RADIO TEST REPORT

Report No: STS2007111W01

Issued for

LYNQ Technologies, Inc.

19 Morris Avenue Building 128, Brooklyn, NY, 11205, USA

Product Name:	Lynq Network Stack Module
Brand Name:	Lynq
Model Name:	LNQNSM01
Series Model:	LNQNSM
FCC ID:	2ARHMLNQNSM01
IC:	24896-LYNQNSM01
Test Standard:	FCC Part 15.247 RSS-247 Issue 2, February 2017 RSS-Gen Issue 5, March 2019

Shenzhen STS Test Services Co., Ltd.
A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ,
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TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com

TEST RESULT CERTIFICATION

Applicant's Name ..... :	LYNQ Technologies, Inc.
Address ..... :	19 Morris Avenue Building 128, Brooklyn, NY, 11205, USA
Manufacturer's Name ..... :	Season Group
Address ..... :	Unit 3, 5/F Sun Fung Industrial Building, 8 Ma Kok Street, Tsuen Wan, New Territories, Hong Kong

Product Description

Product Name ..... :	Lynq Network Stack Module
Brand Name ..... :	Lynq
Model Name ..... :	LNQNSM01
Series Model ..... :	LNQNSM
Test Standards ..... :	FCC Part15.247 RSS-247 Issue 2, February 2017 RSS-Gen Issue 5, March 2019
Test Procedure ..... :	ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC/IC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test.....:

Date of receipt of test item.....:	31 July 2020
Date (s) of performance of tests .:	31 July 2020 ~ 26 Aug. 2020
Date of Issue .....:	26 Aug. 2020
Test Result .....:	Pass

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Vita Li

(Vita Li)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	26 Aug. 2020	STS2007111W01	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247,Subpart C RSS-247 Issue 2			
Standard Section	Test Item	Judgment	Remark
15.207 RSS-Gen (8.8)	Conducted Emission	PASS	--
15.247(a)(1) RSS-247 (5.1)	Hopping Channel Separation	PASS	--
15.247(b)(2) RSS-247 (5.1)	Output Power	PASS	--
15.209 RSS-247 (5.5)	Radiated Spurious Emission	PASS	--
15.247(d) RSS-247 (5.5)	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(1)(i) RSS-247 (5.1)	Number of Hopping Frequency	PASS	--
15.247(f) RSS-247 (5.1)	Dwell Time	PASS	--
15.247(a)(1) RSS-247 (5.1) RSS-Gen (6.7)	20dB Bandwidth 99% Bandwidth	PASS	--
15.205 RSS-Gen (8.9&8.10)	Restricted bands of operation	PASS	--
Part 15.247(d)/part 15.209(a) RSS-247 (5.5)	Band Edge Emission	PASS	--
15.203 RSS-Gen (6.8)	Antenna Requirement	PASS	--
RSS-Gen (6.11&8.11)	Frequency Stability	PASS	--

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
FCC test Firm Registration Number: 625569
IC test Firm Registration Number: 12108A
A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±6.7dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±4.43dB
7	Conducted Emission (150KHz-30MHz)	±5dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Lynq Network Stack Module
Trade Name	Lynq
Model Name	LNQNSM01
Series Model	LNQNSM
Model Difference	Only difference in model name.
Channel List	Please refer to the Note 2.
Frequency	902.475-927.525 MHz(125KHz)
Modulation Type	LoRa
Power Rating	DC 3.6V
Hardware version number	r6
Software version number	r6
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.

2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.475	/	/	/	/
2	902.625	75	915.075	/	/
3	902.775	76	915.225	/	/
/	/	77	915.375	/	/
/	/	/	/	147	927.225
/	/	/	/	148	927.375
/	/	/	/	149	927.525

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	Lynq	LNQNSM01	PCB	N/A	0	Antenna

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Modulation
Mode 1	TX CH01	LoRa
Mode 2	TX CH75	LoRa
Mode 3	TX CH149	LoRa

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report.

For AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 4 : Keeping EUT TX

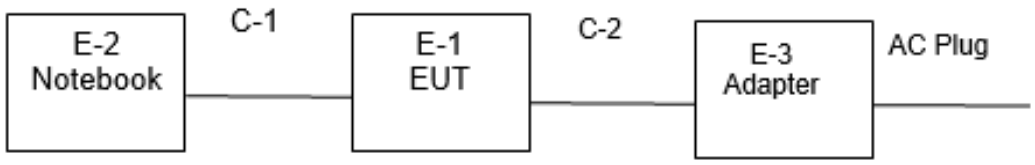
2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

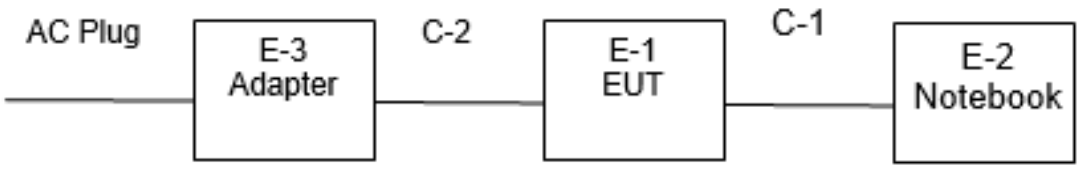
RF Function	Type	Mode Or Modulation type	Ant Gain(dBi)	Power Class	Software For Testing
LORA	125KHz	902MHz-928MHz	0	30	fcc-fixed

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Emission Test



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-3	Adapter	LITEON	PA-1650-86	N/A	N/A
C-2	DC Cable	N/A	N/A	110cm	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Notebook	Lenovo	ThinkPad E470	N/A	N/A
C-1	USB Cable	N/A	N/A	120cm	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in『Length』column.

2.6 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier(0.1M-3GHz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2019.10.12	2020.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2019.10.12	2020.10.11
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Band Reject filter (902-928MHz)	XINCBOKEJI	XBLBQ-DZA05	902-928MHz	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.10.09	2020.10.08
LISN	R&S	ENV216	101242	2019.10.09	2020.10.08
LISN	EMCO	3810/2NM	23625	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
Test SW	FARAD	LZ-RF /LzRf-3A3			

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on art 207(a)&RSS-Gen limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

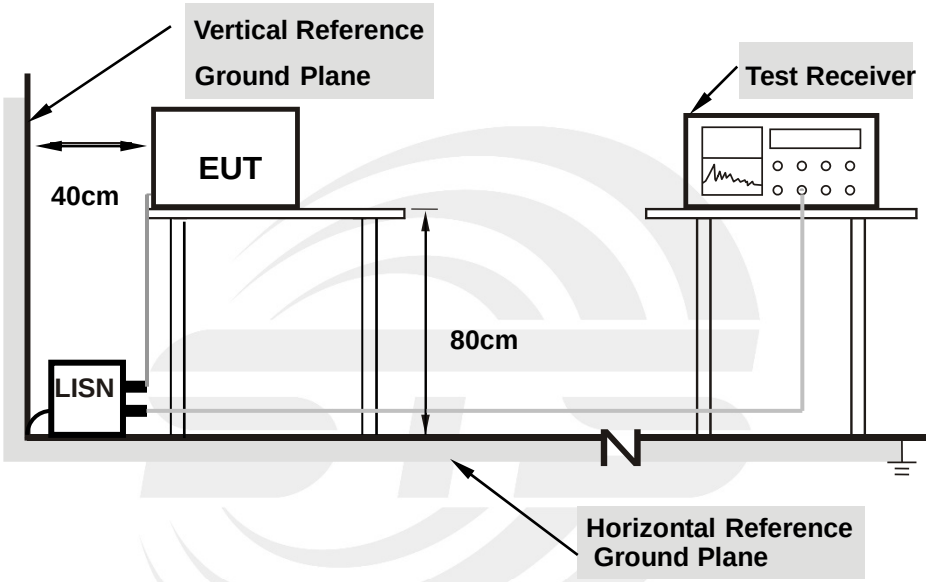
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 EUT OPERATING CONDITIONS

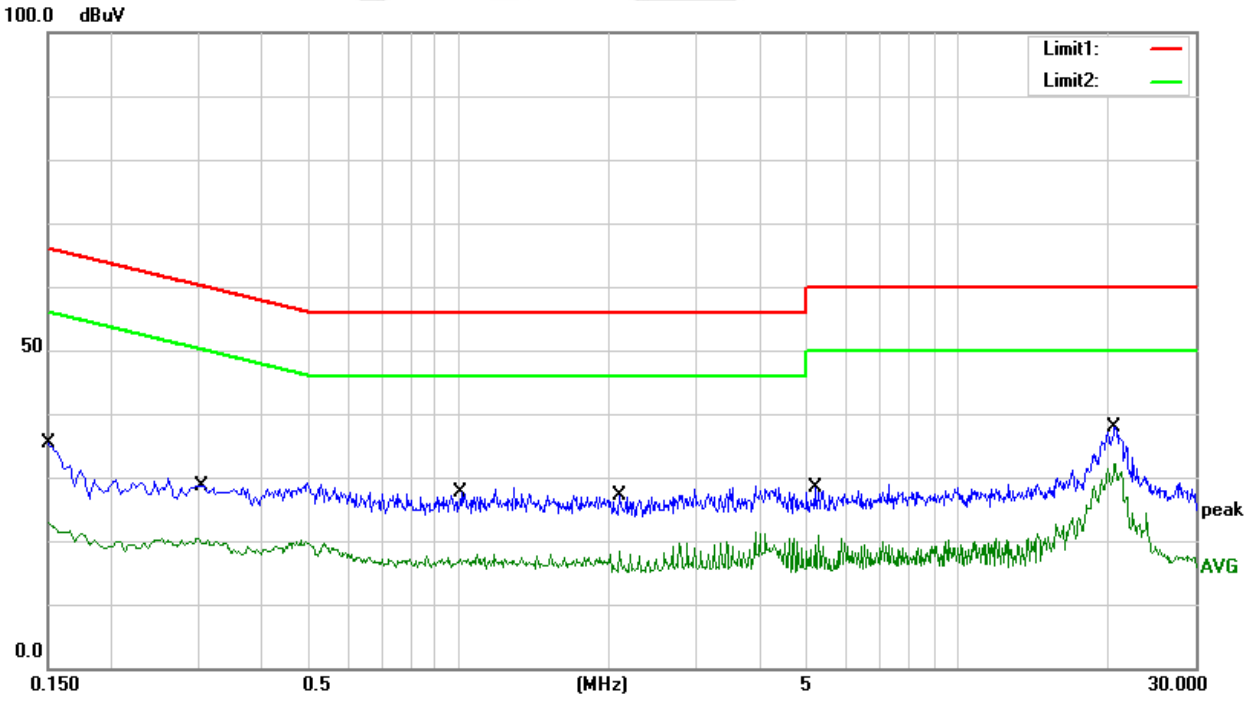
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.5 TEST RESULT

