TEST REPORT

Application No.:	HKEM1907000721AV
Applicant:	RFDESIGN PTY LTD
Product Name:	Modular Radio Modem
Model No.:	900ux-SMT
Standards:	47 CFR Part 15, Subpart C 15.247 RSS-247 Issue 2
Date of Receipt:	2019-07-29
Date of Test:	2019-07-29 to 2019-08-29
Date of Issue:	2019-08-30
Test Result :	**Pass***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further detail.

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		2019-08-30		*Original*

Authorized for issue by:				
Tested by:				
		Vincent Chen /Project Engineer		
Checked by:				
		Eric Fu /Reviewer		

2 Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1)	ANSI C63.10: Clause 6.9.1	PASS
Carrier Frequencies Separation	FCC PART 15 C section 15.247(a)(1)	ANSI C63.10: Clause 7.8.2	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.8.3	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.8.4	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 C section 15.247(a)(1)	ANSI C63.10: Clause 7.7.5	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1)	ANSI C63.10: Clause 7.8.5	PASS
Conducted Emissions at AC Power Line (150kHz-30MHz)	FCC PART 15 C 15.207	ANSI C63.10 (2013) Section 6.2	PASS
Conducted Spurious Emission	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 7.8.8	PASS
Radiated Spurious Emission	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.10.4	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10: clause 7.8.6	PASS
Antenna Requirement	RSS-Gen Section 8.3	N/A	PASS
Pseudorandom Frequency Hopping Sequence	RSS-247 Section 5.1(a)	N/A	PASS
99% Bandwidth	RSS-Gen Section 6.8	ANSI C63.10 Section 6.9.3	PASS
Conducted Peak Output Power	RSS-247 Section 5.4(b)	ANSI C63.10 (2013) Section 7.8.5	PASS
20dB Bandwidth	RSS-247 Section 5.1(a)	ANSI C63.10 Section 6.9.2	PASS

Carrier Frequencies Separation	RSS-247 Section 5.1(b)	ANSI C63.10 (2013) Section 7.8.2	PASS
Hopping Channel Number	RSS-247 Section 5.1(d)	ANSI C63.10 (2013) Section 7.8.3	PASS
Dwell Time	RSS-247 Section 5.1(d)	ANSI C63.10 (2013) Section 7.8.4	PASS
Conducted Band Edges Measurement	RSS-247 Section 5.5	ANSI C63.10 (2013) Section7.8.6	PASS
Conducted Emissions at AC Power Line (150kHz-30MHz)	RSS-Gen Section 8.8	ANSI C63.10 (2013) Section 6.2	PASS
Conducted Spurious Emissions	RSS-247 Section 5.5	ANSI C63.10 (2013) Section 7.8.8	PASS
Radiated Emissions which fall in the restricted bands	Section 3.3 & RSS-Gen Section 8.10	ANSI C63.10 (2013) Section 6.10.5	PASS
Radiated Spurious Emissions	Section 5.5 & RSS-Gen Section 8.9	ANSI C63.10 (2013) Section 6.4&6.5&6.6	PASS
Frequency stability	RSS-Gen Section 8.11	RSS-Gen Section 6.11	Pass*

Note: RSS-Gen is short of RSS-Gen Issue 5, 2018+ Amdt 2019;
RSS-247 is short of RSS-247 Issue 2.

Remark:
* Frequency stability requested in RSS GEN Section 8.1.1 has been complied since the result of band edge can demonstrate.

3 Contents

4 General Information

4.1 Client Information

Applicant:	RFDesign Pty Ltd
Address of Applicant: (FCC grantee registration address)	1/373 Bradman Street, Acacia Ridge, QLD 4110 Brisbane, Australia
Address of Applicant: (IC Company registration address)	U7, 1 Stockwell Place Archerfield 4108 Australia

4.2 Details of E.U.T.

Operating Frequency	Band 1: 902.250 – 914.750MHz Band 2: 915.250 – 927.750MHz
Type of Modulation:	GFSK
Number of Channels	Band 1: 51 Channels Band 2: 51 Channels
Channel Separation:	250 kHz
Dwell time	Per channel is less than 0.4s.
Antenna Type	Dipole RPSMA
Antenna gain:	Antenna 1: 3dBi Antenna 2: 3dBi Remark: Antenna 1 and Antenna 2 cannot transmit simultaneously
MIMO:	N/A
Function:	Wireless transmitter
Power Supply:	USB DC 5V via USB cable with ferrite located in the middle and both ends of the cable
Adapter:	None.

Remark: The device meets the requirements stated within Parts 15.247(g) & (h) in that they were developed under the protocol and operate as a true frequency hopping system. The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Frequency List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**902.25**	21	907.25	41	912.25
2	902.50	22	907.50	42	912.50
3	902.75	23	907.75	43	912.75
4	903.00	24	908.00	44	913.00
5	903.25	25	908.25	45	913.25
6	903.50	26	908.50	46	913.50
7	903.75	27	908.75	47	913.75
8	904.00	28	909.00	48	914.00
9	904.25	29	909.25	49	914.25
10	904.50	30	909.50	50	914.50
11	904.75	31	909.75	51	914.75
12	905.00	32	910.00	**52**	**915.25**
13	905.25	33	910.25	53	915.50
14	905.50	34	910.50	54	915.75
15	905.75	35	910.75	55	916.00
16	906.00	36	911.00	56	916.25
17	906.25	37	911.25	57	916.50
18	906.50	38	911.50	58	916.75
19	906.75	39	911.75	59	917.00
20	907.00	40	912.00	60	917.25

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
61	917.50	81	922.50	101	927.50
62	917.75	82	922.75	**102**	**927.75**
63	918.00	83	923.00		
64	918.25	84	923.25		
65	918.50	85	923.50		
66	918.75	86	923.75		

67	919.00	87	924.00		
68	919.25	88	924.25		
69	919.50	89	924.50		
70	919.75	90	924.75		
71	920.00	91	925.00		
72	920.25	92	925.25		
73	920.50	93	925.50		
74	920.75	94	925.75		
75	921.00	95	926.00		
76	921.25	96	926.25		
77	921.50	97	926.50		
78	921.75	98	926.75		
79	922.00	99	927.00		
80	922.25	100	927.25		

Test frequencies are the lowest channel:1 channel(902.25MHz), middle channel: 52 channel(915.25MHz) and highest channel: 102 channel(927.75MHz)

4.3 Description of Support Units

1. The EUT has been tested with computer (Ref no: EMC01) and test software CoolTerm Ver.1.4.4.227 to fixed frequency and air speed (12kBaud / 64kBaud / 125kBaud / 224kBaud) to testing which are provided by lab
2. USB cable with ferrite located in the middle and both ends of the cable

4.4 Deviation from Standards

None

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.

4.7 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

4.8 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.9 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 7.25 x 10^{-8}
2	Duty cycle	± 0.37%
3	Occupied Bandwidth	± 3%
4	Conduction emission	± 3.0dB (150kHz to 30MHz)
5	RF conducted power	± 0.75dB
6	RF power density	± 2.84dB
7	Conducted Spurious emissions	± 0.75dB
8	RF Radiated power	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
9	Radiated Spurious emission test	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
10	Temperature test	± 1℃
11	Humidity test	± 3%
12	Supply voltages	± 1.5%
13	Time	± 3%

5 Equipment Used during Test

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2019-06-13	2024-06-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2019-07-11	2020-07-10
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018-09-25	2020-09-23
LISN	ETS-LINDGREN	3816/2	SEM007-02	2019-04-01	2020-03-31
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019-04-01	2020-03-31

Conducted Peak Output Power					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

20dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A

Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Carrier Frequencies Separation

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Hopping Channel Number

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26

Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Dwell Time

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Conducted Band Edges Measurement

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06

Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2020-09-23
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2019-04-01	2020-03-31
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24
Electric and Magnetic Field Analyzer	Narda	NBM-550/EHP -50F	EMC2143	2018-02-07	2020-02-06
Electric Field Probe (100KHz-3GHz)	WANDEL & GOLTERMANN	EMR-20	EMC0907	2019-05-21	2020-05-20
EMF Tester	Narda	ELT-400	SZE039-4	2019-07-08	2020-07-07

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11

Pre-amplifier (18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier (18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

RE in Chamber					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date**	**Cal. Due date**
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-05	2018-09-25	2019-09-24

(20Hz-8.4GHz)					
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2019-04-01	2020-03-31
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2019-07-11	2020-07-10

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2019-04-04	2020-04-03

6 Test Results

6.1 E.U.T. test conditions

Test Voltage: DC 5V

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Requirements: **15.31(e):** For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

15.32: Power supplies and CPU boards used with personal computers and for which separate authorizations are required to be obtained shall be tested as follows: Testing shall be in accordance with the procedures specified in Section 15.31 of this part.

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

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Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

6.2 Antenna Requirement

6.2.1 Standard requirement

15.203 requirement:

For intentional device. According to 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.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 902-928MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

RSS-Gen Section 6.8

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

6.2.2 EUT Antenna

The antenna is dedicated antenna with Female RP-SMA unique connector. The maximum gain of the antenna is 3 dBi.

Remark: Photos refer to Appendix: External Photo

Test result: The unit does meet the FCC requirements.

6.3 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207, RSS-Gen Section 8.8

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

6.3.1 E.U.T. Operation

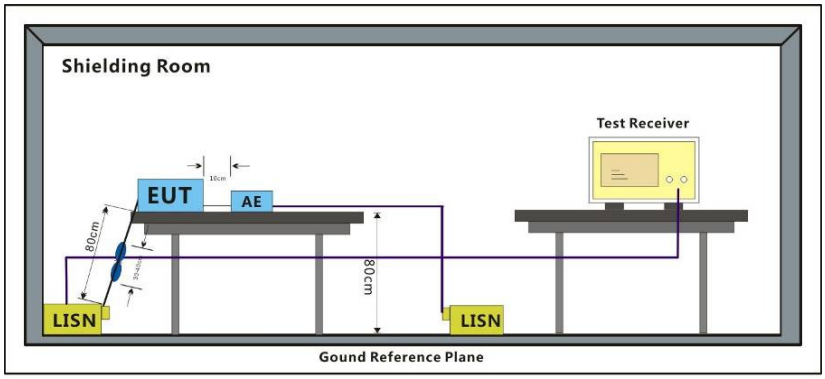
Operating Environment:

Temperature: 25.0 °C Humidity: 55 % RH :

Test mode: 1:(2.4g wifi)TX_Keep the EUT transmitted the continuous modulation test signal at the specific channel(s).

The worst case for final test: 1:(2.4g wifi)TX_Keep the EUT transmitted the continuous modulation test signal at the specific channel(s).

