
FCC Test Report

Report No.: AGC00927191202FE03

FCC ID : 2AKARUD18RW-F

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION : UHF Card Issuer

BRAND NAME : ZKRADIO

MODEL NAME : UD18RW-F, UR20RW-F

APPLICANT : Guangdong ZK Radio Electronic Tech Co., Ltd

DATE OF ISSUE : Nov. 24, 2020

STANDARD(S) : FCC Part 15.247

REPORT VERSION : V1.0

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Nov. 24, 2020	Valid	Initial Release

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TABLE OF CONTENTS

1. VERIFICATION OF CONFORMITY	5
2. GENERAL INFORMATION.....	5
2.1. PRODUCT DESCRIPTION	6
2.2. TABLE OF CARRIER FREQUENCIES	6
2.3. RECEIVER INPUT BANDWIDTH.....	7
2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE.....	7
2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR.....	7
2.6. RELATED SUBMITTAL(S) / GRANT (S)	7
2.7. TEST METHODOLOGY	7
2.8. SPECIAL ACCESSORIES.....	7
2.9. EQUIPMENT MODIFICATIONS.....	7
2.10. ANTENNA REQUIREMENT.....	7
3. MEASUREMENT UNCERTAINTY	8
4. DESCRIPTION OF TEST MODES.....	9
5. SYSTEM TEST CONFIGURATION	10
5.1. CONFIGURATION OF EUT SYSTEM.....	10
5.2. EQUIPMENT USED IN EUT SYSTEM.....	10
5.3. SUMMARY OF TEST RESULTS.....	10
6. TEST FACILITY	11
7. PEAK OUTPUT POWER	12
7.1. MEASUREMENT PROCEDURE.....	12
7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	12
7.3. LIMITS AND MEASUREMENT RESULT	13
8. 20DB BANDWIDTH	15
8.1. MEASUREMENT PROCEDURE.....	15
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	15
8.3. LIMITS AND MEASUREMENT RESULTS	15
9. CONDUCTED SPURIOUS EMISSION	17
9.1. MEASUREMENT PROCEDURE.....	17
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	17
9.3. MEASUREMENT EQUIPMENT USED	17
9.4. LIMITS AND MEASUREMENT RESULT	17

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10. RADIATED EMISSION.....	22
10.1. MEASUREMENT PROCEDURE.....	22
10.2. TEST SETUP	24
10.3. LIMITS AND MEASUREMENT RESULT	25
10.4. TEST RESULT	25
11. NUMBER OF HOPPING FREQUENCY	31
11.1. MEASUREMENT PROCEDURE	31
11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION).....	31
11.3. MEASUREMENT EQUIPMENT USED.....	31
11.4. LIMITS AND MEASUREMENT RESULT	31
12. TIME OF OCCUPANCY (DWELL TIME)	32
12.1. MEASUREMENT PROCEDURE.....	32
12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)	32
12.3. MEASUREMENT EQUIPMENT USED	32
12.4. LIMITS AND MEASUREMENT RESULT	32
13. FREQUENCY SEPARATION	36
13.1. MEASUREMENT PROCEDURE.....	36
13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)	36
13.3. MEASUREMENT EQUIPMENT USED	36
13.4. LIMITS AND MEASUREMENT RESULT	36
14. FCC LINE CONDUCTED EMISSION TEST	37
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST	37
14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST	37
14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST	38
14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST	38
14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST	39
APPENDIX A: PHOTOGRAPHS OF TEST SETUP	41
APPENDIX B: PHOTOGRAPHS OF EUT	43

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1. VERIFICATION OF CONFORMITY

Applicant	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang,Shenzhen,China
Manufacturer	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang,Shenzhen,China
Factory	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang,Shenzhen,China
Product Designation	UHF Card Issuer
Brand Name	ZKRADIO
Test Model	UD18RW-F
Serial Model	UR20RW-F
Difference Description	All the same except the model name.
Date of test	Jun. 10, 2020~Nov. 24, 2020
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Prepared By

Calvin Liu

Calvin Liu
(Project Engineer)

Nov. 24, 2020

Reviewed By

Max Zhang

Max Zhang
(Reviewer)

Nov. 24, 2020

Approved By

Forrest Lei

Forrest Lei
(Authorized Officer)

Nov. 24, 2020

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is “RFID” designed as a “UHF Card Issuer”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency Band	902MHz-928MHz
Operation Frequency	902.4MHz-926MHz
RF Output Power	22.016dBm(Max)
Modulation	ASK(FHSS)
Number of channels	60
Hardware Version	UD18RW-E/F_V2.00
Software Version	UD18RW-EF(UD021UD022)_V2.01
Antenna Designation	Ceramic Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain	10dBi
Power Supply	DC 5V from USB.

2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
902~926MHZ	1	902.4MHz
	2	902.8MHz
	:	:
	59	925.6MHz
	60	926.0MHz

Note: The channel spacing is 0.4MHz.

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2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 400kHz.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a 60 hopping sequence in data mode:

21,23,33,25,27,31,07,09,13,11,15,02,06,01,03,05,04,08,10,12,14,16,17,18,19,20,
24,26,27,28,29,30,32,34,35,36,37,38,40,41,42,43,45,44,47,46,48,49,50,51, 52, 53, 54, 55, 56, 57, 58, 59, 60

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, $U_c = \pm 3.2$ dB
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9$ dB
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8$ dB
- Uncertainty of total RF power, conducted, $U_c = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, $U_c = \pm 2.7$ dB
- Uncertainty of Occupied Channel Bandwidth: $U_c = \pm 2$ %
- Uncertainty of Dwell Time: $U_c = \pm 2$ %
- Uncertainty of Frequency: $U_c = \pm 2$ %

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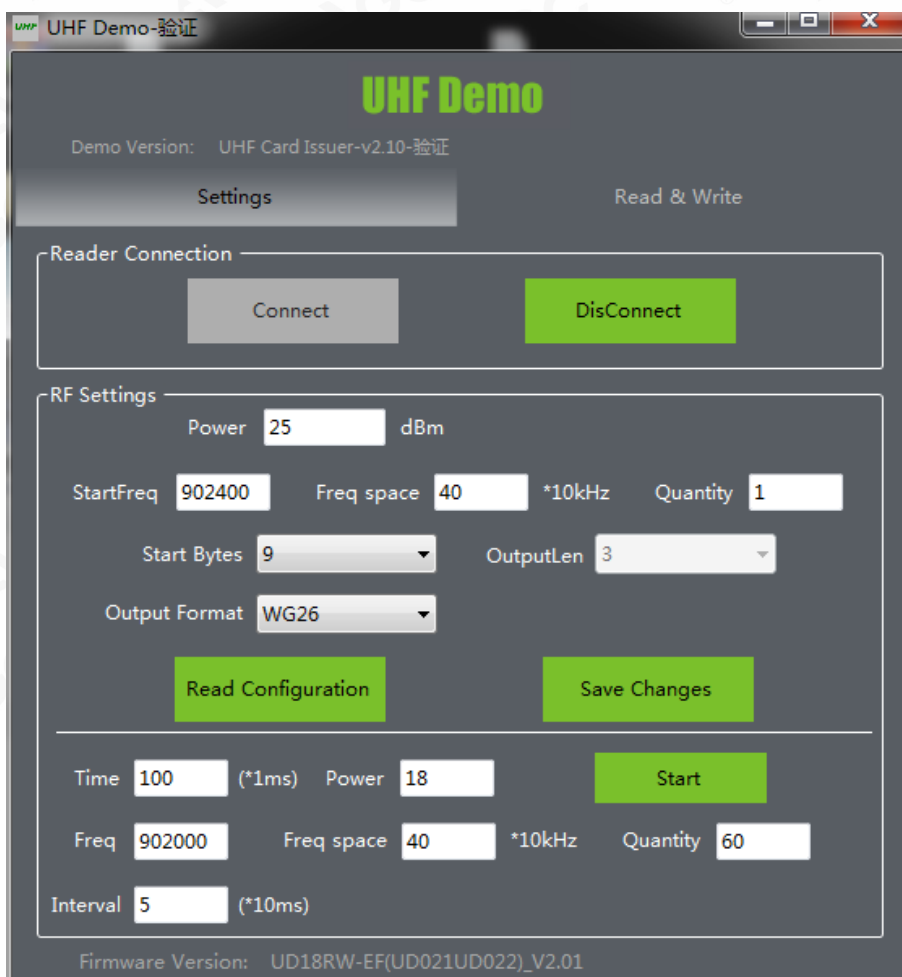


4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX 902.4 MHz
2	Middle channel TX 914.0 MHz
3	High channel TX 926.0 MHz
4	Normal hopping mode

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. The test software is the UHF Card Issuer-v2.10 which can set the EUT into the individual test modes.