Temperature:	27.4(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	15.20	20.23	35.43	66.00	-30.57	QP
2	0.1500	2.70	20.23	22.93	56.00	-33.07	AVG
3	0.3060	8.00	20.71	28.71	60.08	-31.37	QP
4	0.3060	-0.26	20.71	20.45	50.08	-29.63	AVG
5	1.0140	7.57	20.16	27.73	56.00	-28.27	QP
6	1.0140	-2.40	20.16	17.76	46.00	-28.24	AVG
7	2.1100	7.16	20.05	27.21	56.00	-28.79	QP
8	2.1100	-1.58	20.05	18.47	46.00	-27.53	AVG
9	5.1780	8.37	19.94	28.31	60.00	-31.69	QP
10	5.1780	0.96	19.94	20.90	50.00	-29.10	AVG
11	20.6100	17.20	20.62	37.82	60.00	-22.18	QP
12	20.6100	11.60	20.62	32.22	50.00	-17.78	AVG

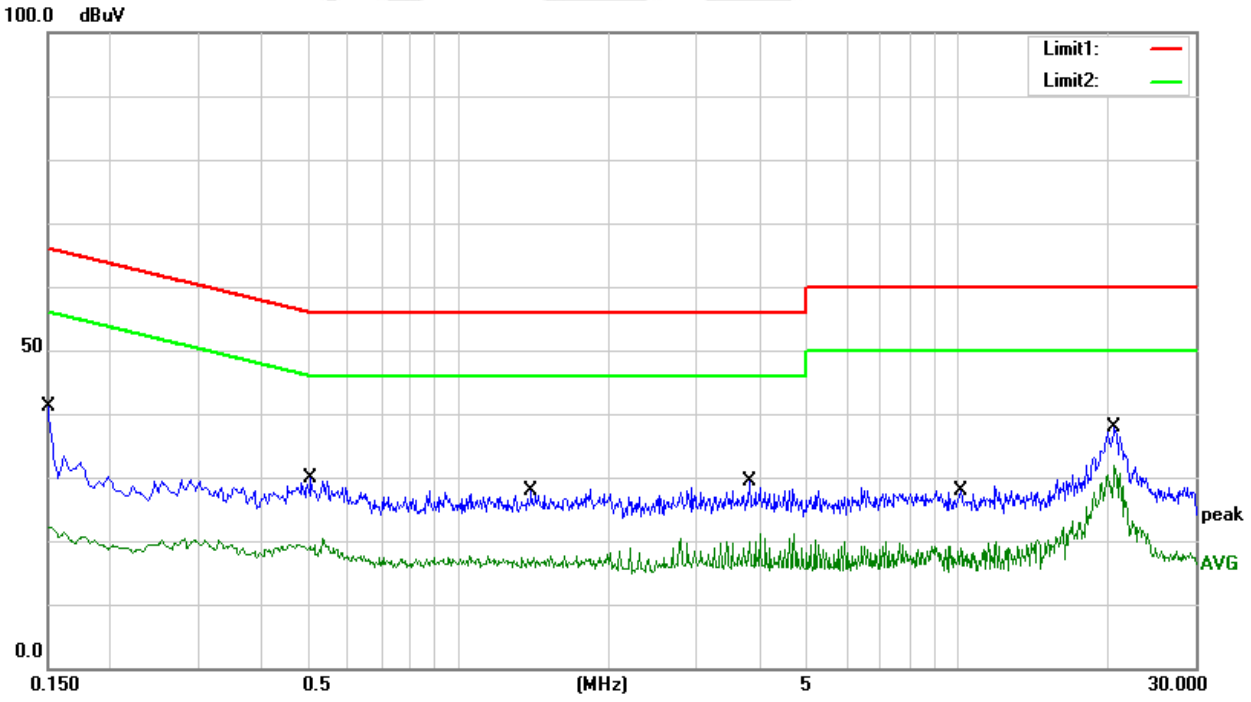
Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter（10dB）



Temperature:	27.4(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	20.90	20.23	41.13	66.00	-24.87	QP
2	0.1500	2.01	20.23	22.24	56.00	-33.76	AVG
3	0.5060	9.30	20.47	29.77	56.00	-26.23	QP
4	0.5060	-1.18	20.47	19.29	46.00	-26.71	AVG
5	1.4020	7.76	20.12	27.88	56.00	-28.12	QP
6	1.4020	-2.69	20.12	17.43	46.00	-28.57	AVG
7	3.8340	9.37	19.96	29.33	56.00	-26.67	QP
8	3.8340	-0.01	19.96	19.95	46.00	-26.05	AVG
9	10.1580	7.75	20.13	27.88	60.00	-32.12	QP
10	10.1580	-1.31	20.13	18.82	50.00	-31.18	AVG
11	20.6100	17.15	20.62	37.77	60.00	-22.23	QP
12	20.6100	11.27	20.62	31.89	50.00	-18.11	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter（10dB）



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a), RSS-Gen Issue 5 and RSS-247 Issue 2, February 2017 (5.5) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

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

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

IC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz(Peak/QP/AV)
Stop Frequency	150KHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/ 3 MHz(AVG)

For Band Edge

Note: The EUT main frequency is too far away from the restricted band, so the band edge of the radiation method is not tested.

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) 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.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

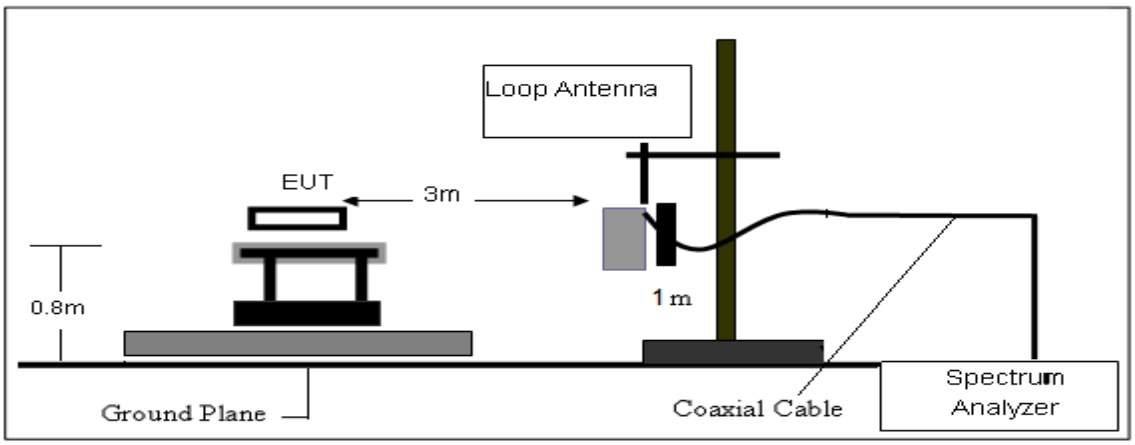
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

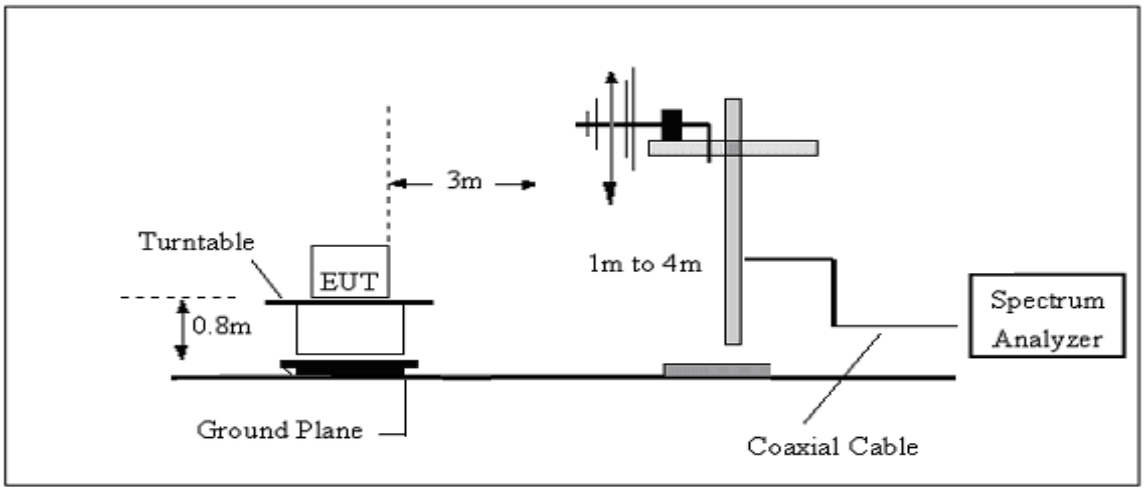
No deviation.

3.2.4 TESTSETUP

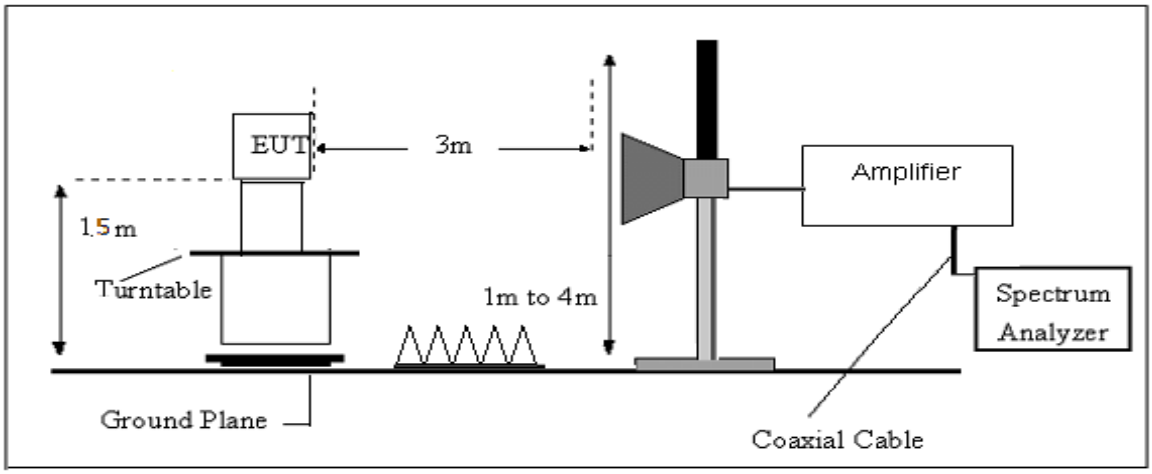
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.3(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Test Mode:	TX Mode