6.3.2 Test Setup Diagram



6.3.3 Measurement Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

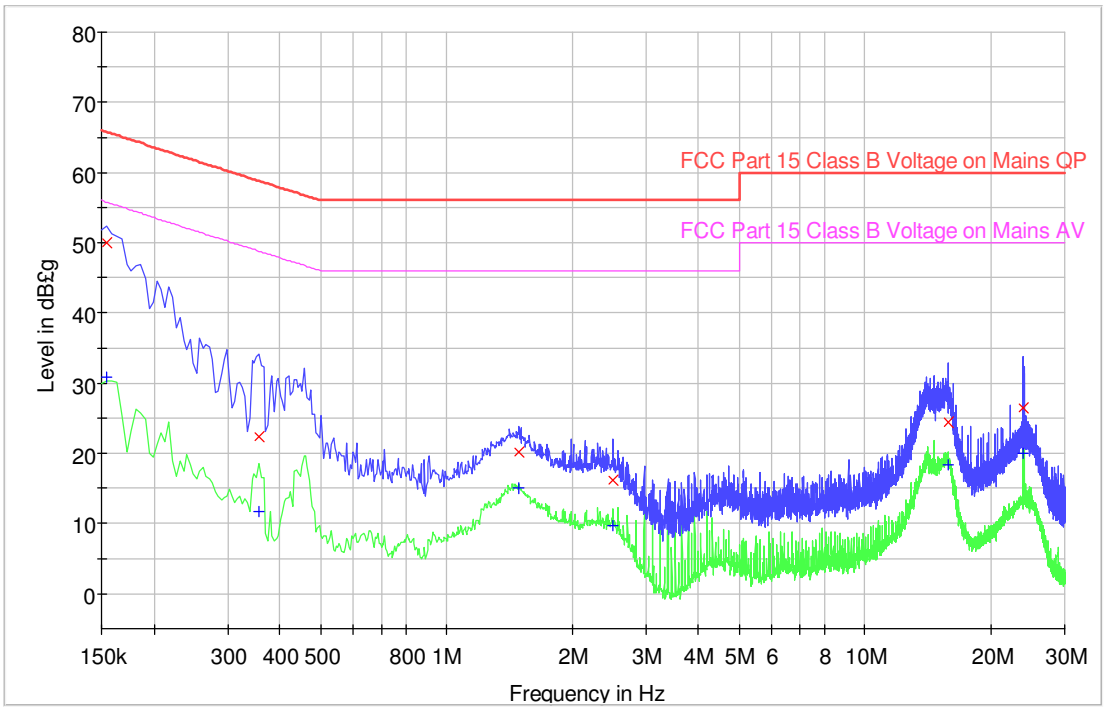
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Neutal



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Corr. (dB)	QuasiPeak Limit	QuasiPeak Over Limit	Average Limit	Average Over Limit
0.154000	50.0	30.8	10.2	65.8	-15.8	55.8	-25.0
0.358000	22.5	11.7	10.2	58.8	-36.3	48.8	-37.1
1.490000	20.3	15.1	10.2	56.0	-35.7	46.0	-30.9
2.494000	16.2	9.8	10.2	56.0	-39.8	46.0	-36.2
15.818000	24.5	18.3	10.6	60.0	-35.5	50.0	-31.7
23.941500	26.4	20.1	10.6	60.0	-33.6	50.0	-29.9

Level = Read Level + LISN Factor + Cable Loss.

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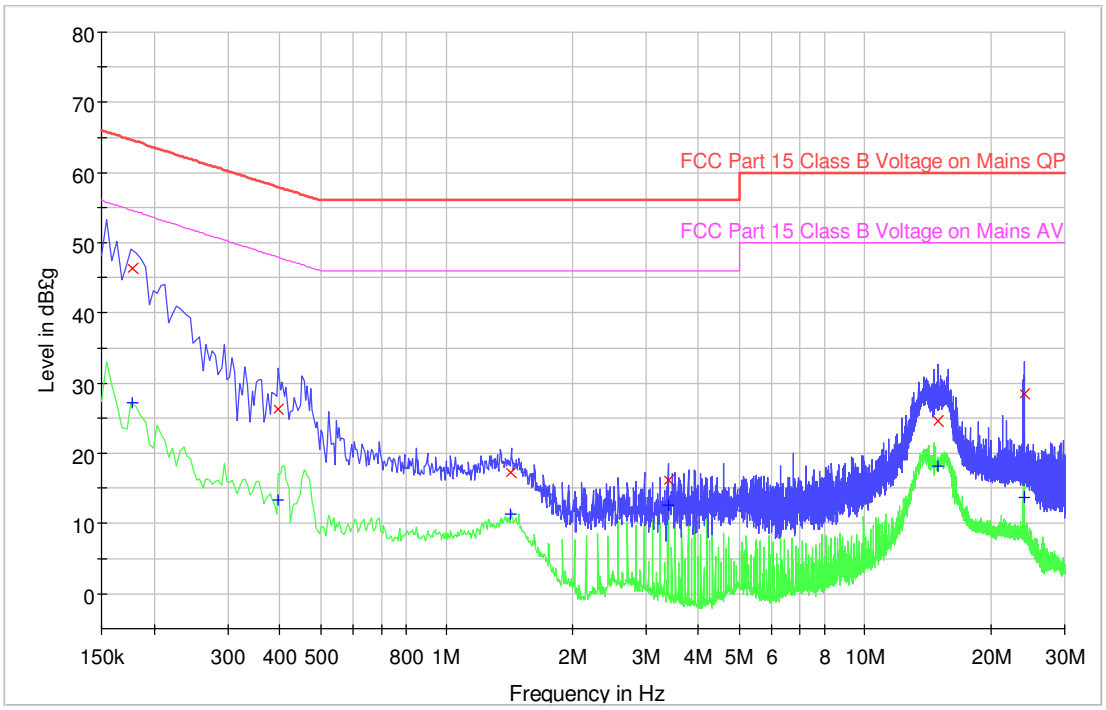
Live



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Corr. (dB)	QuasiPeak Limit	QuasiPeak Over Limit	Average Limit	Average Over Limit
0.178000	46.4	27.2	10.2	65.8	-18.2	55.8	-27.4
0.398000	26.2	13.3	10.2	58.8	-31.7	48.8	-34.6
1.430000	17.3	11.3	10.2	56.0	-38.7	46.0	-34.7
3.382000	16.2	12.6	10.2	56.0	-39.8	46.0	-33.4
14.942000	24.6	18.1	10.6	60.0	-35.4	50.0	-31.9
24.018000	28.5	13.7	10.6	60.0	-31.5	50.0	-36.3

6.4 20dB Bandwidth

Test Requirement: FCC Part 15 C section 15.247(a)

RSS-247 Section 5.1(a)

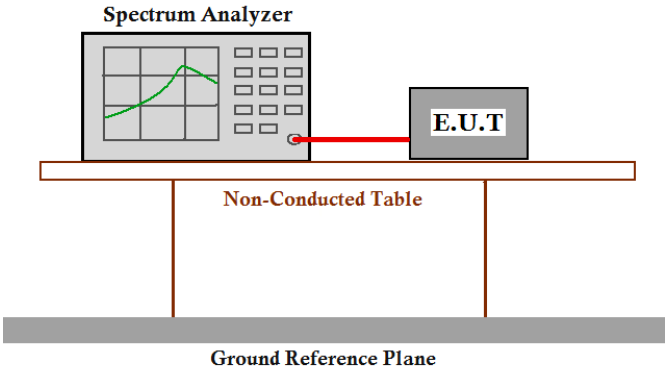
For FHSS in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

Test Method: ANSI C63.10: Clause 6.9.1

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (902.250MHz), middle (915.250 MHz) and highest (927.750MHz) channel. to find antenna 1 and air speed 224kBaud is the worst case mode.

Only worst case data is shown on this report

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW >= 1% of the 20dB bandwidth VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.

4. Mark the peak frequency and -20 dB points bandwidth.

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Test result:

Test Channel	Bandwidth(kHz)	limit (kHz)
Lowest	238.8	Less than 250kHz
Middle	237.3	Less than 250kHz
Highest	237.3	Less than 250kHz

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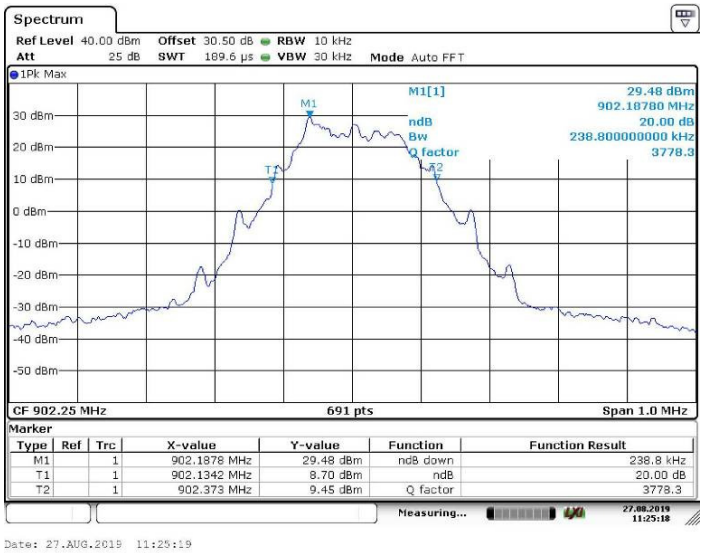
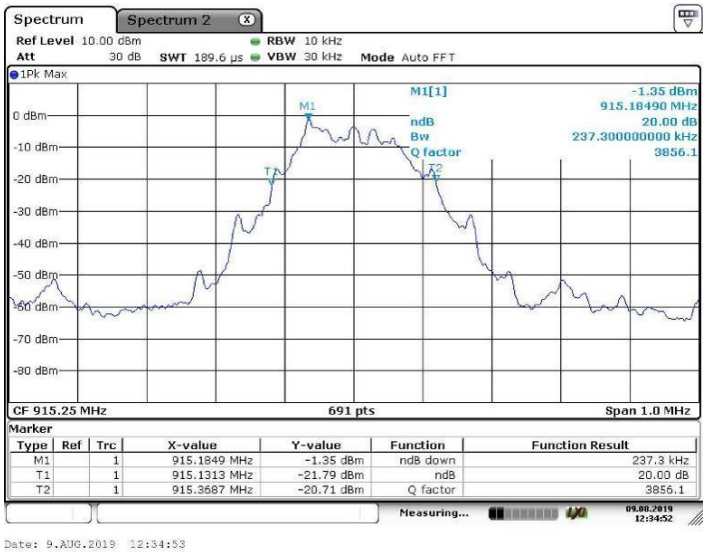
Result plot as follows:

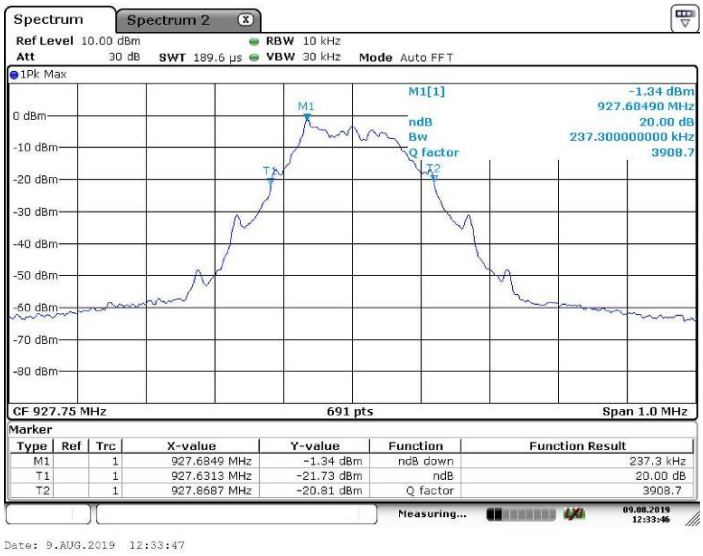
Lowest Channel



Middle Channel



Highest Channel



6.5 Carrier Frequencies Separation

Test Requirement: FCC Part 15 C section 15.247(a)

RSS-247 Section 5.1(b)

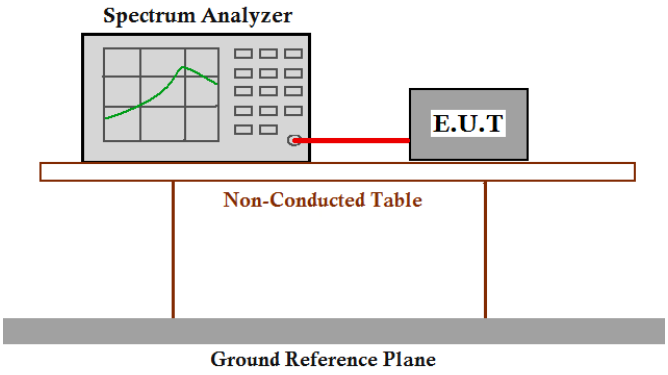
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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.

Test Method: ANSI C63.10 (2013) Section 7.8.2

Test Status: Pre-test the EUT in hopping mode.to find antenna 1 and air speed 224kBaud is the worst-case mode.

Only worst-case data is shown on this report

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW >= 1% of the span, VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test result:

Test Channel	Carrier Frequencies Separated (kHz)	Limit①(kHz)	Pass/Fail
Lower Channels (channel 1 and channel 2)	250.1	Larger than 238.8KHz	Pass
Middle Channels (channel 52 and channel 53)	248.8	Larger than 238.8KHz	Pass
Upper Channels (channel 101 and channel 102)	246.2	Larger than 238.8KHz	Pass

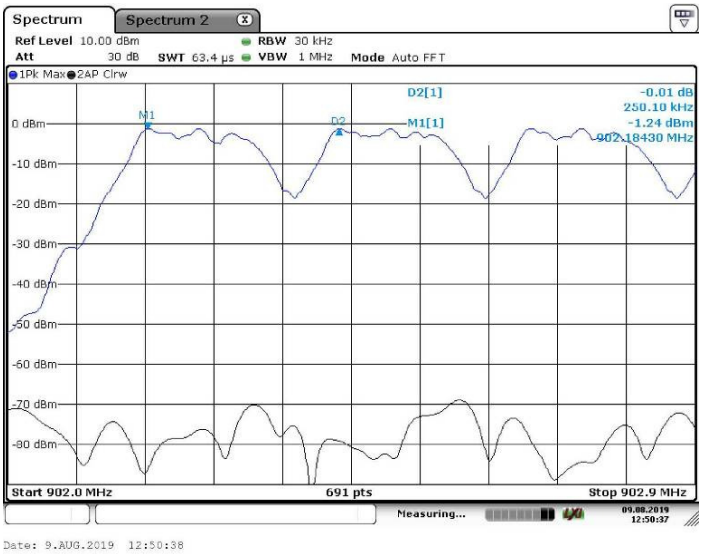
Remark:

① The limit is 20 dB bandwidth

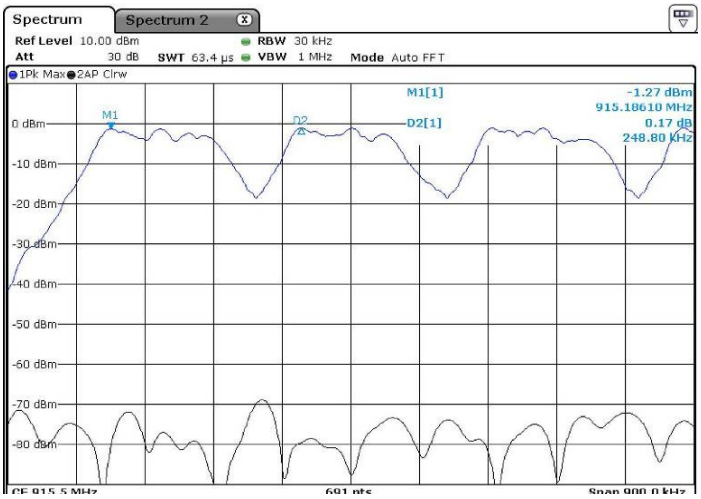
② channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

Result plot as follows:

Lowest Channels: **Carrier Frequencies Separated**



Middle Channels: **Carrier Frequencies Separated**



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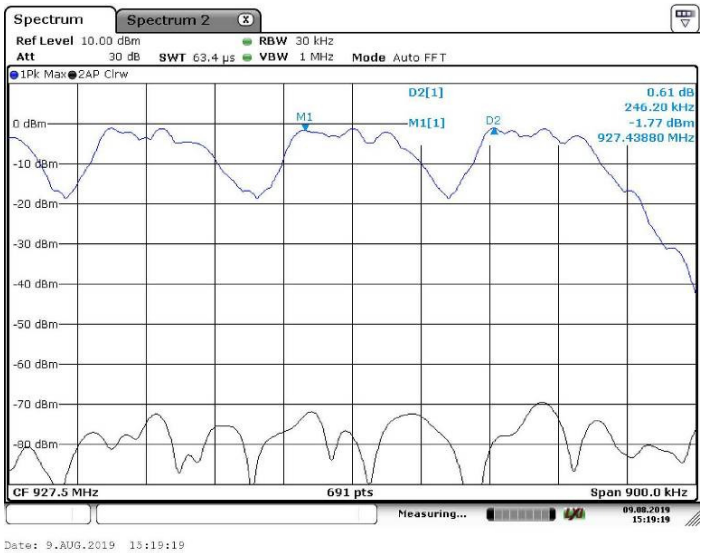
Highest Channels: **Carrier Frequencies Separated**



Test result: The unit does meet the FCC requirements.

6.6 Hopping Channel Number

Test Requirement: FCC Part15 C section 15.247(a)

RSS-247 Section 5.1(c)

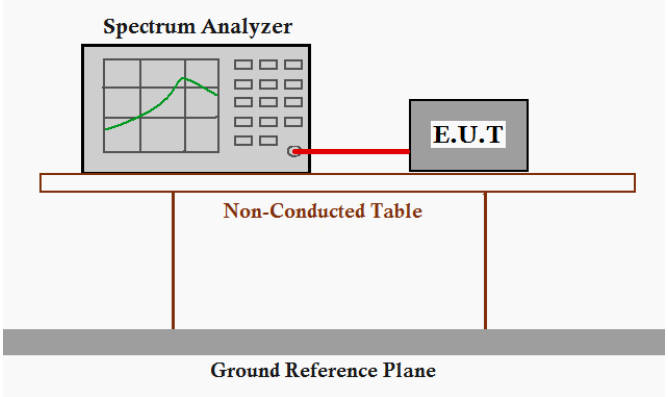
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; 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.

Test Method: ANSI C63.10 (2013) Section 7.8.3

Test Status: Pre-test the EUT in hopping mode to find antenna 1 and air speed 224k Baud is the worst case mode.

Only worst case data is shown on this report

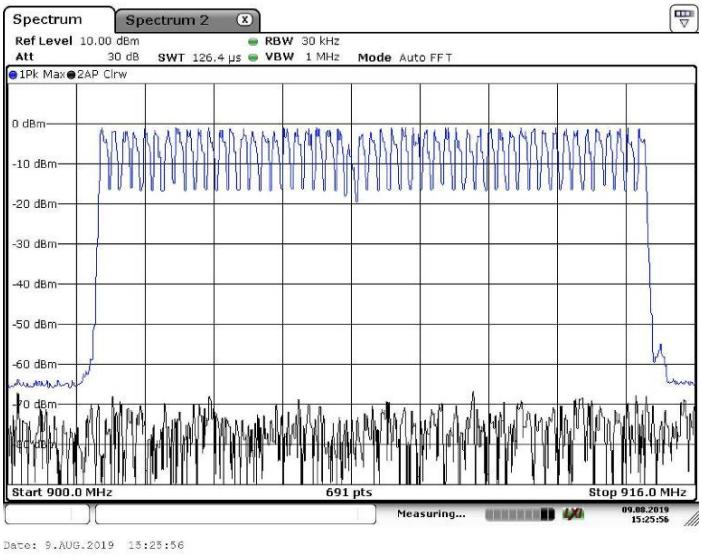
Test Configuration:



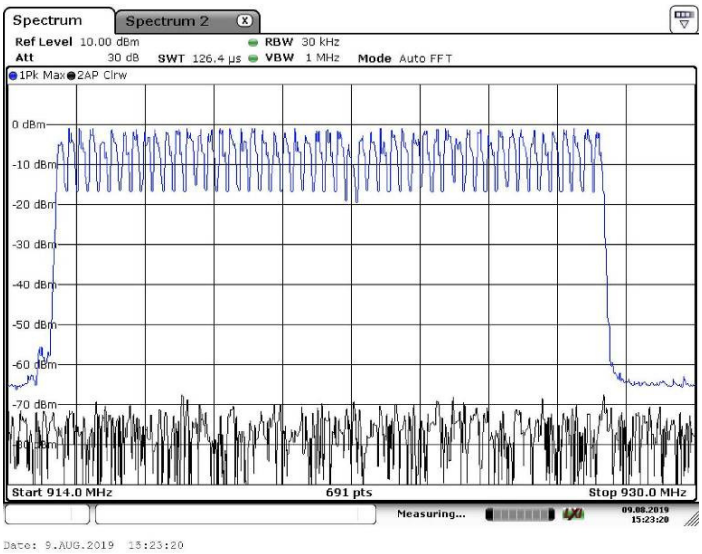
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 10 kHz. VBW = 10 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 901 MHz. stop frequency = 929 MHz. Submit the test result graph.

Test result (channel 1 to channel 51): Total channels are 51 channels.



Test result(channel 51 to 102): Total channels are 51 channels.



Test result: The unit does meet the FCC requirements.