The screenshot shows the 'UHF Demo' software interface. The title bar indicates 'UHF Demo-验证'. The main window has a dark background with green text and buttons. At the top, it says 'Demo Version: UHF Card Issuer-v2.10-验证'. Below this are two tabs: 'Settings' (selected) and 'Read & Write'. Under the 'Settings' tab, there are two main sections: 'Reader Connection' and 'RF Settings'. The 'Reader Connection' section has 'Connect' and 'Disconnect' buttons. The 'RF Settings' section contains several input fields and buttons. The 'Power' field is set to 25 dBm. The 'StartFreq' field is 902400, 'Freq space' is 40 *10kHz, and 'Quantity' is 1. The 'Start Bytes' field is 9, and the 'OutputLen' field is 3. The 'Output Format' is set to WG26. There are 'Read Configuration' and 'Save Changes' buttons. At the bottom of the 'RF Settings' section, there are fields for 'Time' (100 *1ms), 'Power' (18), 'Freq' (902000), 'Freq space' (40 *10kHz), 'Quantity' (60), and 'Interval' (5 *10ms). A 'Start' button is also present. At the very bottom, it says 'Firmware Version: UD18RW-EF(UD021UD022)_V2.01'.

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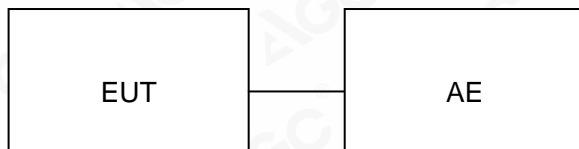
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5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure :



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	UHF Card Issuer	UD18RW-F	2AKARUD18RW-F	EUT
2	PC	HUAWEI	N/A	AE
3	USB Cable	N/A	1.8m, Unshielded	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Peak Output Power	Compliant
§15.247	20 dB Bandwidth	Compliant
§15.247	Spurious Emission	Compliant
15.247&15.209	Radiated Emission	Compliant
§15.207	Conduction Emission	Compliant
§15.247	Number of Hopping Frequency	Compliant
§15.247	Time of Occupancy	Compliant
§15.247	Frequency Separation	Compliant

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun. 08, 2020	Jun. 07, 2021
LISN	R&S	ESH2-Z5	100086	Aug. 24, 2020	Aug. 23, 2021
Test software	R&S	ES-K1 (Ver V1.71)	N/A	N/A	N/A

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 26, 2020	Feb. 25, 2021
Attenuator	ZHINAN	E-002	N/A	Aug. 24, 2020	Aug. 23, 2021
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2017	Sep. 20, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 19, 2020	Sep. 20, 2022
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 12, 2020	Jun. 11, 2021
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 24, 2020	May. 23, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 16, 2019	Oct. 17, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 16, 2020	Oct. 15, 2021
ANTENNA	SCHWARZBECK	VULB9168	D69250	Jan. 09, 2019	Jan. 08, 2021
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

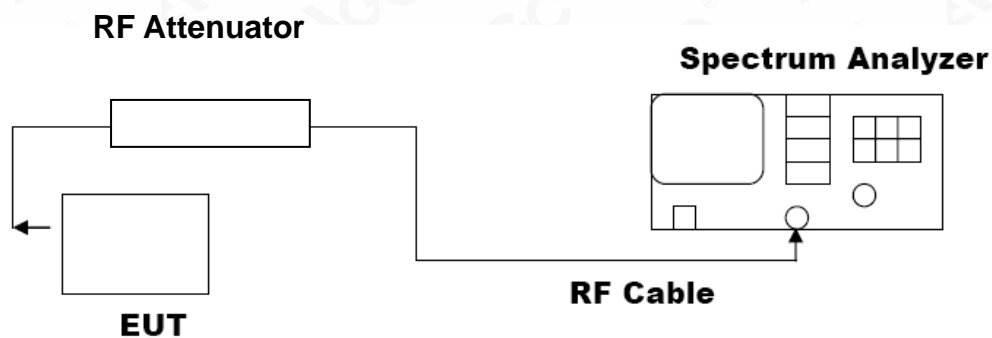
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
3. RBW > 20 dB bandwidth of the emission being measured.
4. VBW \geq RBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



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7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR ASK MODULATION			
Frequency (MHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
902.4	22.016	26	Pass
914.0	19.364	26	Pass
926.0	19.616	26	Pass

Low Channel



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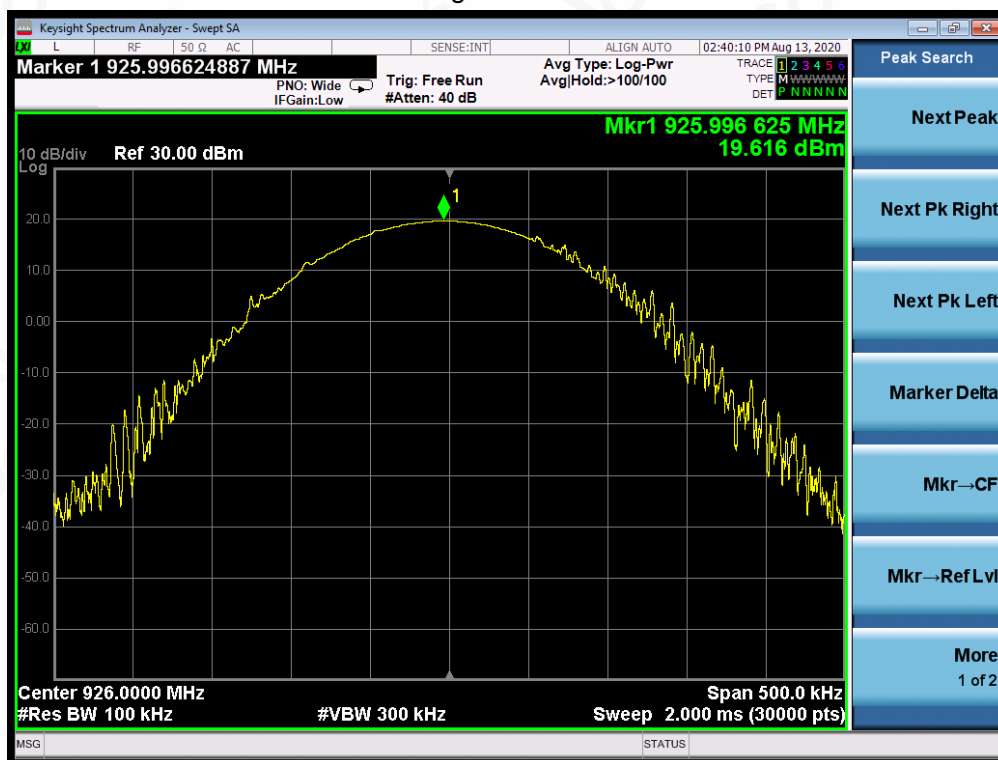
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Middle Channel