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

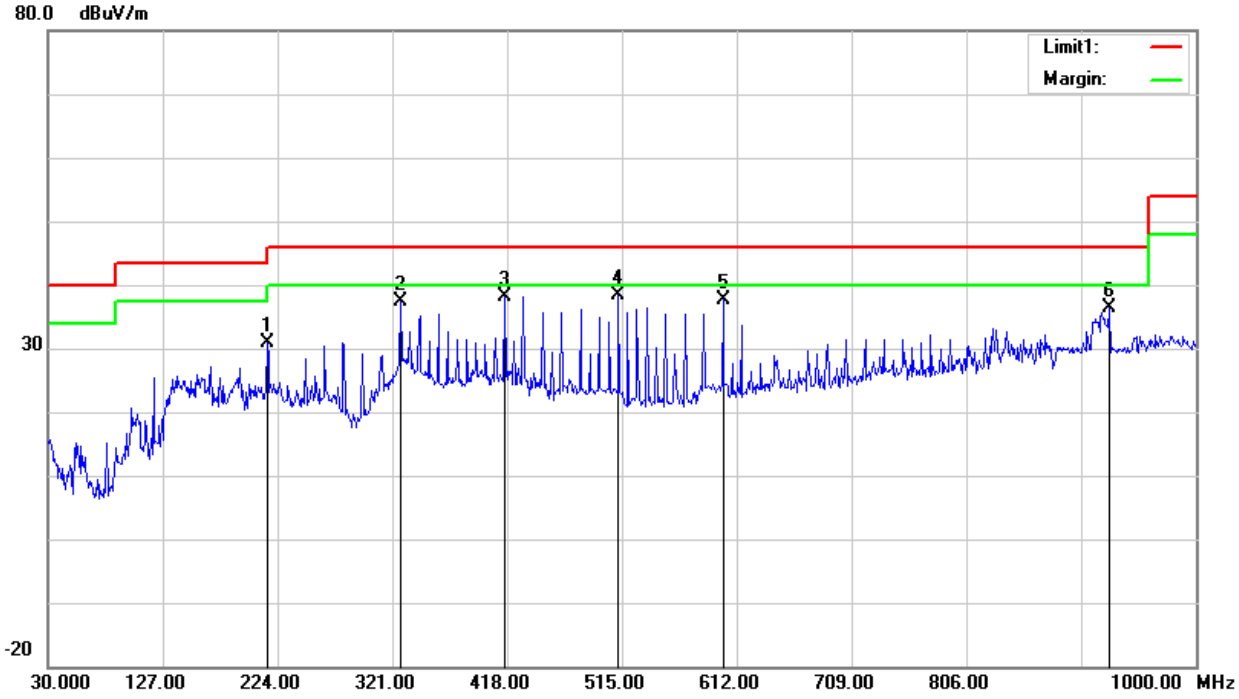
Limit line = specific limits (dBuv) + distance extrapolation factor.

(30MHz-1000MHz)

Temperature:	23.3(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Phase:	Horizontal
Test Mode:	Mode 1/2/3(Mode 3 worst case)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	215.2700	50.93	-20.17	30.76	43.50	-12.74	QP
2	327.7900	51.26	-13.77	37.49	46.00	-8.51	QP
3	416.0600	48.50	-10.28	38.22	46.00	-7.78	QP
4	512.0900	46.39	-7.92	38.47	46.00	-7.53	QP
5	600.3600	43.48	-5.84	37.64	46.00	-8.36	QP
6	927.2500	35.95	0.39	36.34	46.00	-9.66	QP

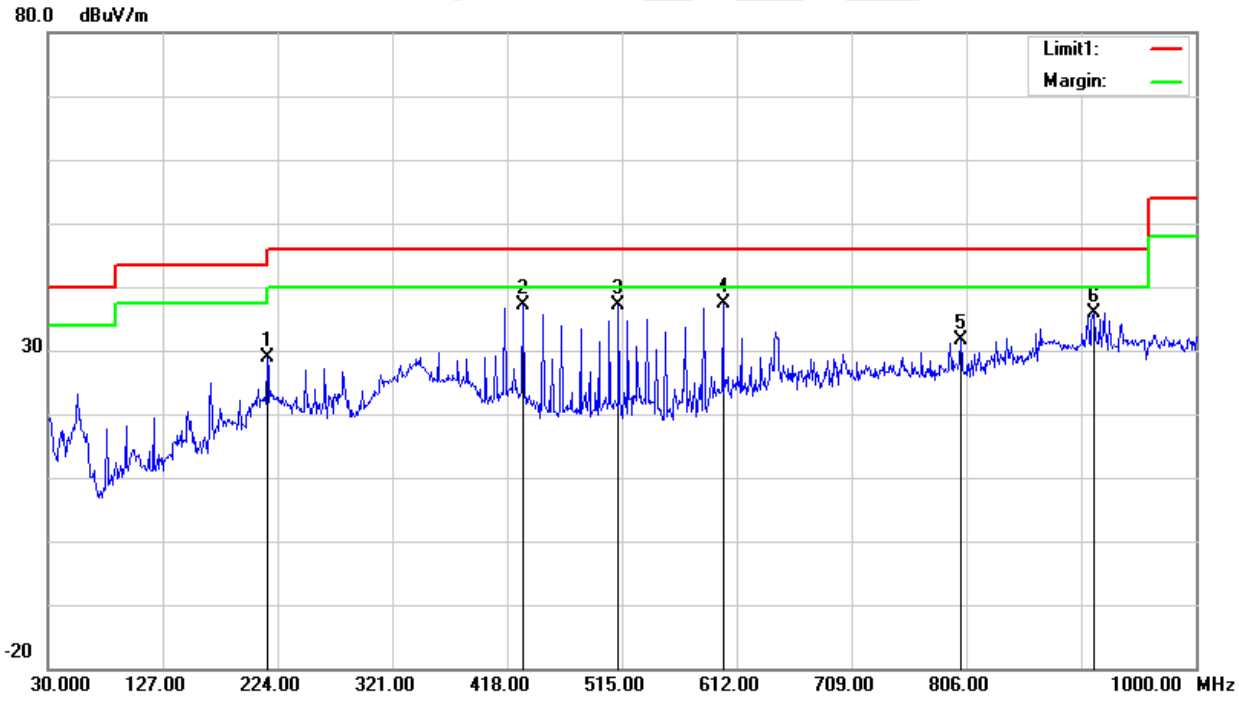
Remark:
1. Margin = Result (Result =Reading + Factor)–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



Temperature:	23.3(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Phase:	Vertical
Test Mode:	Mode 1/2/3(Mode 3 worst case)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	215.2700	49.02	-20.17	28.85	43.50	-14.65	QP
2	431.5800	47.16	-10.13	37.03	46.00	-8.97	QP
3	512.0900	44.99	-7.92	37.07	46.00	-8.93	QP
4	600.3600	43.13	-5.84	37.29	46.00	-8.71	QP
5	801.1500	33.56	-2.04	31.52	46.00	-14.48	QP
6	913.6700	36.03	-0.13	35.90	46.00	-10.10	QP

Remark:
1. Margin = Result (Result =Reading + Factor)–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



(1GHz~25GHz) Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	（dB）	（dB）	（dB/m）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	Type	
Low Channel (902.475 MHz)										
1226.62	62.01	44.70	6.70	28.20	-9.80	52.21	74.00	-21.79	PK	Vertical
1226.62	51.53	44.70	6.70	28.20	-9.80	41.73	54.00	-12.27	AV	Vertical
1226.59	61.31	44.70	6.70	28.20	-9.80	51.51	74.00	-22.49	PK	Horizontal
1226.59	51.31	44.70	6.70	28.20	-9.80	41.51	54.00	-12.49	AV	Horizontal
1805.16	58.26	44.20	9.04	31.60	-3.56	54.70	74.00	-19.30	PK	Vertical
1805.16	50.40	44.20	9.04	31.60	-3.56	46.84	54.00	-7.16	AV	Vertical
1805.16	58.69	44.20	9.04	31.60	-3.56	55.13	74.00	-18.87	PK	Horizontal
1805.16	49.38	44.20	9.04	31.60	-3.56	45.82	54.00	-8.18	AV	Horizontal
2013.81	48.86	44.20	9.86	32.00	-2.34	46.52	74.00	-27.48	PK	Vertical
2013.81	39.04	44.20	9.86	32.00	-2.34	36.70	54.00	-17.30	AV	Vertical
2013.77	48.47	44.20	9.86	32.00	-2.34	46.13	74.00	-27.87	PK	Horizontal
2013.77	38.57	44.20	9.86	32.00	-2.34	36.23	54.00	-17.77	AV	Horizontal
2707.38	54.03	43.50	11.40	35.50	3.40	57.43	74.00	-16.57	PK	Vertical
2707.38	44.15	43.50	11.40	35.50	3.40	47.55	54.00	-6.45	AV	Vertical
2707.39	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Horizontal
2707.39	44.19	43.50	11.40	35.50	3.40	47.59	54.00	-6.41	AV	Horizontal
Middle Channel (915.075 MHz)										
1223.89	62.17	44.70	6.70	28.20	-9.80	52.37	74.00	-21.63	PK	Vertical
1223.89	51.50	44.70	6.70	28.20	-9.80	41.70	54.00	-12.30	AV	Vertical
1223.81	61.28	44.70	6.70	28.20	-9.80	51.48	74.00	-22.52	PK	Horizontal
1223.81	51.25	44.70	6.70	28.20	-9.80	41.45	54.00	-12.55	AV	Horizontal
1830.27	59.46	44.20	9.04	31.60	-3.56	55.90	74.00	-18.10	PK	Vertical
1830.27	50.08	44.20	9.04	31.60	-3.56	46.52	54.00	-7.48	AV	Vertical
1830.27	58.35	44.20	9.04	31.60	-3.56	54.79	74.00	-19.21	PK	Horizontal
1830.27	50.50	44.20	9.04	31.60	-3.56	46.94	54.00	-7.06	AV	Horizontal
2009.26	49.32	44.20	9.86	32.00	-2.34	46.98	74.00	-27.02	PK	Vertical
2009.26	39.63	44.20	9.86	32.00	-2.34	37.29	54.00	-16.71	AV	Vertical
2009.23	47.54	44.20	9.86	32.00	-2.34	45.20	74.00	-28.80	PK	Horizontal
2009.23	39.04	44.20	9.86	32.00	-2.34	36.70	54.00	-17.30	AV	Horizontal
2745.51	53.81	43.50	11.40	35.50	3.40	57.21	74.00	-16.79	PK	Vertical
2745.51	44.09	43.50	11.40	35.50	3.40	47.49	54.00	-6.51	AV	Vertical
2745.51	54.33	43.50	11.40	35.50	3.40	57.73	74.00	-16.27	PK	Horizontal
2745.51	43.57	43.50	11.40	35.50	3.40	46.97	54.00	-7.03	AV	Horizontal

