FCC RF TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

DECT Cordless VoIP Phone

ISSUED TO
Grandstream Networks, Inc.

126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

Tested by: Hu Chao
Hu Chao
(Engineer)
Date Feb. 09. 2018

Approved by:
Wei Yanquan
(Chief Engineer)
Date Feb. 09. 2018

Report No.:	BL-SZ17C0361-601
EUT Name:	DECT Cordless VoIP Phone
Model Name:	DP720 (Handset Unit)
Brand Name:	Grandstream
Test Standard:	FCC Part 15, subpart D
FCC ID:	YZZ-DP720
Test conclusion:	Pass
Test Date:	Dec. 27, 2017 ~ Feb. 09, 2018
Date of Issue:	Feb. 09, 2018

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Revision History

Version	Issue Date	Revisions Content
Rev. 01	Jan. 31, 2018	Initial Issue
Rev. 02	Feb. 09, 2018	Revise the channel 0 frequency on page 9, update the test data of in-band on page 50.

TABLE OF CONTENTS

1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20 to 25℃
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

1.4 Announce

(1) The test report reference to the report template version v1.0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Grandstream Networks, Inc.
Address	126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

2.2 Manufacturer Information

Manufacturer	Grandstream Networks, Inc.
Address	126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 Ancillary Equipment

Ancillary Equipment 1	Adapter 1	
	Brand Name	N/A
	Model Name	F05L5-050100SPAU L.P.S
	Rated Input	100-240 V~, 0.2 A, 50/60 Hz
	Rated Output	5 V⎓ 1 A
Ancillary Equipment 2	Adapter 2	
	Brand Name	N/A
	Model Name	F06US0500100A
	Rated Input	100-240 V~, 0.2 A, 50/60 Hz
	Rated Output	5 V⎓ 1 A
Ancillary Equipment 3	Adapter 3	
	Brand Name	N/A
	Model Name	NBS05B050100VU
	Rated Input	100-240 V~, 0.2 A, 50/60 Hz
	Rated Output	5 V⎓ 1 A

2.5 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Frequency Range	1920 – 1930 MHz
Number of Channels	5 Channels, 5x12 = 60 TDMA Duplex Channels
Modulation Type	GFSK
Number of Antennas	1
Product Type	☒ Mobile ☐ Portable ☐ Fix Location
Antenna Type	Dipole
Antenna Gain	1.5dBi
About the Product	This DECT product is a DECT Cordless VoIP Phone.

All channel list

Channel number	Channel Frequency	Channel number	Channel Frequency
0	**1928.488**	3	1923.264
1	1926.720	4	**1921.536**
2	**1924.992**	--	--

2.6 General Description for Equipment under Test (EUT)

EUT Type	DECT Cordless VoIP Phone
Model Name Under Test	DP720 (Handset Unit)
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V2.0
Software Version	1.0.3.31
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	N/A

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart D (10-1-16 Edition)	Miscellaneous Wireless Communications Services
2	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
3	ANSI C63.17-2013	American National Standard Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices.

3.2 Verdict

No.	Description	FCC PART No.	ISED Part No.	Test Result	Verdict
General Technical Requirements					
1	Antenna Requirement	15.203; 15.317	RSS-GEN 8.3	N/A	Pass[Note 1]
2	Labeling Requirement	15.19(a)(3)	RSP-100 3.1	N/A	Pass[Note 2]
3	Digital Modulation Techniques	15.319 (b)	5.1	N/A	Pass[Note 3]
4	Conducted emission	15.107(a); 15.207(a)	5.4 RSS-GEN 8.8	ANNEX A.1	Pass
5	Peak transmit power	15.319(c)(e), 15.31(e)	5.6 RSS-GEN 8.3	ANNEX A.2	Pass
6	Power spectral density	15.319 (d)	5.7	ANNEX A.3	Pass
7	Emission bandwidth	15.323 (a)	5.5 RSS-GEN 6.6	ANNEX A.4	Pass
8	Emission Inside and Out the sub-band	15.323 (d)	5.8.1; 5.8.2	ANNEX A.5	Pass
9	Carrier Frequency Stability	15.323(f)	5.3	ANNEX A.6	Pass
Specific Requirements for UPCS Device					
10	Frame repetition Stability, period and jitter	15.323(e)	5.2(1)(13)	ANNEX A.7	Pass
11	Monitoring the time	15.323 (c)(1)	5.2(1)	ANNEX A.8	Pass
12	Monitoring threshold	15.323 (c)(2) (9)	5.2(2) (9)	ANNEX A.9	Pass
13	Maximum transmit period	15.323 (c)(3)	5.2(3)	ANNEX A.10	Pass
14	Acknowledgment system	15.323 (c)(4)	5.2(4)	ANNEX A.11	Pass
15	Least Interfered Channel, LIC	15.323 (c)(5)	5.2(5)	ANNEX A.12	Pass
16	Random waiting	15.323 (c)(6)	5.2(6)	ANNEX A.13	Pass
17	Monitoring bandwidth and reaction time	15.323 (c)(7)	5.2(7)	ANNEX A.14	Pass
18	Monitoring antenna	15.323 (c)(8)	5.2(8)	ANNEX A.15	Pass
19	Duplex system LBT	15.323 (c)(10)	5.2(10)	ANNEX A.16	Pass
20	Co-located device LBT	15.323 (c)(11)	5.2(11)	ANNEX A.17	Pass
21	Fair access	15.323 (c)(12)	5.2(12)	ANNEX A.18	Pass
22	Radiated Emission	15.319 (g)	5.2(13)	ANNEX A.19	Pass

Note [1]: Please refer to section 5.1.

Note [2]: Customer declaration .See separate documents showing the label design and the placement of the label on the EUT.

Note[3]: The requirement is all transmissions must use only digital modulation techniques. They are made in accordance with ANSI C63.17 sub-clause 6.1.4. Please refer to the technical description or relevant DECT standards for more details.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	45% - 55%	
Atmospheric Pressure	100 kPa - 102 kPa	
Temperature	NT (Normal Temperature)	+22℃ to +25℃
Working Voltage of the EUT	NV (Normal Voltage)	3.7 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2017.06.22	2018.06.21
Switch Unit with OSP-B157	ROHDE&SCHWARZ	OSP120	101270	2017.06.22	2018.06.21
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2017.09.07	2018.09.06
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2017.06.22	2018.06.21
LISN	SCHWARZBECK	NSLK 8127	8127-687	2017.06.22	2018.06.21
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2017.06.22	2018.06.21
Power Splitter	KMW	DCPD-LDC	1305003215	--	--
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2017.06.22	2018.06.21
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2017.06.22	2018.06.21
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2017.06.22	2018.06.21
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2017.06.22	2018.06.21
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2017.06.22	2018.06.21
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2017.06.22	2018.06.21
Test Antenna-Horn(15-26.5 GHz)	SCHWARZBECK	BBHA 9170	9170-305	2017.06.22	2018.06.21
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.24	2019.02.23
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60 *7.35m	N/A	2016.08.09	2018.08.08
Shielded Enclosure	ChangNing	CN-130701	130703	--	--
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2017.06.22	2018.06.21
Power Amplifier	OPHIR RF	5225F	1037	2017.02.17	2018.02.16
Power Amplifier	OPHIR RF	5273F	1016	2017.02.17	2018.02.16
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A

4.3 Measurement Uncertainty

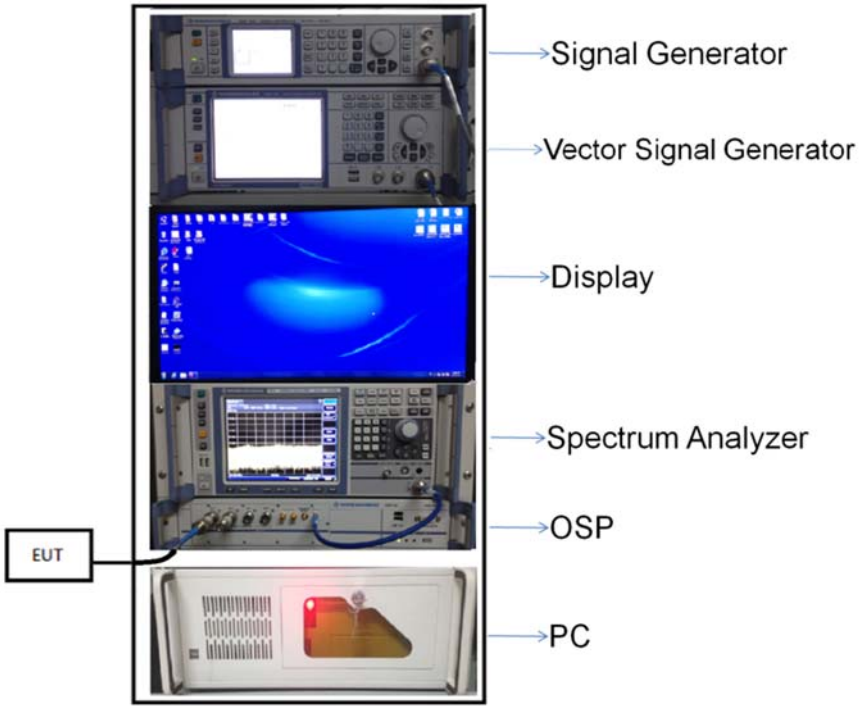
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