6.7 Dwell Time

Test Requirement: FCC Part 15 C section 15.247(a)

RSS-247 Section 5.1(c)(d)

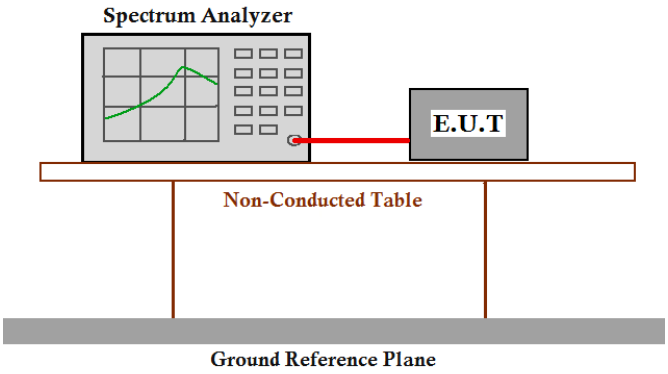
Frequency hopping systems in the 902-928 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Method: ANSI C63.10 (2013) Section 7.8.4

Test Status: Test the EUT in hopping mode at the lowest (902.250 MHz), middle (915.2500 MHz) and highest (927.750 MHz) channel at antenna 1 and air speed 12kBaud as the worst-case mode.

Only worst-case data is shown on this report

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Set RBW = 100 kHz and VBW = 100 kHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = Max hold;
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g. data rate. modulation format. etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

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Test Result:

The test period: T= 20 s

1. Channel 1: 902.250 MHz										
time slot	=	17.71	(ms)	*	5		=	88.55	ms	
2. Channel 52: 915.250 MHz										
time slot	=	17.68	(ms)	*	5	*	=	88.4	ms	
3. Channel 102: 927.750 MHz										
time slot	=	17.68	(ms)	*	5	*	=	88.4	ms	

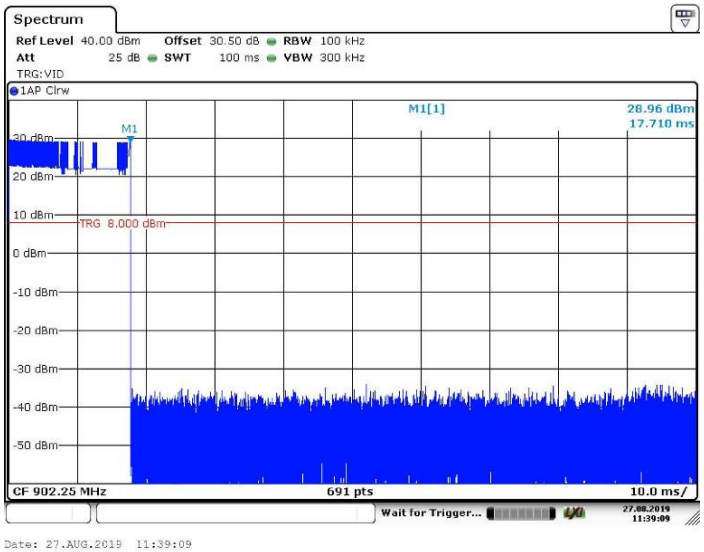
The results are not greater than 0.4 seconds.

The unit does meet the FCC requirements.

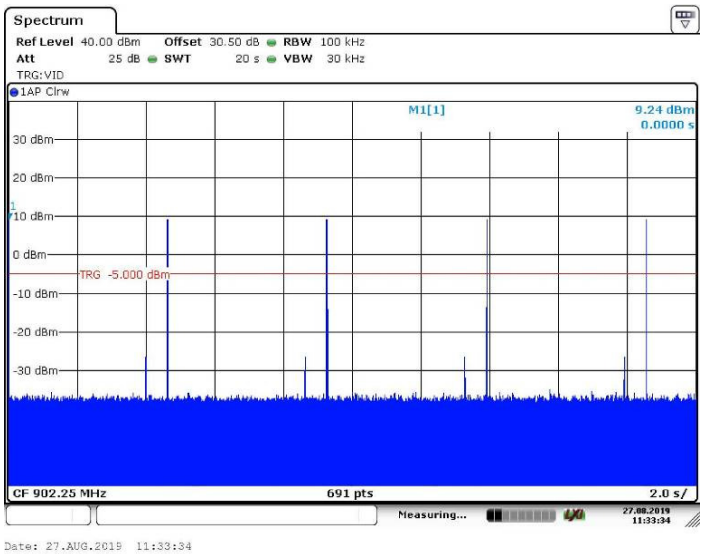
Result plot as follows:

1. Lowest channel (902.250 MHz):

Pulse Width:

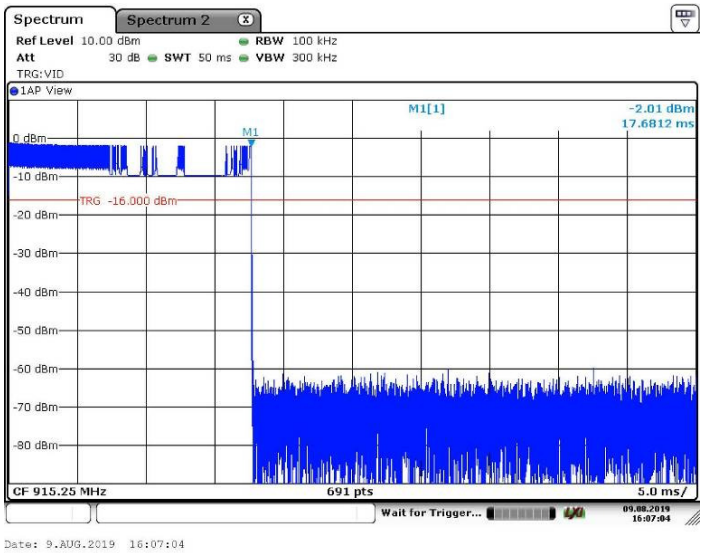


Number of Pulses in 20s observation period:

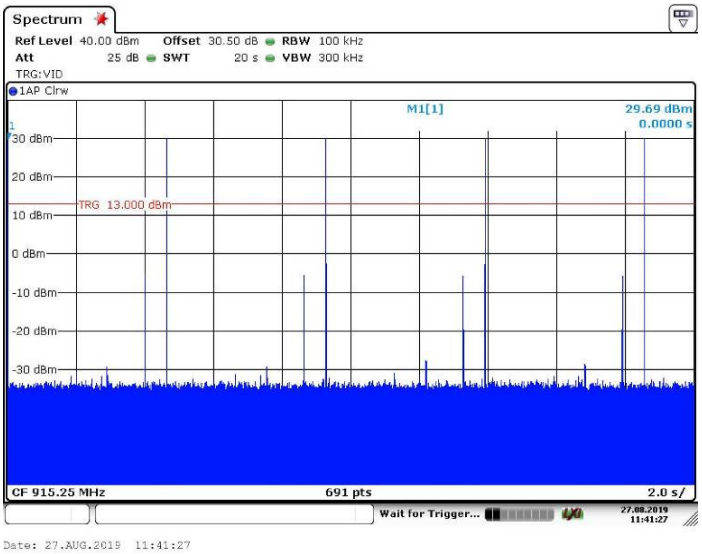


2. Middle Channel (915.250 MHz):

Pulse Width:

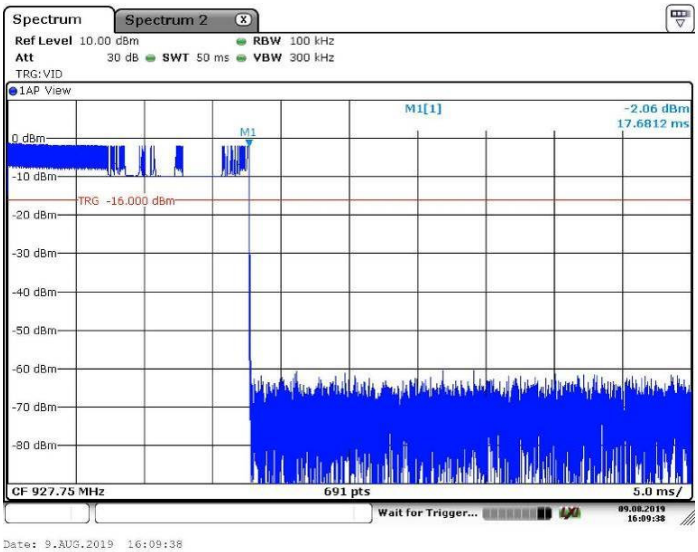


Number of Pulses in 20s observation period:

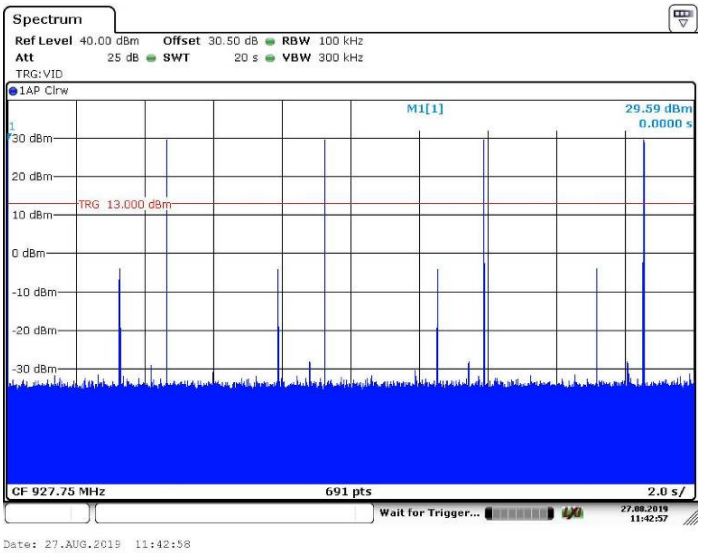


3. Highest Channel (927.750 MHz):

Pulse Width:



Number of Pulses in 20s observation period:



6.8 Pseudorandom Frequency Hopping Sequence

6.8.1 Standard requirement

15.247(a)(1) requirement:

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.

RSS-247 Section 5.1(a)

The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. 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.