High Channel (927.525 MHz)										
1221.04	61.18	44.70	6.70	28.20	-9.80	51.38	74.00	-22.62	PK	Vertical
1221.04	51.31	44.70	6.70	28.20	-9.80	41.51	54.00	-12.49	AV	Vertical
1220.97	61.12	44.70	6.70	28.20	-9.80	51.32	74.00	-22.68	PK	Horizontal
1220.97	50.54	44.70	6.70	28.20	-9.80	40.74	54.00	-13.26	AV	Horizontal
1855.27	58.83	44.20	9.04	31.60	-3.56	55.27	74.00	-18.73	PK	Vertical
1855.27	49.80	44.20	9.04	31.60	-3.56	46.24	54.00	-7.76	AV	Vertical
1855.20	59.41	44.20	9.04	31.60	-3.56	55.85	74.00	-18.15	PK	Horizontal
1855.20	50.43	44.20	9.04	31.60	-3.56	46.87	54.00	-7.13	AV	Horizontal
2004.55	48.67	44.20	9.86	32.00	-2.34	46.33	74.00	-27.67	PK	Vertical
2004.55	40.08	44.20	9.86	32.00	-2.34	37.74	54.00	-16.26	AV	Vertical
2004.60	47.61	44.20	9.86	32.00	-2.34	45.27	74.00	-28.73	PK	Horizontal
2004.60	39.53	44.20	9.86	32.00	-2.34	37.19	54.00	-16.81	AV	Horizontal
2782.48	53.95	43.50	11.40	35.50	3.40	57.35	74.00	-16.65	PK	Vertical
2782.48	44.30	43.50	11.40	35.50	3.40	47.70	54.00	-6.30	AV	Vertical
2782.45	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Horizontal
2782.45	44.30	43.50	11.40	35.50	3.40	47.70	54.00	-6.30	AV	Horizontal

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

   Emission Level = Reading + Factor

2) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d)&RSS-247 Issue 2, February 2017 (5.5), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 901.975– 902.975 MHz Upper Band Edge: 927.025 – 928.025 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Hopping Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 890– 903 MHz Upper Band Edge: 926 – 935 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

4.3 TEST SETUP

The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

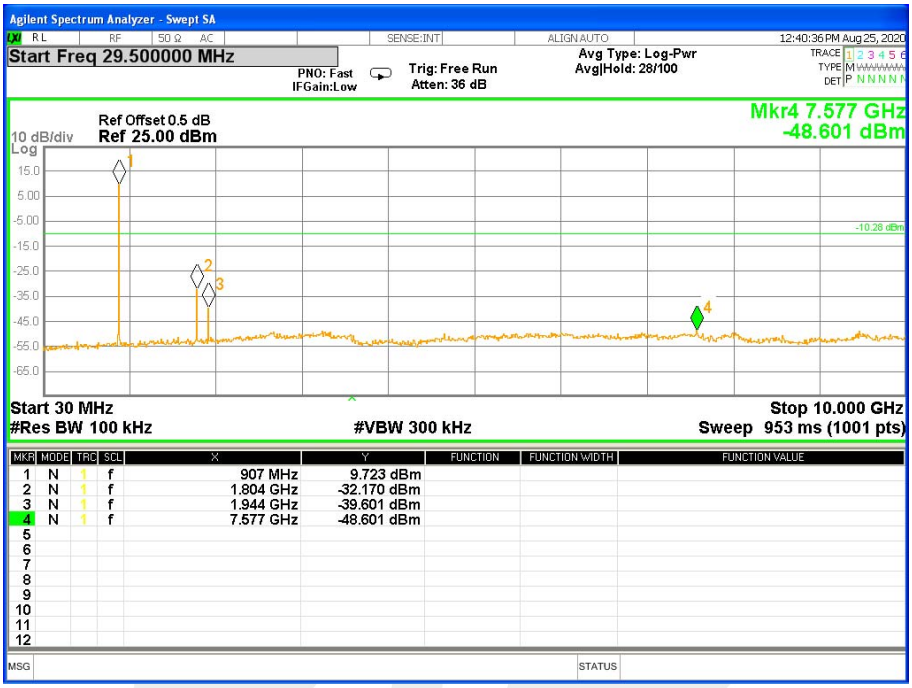
4.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

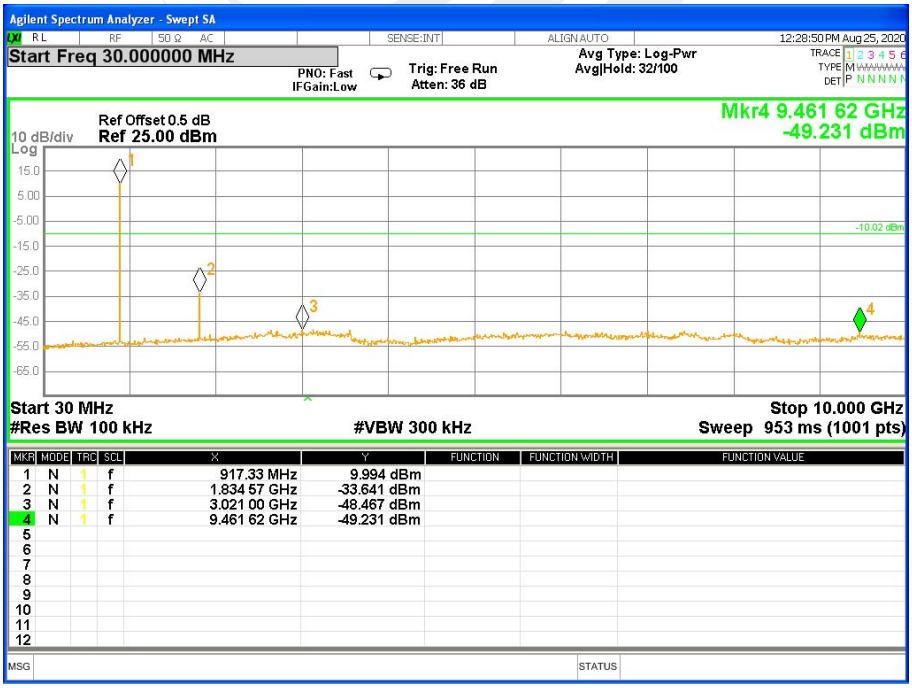
4.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	LoRa-01/75/149 CH	Test Voltage:	DC 3.6V

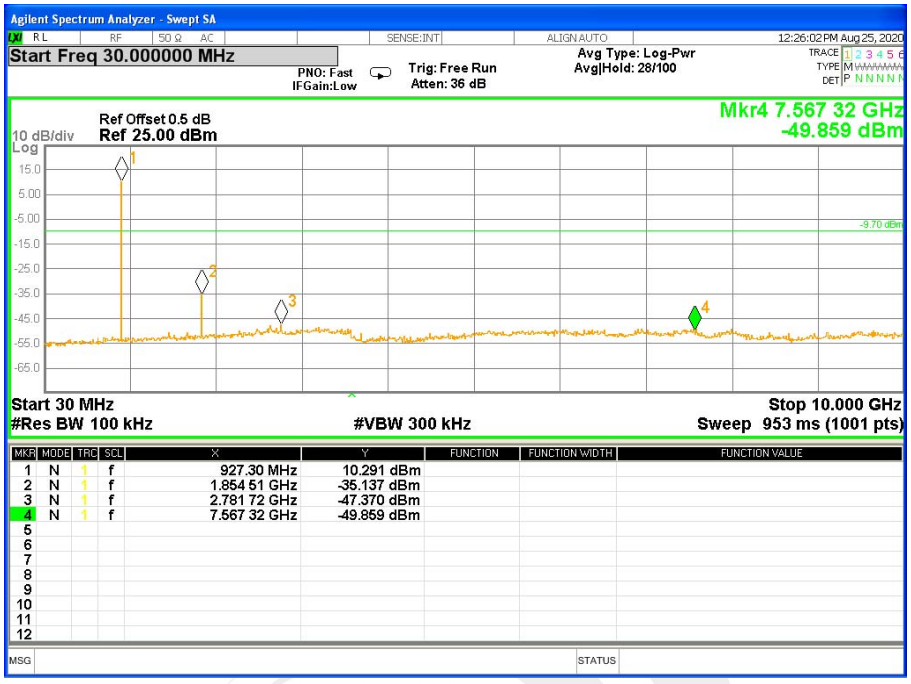
01 CH



75 CH

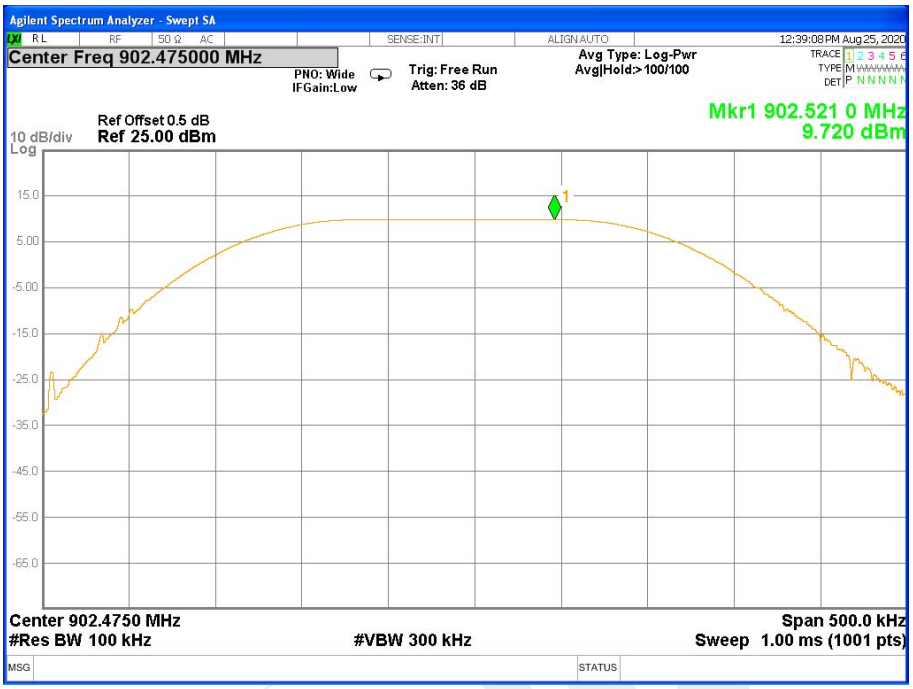


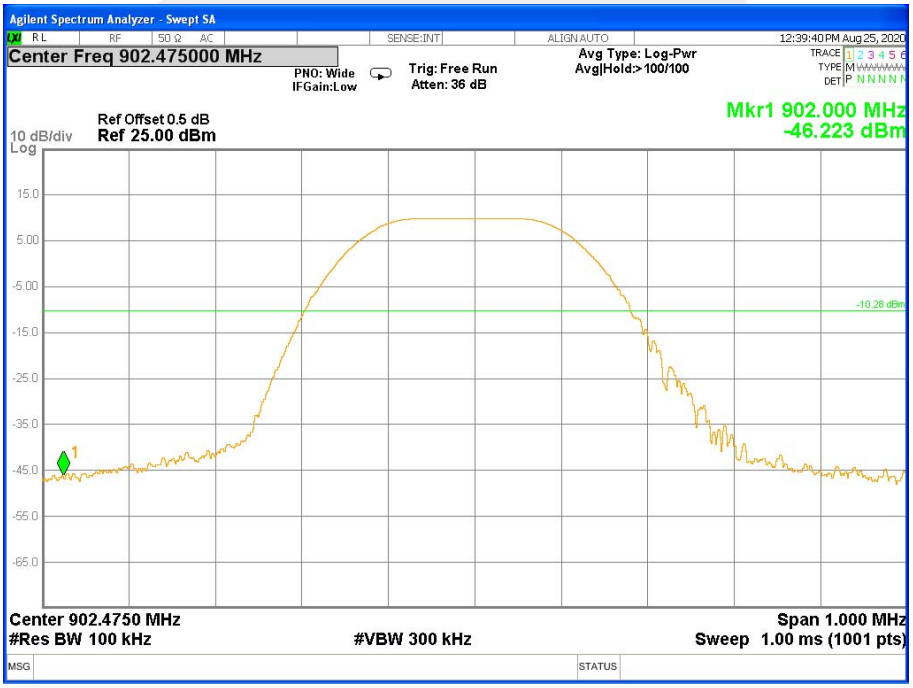
149 CH


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
12:26:02 PM Aug 25, 2020
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold: 28/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 25.00 dBm
Mkr4 7.567 32 GHz
-49.859 dBm
15.0
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-9.70 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 953 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 927.30 MHz 10.291 dBm
2 N 1 f 1.854 51 GHz -35.137 dBm
3 N 1 f 2.781 72 GHz -47.370 dBm
4 N 1 f 7.567 32 GHz -49.859 dBm
5
6
7
8
9
10
11
12
MSG
STATUS