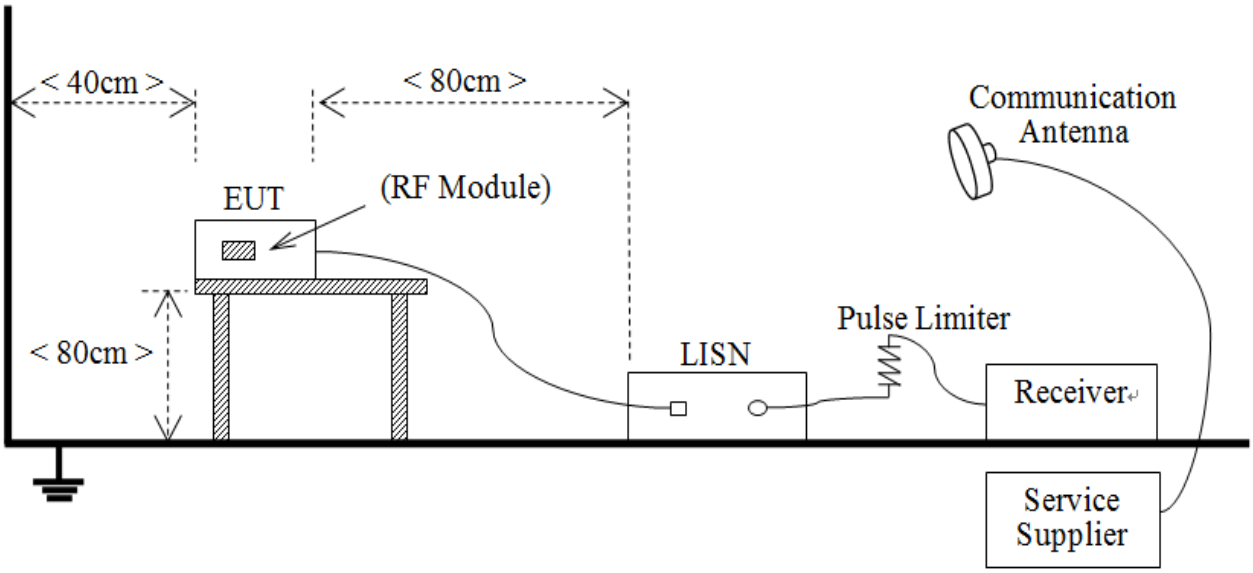
4.4 Description of Test Setup

4.4.1 For Antenna Port Test



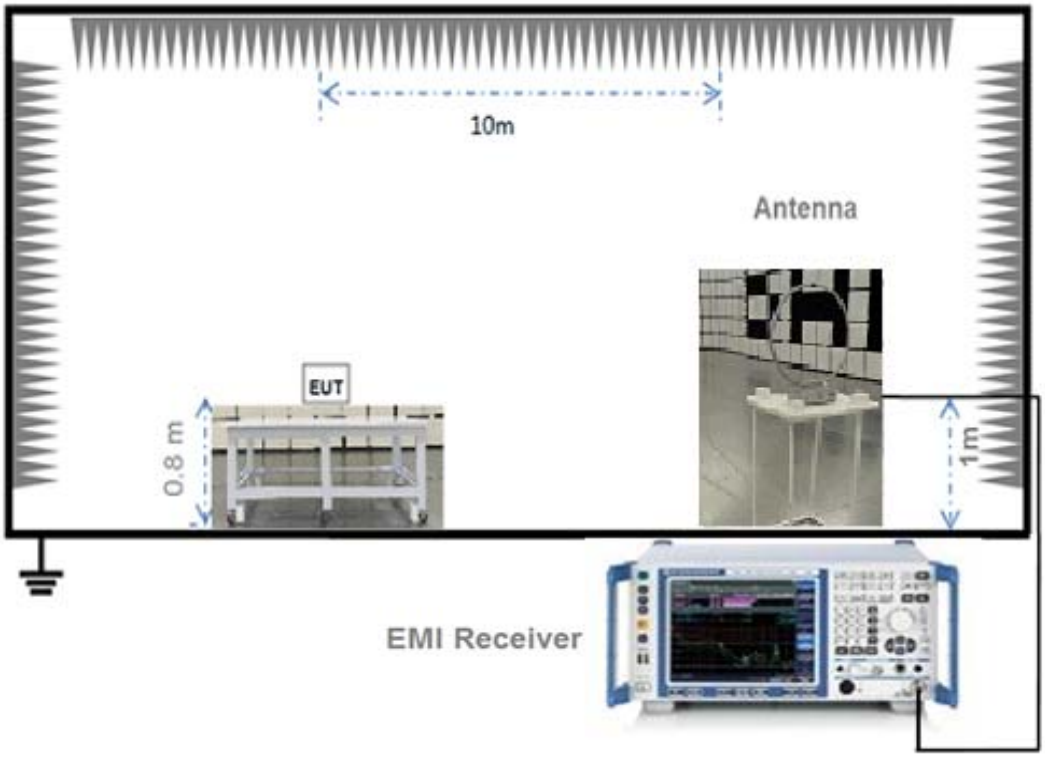
(Diagram 1)

4.4.2 For AC Power Supply Port Test



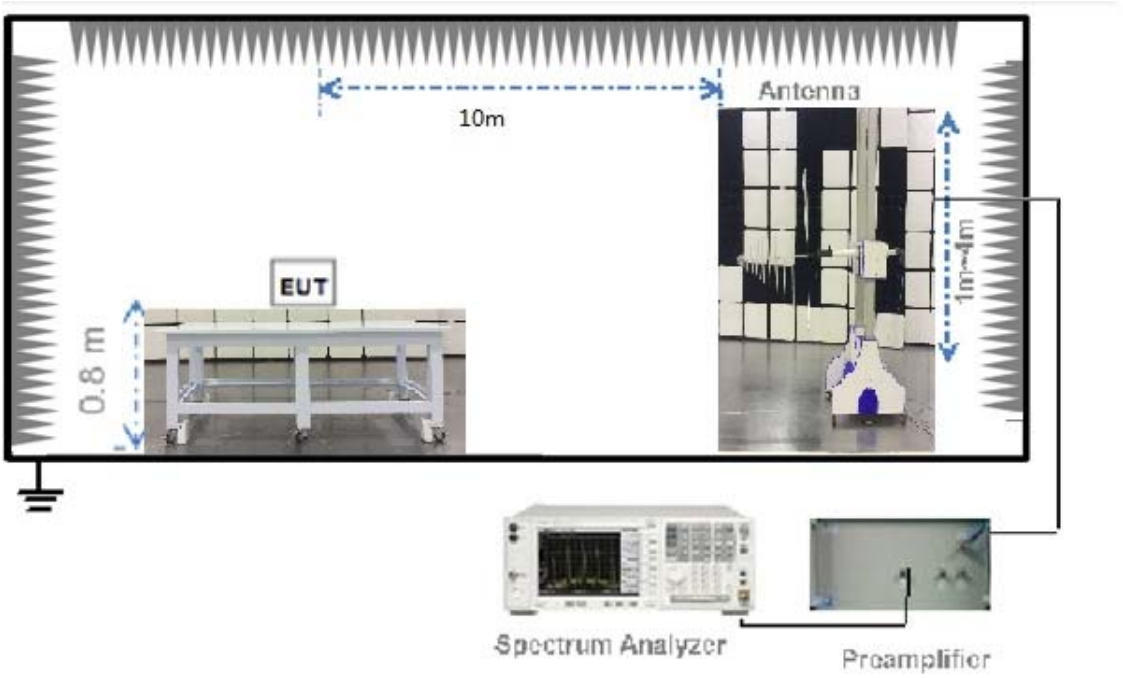
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



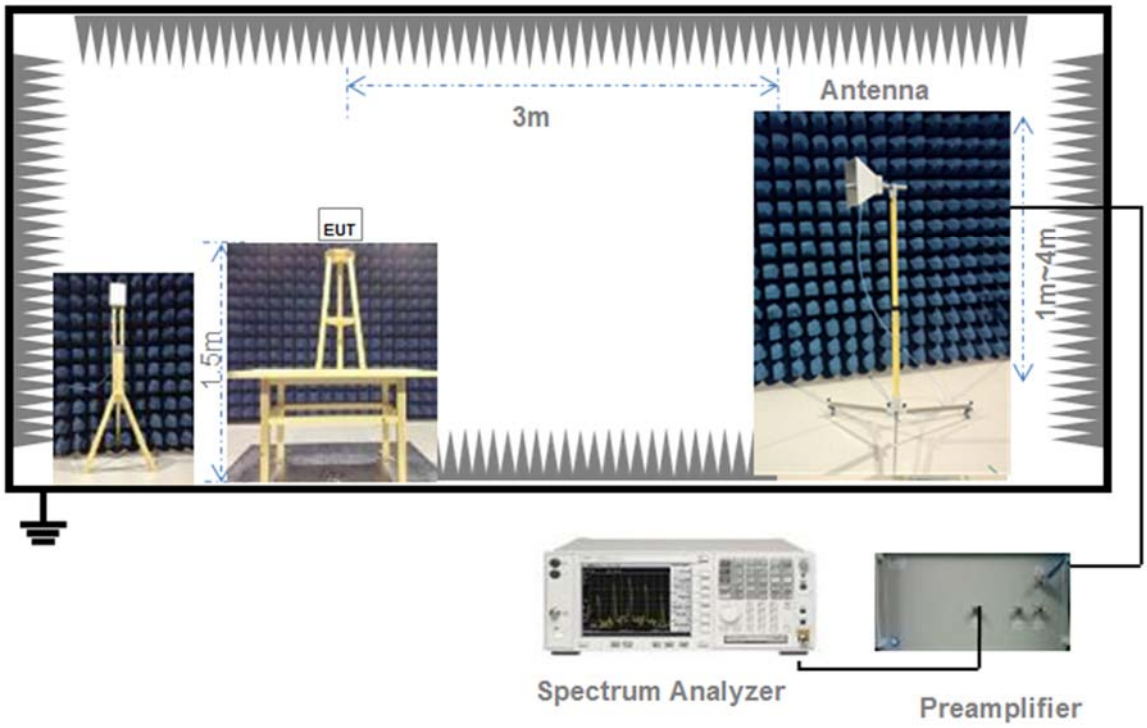
(Diagram 3)

4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.5 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.317

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
Compliance with 15.203, use of a standard antenna jack or electrical connector is prohibited.	The antenna is the unique connector with a wire antenna.

Reference Documents	Item
Photo	

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Conducted Emission

5.2.1 Limit

FCC §15.207; RSS-GEN, 8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.2.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.
Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Peak transmit power

5.3.1 Test Limit

FCC § 15.319(c)(e); RSS-213, 5.6

Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3dBi.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

Reference to ANSI C63.17, Clause 6.1.2.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Power Spectral density (PSD)

5.4.1 Limit

FCC §15.319(d); RSS-213, 5.7

Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

Reference to ANSI C63.17, Clause 6.1.5.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Emission Bandwidth

5.5.1 Limit

FCC §15.323 (a); RSS-213, 5.5 RSS-GEN, 6.6

The 26 dB and 99% Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

Reference to ANSI C63.17, Clause 6.1.3.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Emission Inside and Out the sub-band

5.6.1 Limit

FCC §15.323 (d); RSS-213, 5.8

In-Band Emissions:

B < f ≤ 2B: at least 30 dB below max. permitted peak power

2B < f ≤ 3B: at least 50 dB below max. permitted peak power

3B < f ≤ UPCS Band Edge: at least 60 dB below max. permitted peak power

Out-of-Band Emissions:

f ≤ 1.25MHz outside UPCS band: ≤ -9.5dBm

1.25MHz ≤ f ≤ 2.5MHz outside UPCS band: ≤ -29.5 dBm

f ≥ 2.5MHz outside UPCS band: ≤ -39.5 dBm

5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

Reference to ANSI C63.17, Clause 6.1.6.

5.6.4 Test Result

Please refer to ANNEX A.5.

5.7 Carrier Frequency Stability

5.7.1 Limit

FCC §15.323 (f); RSS-213, 5.3

The frequency stability of the carrier frequency of the intentional radiator shall be maintained within ±10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of −20° to + 50 °C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further. Requirement to vary supply voltage.

5.7.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

Reference to ANSI C63.17, Clause 6.2.1.

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Frame repetition Stability, period and jitter

5.8.1 Requirements

FCC §15.323 (e); RSS-213, 5.2(1) (13)

The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in this band shall be 20 milliseconds or 10 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per million (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm. The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

5.8.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

Reference to ANSI C63.17, Clause 6.2.2&6.2.3.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Monitoring the time

5.9.1 Limit

FCC §15.323 (c) (1); RSS-213, 5.2(1)

Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit for a period of at least 10 milliseconds for systems designed to use a 10 milliseconds or shorter frame period or at least 20 milliseconds for systems designed to use a 20 milliseconds frame period.

5.9.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

Reference to ANSI C63.17, Clause 7.3.3.

5.9.4 Test Result

Please refer to ANNEX A.8.

5.10 Monitoring threshold

5.10.1 Limit

FCC §15.323 (c) (2); RSS-213, 5.2(2)

The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth used by the device.

FCC §15.323 (c) (9); RSS-213, 5.2(9)

Devices that have a power output lower than the maximum permitted under this subpart may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

5.10.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

Reference to ANSI C63.17, Clause 7.3.1.

