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http://www.sgsgroup.kr

TEST REPORT

of

FCC Part 15 Subpart C §15.247

FCC ID: 2AWMDA611

Equipment Under Test	:	RFID Smart Reader
Model Name	:	a611
Variant Model Name(s)	:	-
Applicant	:	Apulse Technology Co., Ltd.
Manufacturer	:	Apulse Technology Co., Ltd.
Date of Receipt	:	2021.04.20
Date of Test(s)	:	2021.05.03 ~ 2021.06.23
Date of Issue	:	2021.06.24

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: Murphy Kim

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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Phone No. : +82 31 688 0901
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1.2. Details of Applicant

Applicant : Apulse Technology Co., Ltd
Address : C-1211, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, South Korea, 14322
Contact Person : Jang, Robin
Phone No. : +82 10 5526 0605

1.3. Details of Manufacturer

Company : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product	RFID Smart Reader
Model Name	a611
Serial Number	Conducted: 001, Radiated: 002
Power Supply	DC 4 V
Frequency Range	902.75 ㎒ ~ 927.25 ㎒ (RFID)
Modulation Technique	ASK
Number of Channels	50 channels (RFID)
Antenna Type	PCB Patch antenna
Antenna Gain	0.89 ㏈i
H/W Version	V1.0
S/W Version	V095

1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMR40	100272	Jun. 16, 2022	Annual	Jun. 16, 2023
Signal Generator	R&S	SMBV100A	255834	May 25, 2022	Annual	May 25, 2023
Spectrum Analyzer	R&S	FSV30	103210	Dec. 08, 2021	Annual	Dec. 08, 2022
Spectrum Analyzer	Agilent	N9020A	MY53421758	Aug. 26, 2022	Annual	Aug. 26, 2023
Attenuator	AEROFLEX / INMET	40AH2W-10	40G-1	Jun. 08, 2022	Annual	Jun. 08, 2023
High Pass Filter	Wainwright Instrument GmbH	WHKX1.5/15G-6SS	4	Jun. 09, 2022	Annual	Jun. 09, 2023
Power Sensor	R&S	NRP-Z81	100669	May 06, 2022	Annual	May 06, 2023
DC Power Supply	R&S	HMP2020	019258024	Oct. 29, 2021	Annual	Oct. 29, 2022
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2022	Annual	Aug. 04, 2023
Signal Conditioning Unit	R&S	SCU-18	10117	Jun. 13, 2022	Annual	Jun. 13, 2023
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2021	Biennial	Aug. 23, 2023
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Feb. 07, 2022	Annual	Feb. 07, 2023
Horn Antenna	R&S	HF906	100326	Feb. 18, 2022	Annual	Feb. 18, 2023
EMI Test Receiver	R&S	ESU26	100109	Jan. 18, 2022	Annual	Jan. 18, 2023
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	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/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-NMSNMS (4 m)	J1023142	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	micro-coax UTiflex	142A SERIES 502839-8 (10 m)	90000034	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	RFONE	PL360P-292M292M-1.5 M-A	20200324002	Aug. 18, 2022	Semi-Annual	Feb. 18, 2023

Note;

- For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibraition due date.

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C		
Section	**Test Item(s)**	**Result**
15.205(a) 15.209 15.247(d)	Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	Complied
15.247(a)(1)(i)	20 dB Bandwidth	Complied
15.247(a)(1)(i) 15.247(b)(2)	Maximum Peak Conducted Output Power	Complied
15.247(a)(1)(i)	Carrier Frequency Separation	Complied
15.247(a)(1)(i)	Number of Hopping Frequencies	Complied
15.247(a)(1)(i)	Time of Occupancy (Dwell Time)	Complied
15.207	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. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the DUT.

1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

1.9.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.9.2. Radiation Test

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB)

1.10. Measurement Uncertainty

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

Parameter	Uncertainty	
RF Output Power	0.32 dB	
Occupied Bandwidth	3.90 ㎑	
Conducted Spurious Emission	0.61 dB	
Radiated Emission, 9 ㎑ to 30 ㎒	H	3.30 dB
	V	3.30 dB
Radiated Emission, below 1 ㎓	H	4.80 dB
	V	5.20 dB
Radiated Emission, above 1 ㎓	H	3.90 dB
	V	4.00 dB

All measurement uncertainty values are shown with a coverage factor *k* = 2 to indicate a 95 % level of confidence.

1.11. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL002335	2021.06.24	Initial

1.12. Information of software for test

- Using the software of Total Control V 7.0.0 to testing of EUT.

1.13. Duty Cycle of EUT

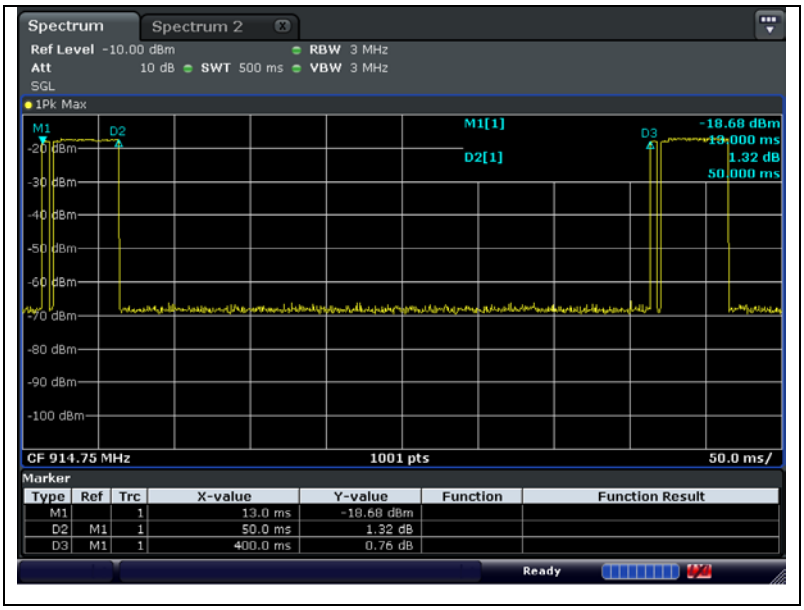
Regarding to KDB 558074 D01 15.247 Meas Guidance v05r02, 6, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below;
Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

Duty Cycle (%)
12.50

Remark;