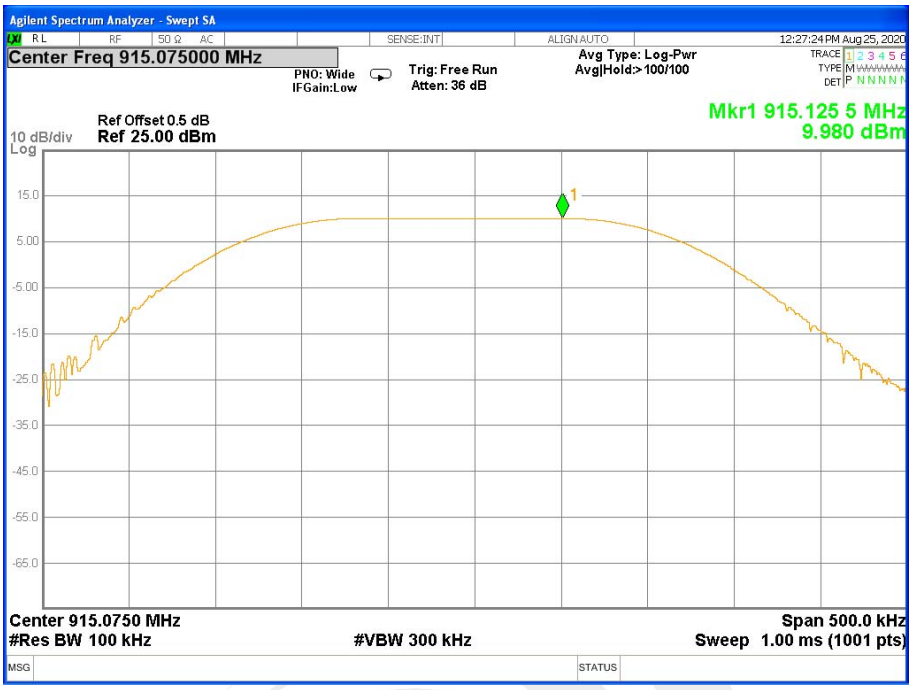
For Band edge(it's also the reference level for conducted spurious emission)

01 CH

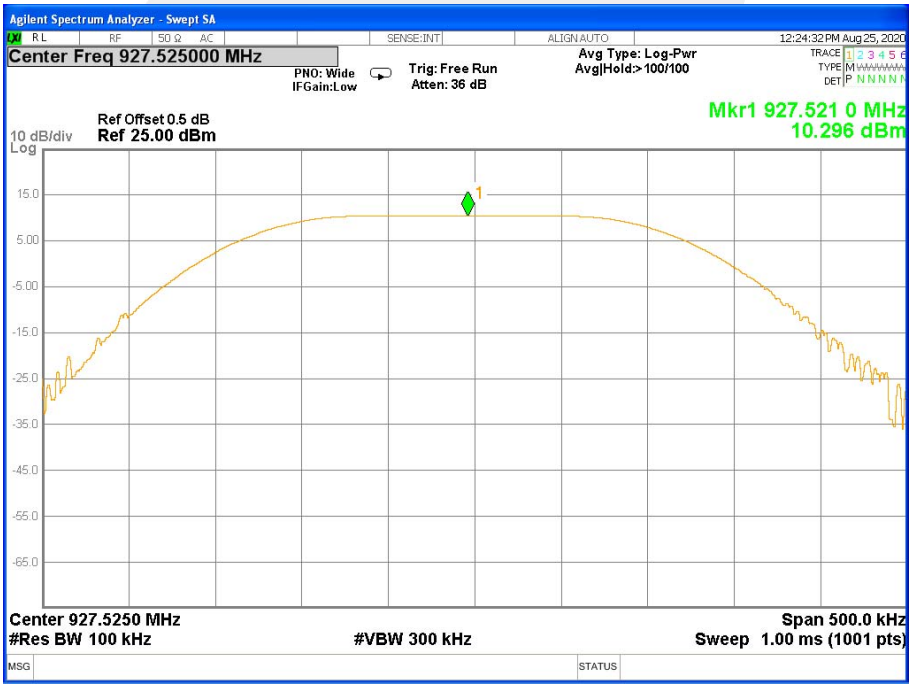


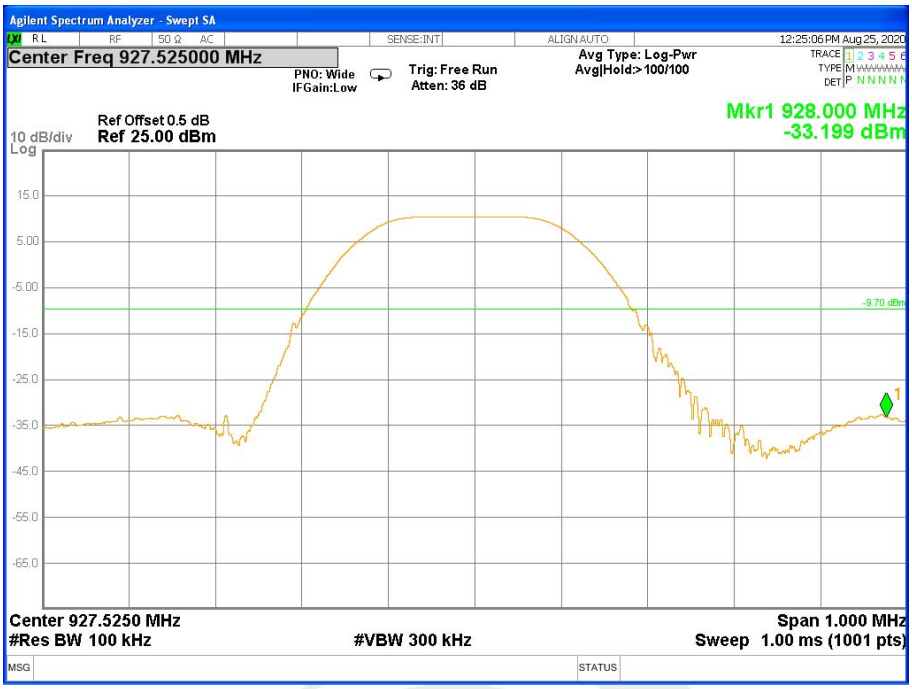


75 CH


Agilent Spectrum Analyzer - Swept SA
Center Freq 915.075000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:27:24 PM Aug 25, 2020
Ref Offset 0.5 dB
10 dB/div
Log
Ref 25.00 dBm
Mkr1 915.125 5 MHz
9.980 dBm
Center 915.0750 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)

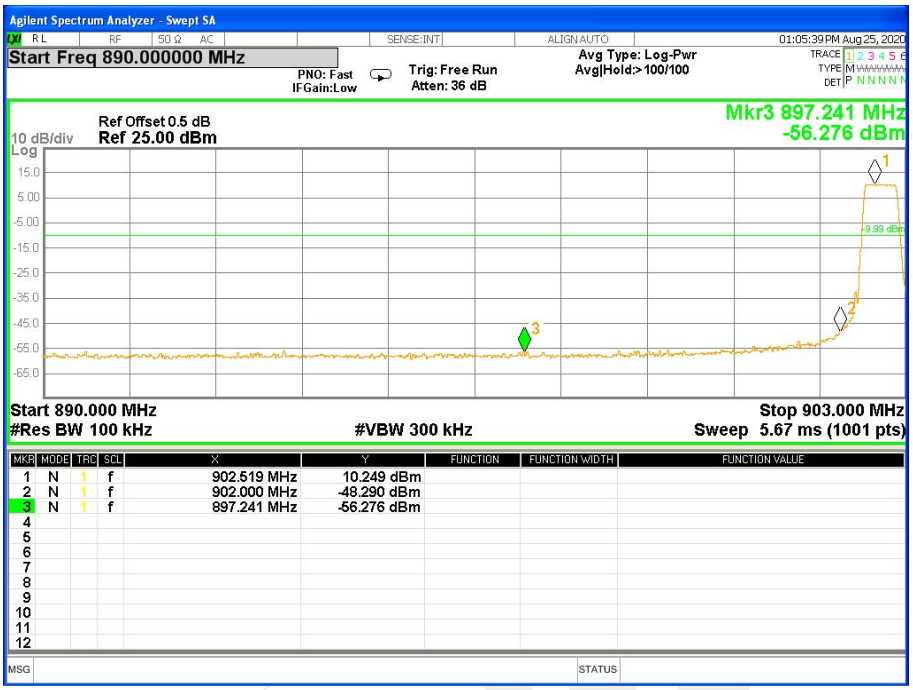
149 CH

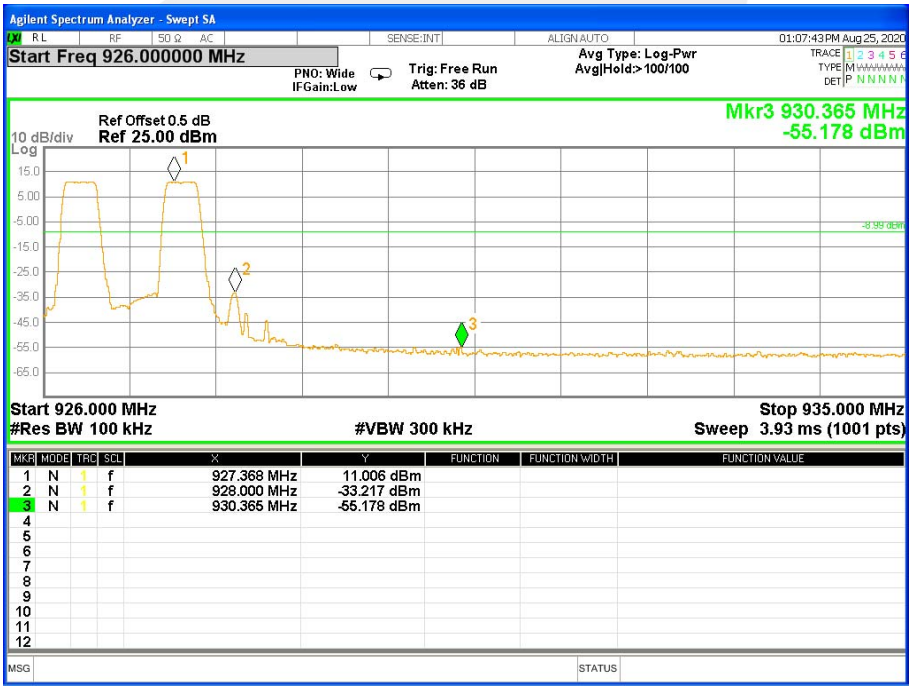

Agilent Spectrum Analyzer - Swept SA
Center Freq 927.525000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:24:32 PM Aug 25, 2020
Ref Offset 0.5 dB
10 dB/div
Log
Ref 25.00 dBm
Mkr1 927.521 0 MHz
10.296 dBm
Center 927.5250 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 927.525000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:25:06 PM Aug 25, 2020
Ref Offset 0.5 dB
10 dB/div
Log
Ref 25.00 dBm
Mkr1 928.000 MHz
-33.199 dBm
15.0
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-9.70 dBm
Center 927.5250 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 1.000 MHz
Sweep 1.00 ms (1001 pts)
MSG
STATUS