5.10.4 Test Result

Please refer to ANNEX A.9.

5.11 Maximum transmit period

5.11.1 Limit

FCC §15.323 (c) (3); RSS-213, 5.2(3)

If no signal above the threshold level is detected, transmission may commence and continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

5.11.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.11.3 Test Procedure

Reference to ANSI C63.17, Clause 8.2.2.

5.11.4 Test Result

Please refer to ANNEX A.10.

5.12 Acknowledgment system

5.12.1 Limit

FCC §15.323 (c) (4); RSS-213, 5.2(4)

Once access to specific combined time and spectrum windows is obtained an acknowledgment from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgments must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgment, at which time the access criteria must be repeated.

5.12.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.12.3 Test Procedure

Reference to ANSI C63.17, Clause 8.2.

5.12.4 Test Result

Please refer to ANNEX A.11.

5.13 Least Interfered Channel, LIC

5.13.1 Limit

FCC §15.323 (c) (5); RSS-213, 5.2(5)

If access to spectrum is not available as determined by the above, and a minimum of 20 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level may be accessed. A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 milliseconds frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value. The power measurement resolution for this comparison must be accurate to within 6 dB. No device or group of cooperating devices located within 1 meter of each other shall during any frame period occupy more than 6 MHz of aggregate bandwidth, or alternatively, more than one third of the time and spectrum windows defined by the system.

5.13.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.13.3 Test Procedure

Reference to ANSI C63.17, Clause 7.3.2 and 7.3.3.

5.13.4 Test Result

Please refer to ANNEX A.12.

5.14 Random waiting

5.14.1 Limit

FCC §15.323 (c) (6); RSS-213, 5.2(6)

If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

5.14.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.14.3 Test Procedure

Reference to ANSI C63.17, Clause 8.1.3

5.14.4 Test Result

Please refer to ANNEX A.13.

5.15 Monitoring bandwidth and reaction time

5.15.1 Limit

FCC §15.323 (c) (7); RSS-213, 5.2(7)

The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than 50xSQRT (1.25/emission bandwidth in MHz) microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be 35xSQRT (1.25/emission bandwidth in MHz) microseconds but shall not be required to be less than 35 microseconds.

5.15.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.15.3 Test Procedure

Reference to ANSI C63.17, Clause 7.4 and 7.5.

5.15.4 Test Result

Please refer to ANNEX A.14.

5.16 Monitoring antenna

5.16.1 Limit

FCC §15.323 (c) (8); RSS-213, 5.2(8)

The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

5.16.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.16.3 Test Procedure

Reference to ANSI C63.17, Clause 4.

5.16.4 Test Result

Please refer to ANNEX A.15.

5.17 Duplex system LBT

5.17.1 Limit

FCC §15.323 (c) (10); RSS-213, 5.2(10)

An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

5.17.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.17.3 Test Procedure

Reference to ANSI C63.17, Clause 8.3.

5.17.4 Test Result

Please refer to ANNEX A.16.

5.18 Co-located device LBT

5.18.1 Limit

FCC §15.323 (c) (11); RSS-213, 5.2(11)

An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a collocated (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within 1.25 MHz of the center frequency of channel(s) already occupied by that device or collocated cooperating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

5.18.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.18.3 Test Procedure

Reference to ANSI C63.17, Clause 8.4.

5.18.4 Test Result

Please refer to ANNEX A.17.

5.19 Fair access

5.19.1 Limit

FCC §15.323 (c) (12); RSS-213, 5.2(12)

The provisions of (c)(10) or (c)(11) of this section shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

5.19.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.19.3 Test Result

Please refer to ANNEX A.18.

5.20 Radiated Emission

5.20.1 Limit

FCC §15.209&15.319(g);

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

1. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

2. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.20.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.20.3 Test Procedure

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

E = EIRP – 20log D + 104.8

where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

Peak power measurement procedure

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 1.

b) VBW ≥ 3 x RBW.

c) Detector = Peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Table 1—RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz

> 1000 MHz	1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW ≥ 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20 log(1/x), where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

5.20.4 Test Result

Please refer to ANNEX A.19.

ANNEX A TEST RESULT

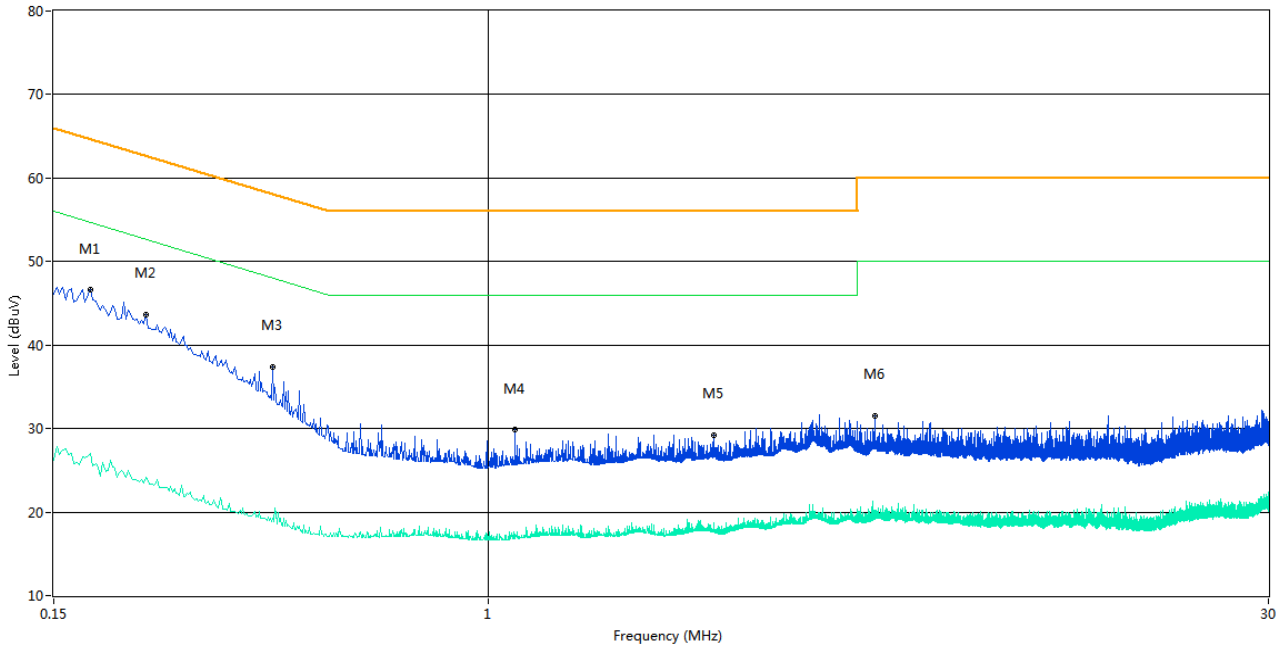
A.1 Conducted Emissions

Note: The EUT is working in the Normal link mode.

Test Data and Plots

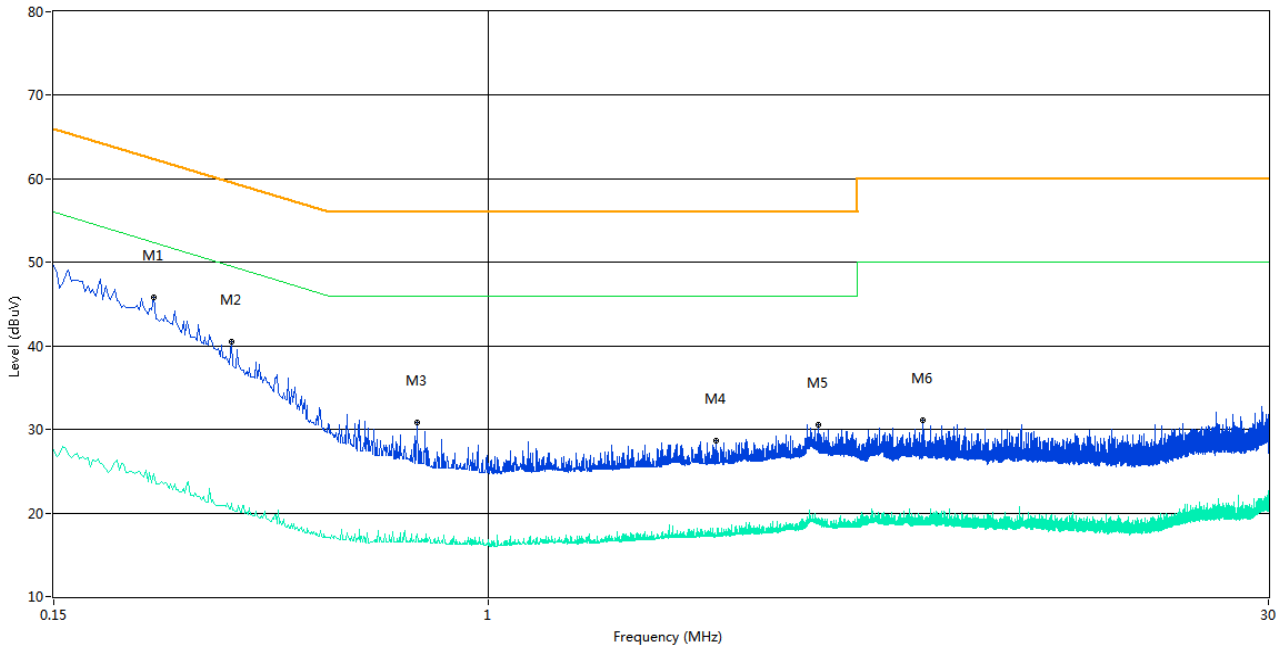
Adapter 1

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.176	46.6	10.04	64.7	18.10	Peak	L Line	Pass
1**	0.176	27.1	10.04	54.7	27.60	AV	L Line	Pass
2	0.224	43.7	10.04	62.7	19.00	Peak	L Line	Pass
2**	0.224	24.1	10.04	52.7	28.60	AV	L Line	Pass
3	0.390	37.3	10.04	58.1	20.80	Peak	L Line	Pass
3**	0.390	19.2	10.04	48.1	28.90	AV	L Line	Pass
4	1.122	29.8	10.06	56.0	26.20	Peak	L Line	Pass
4**	1.122	17.3	10.06	46.0	28.70	AV	L Line	Pass
5	2.666	29.2	10.11	56.0	26.80	Peak	L Line	Pass
5**	2.666	18.0	10.11	46.0	28.00	AV	L Line	Pass
6	5.392	31.6	10.18	60.0	28.40	Peak	L Line	Pass
6**	5.392	19.8	10.18	50.0	30.20	AV	L Line	Pass