High Channel



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8. 20DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
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; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR ASK MOUDULATION			
Applicable Limits	Measurement Result		
	Test Data (kHz)		Criteria
N/A	Low Channel	68.30	PASS
	Middle Channel	65.04	PASS
	High Channel	57.84	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

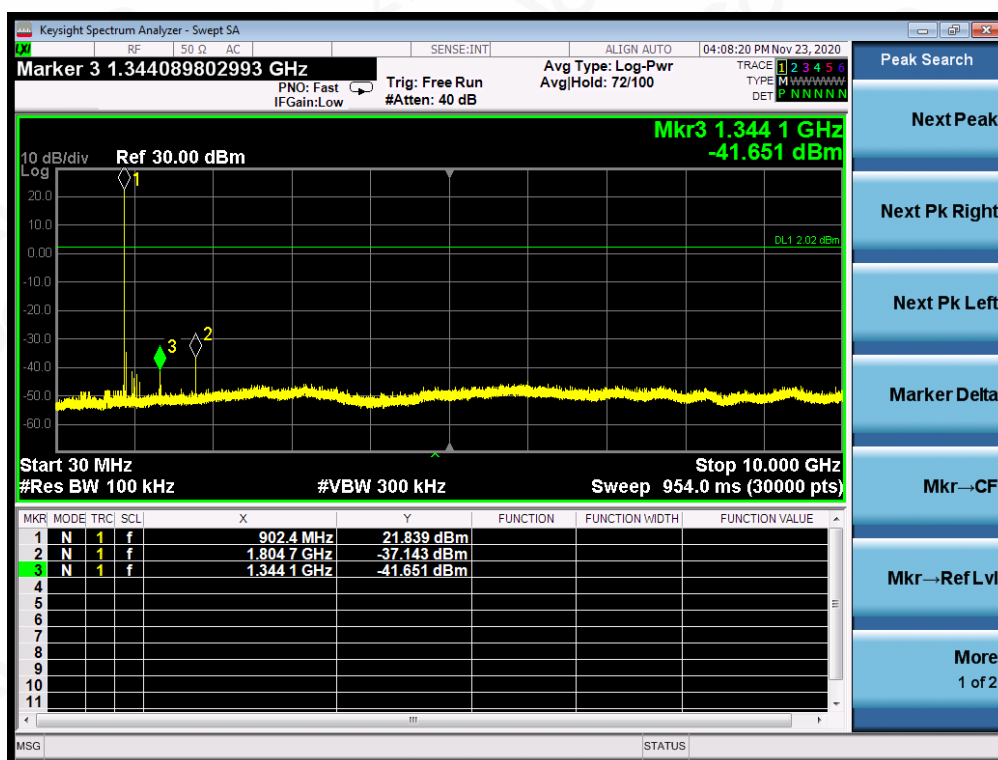
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions 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))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

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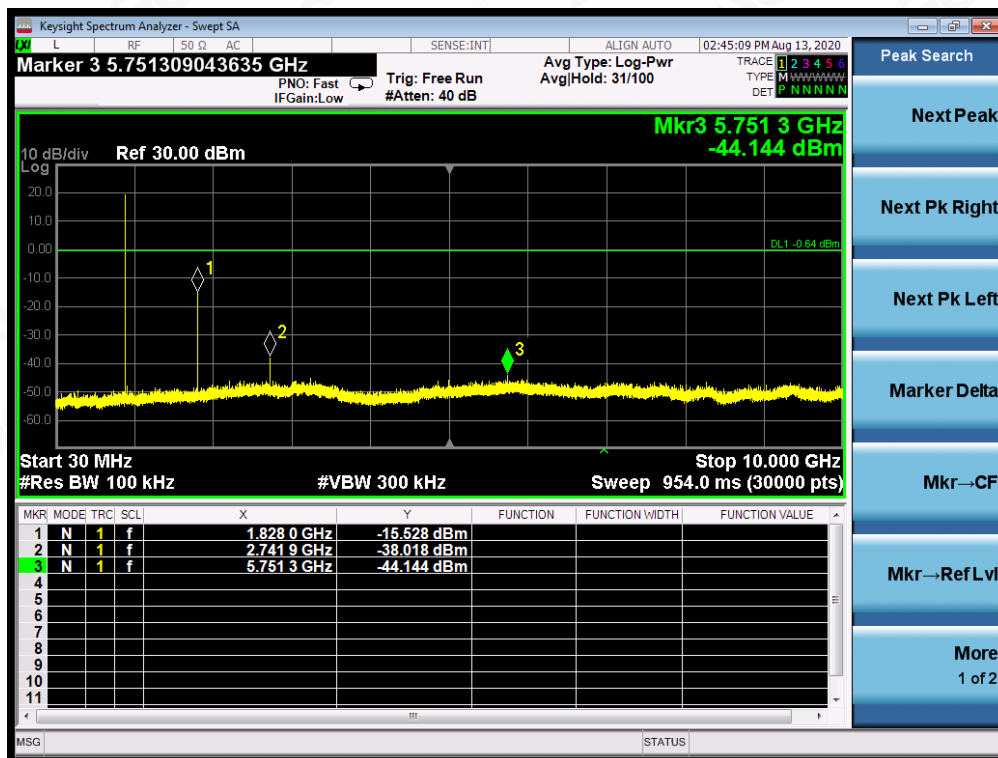
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TEST RESULT FOR ENTIRE FREQUENCY RANGE ASK MODULATION IN LOW CHANNEL



ASK MODULATION IN MIDDLE CHANNEL

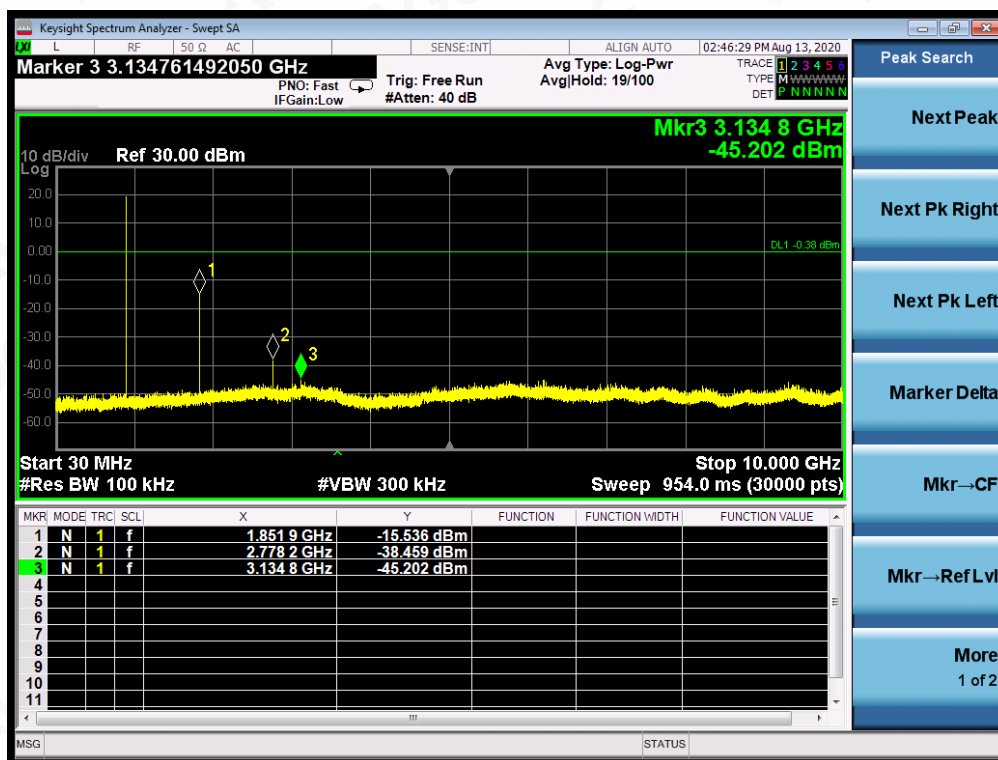


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ASK MODULATION IN HIGH CHANNEL