1. Duty Cycle (%) = (Tx on time / Tx on + off time) x 100

- Test plot

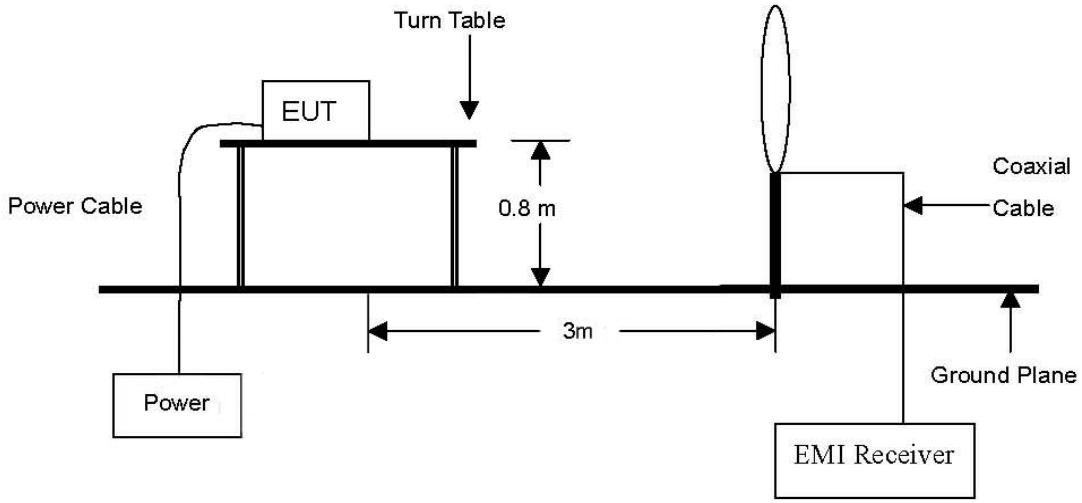


2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

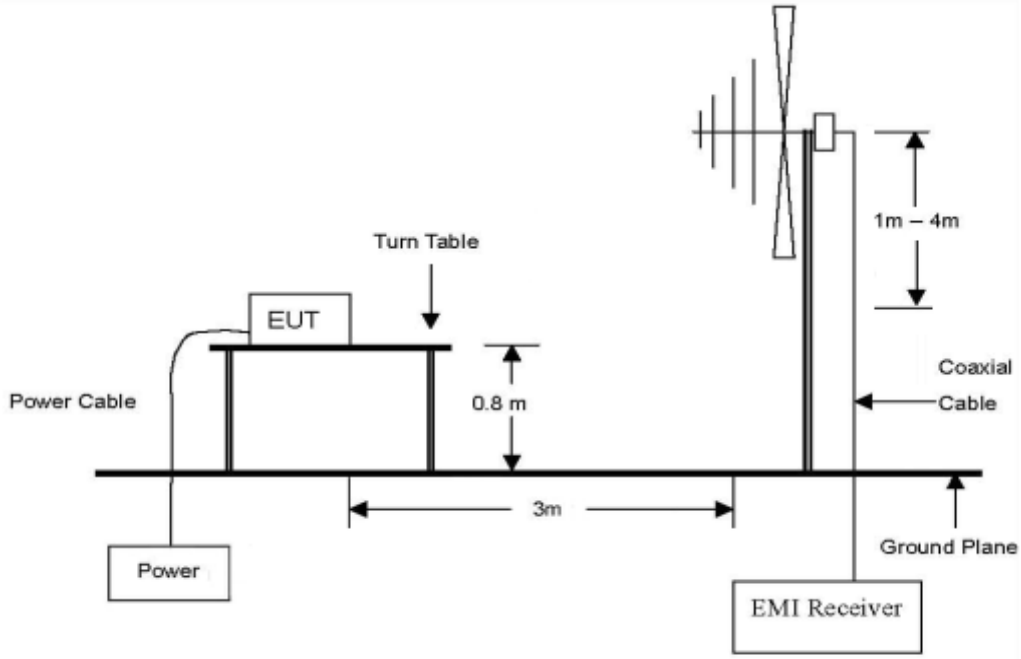
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

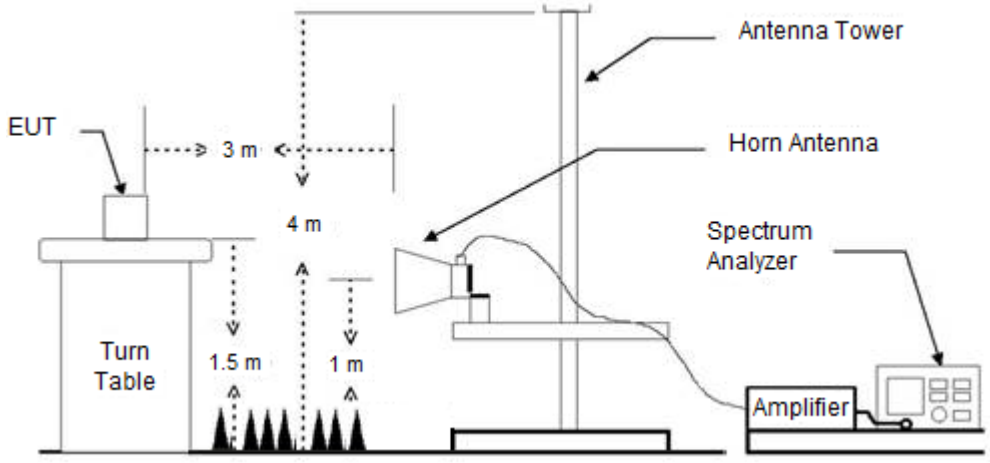
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.



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



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.1.2. Conducted Spurious Emissions

2.2. Limit

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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 (㎶/m)	Measurement Distance (Meters)
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.

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 below 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.

2.3.2. Test Procedures for emission from above 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 below 1 ㎓ and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. 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.
3. The antenna is a bi-log antenna, a horn 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.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. For frequency above 1 ㎓, set spectrum analyzer detector to peak, and resolution bandwidth is 1 ㎒ and video bandwidth is 3 ㎒.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is $1/T_{on}$ ㎐ (T_{on} = On-time of the Pulsed emission) for Average detection (AV) at frequency above 1 ㎓. VBW = 10 ㎐ > $1/T_{on}$ ㎐, pulse width in seconds (T_{on} = 350 ㎳).
4. Definition of DUT Axis.
   Definition of the test orthogonal plan for EUT was described in the test setup photo.
   The test orthogonal plan of EUT is **X – axis** during radiation test.

2.3.3. Test Procedures for Conducted Spurious Emissions

2.3.3.1. Band-edge Compliance of RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.
Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
RBW ≥ 100 ㎑
VBW = 300 ㎑
Sweep = auto
Detector function = peak
Trace = max hold

2.3.3.2. Spurious RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.
RBW = 1 ㎒
VBW = 3 ㎒
Sweep = auto
Detector function = peak
Trace = max hold

2.3.3.3. TDF function

- For plots showing conducted spurious emissions from 9 ㎑ to 10 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.
So, the reading values shown in plots were final result.

2.4. Test Results

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

2.4.1. Radiated Spurious Emission

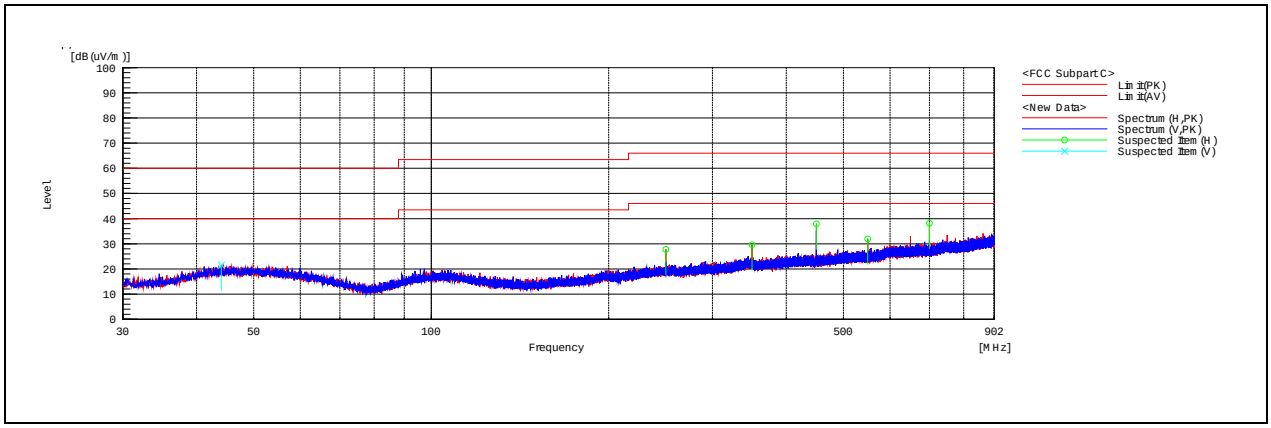
The following table shows the highest levels of radiated emissions.
The frequency spectrum from 9 ㎑ to 10 ㎓ was investigated.