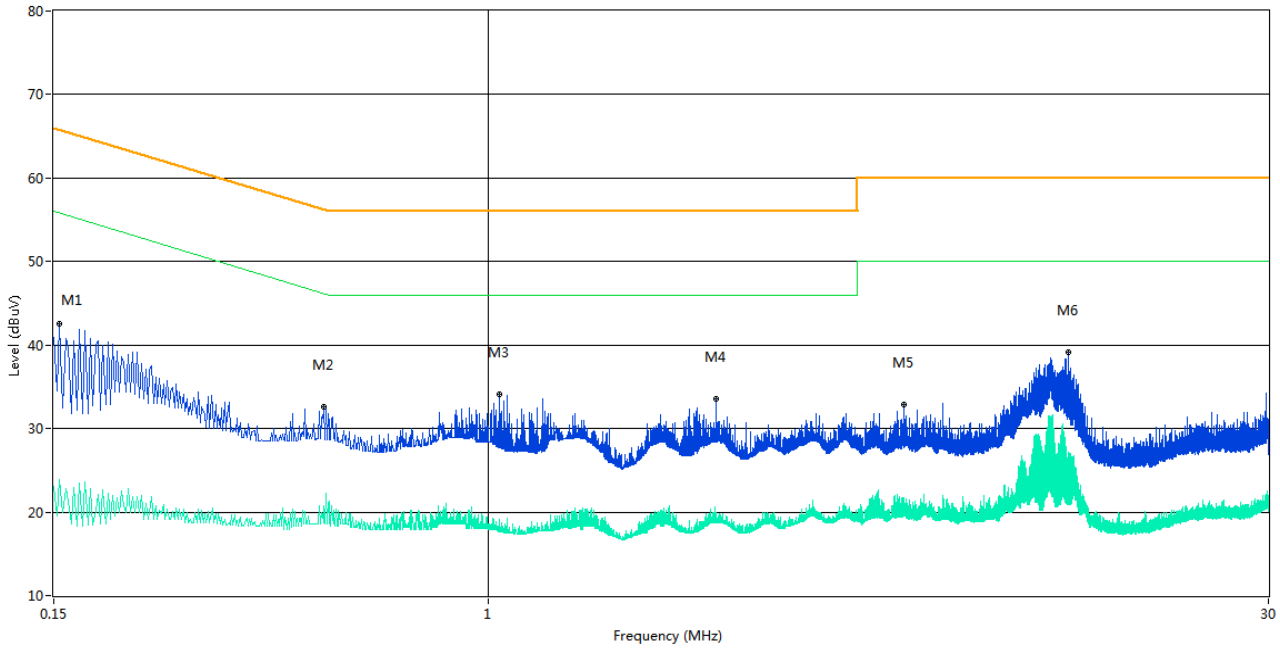
PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.232	45.9	10.04	62.4	16.50	Peak	N Line	Pass
1**	0.232	24.6	10.04	52.4	27.80	AV	N Line	Pass
2	0.326	40.5	10.04	59.6	19.10	Peak	N Line	Pass
2**	0.326	21.2	10.04	49.6	28.40	AV	N Line	Pass
3	0.732	30.8	10.05	56.0	25.20	Peak	N Line	Pass
3**	0.732	17.5	10.05	46.0	28.50	AV	N Line	Pass
4	2.692	28.7	10.11	56.0	27.30	Peak	N Line	Pass
4**	2.692	17.3	10.11	46.0	28.70	AV	N Line	Pass
5	4.212	30.6	10.15	56.0	25.40	Peak	N Line	Pass
5**	4.212	18.9	10.15	46.0	27.10	AV	N Line	Pass
6	6.652	31.2	10.22	60.0	28.80	Peak	N Line	Pass
6**	6.652	18.9	10.22	50.0	31.10	AV	N Line	Pass

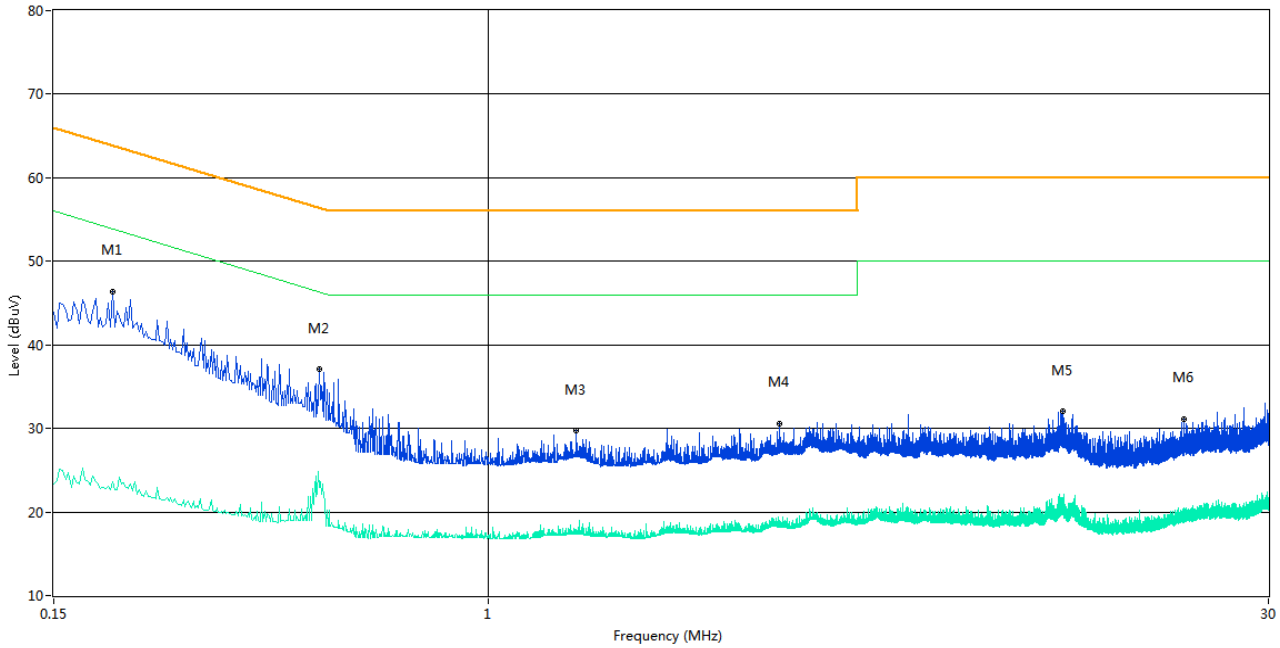
Adapter 2

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.154	42.5	10.04	65.8	23.30	Peak	L Line	Pass
1**	0.154	23.9	10.04	55.8	31.90	AV	L Line	Pass
2	0.488	32.6	10.05	56.2	23.60	Peak	L Line	Pass
2**	0.488	20.7	10.05	46.2	25.50	AV	L Line	Pass
3	1.046	34.1	10.06	56.0	21.90	Peak	L Line	Pass
3**	1.046	19.1	10.06	46.0	26.90	AV	L Line	Pass
4	2.698	33.6	10.11	56.0	22.40	Peak	L Line	Pass
4**	2.698	20.0	10.11	46.0	26.00	AV	L Line	Pass
5	6.124	32.9	10.20	60.0	27.10	Peak	L Line	Pass
5**	6.124	21.5	10.20	50.0	28.50	AV	L Line	Pass
6	12.550	39.1	10.38	60.0	20.90	Peak	L Line	Pass
6**	12.550	21.8	10.38	50.0	28.20	AV	L Line	Pass

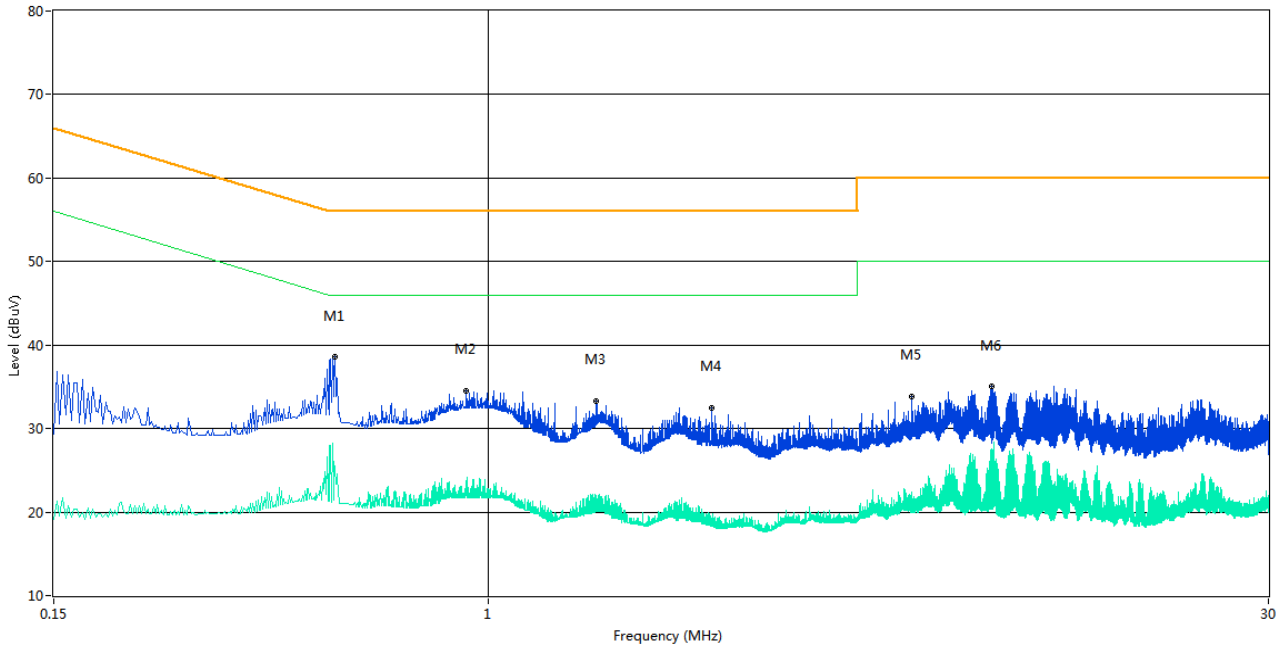
PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.194	46.3	10.04	63.9	17.60	Peak	N Line	Pass
1**	0.194	23.6	10.04	53.9	30.30	AV	N Line	Pass
2	0.478	37.0	10.05	56.4	19.40	Peak	N Line	Pass
2**	0.478	22.9	10.05	46.4	23.50	AV	N Line	Pass
3	1.464	29.7	10.07	56.0	26.30	Peak	N Line	Pass
3**	1.464	17.5	10.07	46.0	28.50	AV	N Line	Pass
4	3.552	30.5	10.13	56.0	25.50	Peak	N Line	Pass
4**	3.552	18.5	10.13	46.0	27.50	AV	N Line	Pass
5	12.238	32.1	10.37	60.0	27.90	Peak	N Line	Pass
5**	12.238	21.7	10.37	50.0	28.30	AV	N Line	Pass
6	20.764	31.2	10.61	60.0	28.80	Peak	N Line	Pass
6**	20.764	19.3	10.61	50.0	30.70	AV	N Line	Pass