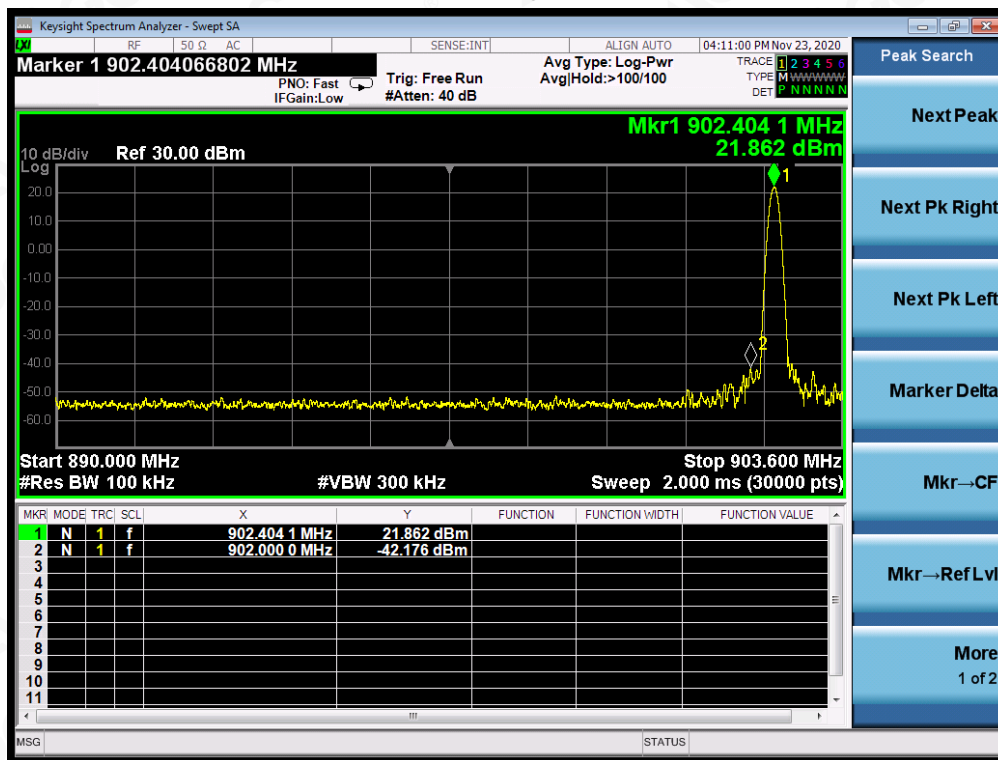
Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

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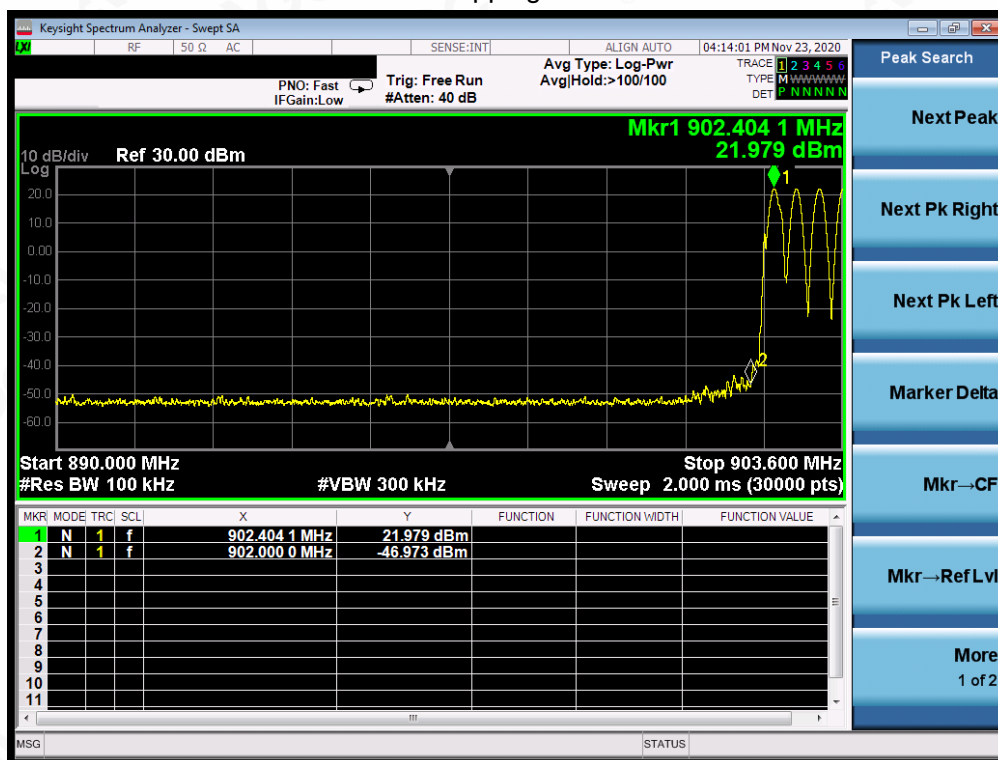
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TEST RESULT FOR BAND EDGE ASK MODULATION IN LOW CHANNEL Hopping off