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)
249.99	34.80	Peak	H	18.30	-25.39	27.71	46.00	18.29
349.99	34.10	Peak	H	20.80	-25.17	29.73	46.00	16.27
449.99	41.90	Peak	H	21.70	-25.73	37.87	46.00	8.13
549.99	34.40	Peak	H	23.50	-25.82	32.08	46.00	13.92
700.01	38.20	Peak	H	25.30	-25.31	38.19	46.00	7.81
929.89	30.60	Peak	H	28.10	-24.05	34.65	46.00	11.35

Remark;

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **High Channel** as worst case among other modes.
3. Radiated spurious emission measurement as below.
   (Actual = Reading + AF + AMP + CL)
4. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

- Test plots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[MHz]
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Limit(AV)
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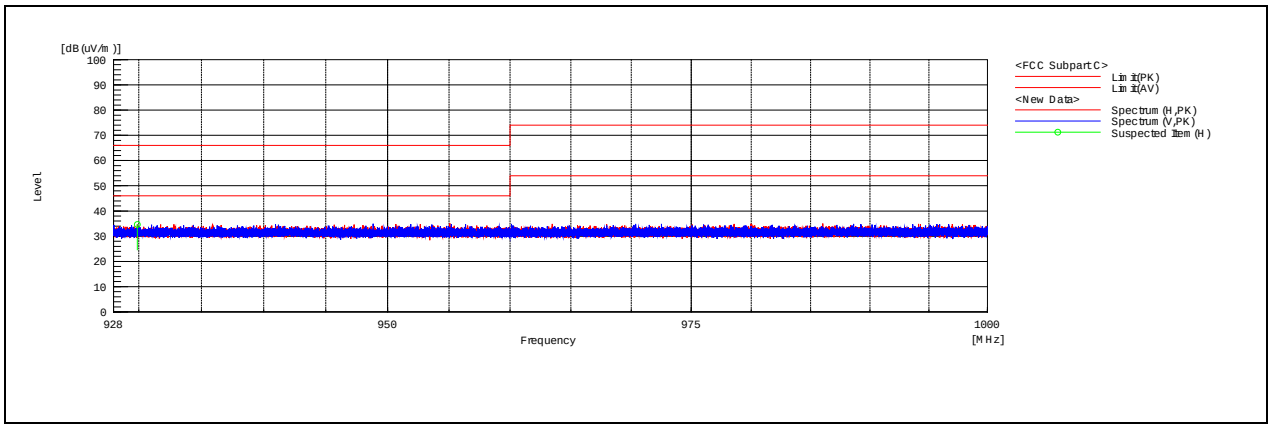
Spectrum(H,PK)
Spectrum(V,PK)
Suspected Item(H)
Suspected Item(V)


[dB(uV/m)]
Level
Frequency
[MHz]
<FCC SubpartC>
Limit(PK)
Limit(AV)
<New Data>
Spectrum(H,PK)
Spectrum(V,PK)
Suspected Item(H)

A. Low Channel (902.75 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
901.92	12.19	Peak	H	27.96	3.78	**43.93**	46.00	2.07
902.00	10.81	Peak	H	27.96	3.78	42.55	46.00	3.45

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)
*2 708.21	59.34	Peak	H	28.88	-37.98	50.24	74.00	23.76
*3 610.77	47.03	Peak	H	31.56	-36.71	41.88	74.00	32.12
Above 3 700.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (914.75 ㎒)

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)
*2 744.29	59.25	Peak	H	28.81	-37.97	50.09	74.00	23.91
Above 2 800.00	Not detected	-	-	-	-	-	-	-

C. High Channel (927.25 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
928.00	9.91	Peak	H	28.14	3.90	41.95	46.00	4.05
928.10	9.59	Peak	H	28.14	3.90	41.63	46.00	4.37

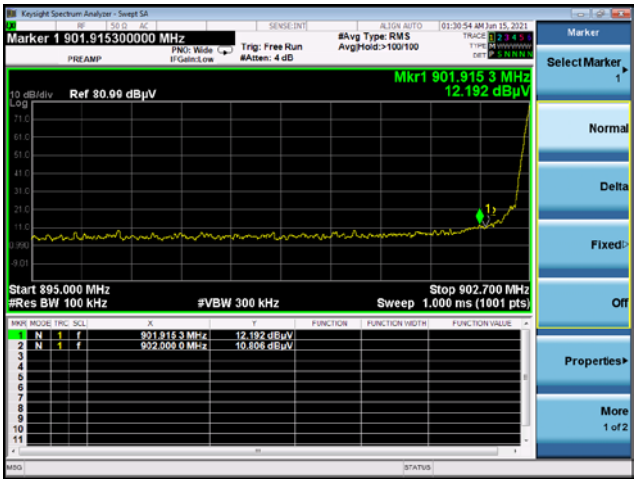
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 854.32	50.98	Peak	H	27.59	-39.50	39.07	74.00	34.93
*2 781.73	62.39	Peak	H	28.86	-37.90	53.35	74.00	20.65
Above 2 800.00	Not detected	-	-	-	-	-	-	-

Remark;

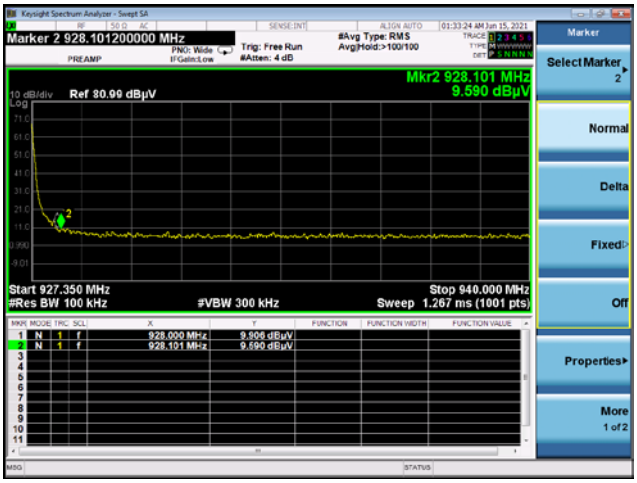
1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL or Reading + AF + AMP + CL.
5. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 ㏈.
6. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