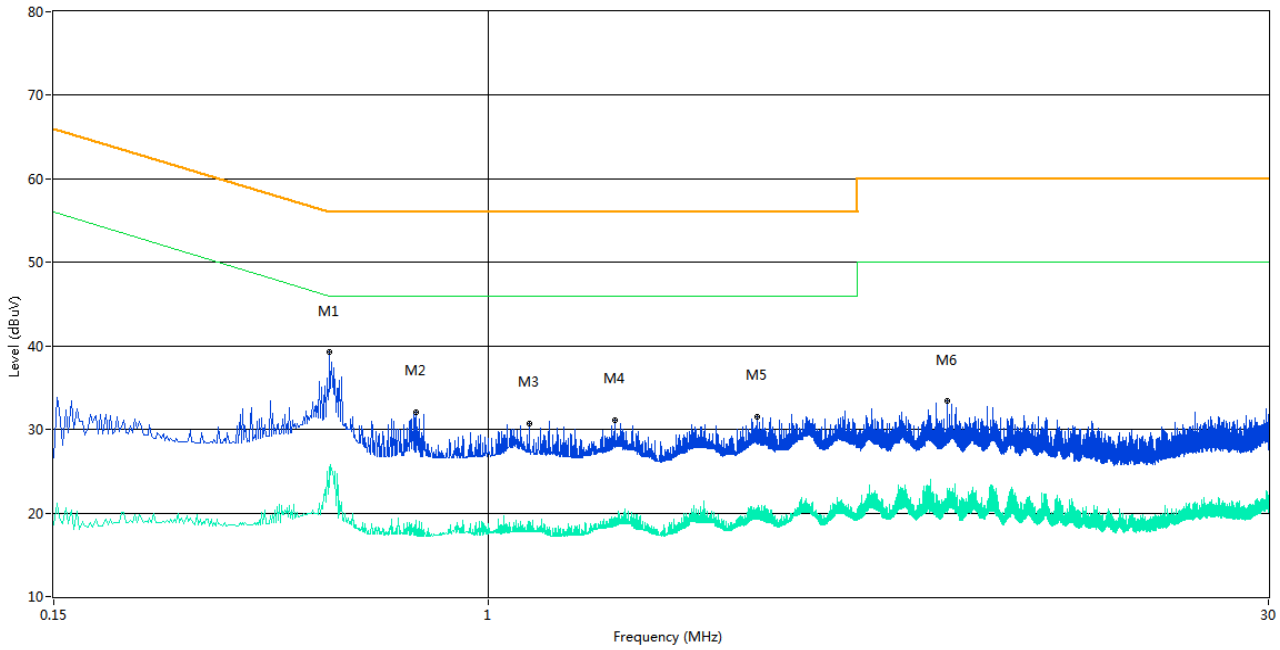
Adapter 3

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.512	38.5	10.05	56.0	17.50	Peak	L Line	Pass
1**	0.512	25.1	10.05	46.0	20.90	AV	L Line	Pass
2	0.908	34.5	10.06	56.0	21.50	Peak	L Line	Pass
2**	0.908	23.8	10.06	46.0	22.20	AV	L Line	Pass
3	1.600	33.3	10.08	56.0	22.70	Peak	L Line	Pass
3**	1.600	21.3	10.08	46.0	24.70	AV	L Line	Pass
4	2.648	32.5	10.11	56.0	23.50	Peak	L Line	Pass
4**	2.648	19.2	10.11	46.0	26.80	AV	L Line	Pass
5	6.342	33.8	10.21	60.0	26.20	Peak	L Line	Pass
5**	6.342	20.6	10.21	50.0	29.40	AV	L Line	Pass
6	8.970	35.1	10.28	60.0	24.90	Peak	L Line	Pass
6**	8.970	27.3	10.28	50.0	22.70	AV	L Line	Pass

PHASE N



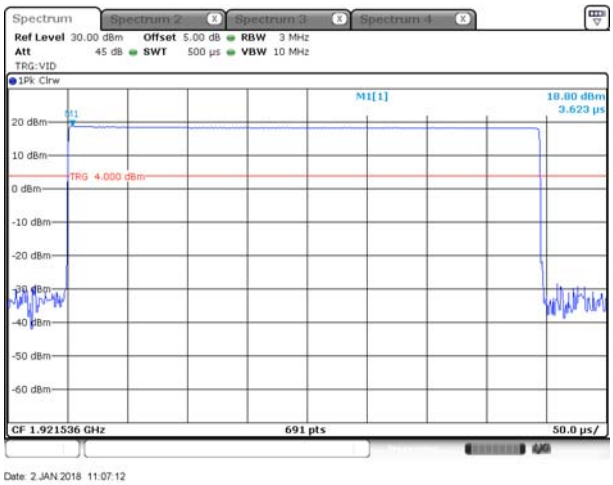
No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.500	39.2	10.05	56.0	16.80	Peak	N Line	Pass
1**	0.500	23.1	10.05	46.0	22.90	AV	N Line	Pass
2	0.730	32.1	10.05	56.0	23.90	Peak	N Line	Pass
2**	0.730	19.1	10.05	46.0	26.90	AV	N Line	Pass
3	1.194	30.7	10.07	56.0	25.30	Peak	N Line	Pass
3**	1.194	17.0	10.07	46.0	29.00	AV	N Line	Pass
4	1.732	31.1	10.08	56.0	24.90	Peak	N Line	Pass
4**	1.732	19.3	10.08	46.0	26.70	AV	N Line	Pass
5	3.234	31.5	10.12	56.0	24.50	Peak	N Line	Pass
5**	3.234	19.8	10.12	46.0	26.20	AV	N Line	Pass
6	7.386	33.4	10.24	60.0	26.60	Peak	N Line	Pass
6**	7.386	19.5	10.24	50.0	30.50	AV	N Line	Pass

A.2 Peak transmit power.

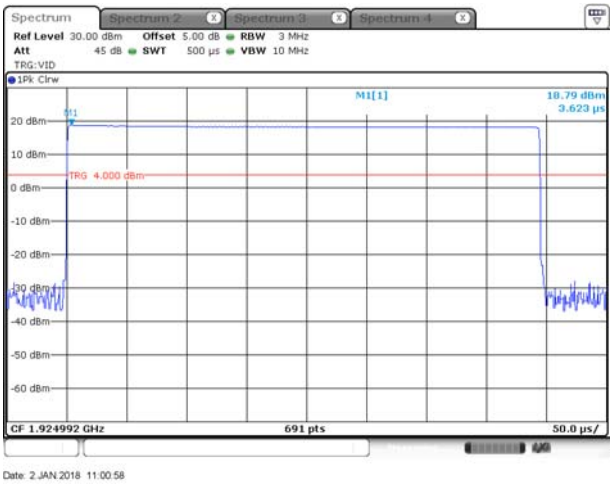
Note: Conducted: 100μW x SQRT (B) where B is the measured Emission Bandwidth in Hz,the antenna gain less than 3dBi.

Frequency (MHz)	Measured Output Peak Power (dBm)	Maximum Antenna Gain (dBi)	Maximum Radiated Output Power Peak (dBm)	Limit (dBm)	Verdict
Low	18.80	1.5dBi	20.30	20.73	Pass
Middle	18.79	1.5dBi	20.29	20.73	Pass
High	18.83	1.5dBi	20.33	20.73	Pass

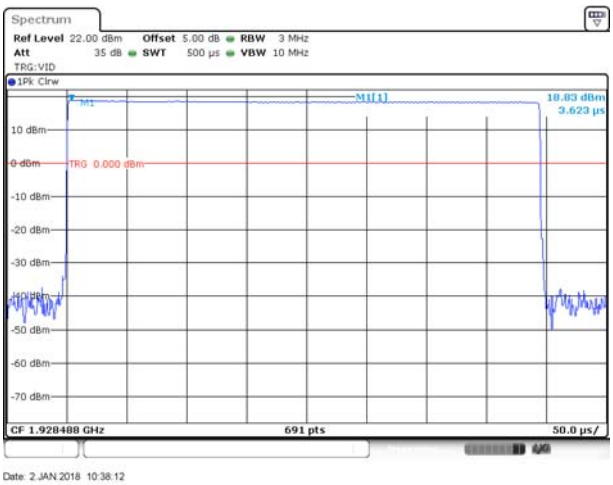
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



A.3 Power Spectral Density (PSD)

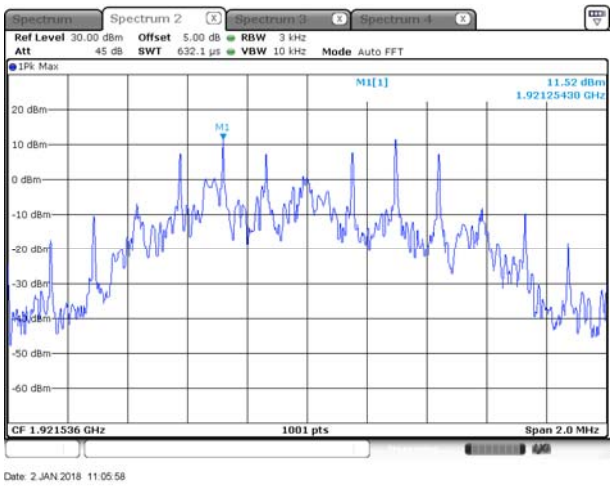
Test Data

802.11b Mode:

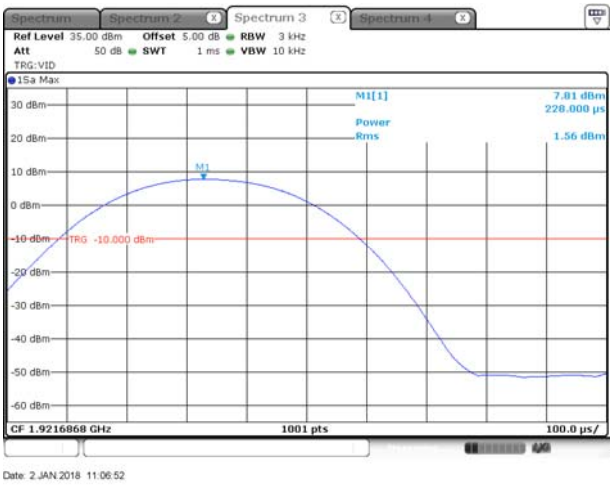
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low	1.56	4.7	Pass
Middle	1.45	4.7	Pass
High	1.19	4.7	Pass