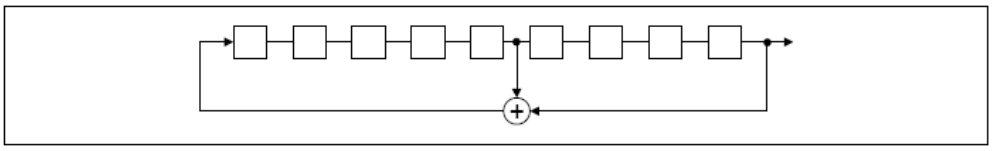
6.8.2 EUT Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

• Number of shift register stages: 9

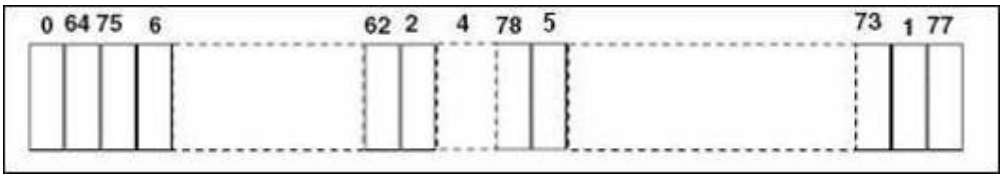
• Length of pseudo-random sequence: 2^9 -1 = 511 bits

• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

6.9 Maximum Peak Output Power

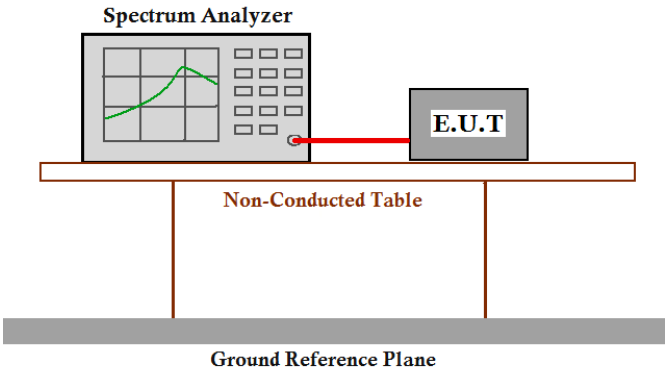
Test Requirement: FCC Part 15 C section 15.247(b)
RSS-247 Section 5.4
For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

Test Method: ANSI C63.10 (2013) Section 7.8.5

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

Test mode: Pre-test the EUT in continuous transmitting mode at the lowest (902.250 MHz), middle (915.750 MHz) and highest (927.750 MHz) channel to find antenna 1 and air speed 224kBaud is the worst case mode.
Only worst case data is shown on this report

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 300 kHz. VBW = 1 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

Test Result:				
Test Channel	**Fundamental Frequency (MHz)**	**Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	902.250	29.46	30.0	Pass
Middle	915.250	**29.50**	30.0	Pass
Highest	927.750	29.47	30.0	Pass
Remark: Cable loss=0.5 dB				
Test result: The unit does meet the FCC requirements.				

Result plot as follows:

Lowest Channel (902.250 MHz):

Date: 9.AUG.2019 16:39:25

Middle Channel (915.250 MHz):

Date: 9.AUG.2019 16:40:43

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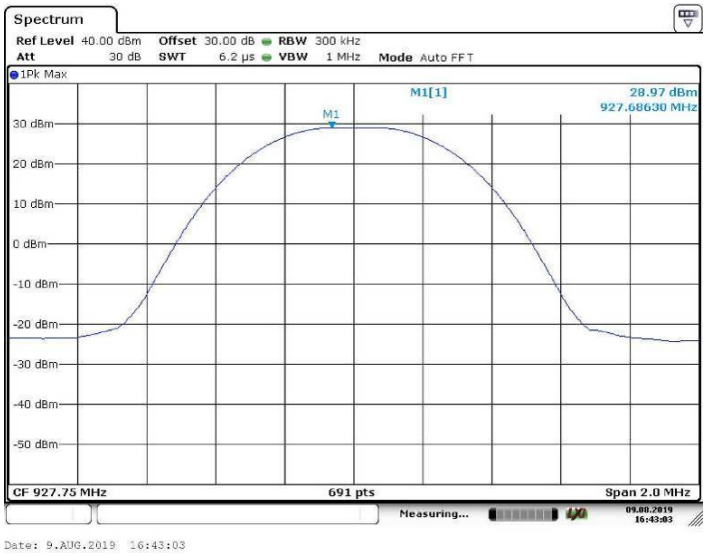
Highest Channel (927.750 MHz):



Remark: Cable loss (=0.5 dB) is added to the measurement results.

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6.10 Conducted Spurious Emissions

Test Requirement: FCC Part15 C section 15.247 (d)

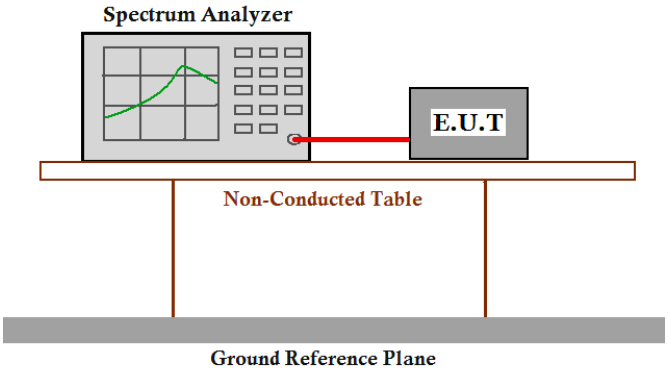
RSS-247 Section 5.5

In any 100 kHz 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 dB below that in the 100 kHz 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 dB instead of 20 dB.

Test Method: ANSI C63.10 (2013) Section 7.8.8

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (902.250 MHz), middle (915.250 MHz) and highest (927.750 MHz) channel to find antenna 1 and air speed 250kBaud is the worst-case mode.
Only worst-case data is shown on this report

Test Configuration:



Test Procedure:

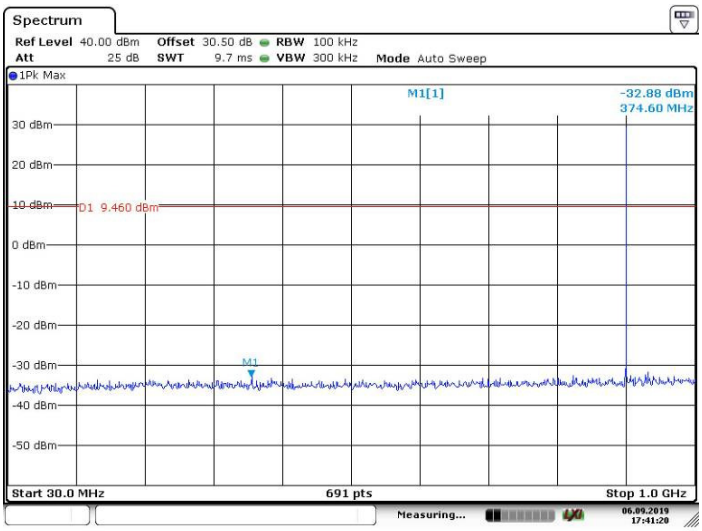
1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100 kHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

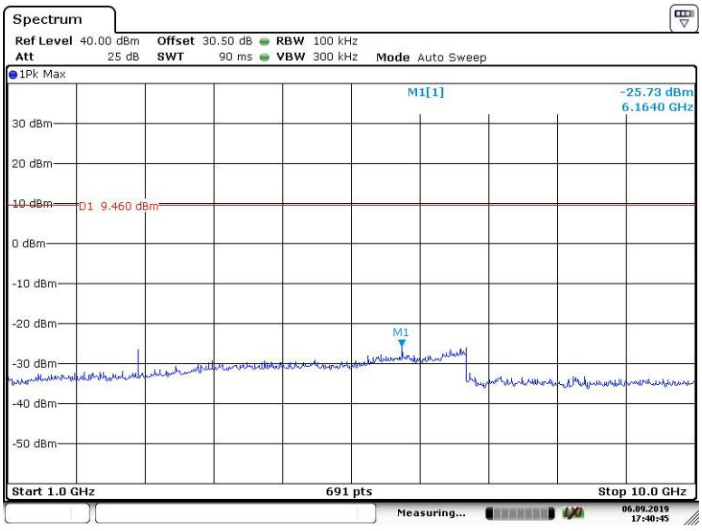
Result plot as follows:

Lowest Channel:

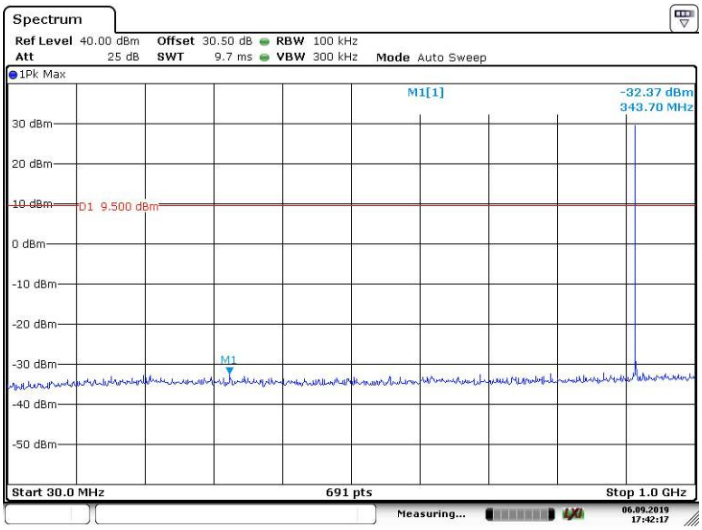
Lowest Channel: 30 MHz to 1 GHz



Lowest Channel: 1 GHz to 10 GHz

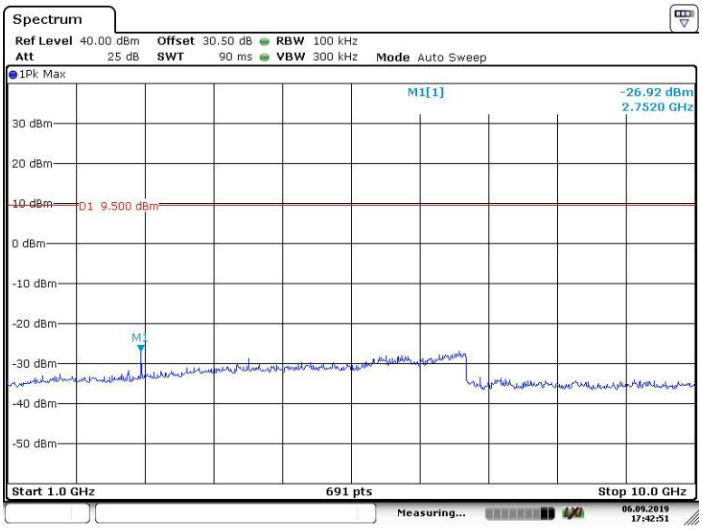


Middle Channel: 30 MHz to 1 GHz



Date: 6.SEP.2019 17:42:17

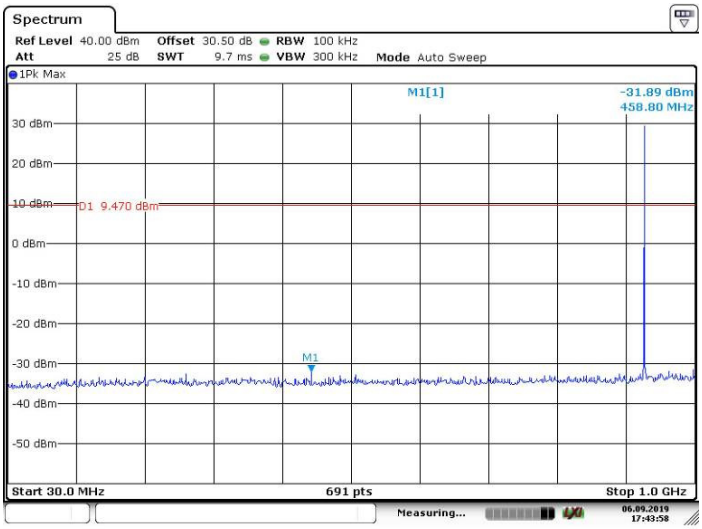
Middle Channel: 1 GHz to 10 GHz



Date: 6.SEP.2019 17:42:52

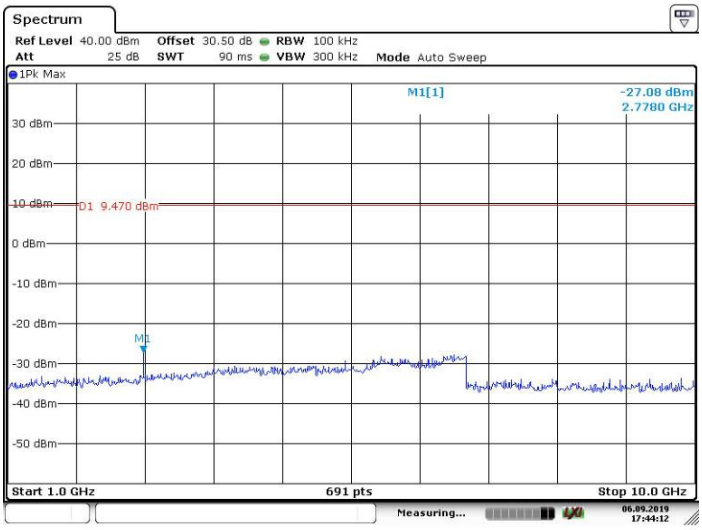
Highest Channel:

Highest Channel: 30 MHz to 1 GHz



Date: 6.SEP.2019 17:43:58

Highest Channel: 1 GHz to 10 GHz



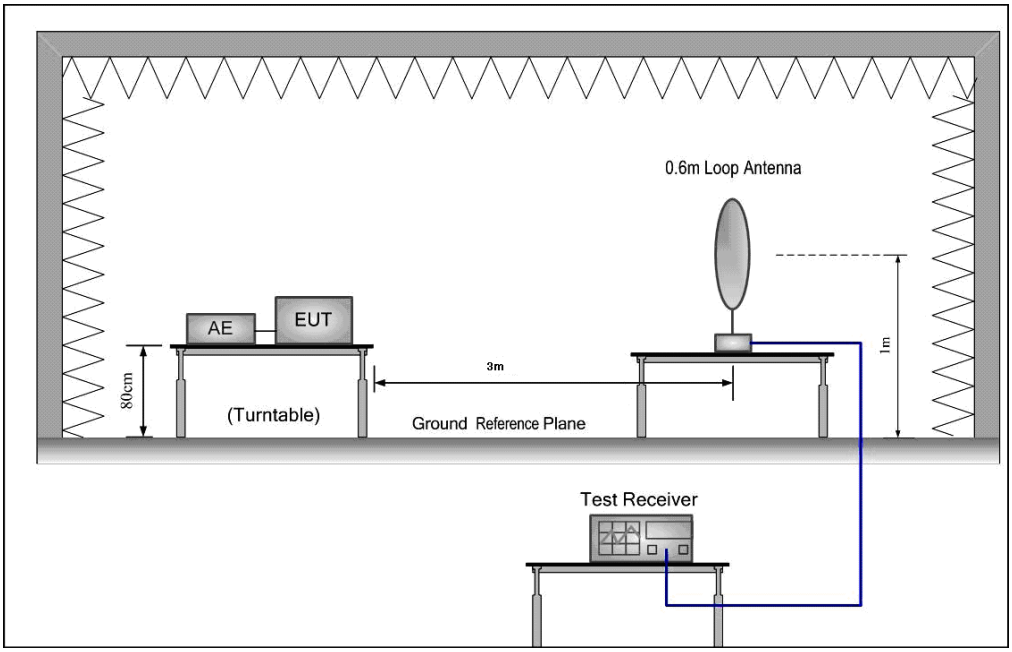
Date: 6.SEP.2019 17:44:12

6.11 Radiated Spurious Emissions

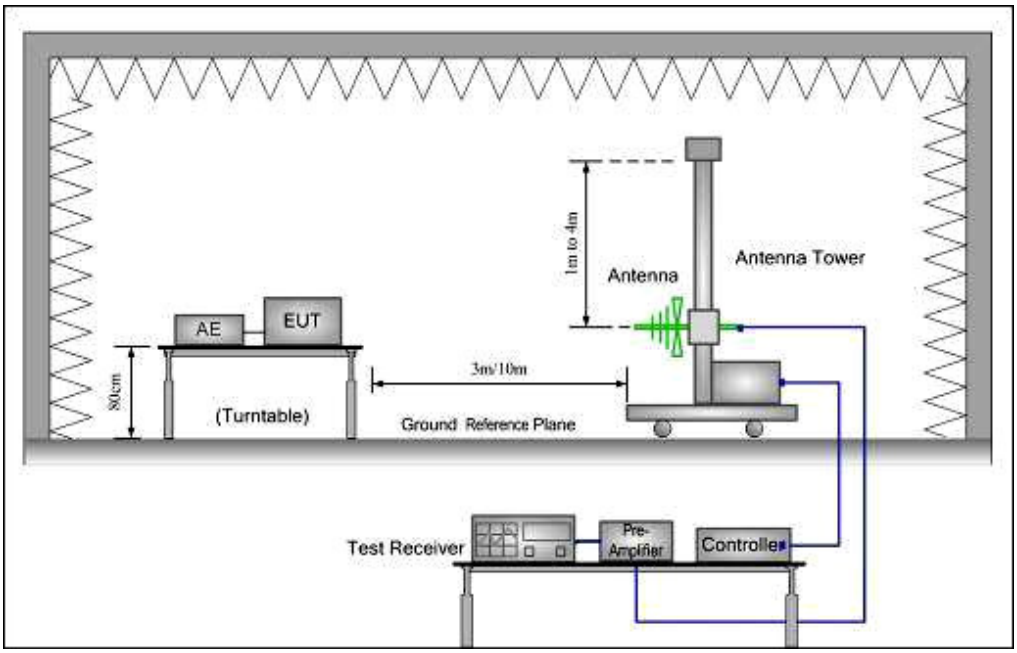
Test Requirement:	FCC Part15 C section 15.247(d) Section 5.5 & RSS-Gen Section 8.9 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that Contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, and provided the transmitter demonstrates compliance with the peak conducted power limits.
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (902.250 MHz), middle (915.250 MHz) and highest (927.750 MHz) channel to find antenna 1 and air speed 224kBaud is the worst case mode. Only worst case data is shown on this report
Detector:	For PK value: RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ≥ 1 GHz, VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold
General Limit:	40.0 dBμV/m between 30MHz & 88MHz 43.5 dBμV/m between 88MHz & 216MHz 46.0 dBμV/m between 216MHz & 960MHz 54.0 dBμV/m above 960MHz

Test Configuration:

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



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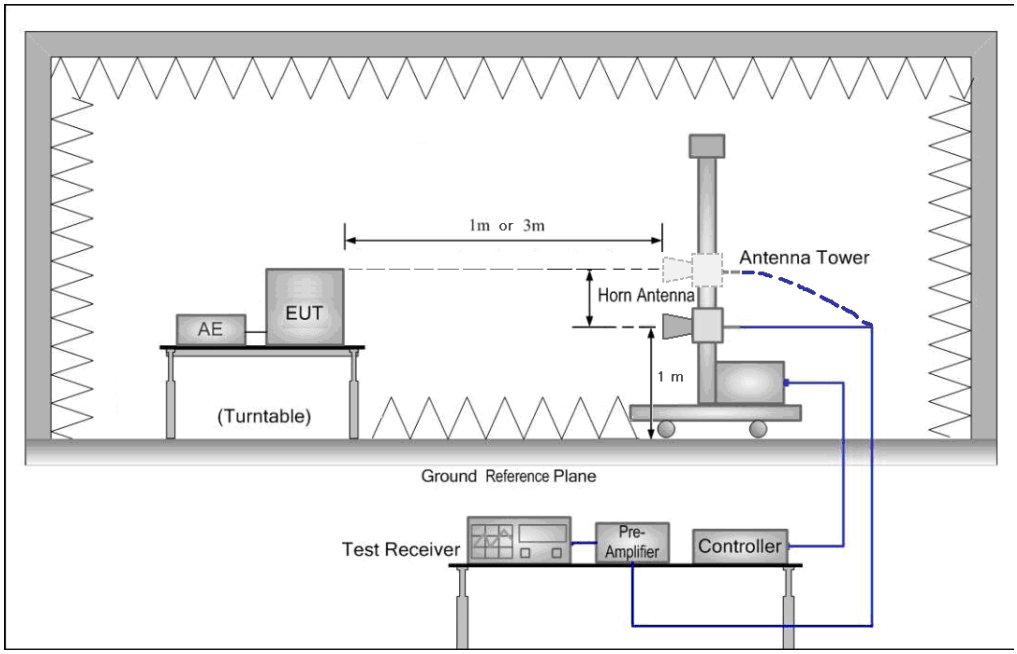
3) 1 GHz to 40 GHz emissions:



Test Procedure:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2007 was used to perform radiated emission test above 1 GHz.

The receiver scanned from the lowest frequency generated within the EUT to 25GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst-case emissions were reported.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log (dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.

Submit this data.

6.11.1 Harmonic and other spurious emissions

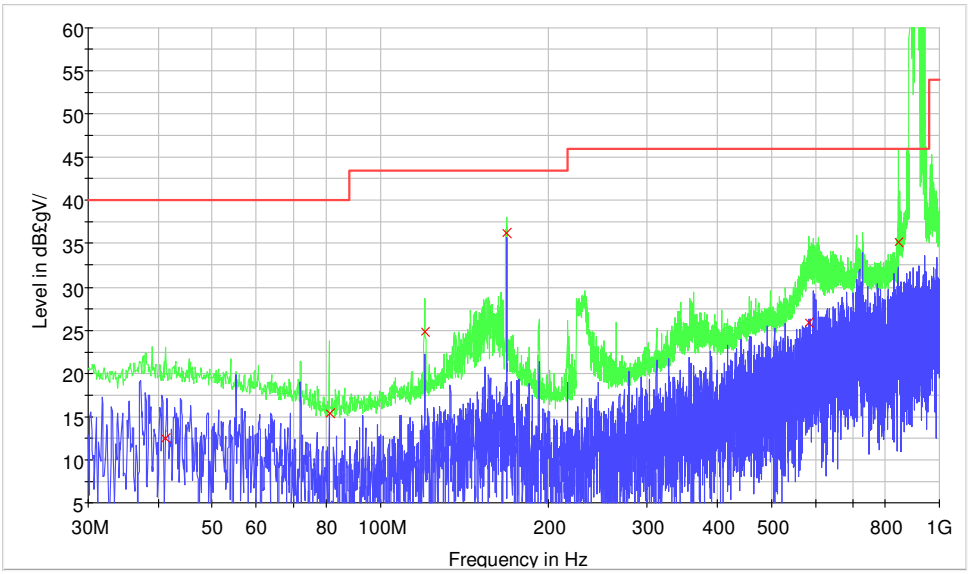
6.11.1.1 Test the lowest Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions. Quasi-Peak Measurement