Hopping on

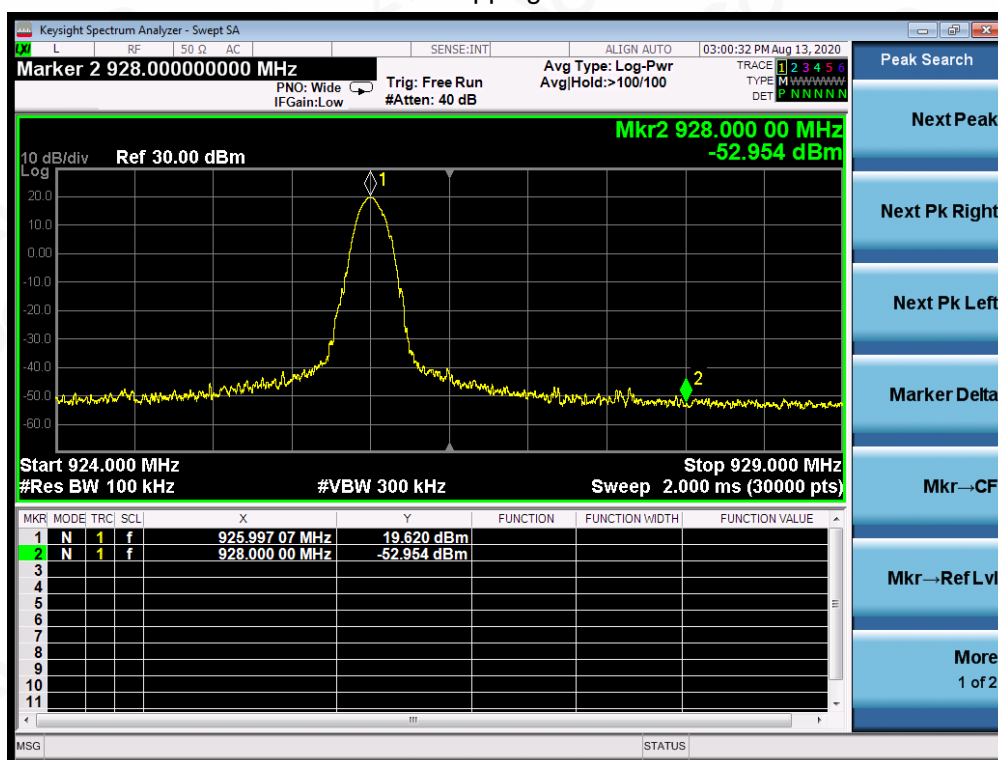


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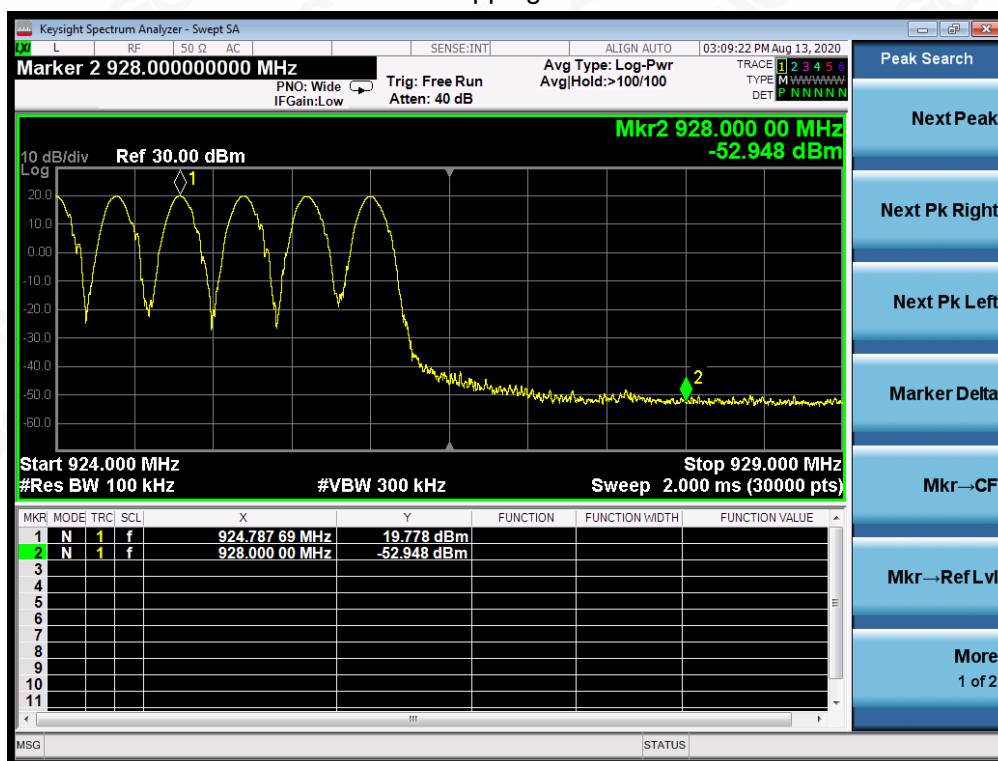
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ASK MODULATION IN HIGH CHANNEL Hopping off



Hopping on



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10. RADIATED EMISSION

10.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

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10.2. TEST SETUP

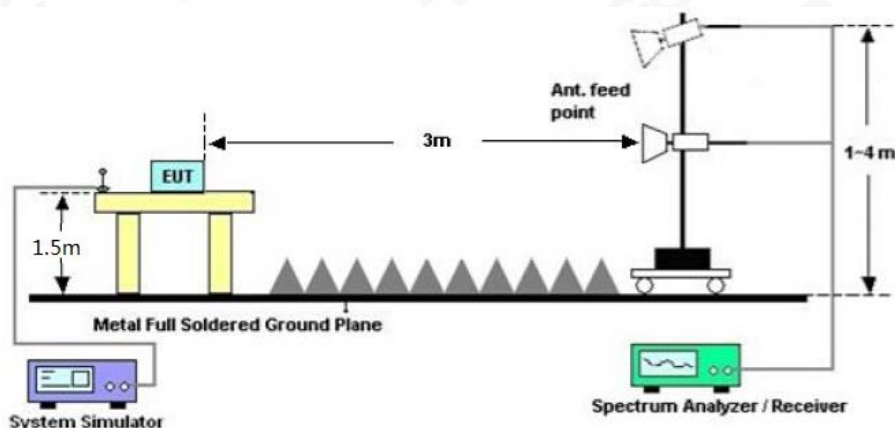
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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10.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

10.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the
permissible value need not be reported.

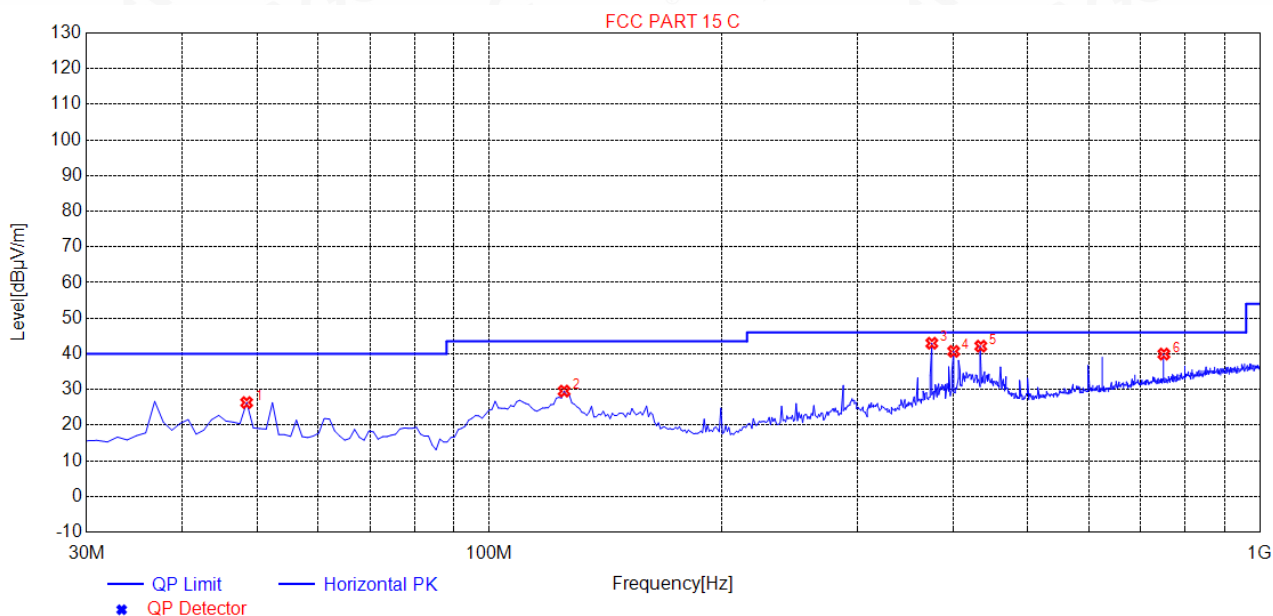
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RADIATED EMISSION BELOW 1GHZ

EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	26.33	11.71	40.00	13.67	200	100	Horizontal
2	125.0600	29.55	13.81	43.50	13.95	200	280	Horizontal
3	375.3200	42.97	18.82	46.00	3.03	100	310	Horizontal
4	400.5400	40.69	19.81	46.00	5.31	100	153	Horizontal
5	434.4900	42.15	20.63	46.00	3.85	200	131	Horizontal
6	750.7100	39.94	27.24	46.00	6.06	100	11	Horizontal