Test plots

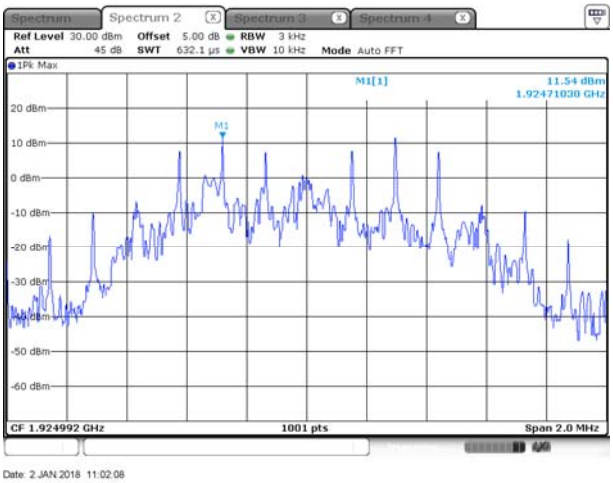
LOW CHANNEL



LOW CHANNEL

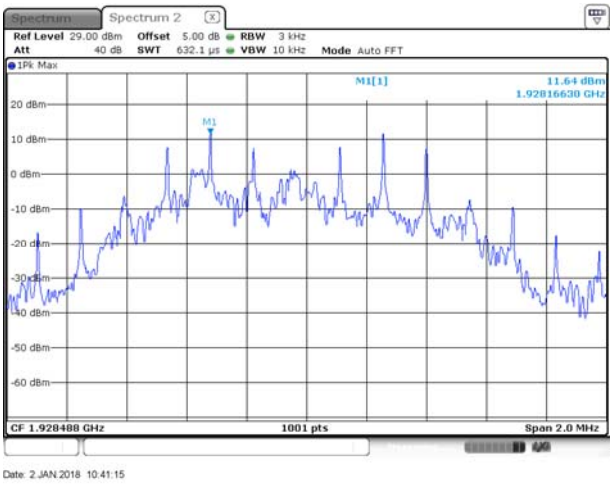


MIDDLE CHANNEL

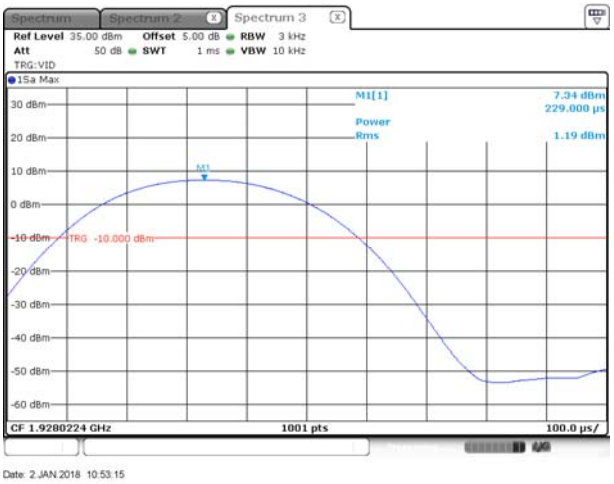


MIDDLE CHANNEL

HIGH CHANNEL



HIGH CHANNEL



A.4 Emission bandwidth

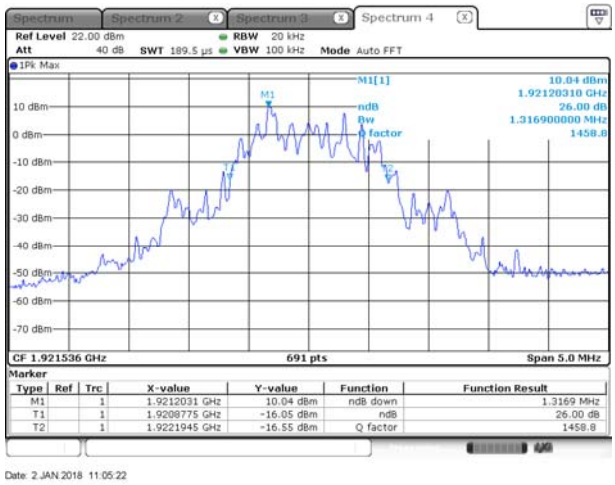
Test Data

Channel	Emission Bandwidth B (MHz)	99% Occupied Bandwidth (MHz)
Low	1.3169	1.2012
Middle	1.3169	1.1939
High	1.3965	1.1939

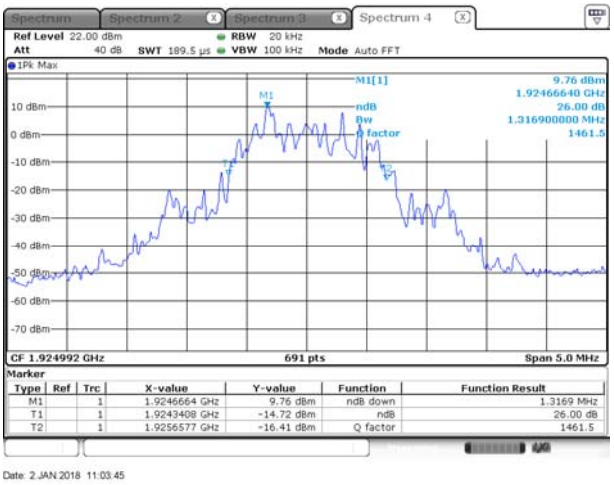
Test plots

Emission Bandwidth B

LOW CHANNEL



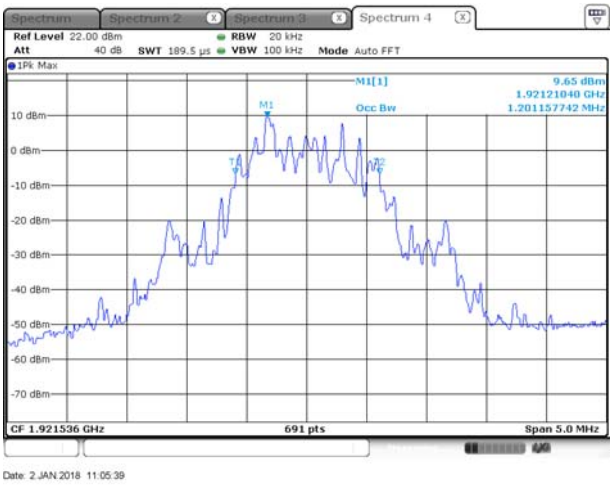
MIDDLE CHANNEL



HIGH CHANNEL

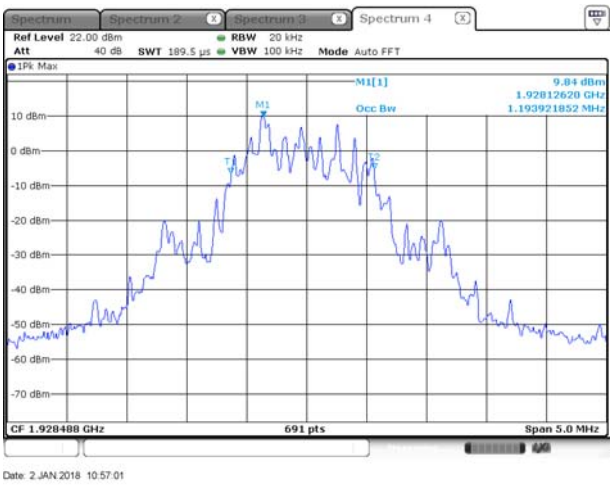
99% Occupied Bandwidth (MHz)