- Test plots

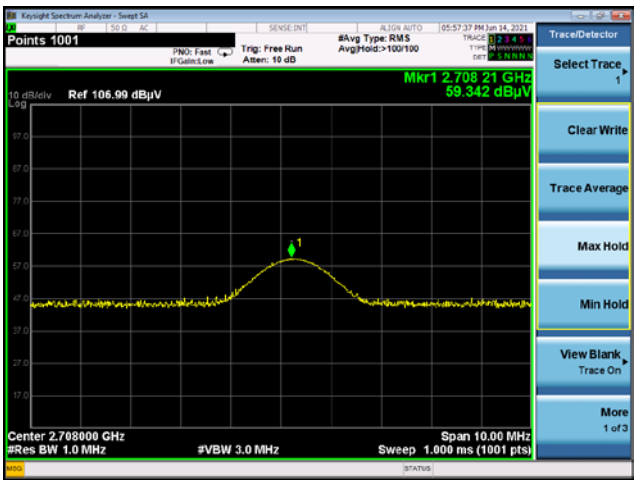
Low channel band edge (Peak)



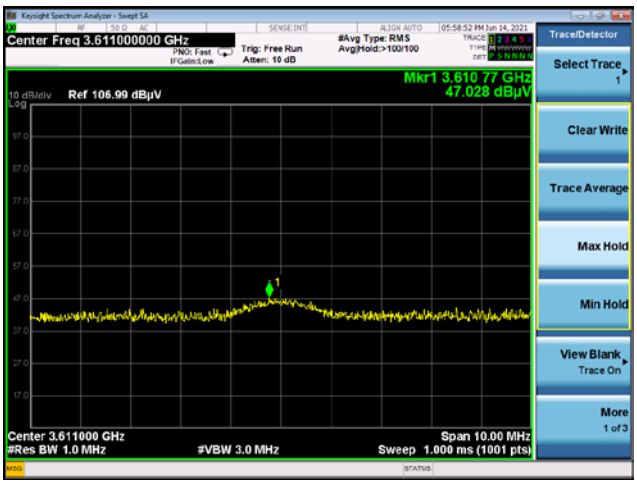
High channel band edge (Peak)



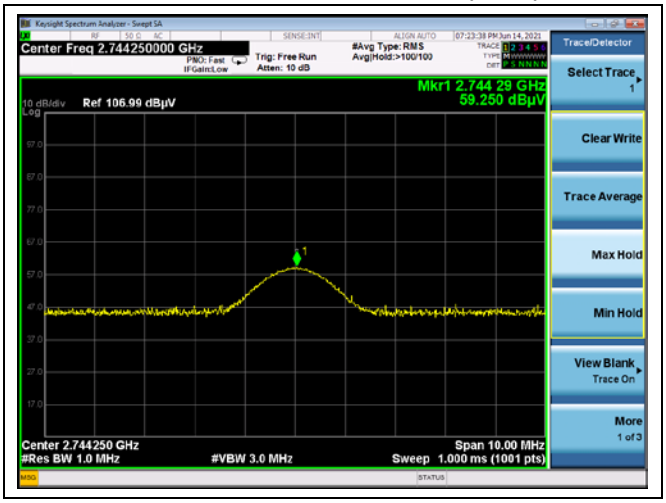
Low channel 3rd harmonic (Peak)



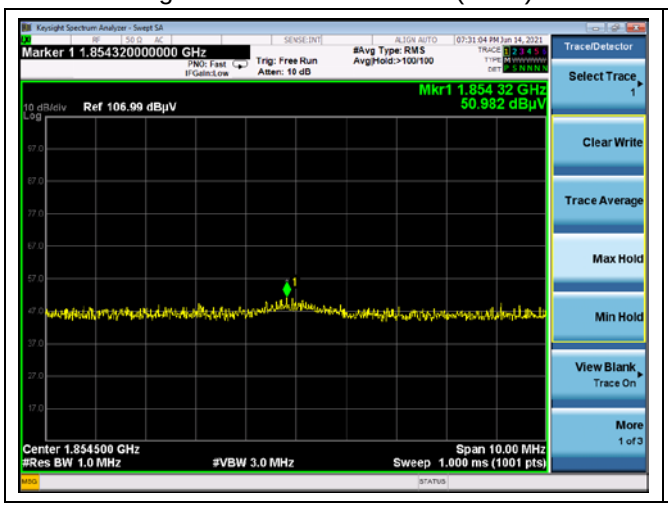
Low channel 4th harmonic (Peak)



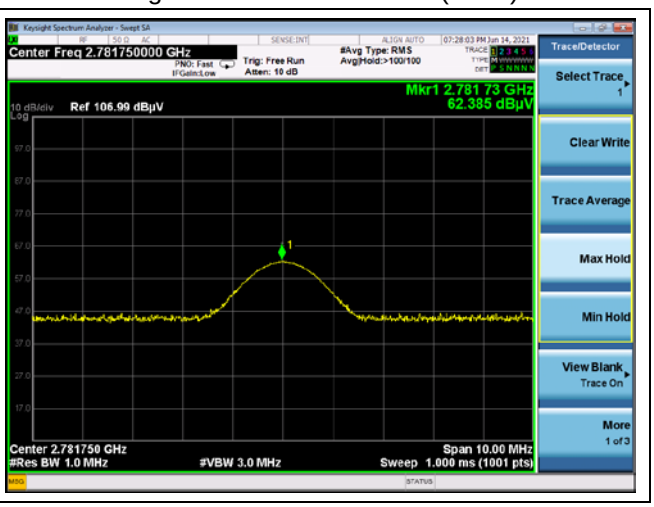
Middle channel 3rd harmonic (Peak)



High channel 2nd harmonic (Peak)