For Hopping Band edge

LoRa





5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, 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 dB bandwidth of the hopping channel is 250 kHz 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 dB bandwidth of the hopping channel is 500 kHz.

EUT 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50.

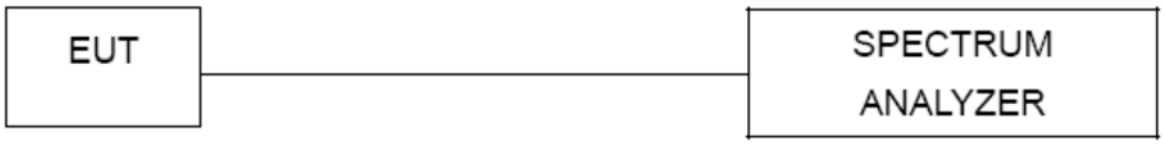
Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	47KHz
VB	150KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

b. Spectrum Setting: RBW= 47KHz, VBW=150KHz, Sweep time = Auto.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -LoRa Mode	Test Voltage:	DC 3.6V

Number of Hopping Channel: 149

Hopping channel

6. AVERAGE TIME OF OCCUPANCY

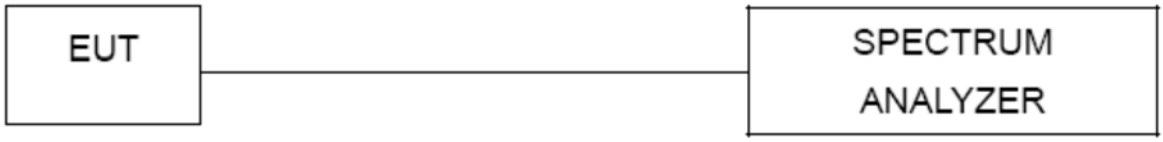
6.1 LIMIT

FCC Part 15.247,Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (f) RSS-247	Average Time of Occupancy	< 0.4sec	902-928	PASS

6.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer.
b. Set RBW =100KHz/VBW =300KHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is 0.4* channel number.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

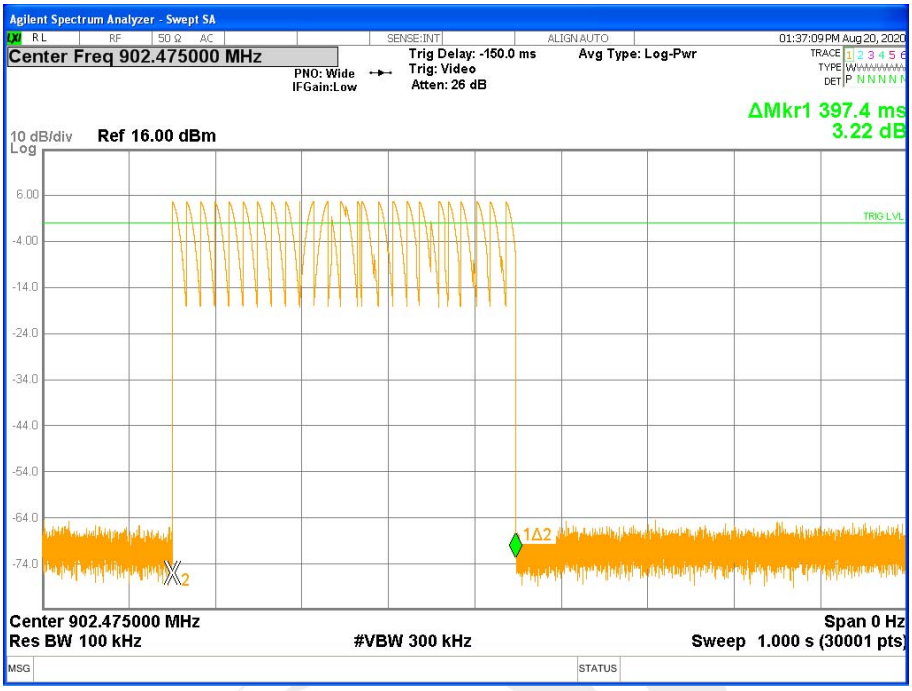
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

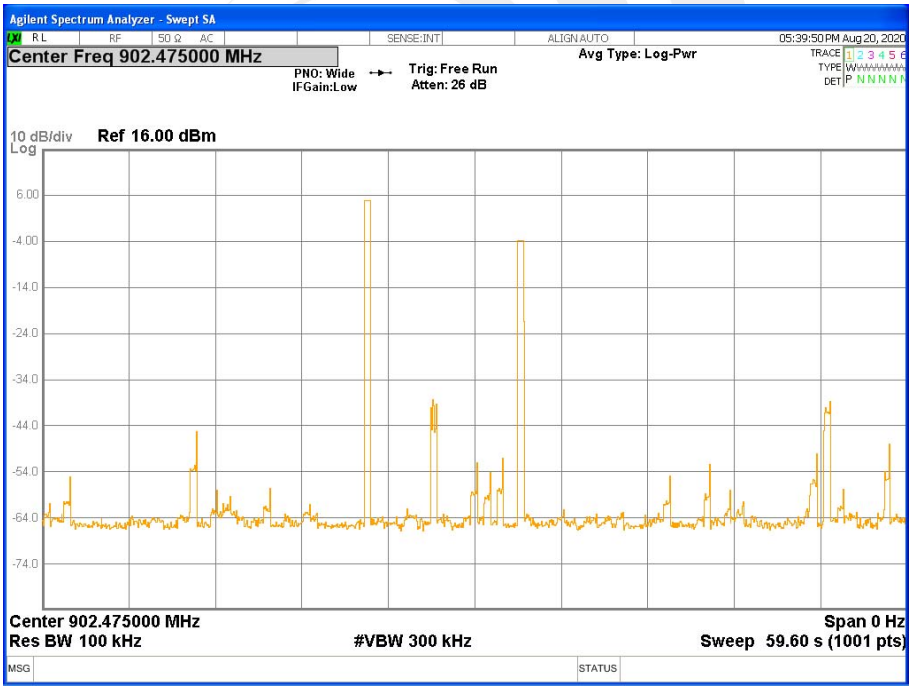
6.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	LoRa	Test Voltage:	DC 3.6V

Channel	Pulse time(ms)	Number of pulses	Dwell Time(s)	Limits(s)
Low	397.400	1	0.397	0.4
Middle	397.400	1	0.397	0.4
High	397.500	1	0.398	0.4

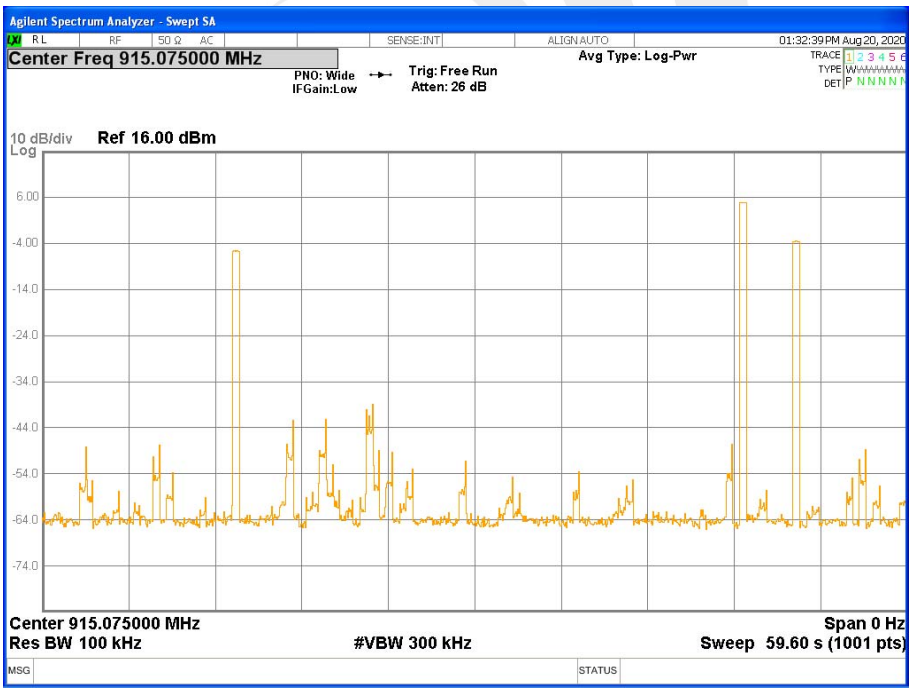
CH01


Agilent Spectrum Analyzer - Swept SA
Center Freq 902.475000 MHz
PNO: Wide
IFGain:Low
Trig Delay: -150.0 ms
Trig: Video
Atten: 26 dB
Avg Type: Log-Pwr
01:37:09 PM Aug 20, 2020
ΔMkr1 397.4 ms
3.22 dB
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
TRIG LVL
1Δ2
Center 902.475000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1.000 s (30001 pts)
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 902.475000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
05:39:50 PM Aug 20, 2020
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
Center 902.475000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 59.60 s (1001 pts)
MSG
STATUS