Quasi-peak measurement:



Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)
41.120	V	14.5	-2.0	12.5	40	-27.5
80.920	V	9.8	5.5	15.3	40	-24.7
119.920	H	12.2	12.6	24.8	43.5	-18.7
167.920	H	14.2	22.0	36.2	43.5	-7.3
583.880	H	21.3	4.6	25.9	46	-20.1
845.560	V	25.8	9.4	35.2	46	-10.8

1. All readings are Quasi-Peak values.

2. Correction Factor = Antenna Factor + Cable Loss.

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1328.0	V	42.4	--	74.0	54.0	Pass
1804.0	V	63.4	45	74.0	54.0	Pass
2706.0.	V	62.7	47.9	74.0	54.0	Pass
3608.0	V	51.6	--	74.0	54.0	Pass
4512.0	V	49.4	--	74.0	54.0	Pass
5414.0	V	66.7	32.4	74.0	54.0	Pass

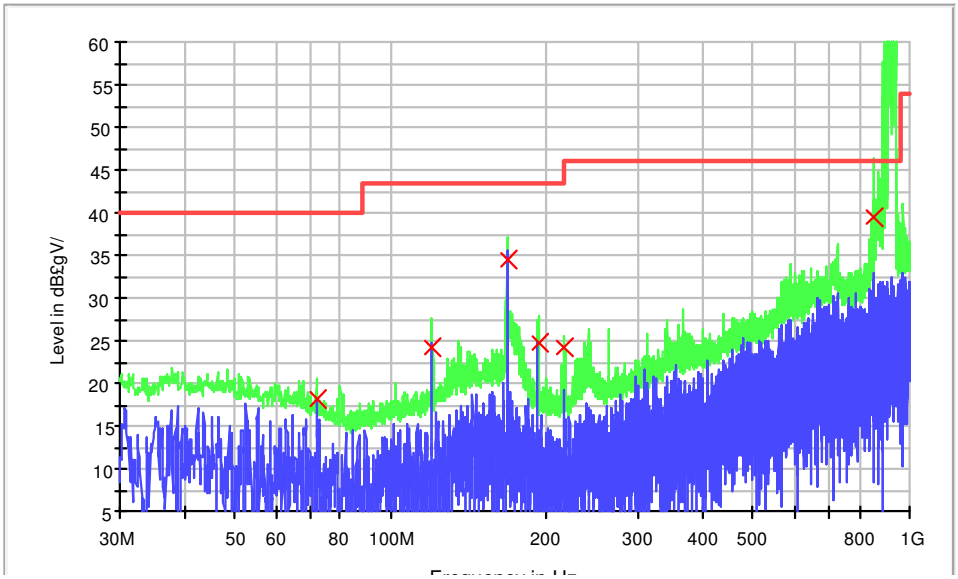
6.11.1.2 Test the middle Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Quasi-peak measurement:



Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)
72.000	V	11.2	7.1	18.3	40	-21.7
119.920	H	12.2	12.0	24.2	43.5	-19.3
167.920	H	14.2	20.2	34.4	43.5	-9.1
192.680	H	11	13.8	24.8	43.5	-18.7
216.040	H	10.5	13.8	24.3	46	-21.7
855.360	V	26	13.4	39.4	46	-6.6

1. All readings are Quasi-Peak values.

2. Correction Factor = Antenna Factor + Cable Loss.

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Remark
		Peak	Average	Peak	Average	
1330.0	V	41.7	--	74.0	54.0	Pass
1831.0	V	62.6	51.0	74.0	54.0	Pass
2746.5	V	61.2	50.8	74.0	54.0	Pass
3662.0	V	52.0	--	74.0	54.0	Pass
4577.5	V	48.8	--	74.0	54.0	Pass
5493.0	V	61.9	32.5	74.0	54.0	Pass

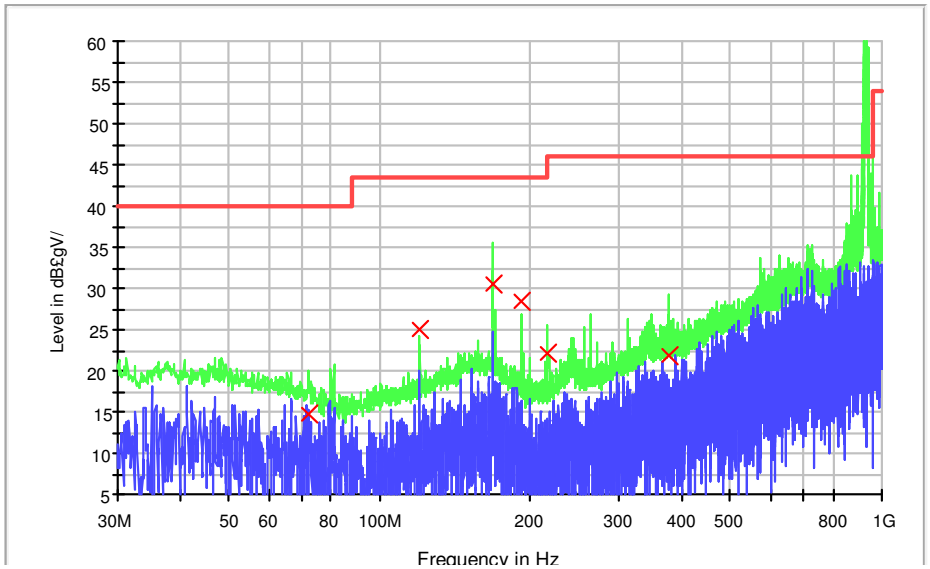
6.11.1.3 Test the highest Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Quasi-peak measurement:



Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBµV)	Emission Level (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)
72.0	H	11.2	3.5	14.7	40	-25.3
119.9	H	12.2	12.8	25.0	43.5	-18.5
168.0	H	14.2	16.4	30.6	43.5	-12.9
192.2	H	11.1	17.3	28.4	43.5	-15.1
216.2	H	10.5	11.7	22.2	46	-23.8
376.1	H	16.2	5.8	22.0	46	-24

1. All readings are Quasi-Peak values.

2. Correction Factor = Antenna Factor + Cable Loss.

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1855.5	V	60.7	42.67	74.0	54.0	Pass
1998.2	V	42.9	--	74.0	54.0	Pass
2771.0	V	49.1	--	74.0	54.0	Pass
3686.5	V	49.6	--	74.0	54.0	Pass
4602.0	V	49.8	--	74.0	54.0	Pass
5517.5	V	64.9	32.3	74.0	54.0	Pass

Remark:

1). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Loss –Preamplifier Factor.

2). As shown in Section, for frequencies above 1000 MHz the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

3). The test is only performed with the EUT in transmitting status since the test frequencies over 1GHz is only required for transmitting status.

Test result: The unit does meet the FCC requirements.

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6.11.2 Radiated Emissions which fall in the restricted bands

Test Requirement: FCC Part15 C Section 15.247(d)

In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Section 3.3 & RSS-Gen Section 8.10

(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, *Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD)*.
(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.
(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Test Method: ANSI C63.10 : Clause 6.4, 6.5 and 6.6

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (902.250 MHz) and highest (927.750 MHz) channel to find antenna 1 and air speed 250kBaud is the worst-case mode.

Only worst-case data is shown on this report

Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit: Section 15.209(a)

40.0 dBμV/m between 30MHz & 88MHz;

43.5 dBμV/m between 88MHz & 216MHz;

46.0 dBμV/m between 216MHz & 960MHz;

54.0 dBμV/m above 960MHz.

Detector: For PK value:
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW

Sweep = auto
Detector function = peak
Trace = max hold
For AV value:
RBW = 1 MHz for f ≥ 1 GHz,
VBW =10 Hz
Sweep = auto
Detector function = peak
Trace = max hold

Test Result:

Test at lowest Channel (902.250 MHz) in transmitting status

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1328.0	V	42.4	--	74.0	54.0	Pass
1804.0	V	63.4	45	74.0	54.0	Pass
2706.0	V	62.7	47.9	74.0	54.0	Pass
3608.0	V	51.6	--	74.0	54.0	Pass
4512.0	V	49.4	--	74.0	54.0	Pass
5414.0	V	66.7	32.4	74.0	54.0	Pass

Test at highest Channel (927.750 MHz) in transmitting status

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
1855.5	V	60.7	42.67	74.0	54.0	Pass
1998.2	V	42.9	--	74.0	54.0	Pass
2771.0	V	49.1	--	74.0	54.0	Pass
3686.5	V	49.6	--	74.0	54.0	Pass
4602.0	V	49.8	--	74.0	54.0	Pass
5517.5	V	64.9	32.3	74.0	54.0	Pass

Remark: above table only record the worse data of emissions in restricted frequency bands.

Test result: The unit does meet the FCC requirements.

FCC Part15 C Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section. only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]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	2655 - 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	
13.36 - 13.41			

RSS-Gen Section 8.10 Restricted bands of operation.

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, *Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD)*.

(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.

(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 – Restricted frequency bands* MHz	**MHz**	**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	* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of
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	RSSs.
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	--	

6.12 Band Edges Requirement

Test Requirement: FCC Part15 C section 15.247
RSS-247 Section 5.5

(d) In any 100 kHz 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 dB below that in the 100 kHz 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 15.247(b)(3)/ section 5.4(d) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a)/ RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a)/ RSS-Gen, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c))/ RSS-Gen Section 8.9.

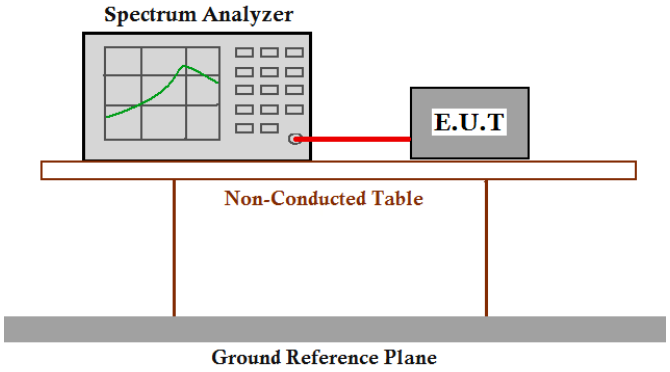
Frequency Band: 902 MHz to 928 MHz

Test Method: ANSI C63.10 (2013) Section 7.8.6

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (902.250 MHz) and highest (927.750 MHz) channel to find antenna 1 and air speed 224kBaud is the worst case mode.