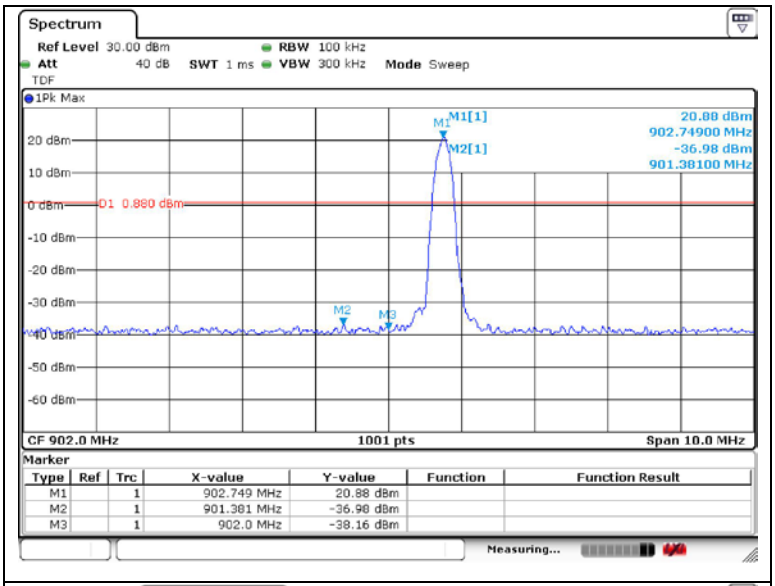


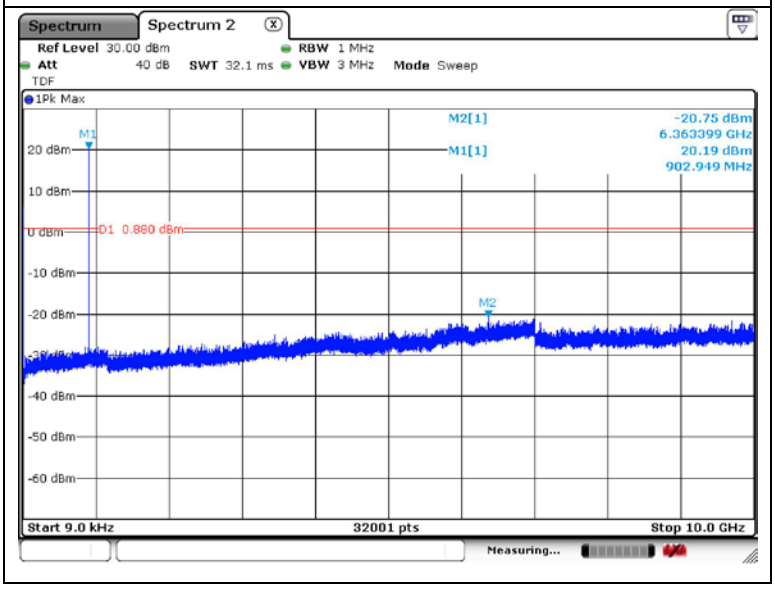
High channel 3rd harmonic (Peak)



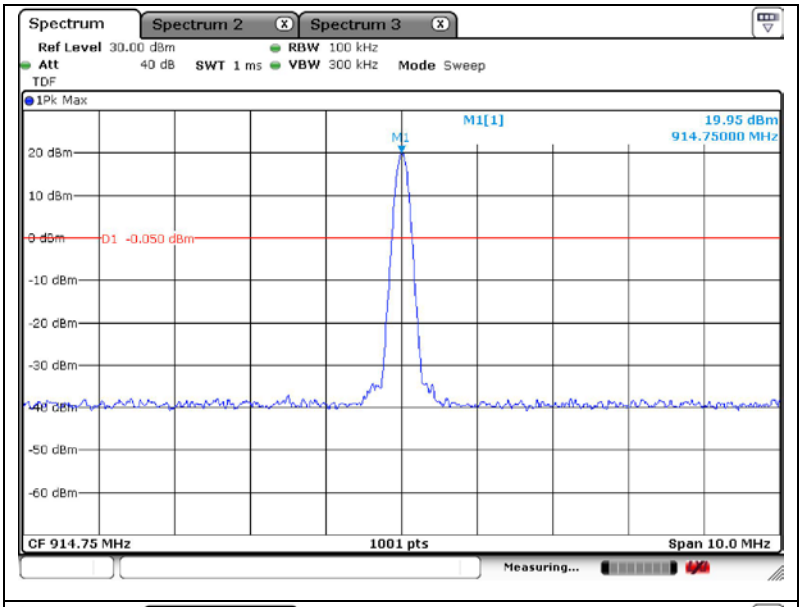
2.4.2. Plot of Spurious Conducted Emissions with hopping disabled