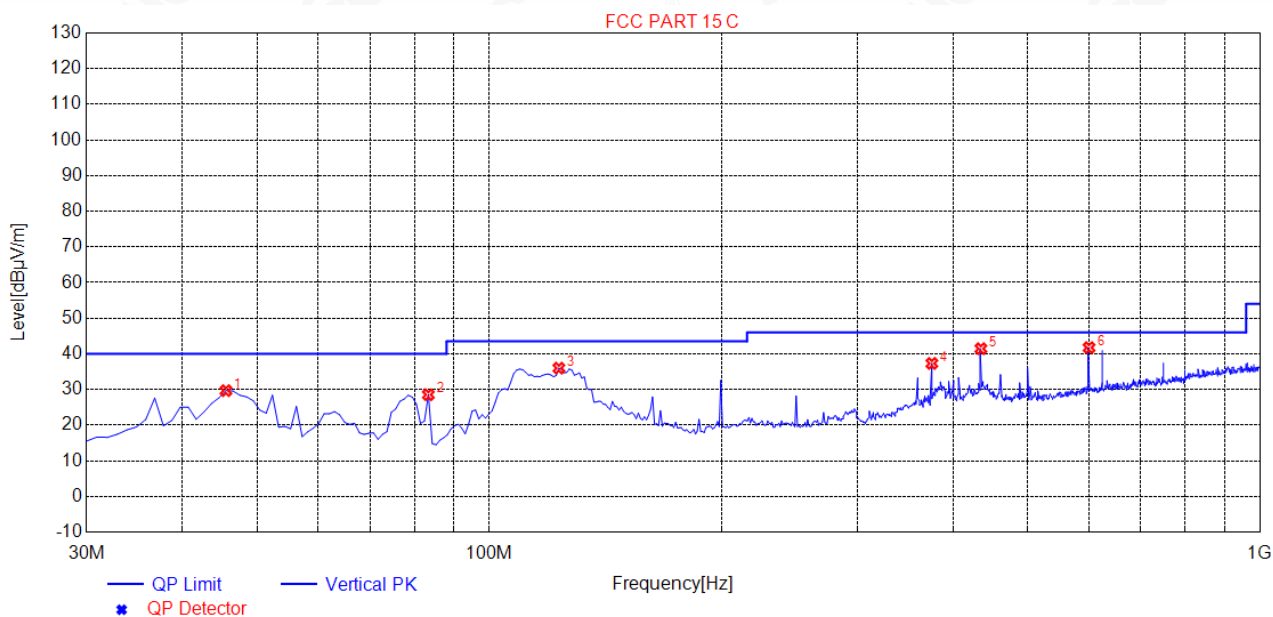
RESULT: PASS

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EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	45.5200	29.68	11.80	40.00	10.32	100	220	Vertical
2	83.3500	28.53	7.18	40.00	11.47	100	210	Vertical
3	123.1200	35.99	13.68	43.50	7.51	100	263	Vertical
4	375.3200	37.31	18.82	46.00	8.69	100	230	Vertical
5	434.4900	41.45	20.63	46.00	4.55	100	359	Vertical
6	600.3600	41.74	24.33	46.00	4.26	100	173	Vertical

RESULT: PASS

Note:

1. Factor=Antenna Factor + Cable loss, Margin= Limit- Measurement.
2. The “Factor” value can be calculated automatically by software of measurement system.
3. All test modes had been pre-tested. The mode 1 is the worst case and recorded in the report.

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RADIATED EMISSION ABOVE 1GHZ

EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2706.003	60.52	-9.27	51.25	74.00	-22.75	peak
2706.003	51.27	-9.27	42.00	54.00	-12.00	AVG
3608.005	58.96	-7.68	51.28	74.00	-22.72	peak
3608.005	49.36	-7.68	41.68	54.00	-12.32	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2706.003	59.36	-9.27	50.09	74.00	-23.91	peak
2706.003	52.54	-9.27	43.27	54.00	-10.73	AVG
3608.005	57.69	-7.68	50.01	74.00	-23.99	peak
3608.005	51.51	-7.68	43.83	54.00	-10.17	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2742.225	60.32	-9.18	51.14	74.00	-22.86	peak
2742.225	51.47	-9.18	42.29	54.00	-11.71	AVG
3656.009	58.38	-7.54	50.84	74.00	-23.16	peak
3656.009	50.21	-7.54	42.67	54.00	-11.33	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2742.225	59.45	-9.18	50.27	74.00	-23.73	peak
2742.225	51.23	-9.18	42.05	54.00	-11.95	AVG
3656.009	58.11	-7.54	50.57	74.00	-23.43	peak
3656.009	50.37	-7.54	42.83	54.00	-11.17	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2778.002	60.85	-9.07	51.78	74.00	-22.22	peak
2778.002	51.37	-9.07	42.30	54.00	-11.70	AVG
3704.005	59.24	-7.38	51.86	74.00	-22.14	peak
3704.005	50.17	-7.38	42.79	54.00	-11.21	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF Card Issuer	Model Name	UD18RW-F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2778.002	60.90	-9.07	51.83	74.00	-22.17	peak
2778.002	52.63	-9.07	43.56	54.00	-10.44	AVG
3704.005	56.99	-7.38	49.61	74.00	-24.39	peak
3704.005	49.38	-7.38	42.00	54.00	-12.00	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

other emissions from 1G~10GHz are attenuated more than 20 dB below the permissible value. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

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11. NUMBER OF HOPPING FREQUENCY

11.1. MEASUREMENT PROCEDURE

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 dB bandwidth, whichever is smaller.
3. VBW \geq RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.
4. Allow the trace to stabilize.

11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

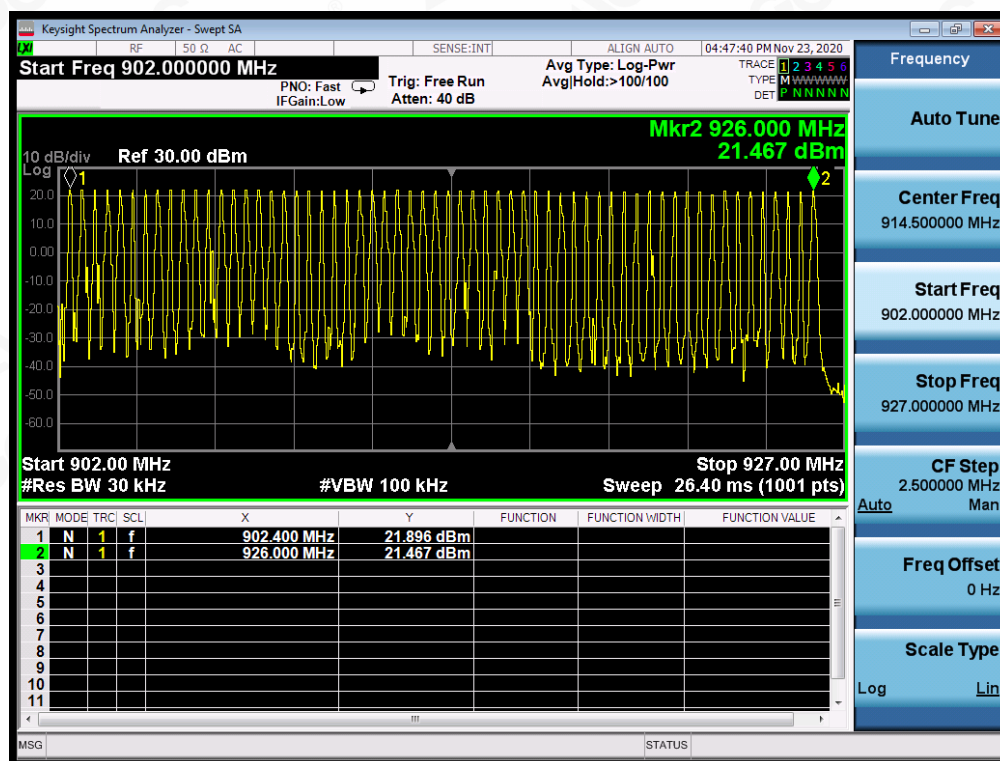
11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

11.4. LIMITS AND MEASUREMENT RESULT

TOTAL NO. OF HOPPING CHANNEL	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
	≥ 50	60	PASS

TEST PLOT FOR NO. OF TOTAL CHANNELS



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12. TIME OF OCCUPANCY (DWELL TIME)

12.1. MEASUREMENT PROCEDURE

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

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be \leq channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) \times (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