LOW CHANNEL



MIDDLE CHANNEL

HIGH CHANNEL

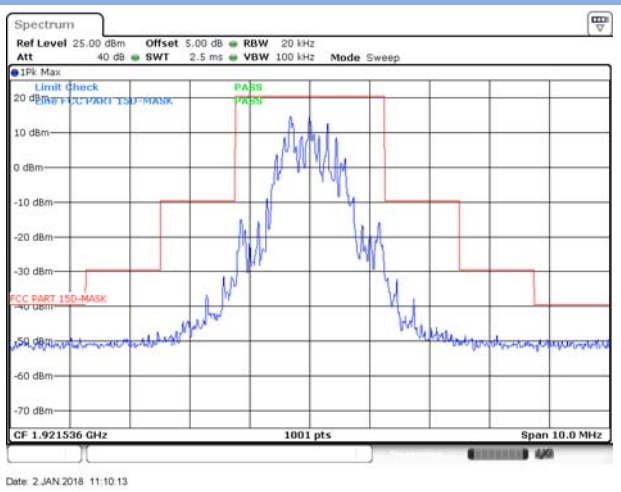


A.5 Emission Inside and Out the sub-band

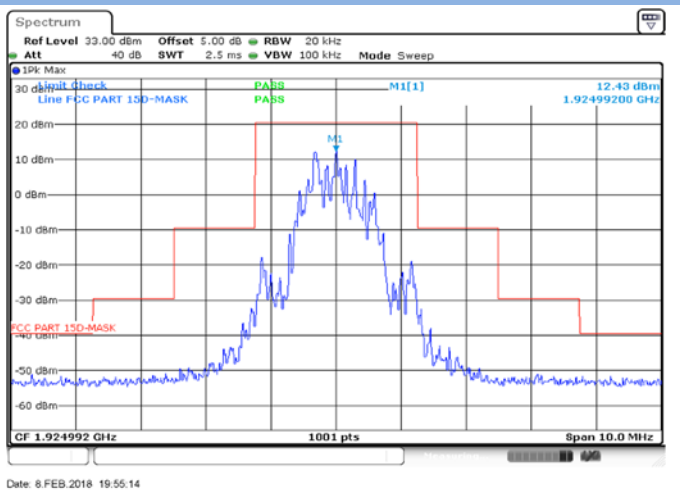
Test Plots

In-band emissions

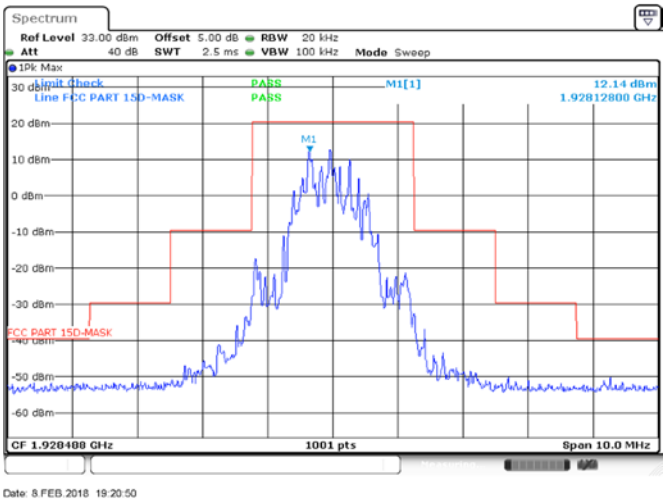
LOW CHANNEL



MIDDLE CHANNEL



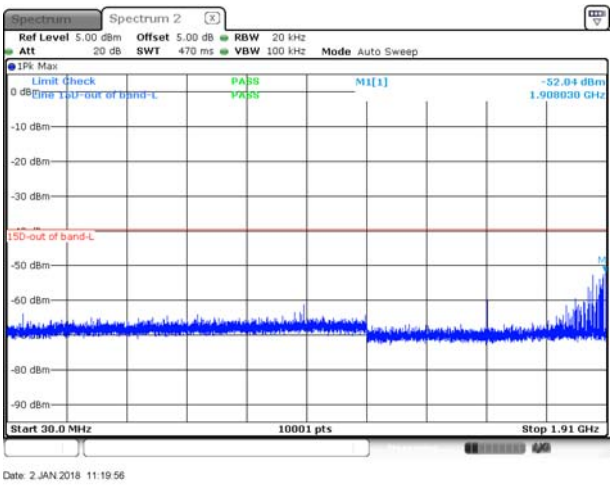
HIGH CHANNEL



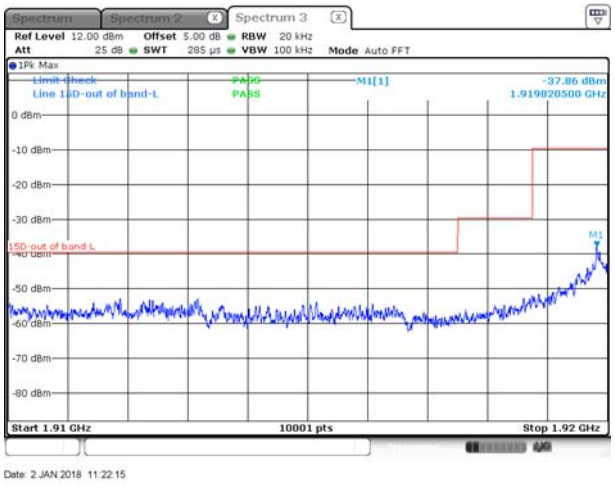
Out of band emissions

Low CHANNEL

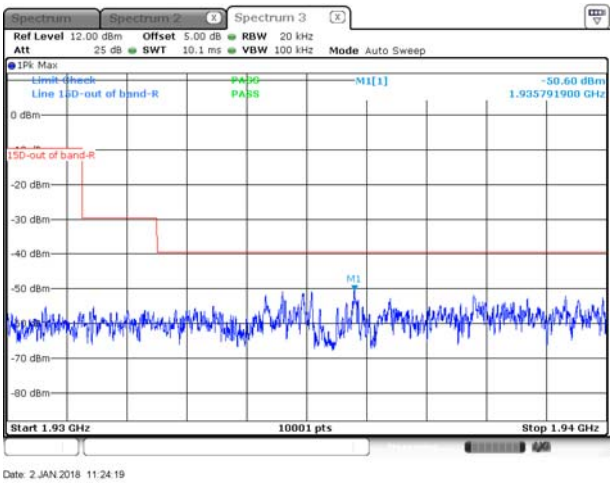
30MHz – 1.91G



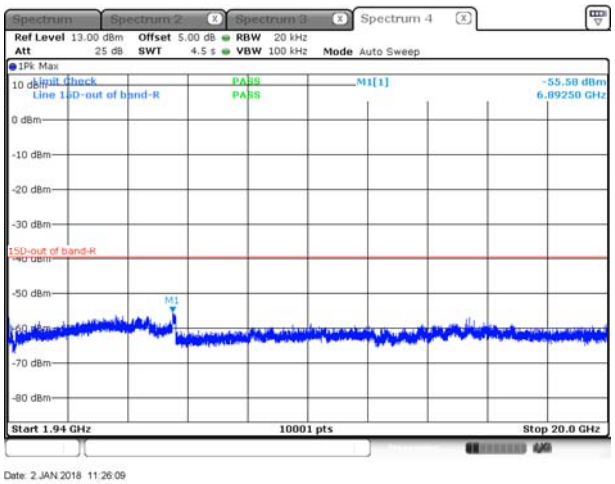
1.91G – 1.92G



1.93G – 1.94G

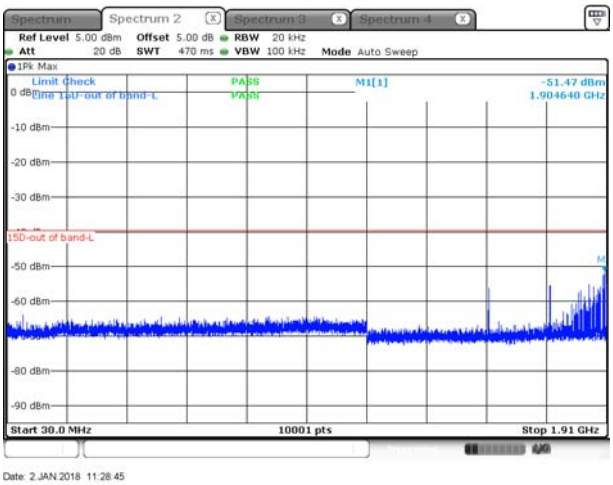


1.94G – 20G

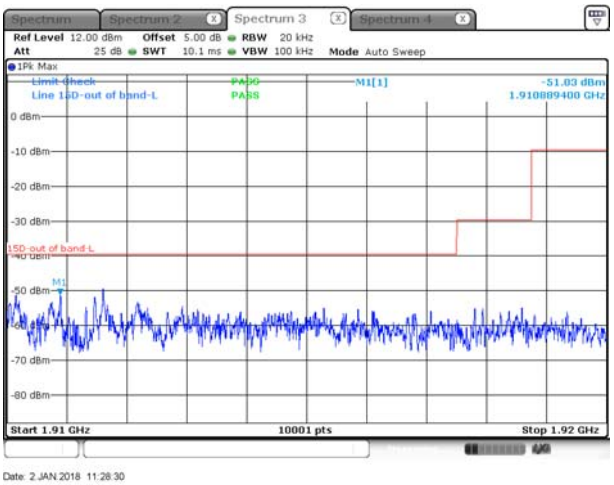


Middle CHANNEL

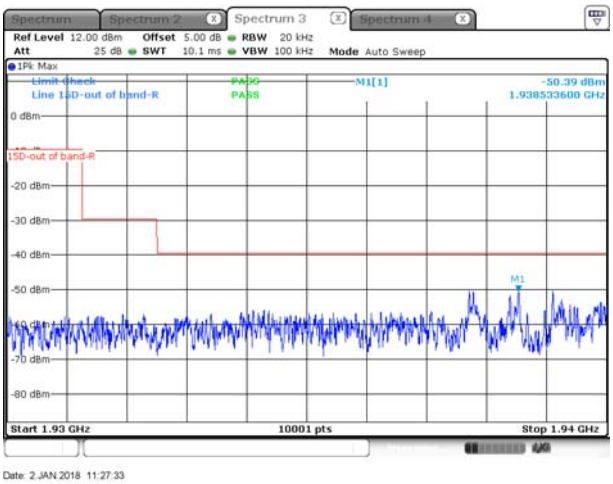
30MHz – 1.91G



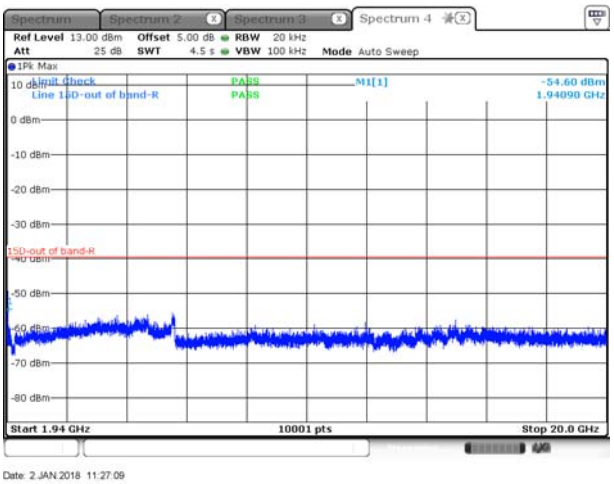
1.91G – 1.92G



1.93G – 1.94G

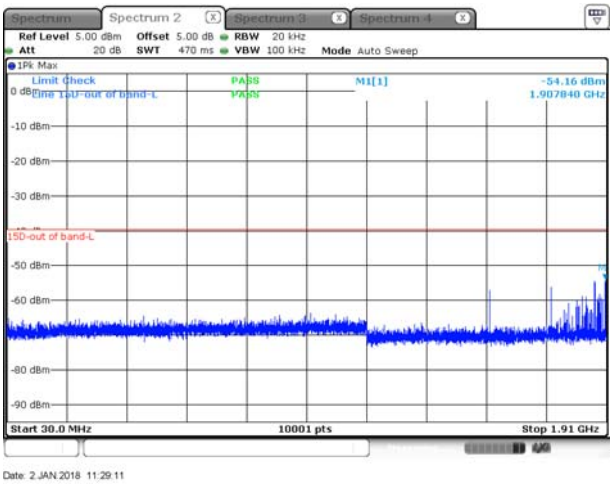


1.94G – 20G

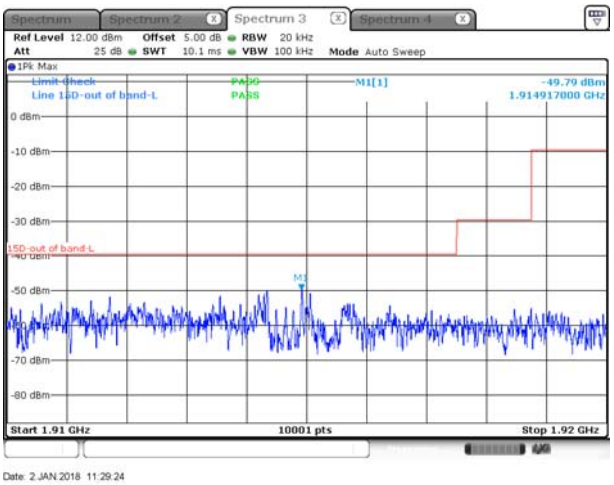


High CHANNEL

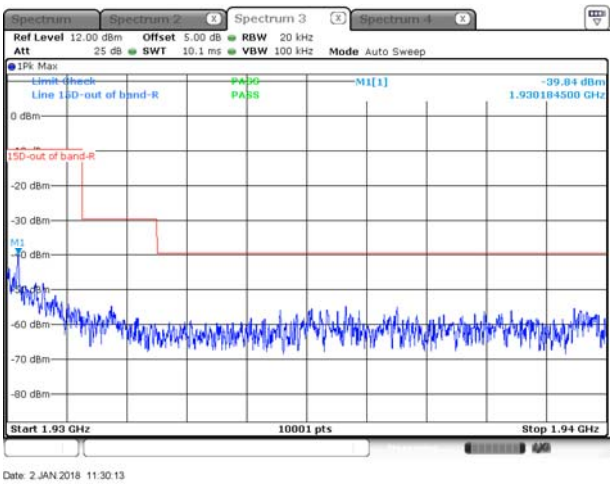
30MHz – 1.91G



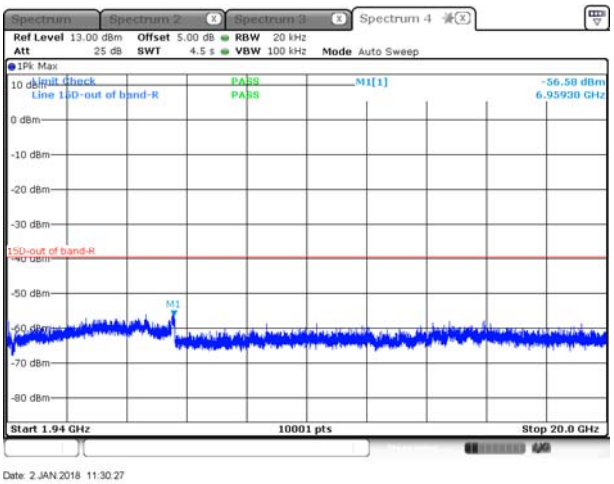
1.91G – 1.92G



1.93G – 1.94G



1.94G – 20G



A.6 Carrier Frequency Stability

Frequency Stability over Power Supply Voltage at Nominal Temperature

Note: Deviation ppm = ((Mean - Measured Frequency) / Mean) x 106

Voltage	Channel Frequency	Difference	Deviation	Limits	Verdict
Tnom	Middle	-4 kHz	2.08 ppm	±10 ppm	Pass
85% of Vnom	Middle	-4 kHz	2.08 ppm	±10 ppm	Pass
115% of Vnom	Middle	3 kHz	1.60 ppm	±10 ppm	Pass

Frequency Stability over Temperature at Nominal Power Supply Voltage

Temp.	Channel Frequency	Difference	Deviation	Limits	Verdict
Vnom	Middle	3 kHz	1.60 ppm	±10 ppm	Pass
-20% of Tnom	Middle	-3 kHz	1.60 ppm	±10 ppm	Pass
+50% of Tnom	Middle	2 kHz	1.04 ppm	±10 ppm	Pass

A.7 Frame repetition Stability, period and jitter

The Frame Repetition Stability is measured with the CMD60. The Frame Repetition Stability is 3 times the standard deviation.