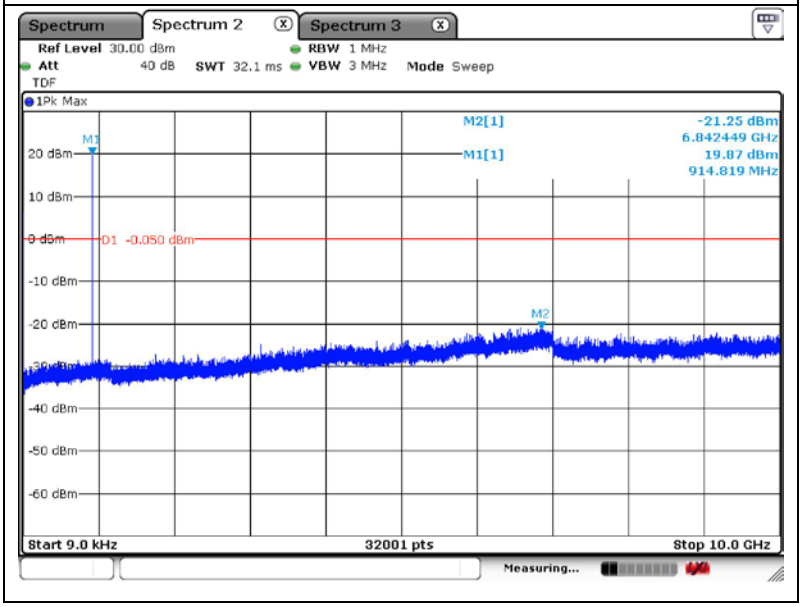
Low channel



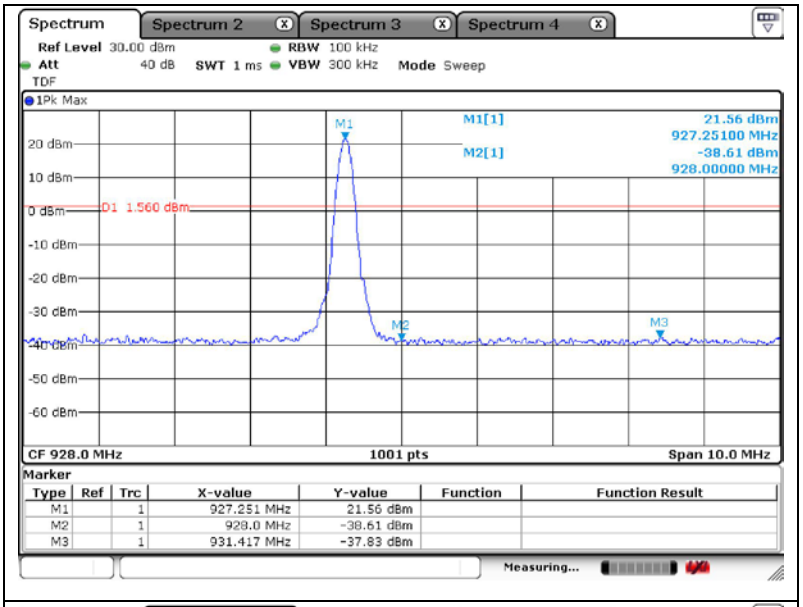


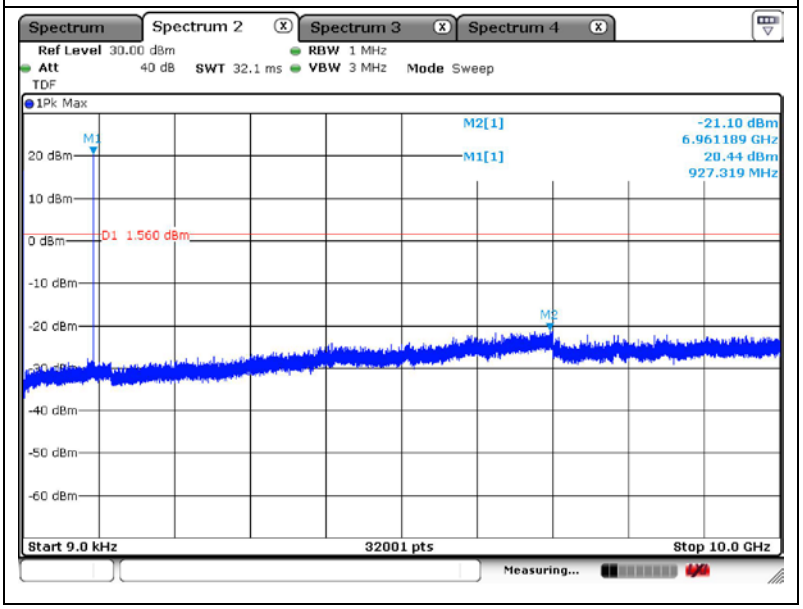
Middle channel





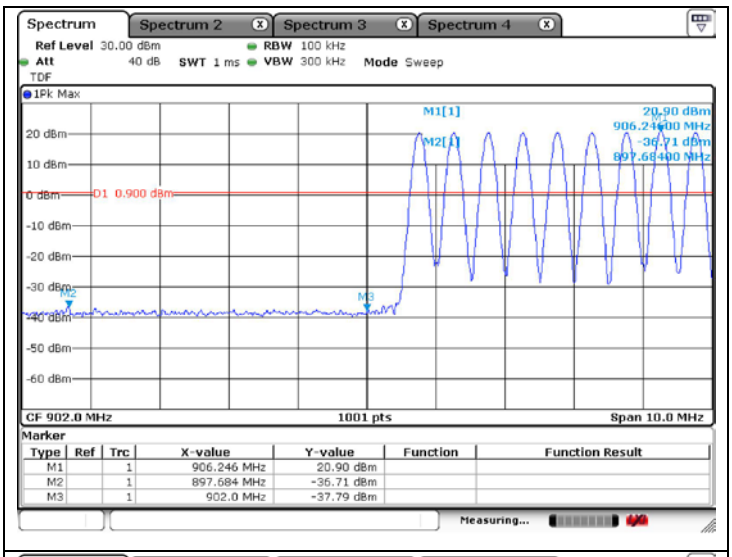
High channel



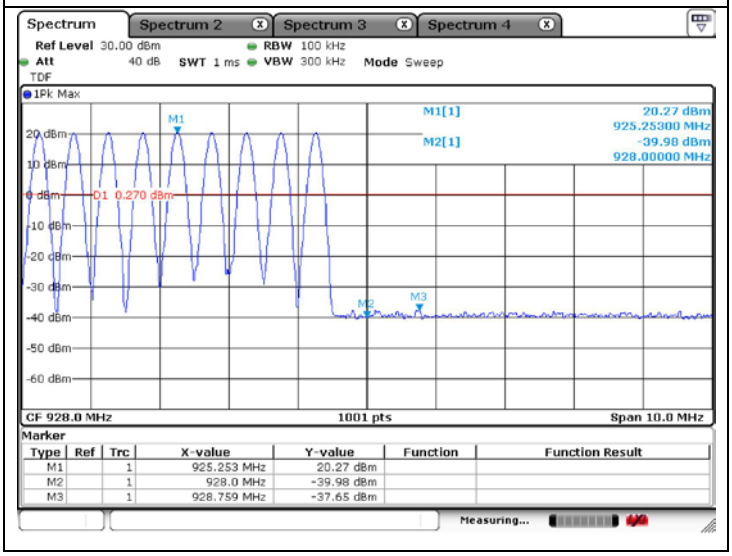


Band edge compliance with hopping enabled

Low Channel



High Channel



3. 20 dB Bandwidth

3.1. Test Setup

3.2. Limit

Limit: Not Applicable

3.3. Test Procedure

The test follows ANSI C63.10-2013.

The 20 dB bandwidth was measured with a spectrum analyzer connected to RF antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Use the following spectrum analyzer setting:

1. Span = approximately 2 to 5 times the 20 dB bandwidth.
2. RBW ≥ 1 % to 5 % of the 20 dB bandwidth.
3. VBW ≥ 3 x RBW
4. Sweep = auto
5. Detector = peak
6. Trace = max hold

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.

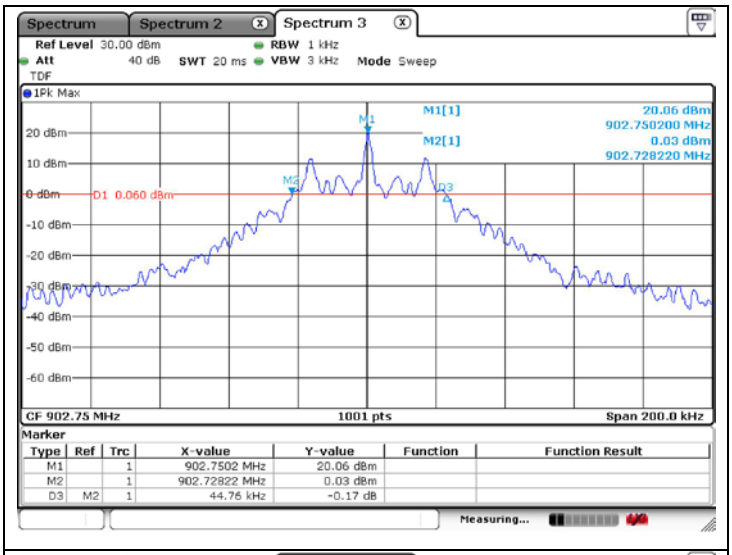
3.4. Test Results

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

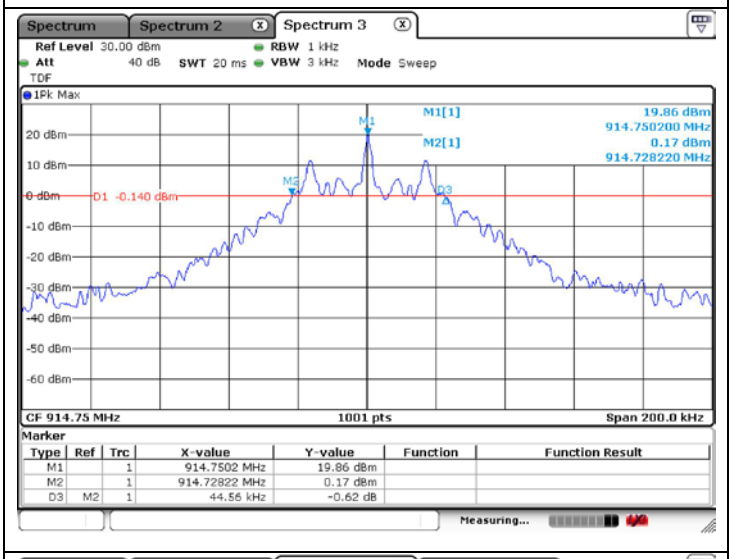
Operation Mode	Channel	Frequency (㎒)	20 ㏈ Bandwidth (㎑)
RFID	Low	902.75	44.76
	Middle	914.75	44.56
	High	927.25	44.96