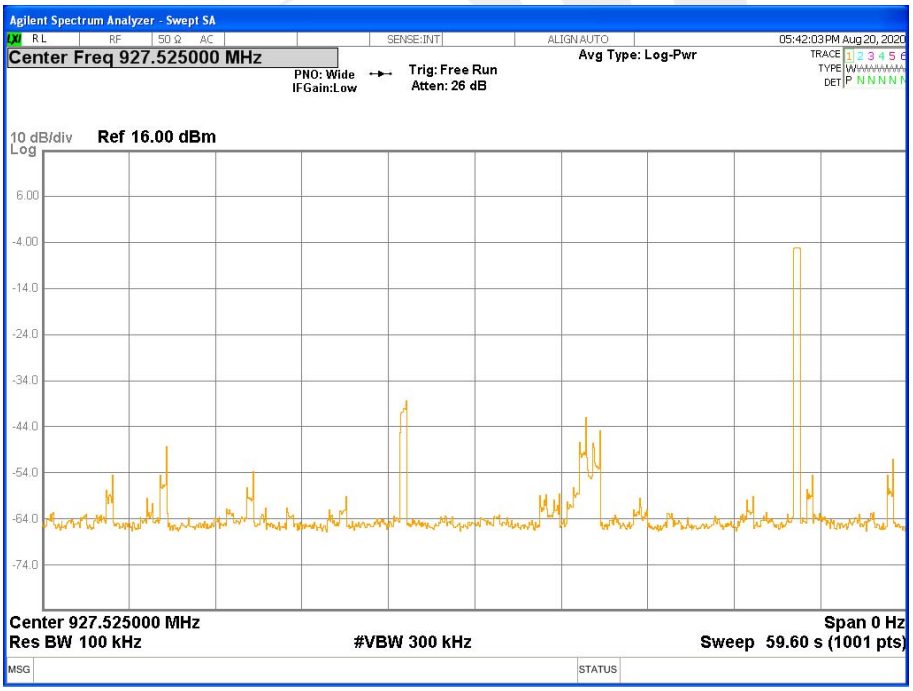
CH75


Agilent Spectrum Analyzer - Swept SA
Center Freq 915.075000 MHz
PNO: Wide
IFGain:Low
Trig Delay: -150.0 ms
Trig: Video
Atten: 26 dB
Avg Type: Log-Pwr
01:21:37 PM Aug 20, 2020
ΔMkr1 397.4 ms
-1.90 dB
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
1Δ2
Center 915.075000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 800.0 ms (30001 pts)
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 915.075000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
01:32:39 PM Aug 20, 2020
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
Center 915.075000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 59.60 s (1001 pts)
MSG
STATUS

CH149


Agilent Spectrum Analyzer - Swept SA
Center Freq 927.525000 MHz
PNO: Wide
IFGain:Low
Trig Delay: -150.0 ms
Trig: Video
Atten: 26 dB
Avg Type: Log-Pwr
01:38:47 PM Aug 20, 2020
ΔMkr1 397.5 ms
-0.03 dB
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
TRIG LVL
1Δ2
Center 927.525000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1.000 s (30001 pts)
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 927.525000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
05:42:03 PM Aug 20, 2020
10 dB/div
Log
Ref 16.00 dBm
6.00
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
Center 927.525000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 59.60 s (1001 pts)
MSG
STATUS

7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

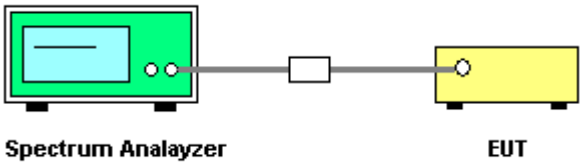
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Spectrum Parameter	Setting
Attenuation	Auto
Span	400KHz
RB	47 KHz
VB	150 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
b. Spectrum Setting: RBW= 47KHz, VBW= 150KHz, Sweep time = Auto.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

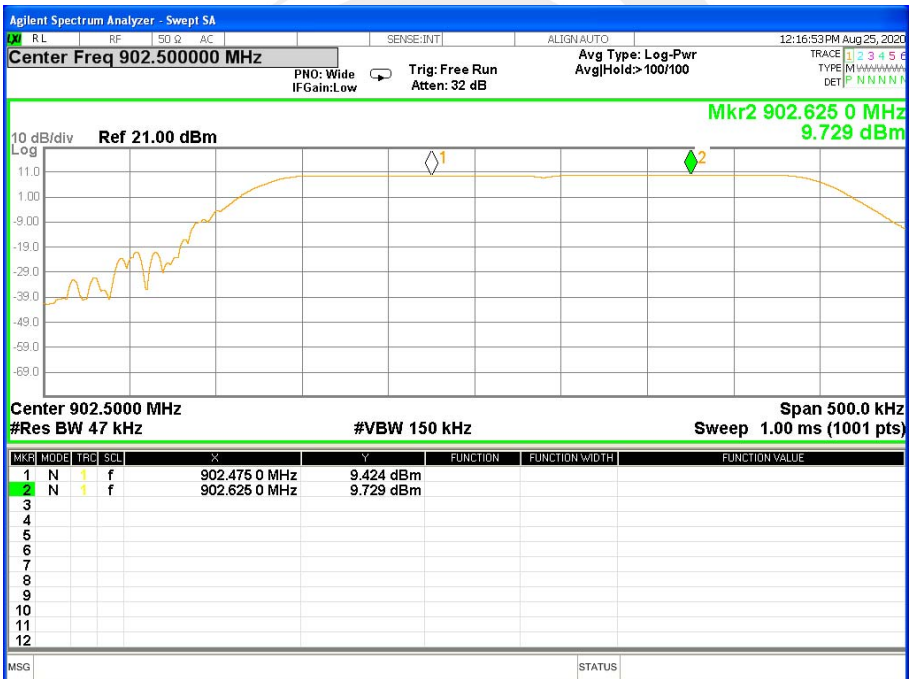
7.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	CH01 / CH75 / CH149	Test Voltage:	DC 3.6V

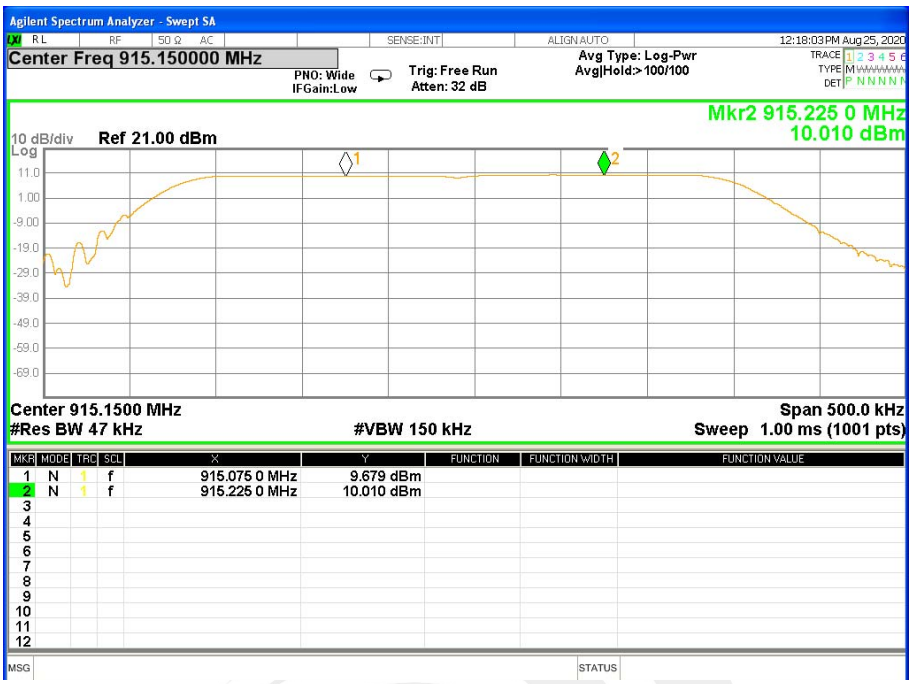
Frequency (MHz)	Mark1 Frequency （MHz）	Mark2 Frequency （MHz）	Ch. Separation (MHz)	Limit (MHz)	Result
902.475	902.475	902.625	0.150	0.142	Complies
915.075	915.075	915.225	0.150	0.140	Complies
927.525	927.375	927.525	0.150	0.138	Complies

For LoRa: Ch. Separation Limits: > 20dB bandwidth

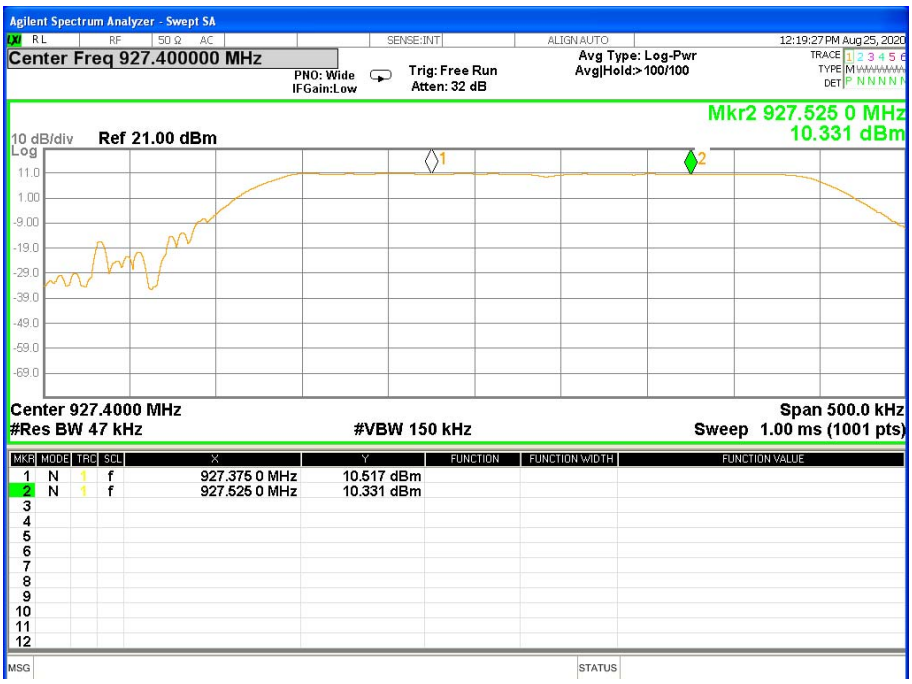
CH01



CH75


Agilent Spectrum Analyzer - Swept SA
Center Freq 915.150000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 32 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:18:03 PM Aug 25, 2020
Mkr2 915.225 0 MHz
10.010 dBm
10 dB/div
Log
Ref 21.00 dBm
11.0
1.00
-9.00
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
Center 915.1500 MHz
#Res BW 47 kHz
#VBW 150 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)
1 N 1 f 915.075 0 MHz 9.679 dBm
2 N 1 f 915.225 0 MHz 10.010 dBm
MSG
STATUS

CH149


Agilent Spectrum Analyzer - Swept SA
Center Freq 927.400000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 32 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:19:27 PM Aug 25, 2020
Mkr2 927.525 0 MHz
10.331 dBm
10 dB/div
Log
Ref 21.00 dBm
11.0
1.00
-9.00
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
Center 927.4000 MHz
#Res BW 47 kHz
#VBW 150 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)
1 N 1 f 927.375 0 MHz 10.517 dBm
2 N 1 f 927.525 0 MHz 10.331 dBm
MSG
STATUS

8. BANDWIDTH TEST

8.1 LIMIT

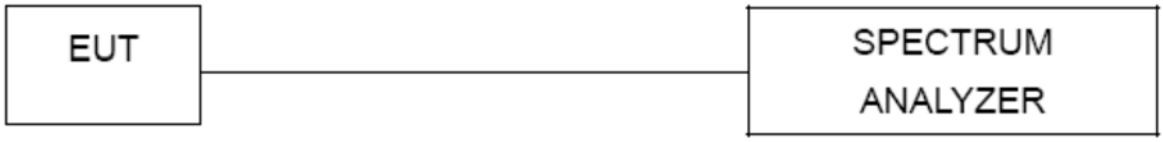
FCC Part15 15.247,Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1) RSS-247	Bandwidth	< 250kHz	902-928	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span	500KHz
RB	3 kHz
VB	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 3KHz, VBW=10KHz, Sweep time = Auto.