12.4. LIMITS AND MEASUREMENT RESULT

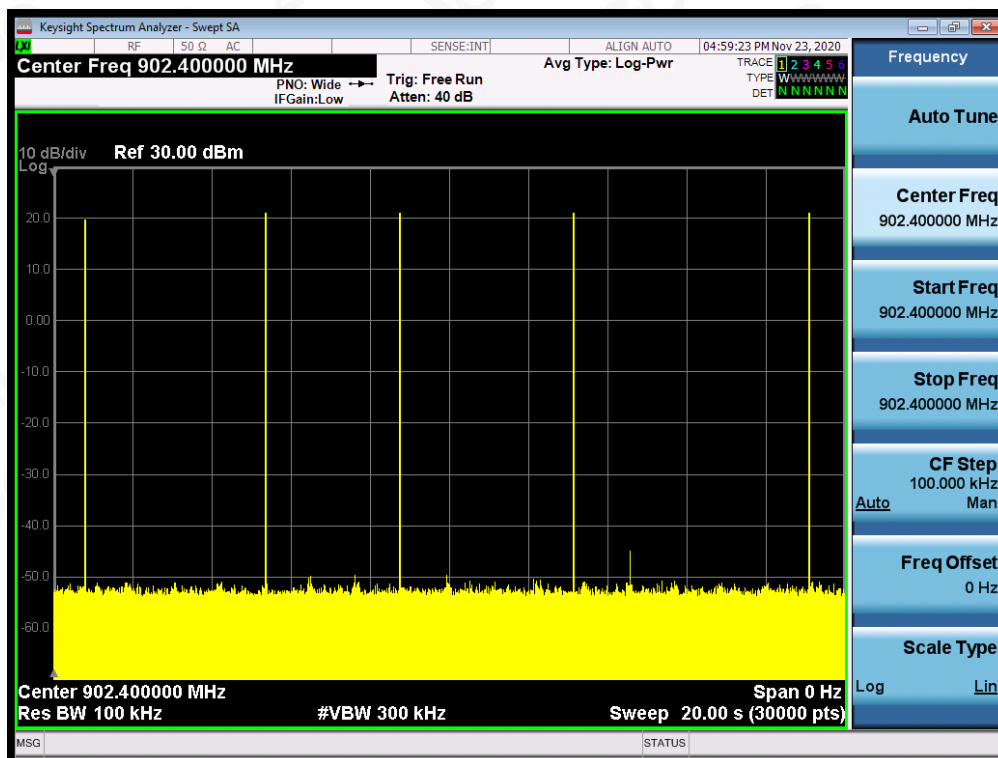
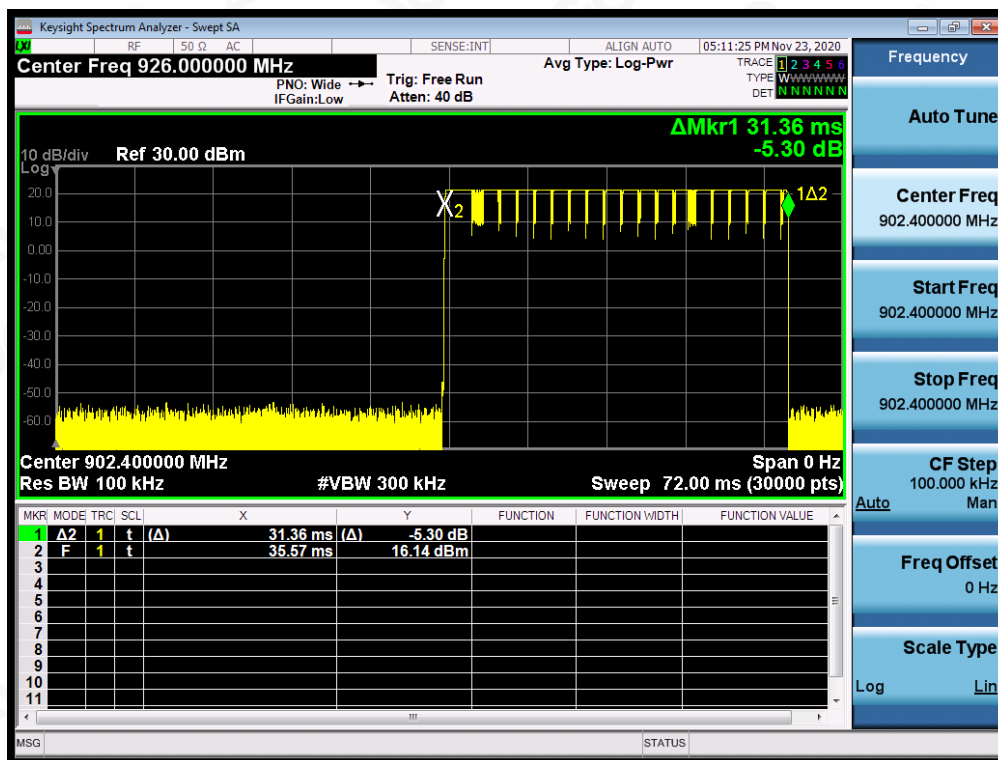
Channel	Time of Pulse (ms)	Number of hops in the period specified in the requirements	Dwell Time (ms)	Limit (ms)
Low	31.36	5	156.8	400
Middle	29.40	5	147.0	400
High	29.66	5	148.3	400

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TEST PLOT OF LOW CHANNEL

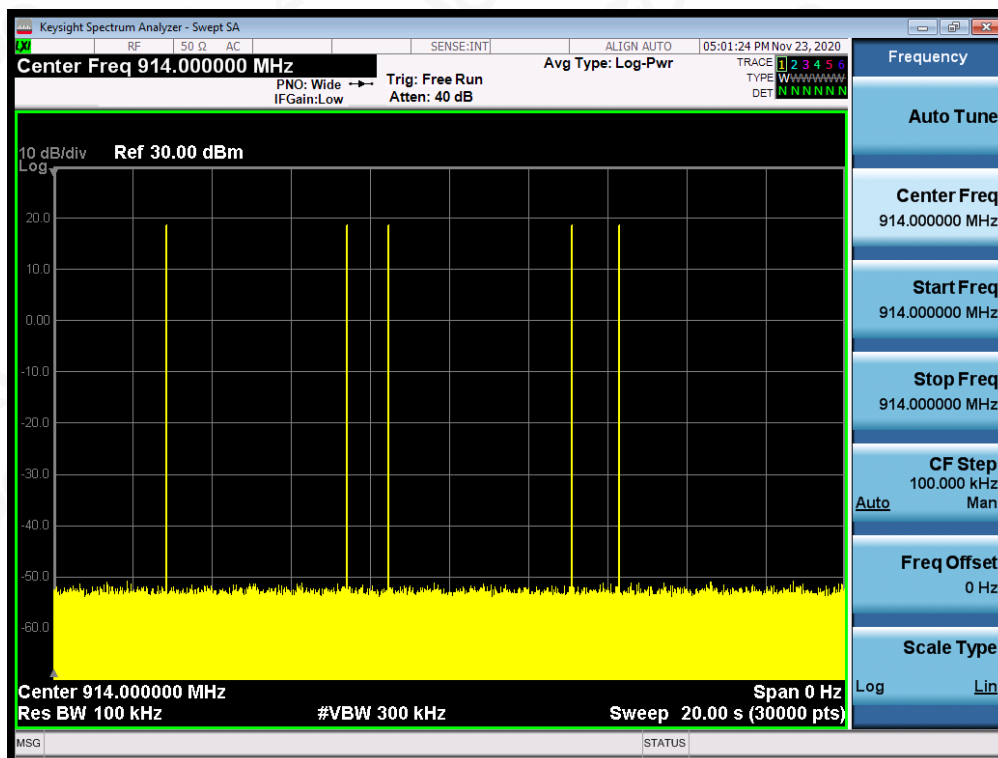
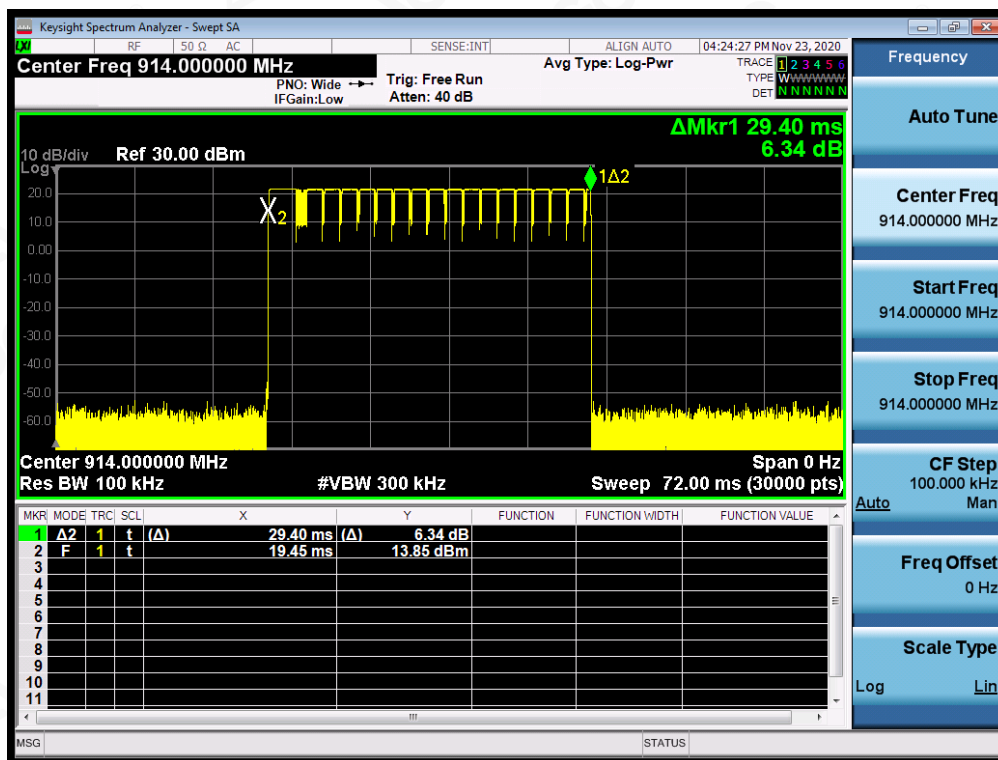