- Test plots

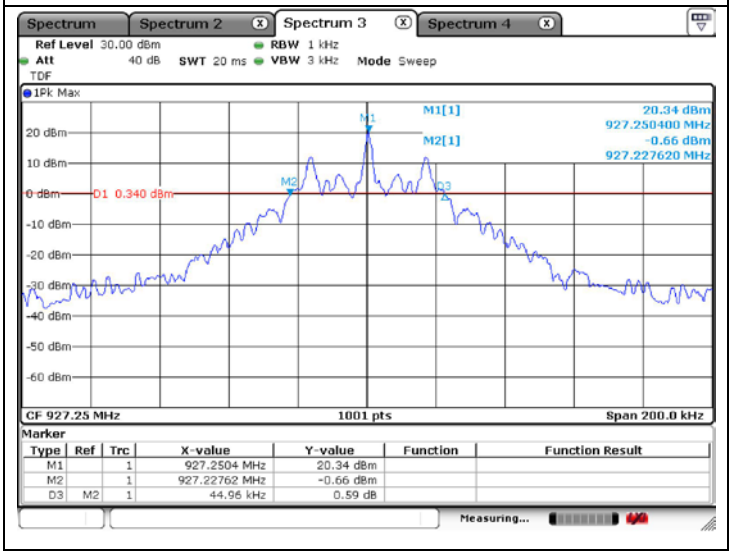
Low Channel



Middle Channel

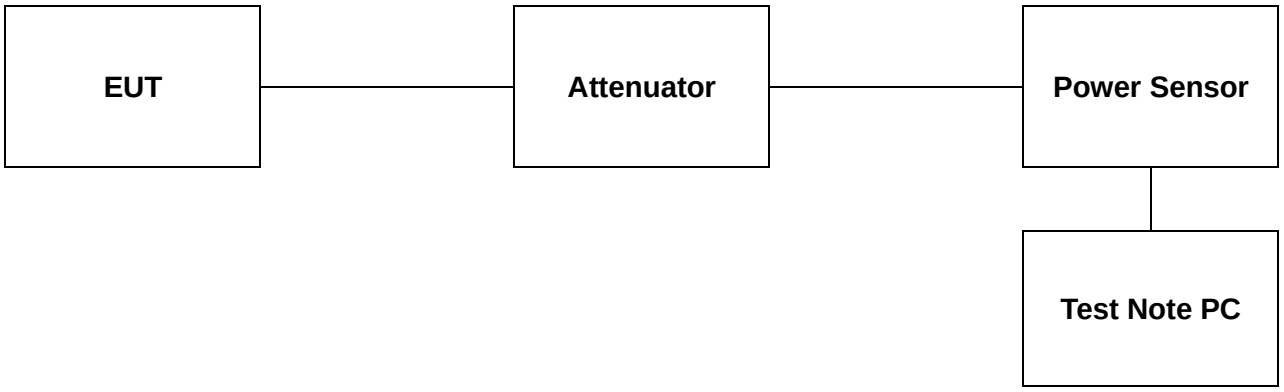


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

1. §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 ㎒ band: if the 20 ㏈ bandwidth of the hopping channel is less than 250 ㎑, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 ㏈ bandwidth of the hopping channel is 250 ㎑ or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 ㏈ bandwidth of the hopping channel is 500 ㎑.
2. §15.247(b)(2), For frequency hopping systems operating in the 902-928 ㎒ band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

4.3. Test Procedure

The test follows ANSI C63.10-2013. Using the power sensor instead of a spectrum analyzer.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
3. Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)
4. Measure peak power each channel.

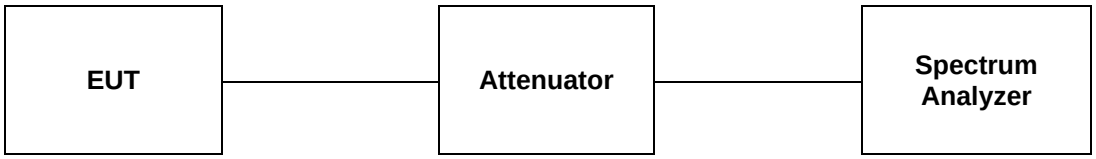
4.4. Test Results

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

Operation Mode	Channel	Frequency (㎒)	Average Power Result (㏈m)	Peak Power Result (㏈m)	Limit (㏈m)
RFID	Low	902.75	**19.70**	20.30	30
	Middle	914.75	19.69	20.25	
	High	927.25	19.41	**20.33**	

5. Carrier Frequency Separation

5.1. Test Setup



5.2. Limit

§15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 ㎒ band: if the 20 ㏈ bandwidth of the hopping channel is less than 250 ㎑, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 ㏈ bandwidth of the hopping channel is 250 ㎑ or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 ㏈ bandwidth of the hopping channel is 500 ㎑.

5.3. Test Procedure

The test follows ANSI C63.10-2013.

Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels
2. RBW: Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW ≥ RBW
4. Sweep: Auto
5. Detector: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

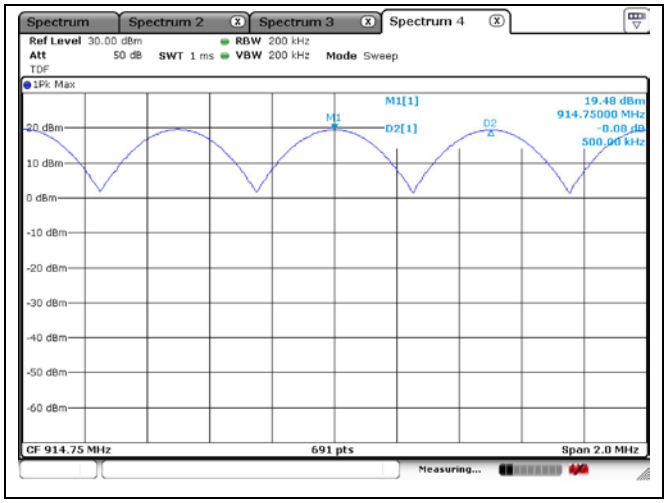
Use the marker-delta function to determine the between the peaks of the adjacent channels.

5.4. Test Results

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

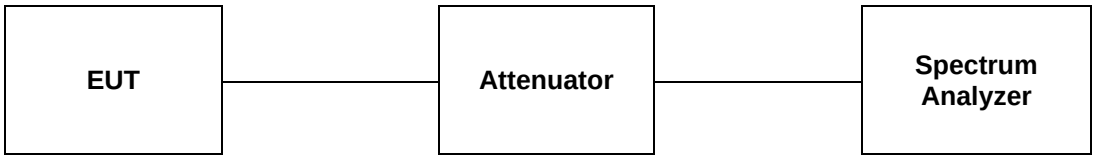
Operation Mode	Frequency (㎒)	Adjacent Hopping Channel Separation (㎑)	20 ㏈ Bandwidth (㎑)
RFID	914.75	500	44.56

- Test plot



6. Number of Hopping Frequencies

6.1. Test Setup



6.2. Limit

§15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 ㎒ band: if the 20 ㏈ bandwidth of the hopping channel is less than 250 ㎑, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 ㏈ bandwidth of the hopping channel is 250 ㎑ or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 ㏈ bandwidth of the hopping channel is 500 ㎑.