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

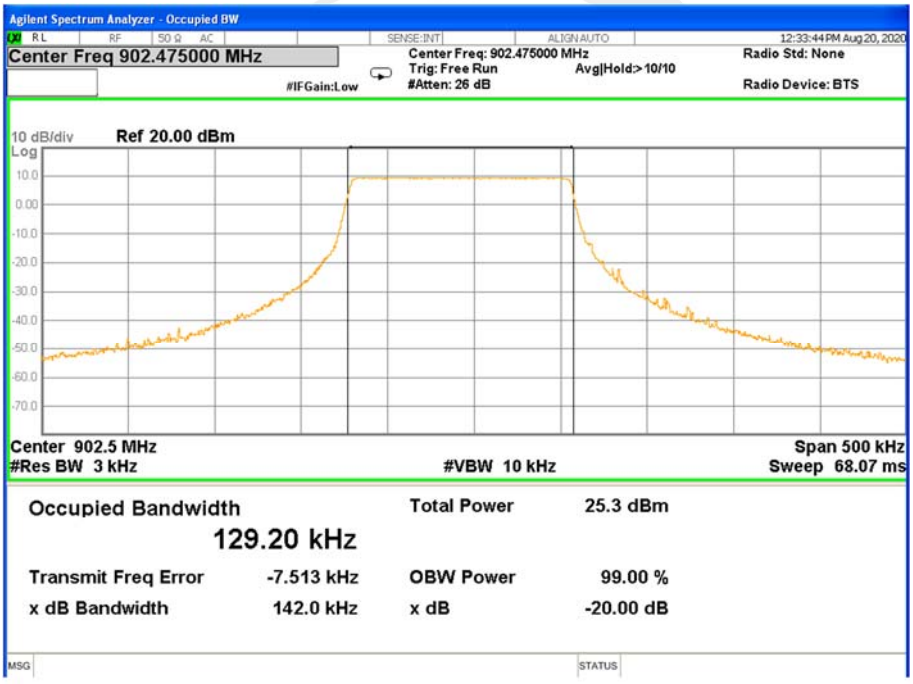
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

8.5 TEST RESULTS

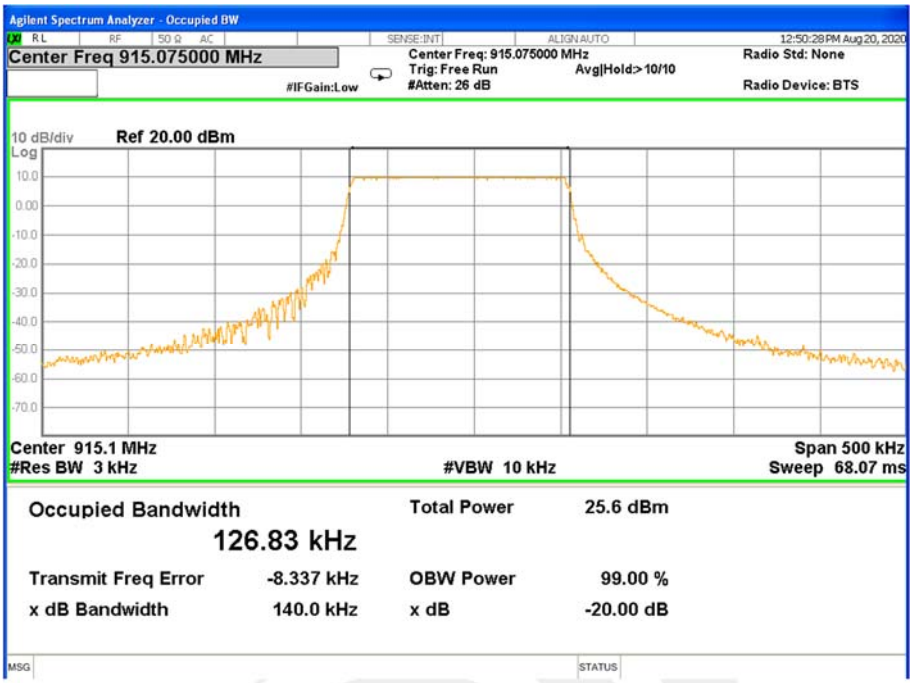
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	CH01 / CH75 / CH149	Test Voltage:	DC 3.6V

Frequency	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
902.475 MHz	0.142	0.129	PASS
915.075 MHz	0.140	0.127	PASS
927.525 MHz	0.138	0.126	PASS

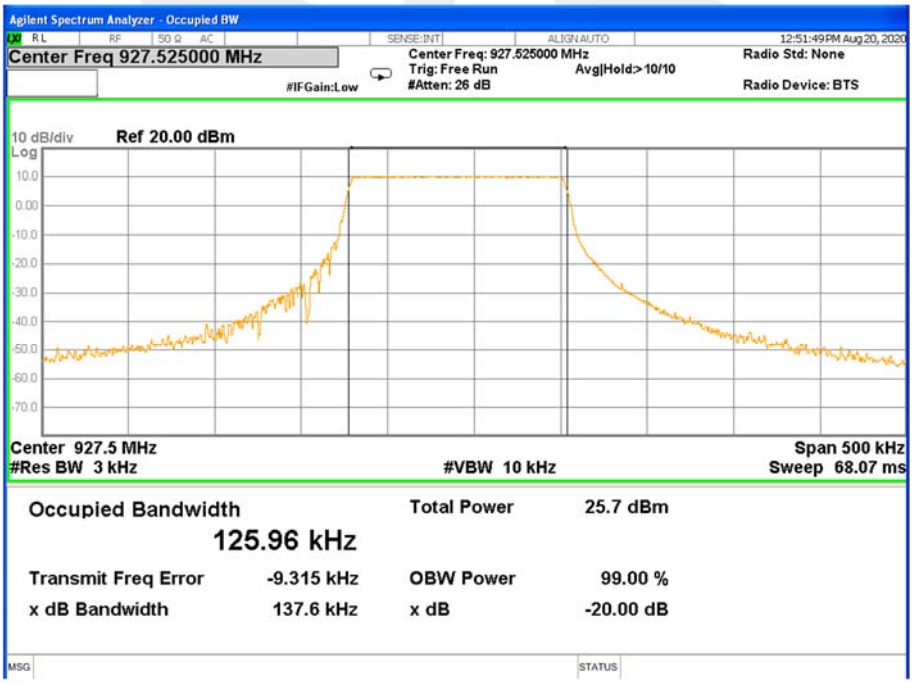
CH01



CH75


Agilent Spectrum Analyzer - Occupied BW
Center Freq 915.075000 MHz
Center Freq: 915.075000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 26 dB
Radio Std: None
Radio Device: BTS
12:50:28 PM Aug 20, 2020
10 dB/div
Ref 20.00 dBm
Log
Center 915.1 MHz
#Res BW 3 kHz
#VBW 10 kHz
Span 500 kHz
Sweep 68.07 ms
Occupied Bandwidth
126.83 kHz
Total Power
25.6 dBm
Transmit Freq Error
-8.337 kHz
OBW Power
99.00 %
x dB Bandwidth
140.0 kHz
x dB
-20.00 dB
MSG
STATUS

CH149


Agilent Spectrum Analyzer - Occupied BW
Center Freq 927.525000 MHz
Center Freq: 927.525000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 26 dB
Radio Std: None
Radio Device: BTS
12:51:49 PM Aug 20, 2020
10 dB/div
Ref 20.00 dBm
Log
Center 927.5 MHz
#Res BW 3 kHz
#VBW 10 kHz
Span 500 kHz
Sweep 68.07 ms
Occupied Bandwidth
125.96 kHz
Total Power
25.7 dBm
Transmit Freq Error
-9.315 kHz
OBW Power
99.00 %
x dB Bandwidth
137.6 kHz
x dB
-20.00 dB
MSG
STATUS

9. OUTPUT POWER TEST

9.1 LIMIT

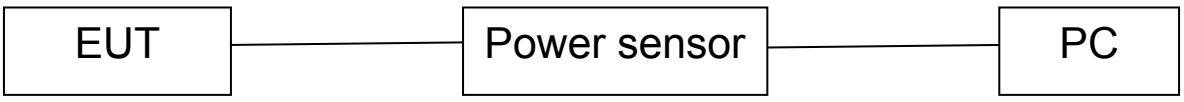
FCC Part 15.247,Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(b)(2) RSS-247	Output Power	1 W	902-928	PASS
RSS-247	EIRP	4W	902-928	PASS

9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:
1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.
b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.
NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.
PKPM1 Peak power meter method:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

9.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 3.6V		

Channel Number	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)
01	902.475	20.42	30.00
75	915.075	20.72	30.00
149	927.525	21.03	30.00

EIRP Power

Frequency (MHz)	Peak Power (dBm)	Antenna Gain (dBi)	ERP Power (dBm)	EIRP Power (dBm)	Limit (dBm)
902.475	20.42	0.00	20.42	22.57	36.02
915.075	20.72	0.00	20.72	22.87	36.02
927.525	21.03	0.00	21.03	23.18	36.02

Note: EIRP = ERP+2.15dB.

10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203&RSS-Gen Issue 5 requirement: For intentional device, according to 15.203&RSS-Gen Issue 5: 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.

10.2 EUT ANTENNA

The EUT antenna is PCB Antenna. It comply with the standard requirement.

11. FREQUENCY STABILITY

11.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/-0.02% of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage,and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees.

11.2 TEST PROCEDURE

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 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 after 2,5,and 10 minutes.
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.

11.3 TEST RESULT

Channel 75 (915.075MHz)

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency(MHz)
4.14	915.0758
3.6	915.0751
3.06	915.0755
Max.Deviation(MHz)	0.0008
Max.Deviation(ppm)	0.87

Rated working voltage: DC 3.6V

Temperature vs. Frequency Stability

Temperature(℃)	Measurement Frequency(MHz)
-30	915.0752
-20	915.0747
-10	915.0752
0	915.0745
10	915.0744
20	915.0744
30	915.0744
40	915.0746
50	915.0745
Max.Deviation(MHz)	0.0002
Max.Deviation(ppm)	0.22

APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※