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TEST PLOT OF MIDDLE CHANNEL

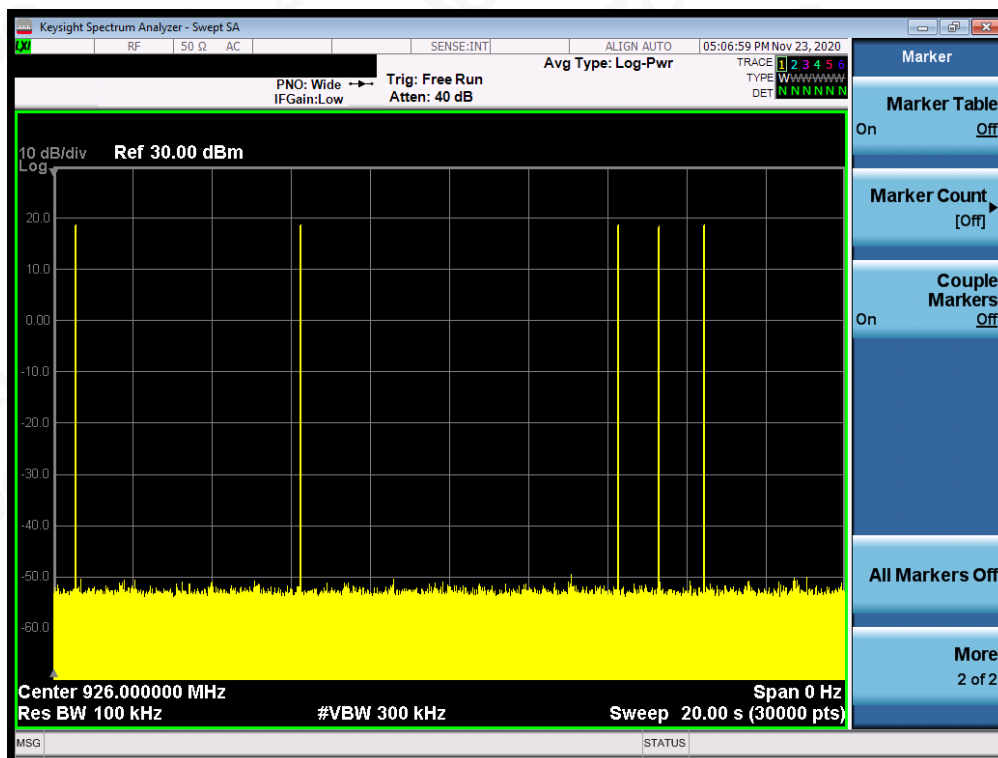
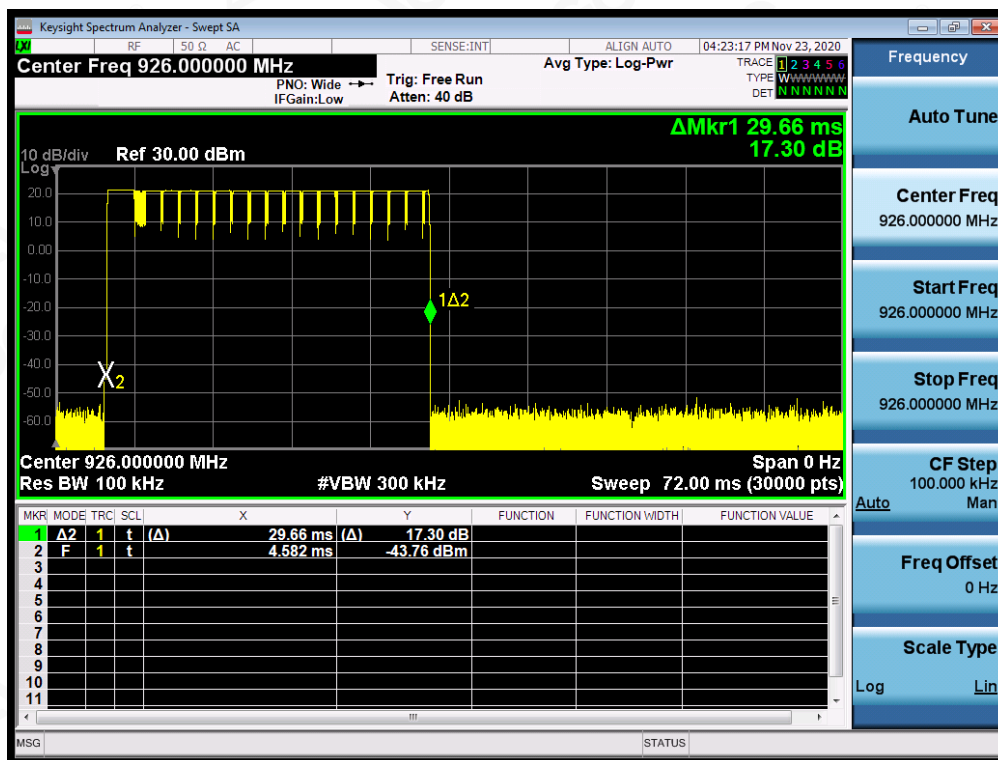


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TEST PLOT OF HIGH CHANNEL



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13. FREQUENCY SEPARATION

13.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. 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. Video (or average) bandwidth (VBW) \geq RBW.
4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

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

13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

13.4. LIMITS AND MEASUREMENT RESULT

CHANNEL	CHANNEL SEPARATION	LIMIT	RESULT
	KHz	KHz	
CH01-CH02	383.6	≥ 20 dB BW	Pass

TEST PLOT FOR FREQUENCY SEPARATION



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