6.3. Test Procedure

The test follows ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

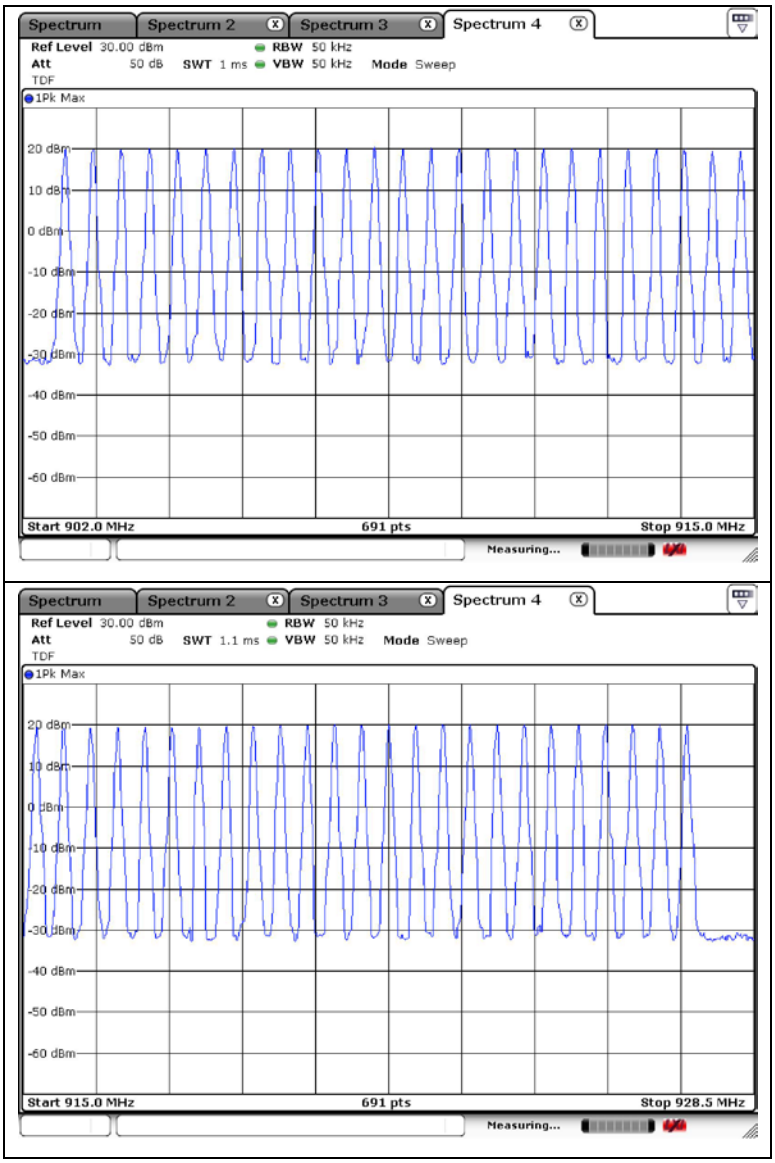
1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30 % of the channel spacing or the 20 ㏈ bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep: Auto
5. Detector function: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

6.4. Test Results

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

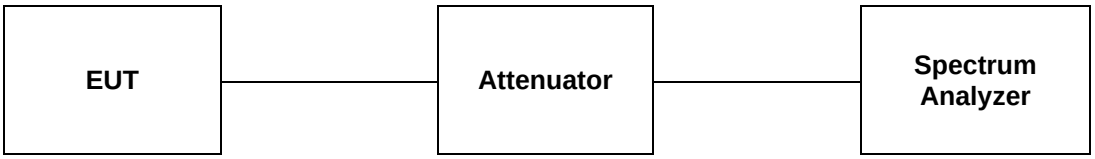
Operation Mode	Number of Hopping Frequency	Limit
RFID	50	≥ 50

- Test plots



7. Time of Occupancy (Dwell Time)

7.1. Test Set up



7.2. Limit

§15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 ㎒ band: if the 20 ㏈ bandwidth of the hopping channel is less than 250 ㎑, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 ㏈ bandwidth of the hopping channel is 250 ㎑ or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 ㏈ bandwidth of the hopping channel is 500 ㎑.

7.3. Test Procedure

The test follows ANSI C63.10-2013.

The EUT must have its hopping function enabled. Use the following spectrum analyzer setting:

1. Span = Zero span, centered on a hopping channel.
2. RBW = 100 ㎑.
3. VBW ≥ RBW.
4. Sweep = As necessary to capture the entire dwell time per hopping channel.
5. Detector = Peak.

Use the marker-delta function to determine the dwell time.

7.4. Test Results

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

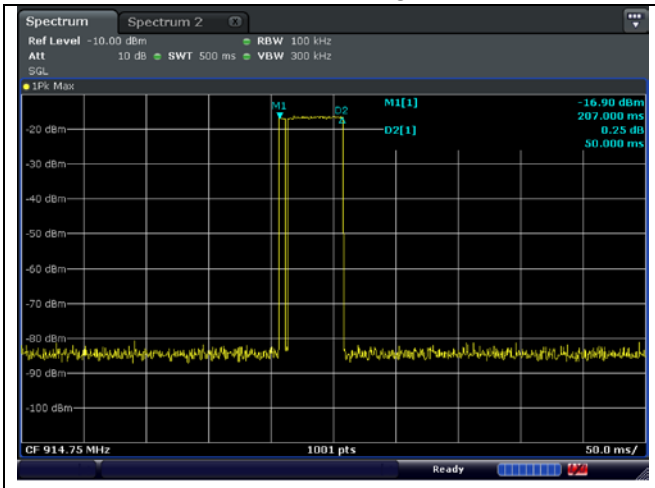
Operation Mode	Frequency (㎒)	Dwell Time (㎳)	Time of occupancy on the Tx Channel in 20 sec (㎳)	Limit for time of occupancy on the Tx Channel in 20 sec (㎳)
RFID	914.75	50.0	100.0	400

Remark;

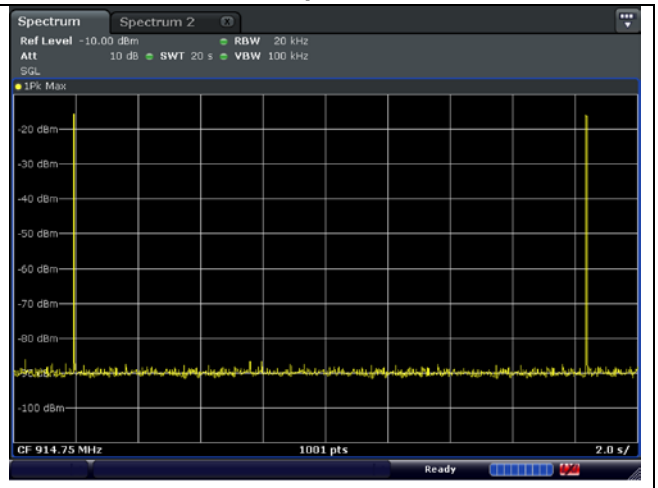
Time of occupancy on the TX channel in 20 sec : 50.0 × 2 = 50.0 ㎳

- Test plots

Time slot length



Number of hops in 20 seconds



8. Antenna Requirement

8.1. Standard Applicable

For intentional device, according to FCC 47 CFR 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section and according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

8.2. Antenna Connected Construction

Antenna used in this product is PCB Patch antenna with gain of 0.89 dBi

- End of the Test Report -