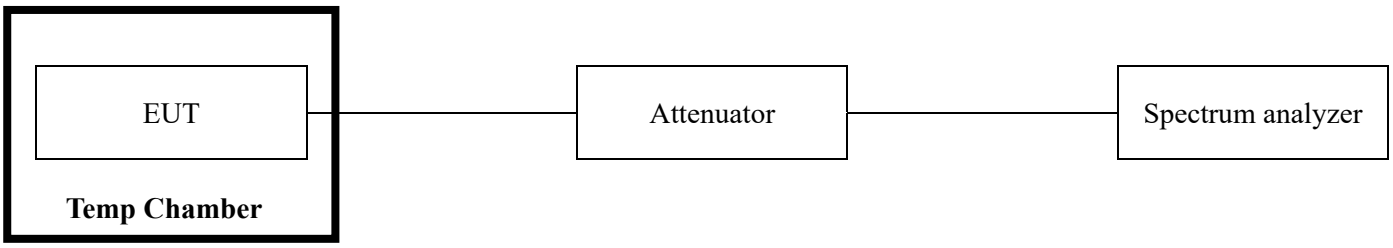
Note.
Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

3.3. Frequency Stability

Test procedure

ANSI C63.10-2013, clause 6.8.1

Test setup



1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
7. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

Limit

According to §15.225 (e), the frequency tolerance of the carrier signal shall be maintained within +/-0.01 % of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test results

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 6.0	-20	Startup	13.561 289	289	0.002 131
			2 minutes	13.561 254	254	0.001 873
			5 minutes	13.561 243	243	0.001 792
			10 minutes	13.561 228	228	0.001 681
		-10	Startup	13.561 320	320	0.002 360
			2 minutes	13.561 310	310	0.002 286
			5 minutes	13.561 298	298	0.002 197
			10 minutes	13.561 286	286	0.002 109
		0	Startup	13.561 355	355	0.002 618
			2 minutes	13.561 351	351	0.002 588
			5 minutes	13.561 340	340	0.002 507
			10 minutes	13.561 338	338	0.002 492
		10	Startup	13.561 412	412	0.003 038
			2 minutes	13.561 401	401	0.002 957
			5 minutes	13.561 398	398	0.002 935
			10 minutes	13.561 367	367	0.002 706
		20	Startup	13.561 500	500	0.003 687
			2 minutes	13.561 502	502	0.003 702
			5 minutes	13.561 505	505	0.003 724
			10 minutes	13.561 506	506	0.003 731
		30	Startup	13.561 521	521	0.003 842
			2 minutes	13.561 522	522	0.003 849
			5 minutes	13.561 524	524	0.003 864
			10 minutes	13.561 527	527	0.003 886
		40	Startup	13.561 536	536	0.003 952
			2 minutes	13.561 536	536	0.003 952
			5 minutes	13.561 537	537	0.003 960
			10 minutes	13.561 542	542	0.003 997
		50	Startup	13.561 558	558	0.004 115
			2 minutes	13.561 563	563	0.004 151
			5 minutes	13.561 565	565	0.004 166
			10 minutes	13.561 568	568	0.004 188
85 %	DC 5.1	23	Startup	13.561 482	482	0.003 554
			2 minutes	13.561 482	482	0.003 554
			5 minutes	13.561 473	473	0.003 488
			10 minutes	13.561 475	475	0.003 503
115 %	DC 6.9	23	Startup	13.561 476	476	0.003 510
			2 minutes	13.561 477	477	0.003 517
			5 minutes	13.561 472	472	0.003 480
			10 minutes	13.561 475	475	0.003 503

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV30	101389	1 year	2020.01.09
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2020.01.15
Loop Antenna	Schwarzbeck	FMZB1513	225	2 years	2021.02.15
Trilog-broadband Antenna	Schwarzbeck	VULB9163	714	2 years	2020.11.26
EMI Test Receiver	R&S	ESU26	100552	1 year	2019.04.11 2020.04.19
Attenuator	HP	8491A	32173	1 year	2019.03.21 2020.03.11
Amplifier	AGILENT	8449B	3008A00538	1 year	2019.06.29
Temperature Chamber	TABAI	MC711P	112000492	1 year	2020.01.16
Pulse Limiter	R&S	ESH3-Z2	101915	1 year	2019.11.26
DC Power Supply	HP	6632B	MY43004130	1 year	2019.06.28

Peripheral device

Device	Manufacturer	Model No.	Serial No.
RFID Tag	-	-	-