Channel	Standard Deviation (ppm)	Frame Repetition (ppm)	The Limit of Frame Repetition Stability (ppm)	Verdict
Middle	0.2	0.6	±10	Pass

Channel	Frame Period (ms)	Max Jitter (μs)	3xStandard Deviation of Jitter (μs)	Limit (μs)		Verdict
				Max Jitter	3 times St.Dev. of Jitter	
Middle	10	0.007	0.006	25	12.5	Pass

Max Jitter = (1/(Frame Period + Pk-Pk)/2) - (1/Frame Period), when Pk-Pk and Frame Period are in Hz.
3 x St. Dev. Jitter 3 x (1/(Frame Period + St. Dev)) - (1/St. Dev)) x 10^6

A.8 Monitoring the time

EUT monitors the combined time and spectrum window prior to initiation of transmission. The observation results as below

Channel Selection	Observation result	Verdict
1. Apply the interference on f1 at level T_U +U_M, and no interference on f2. Initiate transmission and verify the transmission on f2.	EUT transmission on f2	Pass
2. Apply interference on f2 at a level of T_U +U_M, in-band, and immediately remove all interference from f1 and immediately (but not sooner than 20 ms after the interference on f2 is applied) cause the EUT to attempt transmission.	EUT transmission on f1	Pass

A.9 Monitoring threshold

Calculation of Monitoring Threshold Limit:
Lower Threshold:
TL< = 15 logB -184 + 30 - P_{EUT} (dBm)
Upper Threshold:
TU< = 15 logB -184 + 50 - P_{EUT} (dBm)

B is measured Emission Bandwidth in Hz
P_{EUT} is measured Transmitter Power in dBm

The Lower Threshold is applicable for systems which have defined less than 40 duplex system access channels.
The Upper Threshold is applicable for systems with more than 40 duplex system access channels and that implements the Least Interfered Channel Procedure (LIC).
Upper Threshold has been removed from FCC 15D but still exists in the current Industry Canada RSS-213.
Test Data:

Monitor Threshold	Measured Level (dBm)	Limit(dBm)	Verdict
Lower threshold	N/A	Lower threshold + 6 dB	N/A[Note]
Upper threshold	N/A	Upper threshold + 6 dB	N/A

Note: For the EUT which support LIC there is no need to measure lower threshold because it is automatically met by LIC procedure

A.10 Maximum transmit period

Test Data:

Test ref. to ANSI C63.17: 2013 clause 8.2.2	Observation result (H)	Limit(H)	Verdict
Transmission duration on same time and frequency window	2	8	Pass

A.11 Acknowledgment system

Test ref. to ANSI C63.17: 2013 clause 8.2.1	Observation result (s)	Limit(s)	Verdict
Initial transmission without acknowledgements	0.54	1	Pass
Transmission time after loss of acknowledgements	8	30	Pass

A.12 Least Interfered Channel, LIC

Calculation of Monitoring Threshold Limit:

Lower Threshold:

TL< = 15 logB -184 + 30 - P_{EUT} (dBm)

B is measured Emission Bandwidth in Hz

P_{EUT} is measured Transmitter Power in dBm

Test Data:

ANSI C63.17 clause 7.3.2 ref.	EUT transmits on	Verdict
f1 TL + 13 dB, *f2* TL + 6 dB	*f2*	Pass
f1 TL + 6 dB, *f2* TL + 13 dB	*f1*	Pass
f1 TL + 7 dB, *f2* TL	*f2*	Pass
f1 TL, *f2* at TL+ 7 dB	*f1*	Pass

A.13 Random waiting

Test Data:

Random Waiting is not implemented in the EUT.

Conditions	Transmits Channel	Verdict
Interference applied at operating Channel, f1	*f2*	Pass

A.14 Monitoring bandwidth and reaction time

Monitoring bandwidth:

This test is only required if a dedicated monitoring receiver is used. If the test is not carried out the manufacturer shall declare and provide evidence that the monitoring is made through the radio receiver used for communication.

The test is passed if either the Simple Compliance Test or the More Detailed Test is passed.

During this test the spectrum analyzer is observed visually to see if the EUT transmits or not.

The More Detailed Test must be pass at both the -6dB and -12 dB points if the Simple Compliance Test fails.

Test Data:

Test performed	Observation result	Verdict
Simple Compliance test, at ±30% of B	No transmissions	Pass
More Detailed Test, at -6 dB points	N/A	N/A
More Detailed Test, at -12 dB points	N/A	N/A

Note 1: The tested EUT uses the same receiver for monitoring and communication, this test is therefore not required.

Note 2: The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended Transmission.

Reaction time:

By administrative commands and out-of-operating region interference, the EUT is restricted to operate on a single carrier frequency.

Time-synchronized pulsed interference was then applied on the carrier at pulsed levels TU + UM to check that the EUT does not transmit. The level was raised 6 dB for part d) with 35 μs pulses.

The pulses are synchronized with the EUT timeslots and applied cantered within all timeslots.

Test Data:

Test performed	Observation result	Verdict
c) > largest of 50 μs and 50*SQRT(1.25/B)	No transmissions	Pass
d) > largest of 35 μs and 35*SQRT(1.25/B), and with interference level raised 6 dB	No transmissions	Pass

Notes: Since B is larger than 1.25 MHz the test was performed with pulse lengths of 50 μs and 35 μs.

A.15 Monitoring antenna

EUT uses the same antenna used for transmission and monitoring that is in compliance meet above provision.

A.16 Duplex system LBT

Not tested.

A.17 Co-located device LBT

Not appropriate, as the system always monitor both the transmit and receive time/spectrum windows, it is not a co-located device.

A.18 Fair access

Not tested. The tested EUT does not implement this provision. See manufacturer's declaration.

A.19 Radiated Emission

Note1: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note2: The EUT is working in the Normal link mode below 1 GHz.

Note3: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Test data:

30 MHz to 1 GHz, ANT H										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	48.425	10.03	-13.30	30.0	19.97	Peak	352.00	300	Horizontal	Pass
2	102.489	9.38	-15.17	33.5	24.12	Peak	295.00	400	Horizontal	Pass
3	171.100	10.20	-17.48	33.5	23.30	Peak	61.00	300	Horizontal	Pass
4	280.440	14.90	-12.82	36.0	21.10	Peak	249.00	300	Horizontal	Pass
5	326.988	18.63	-11.64	36.0	17.37	Peak	61.00	400	Horizontal	Pass
6	669.070	21.31	-4.46	36.0	14.69	Peak	69.00	100	Horizontal	Pass

30 MHz to 1 GHz, ANT V										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	30.970	26.07	-16.82	30.0	3.93	Peak	22.00	200	Vertical	Pass
2	64.426	21.04	-15.63	30.0	8.96	Peak	223.00	200	Vertical	Pass
3	204.071	19.14	-14.92	33.5	14.36	Peak	193.00	100	Vertical	Pass
4	294.501	20.45	-12.48	36.0	15.55	Peak	148.00	100	Vertical	Pass
5	330.382	18.68	-11.39	36.0	17.32	Peak	131.00	100	Vertical	Pass
6	701.072	20.07	-4.16	36.0	15.93	Peak	210.00	100	Vertical	Pass

1GHz to 20 GHz channel 0 ANT V										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1279.000	41.62	-5.64	74.0	32.38	Peak	142.00	150	Vertical	Pass
2	1928.500	99.41	-4.05	74.0	-25.41	Peak	142.00	150	Vertical	N/A
3	2874.500	45.95	0.86	74.0	28.05	Peak	321.30	150	Vertical	Pass
4	5007.000	45.39	12.82	74.0	28.61	Peak	154.80	150	Vertical	Pass
5	7711.563	47.49	14.32	74.0	26.51	Peak	202.60	150	Vertical	Pass
6	11894.688	50.37	19.17	74.0	23.63	Peak	6.30	150	Vertical	Pass
1GHz to 20 GHz channel 0 ANT H										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1735.000	43.88	-5.18	74.0	30.12	Peak	328.70	150	Horizontal	Pass
2	1928.500	101.74	-4.05	74.0	-27.74	Peak	296.50	150	Horizontal	N/A
3	2892.000	47.59	0.90	74.0	26.41	Peak	287.60	150	Horizontal	Pass
4	3857.000	44.75	8.64	74.0	29.25	Peak	7.00	150	Horizontal	N/A
5	6571.000	46.38	13.54	74.0	27.62	Peak	196.40	150	Horizontal	Pass
6	9461.000	49.58	18.46	74.0	24.42	Peak	45.20	150	Horizontal	Pass

1GHz to 20 GHz channel2 ANT V										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1283.000	42.62	-5.24	74.0	31.38	Peak	152.00	150	Vertical	Pass
2	1925.050	98.54	-4.03	74.0	-24.54	Peak	157.00	150	Vertical	N/A
3	2886.500	46.95	0.87	74.0	27.05	Peak	346.30	150	Vertical	Pass
4	5747.000	47.32	13.16	74.0	26.68	Peak	49.50	150	Vertical	Pass
5	8467.500	48.49	14.32	74.0	25.51	Peak	242.60	150	Vertical	Pass
6	13425.688	50.52	19.17	74.0	23.48	Peak	75.40	150	Vertical	Pass

1 GHz to 20 GHz channel2 ANT H										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1451.000	42.64	-5.79	74.0	31.36	Peak	90.20	150	Horizontal	Pass
2	1925.050	101.71	-4.05	74.0	-27.71	Peak	162.40	150	Horizontal	N/A
3	2409.000	46.73	-4.27	74.0	27.27	Peak	156.60	150	Horizontal	Pass
4	10148.750	43.05	16.72	74.0	30.95	Peak	125.90	150	Horizontal	Pass
5	11243.250	42.82	17.55	74.0	31.18	Peak	203.90	150	Horizontal	Pass
6	13649.500	46.53	19.08	74.0	27.47	Peak	105.00	150	Horizontal	Pass

1 GHz to 20 GHz channel 4 ANT V										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1394.500	43.01	-6.25	74.0	30.99	Peak	314.70	150	Vertical	Pass
2	1921.500	99.65	-5.19	74.0	-25.65	Peak	75.60	150	Vertical	N/A
3	2491.000	44.72	-3.29	74.0	29.28	Peak	325.40	150	Vertical	Pass
4	12618.250	45.40	17.88	74.0	28.60	Peak	245.30	150	Vertical	Pass
5	14166.500	47.72	20.82	74.0	26.28	Peak	188.30	150	Vertical	Pass
6	15313.250	49.68	21.19	74.0	24.32	Peak	0.00	150	Vertical	Pass
1 GHz to 20 GHz channel 4 ANT H										
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1637.000	43.13	-6.10	74.0	30.87	Peak	180.30	150	Horizontal	Pass
2	1921.500	101.47	-5.24	74.0	-27.47	Peak	251.90	150	Horizontal	N/A
3	2391.000	44.65	-3.29	74.0	29.35	Peak	75.30	150	Horizontal	Pass
4	11834.500	44.33	17.67	74.0	29.67	Peak	223.70	150	Horizontal	Pass
5	13641.250	46.24	19.20	74.0	27.76	Peak	159.20	150	Horizontal	Pass
6	15225.250	49.71	21.12	74.0	24.29	Peak	209.50	150	Horizontal	Pass

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ17C0361-AR.pdf”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ17C0361-AW.pdf”.

--END OF REPORT--