Only worst case data is shown on this report

Test Configuration:



Test Procedure: Use the following spectrum analyzer settings:

Span = 10MHz (wide enough to capture the peak level of the emission

operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.)
RBW = 100 kHz (1% of the span) and VBW = 300 kHz
Sweep = auto
Detector function = peak
Trace = max hold

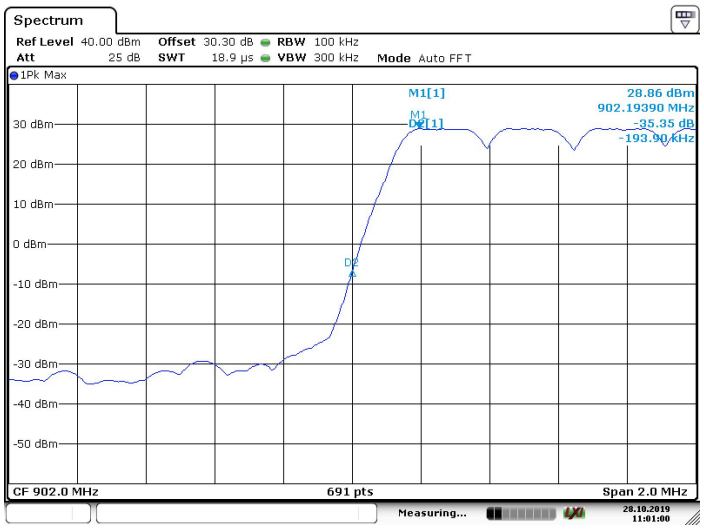
Test Result:

Compare with the output power of the lowest frequency, the Lower Edges attenuated more than 20dB

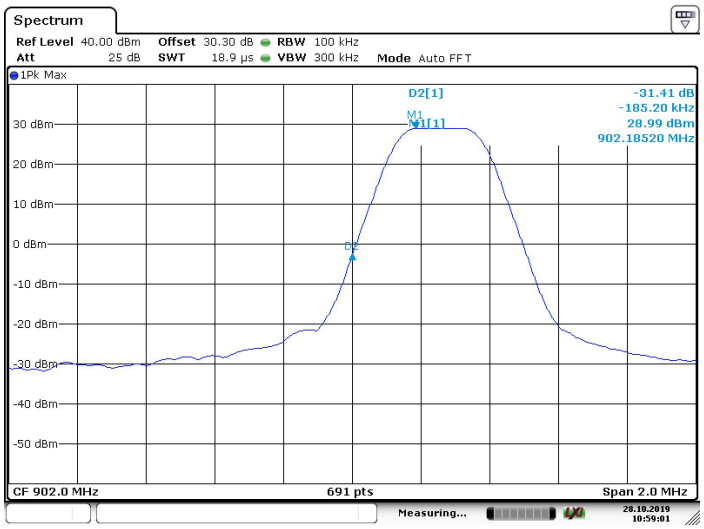
Compare with the output power of the highest frequency, the Upper Edges attenuated more than 20dB.

Lowest channel (902.250 MHz):

Hopping On:

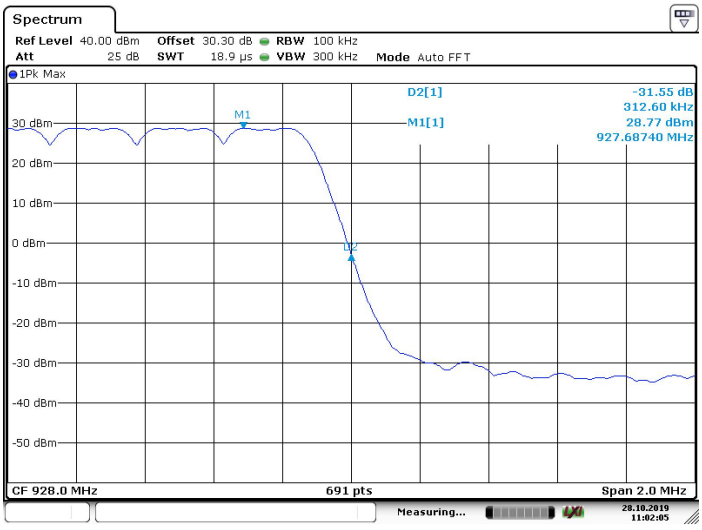


Hopping Off:

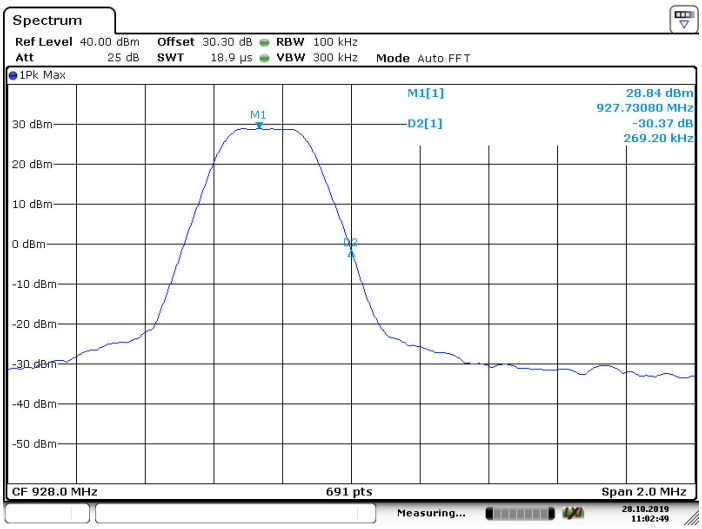


Highest Channel (927.750 MHz):

Hopping On:



Hopping Off:



Test result: The unit does meet the FCC requirements.

6.13 Occupied Bandwidth

Test Requirement: RSS-Gen Section 6.7

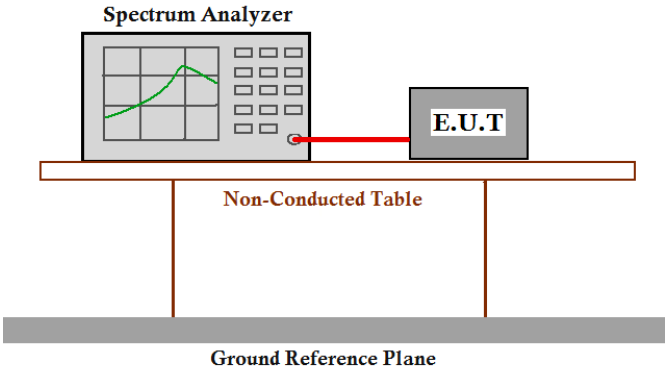
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Test Method: ANSI C63.10 Section 6.9.3

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (902.250MHz), middle (915.250 MHz) and highest (927.750MHz) channel. to find antenna 1 and air speed 224kBaud is the worst-case mode.

Only worst-case data is shown on this report

Test Configuration:



Test Procedure:

1. The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
2. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
3. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

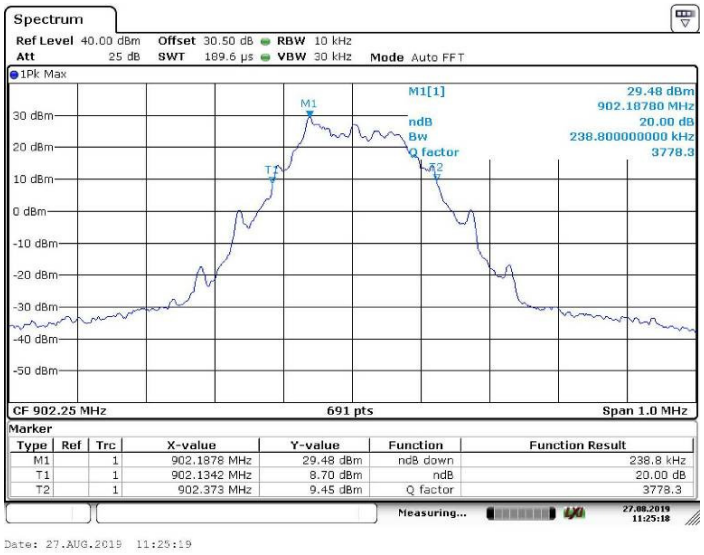
4. Step 1) through step 3) might require iteration to adjust within the specified range.
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

Test result:

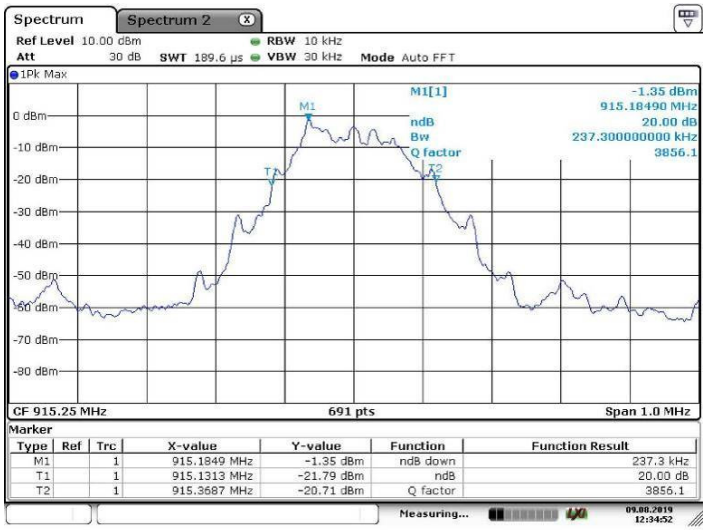
Test Channel	Fundamental Frequency (MHz)	Bandwidth(kHz)	limit (kHz)
Lowest	902.250	224	Less than 250kHz
Middle	915.250	224	Less than 250kHz
Highest	927.750	224	Less than 250kHz

Result plot as follows:

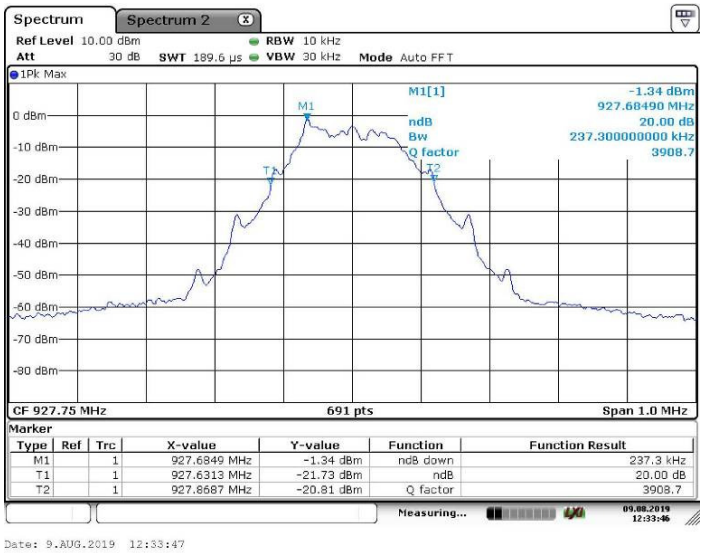
Lowest Channel



Middle Channel



Highest Channel



7 Photographs

7.1 Radiated Spurious Emission Test Setup

Remark: Photos refer to Appendix: Setup Photo

8 EUT Constructional Details

Remark: Photos refer to Appendix: External Photo

End of Report

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