FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013

TEST REPORT

For

Sub-1G module

Model: PPM N1U_SB1

Brand: DELTA

Issued for

Delta Electronics, Inc.

39, Section 2, Huandong Rd., Shanhua Dist., 74144 Tainan, Taiwan

Issued by

Compliance Certification Services Inc.

Tainan Lab.

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

TEL: 886-6-580-2201

FAX: 886-6-580-2202

Issued Date: June 27, 2019

REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 24, 2019	Initial Issue	ALL	Gina Lin
01	June 26, 2019	See the following note rev.01	ALL	Gina Lin
02	June 27, 2019	See the following note rev.02	Page51~54	Gina Lin

Note:

※ Rev.01 Issue Date: June 26, 2019
Revise typo.
Add channel list.

※ Rev.02 Issue Date: June 27, 2019
Add DTS Band Edge.

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1. TEST REPORT CERTIFICATION

Applicant	:	**Delta Electronics, Inc.** 39, Section 2, Huandong Rd., Shanhua Dist., 74144 Tainan, Taiwan
Manufacturer	:	**Delta Electronics (Jiangsu) Ltd.** No.1688, Jiangxing East Rd., Wujiang Eco & Tech Development Zone, Wujiang City, Jiangsu., P.R.C. 215200
Equipment Under Test	:	Sub-1G module
Model Number	:	PPM N1U_SB1
Brand Name	:	
Date of Test	:	January 22, 2019 April 17, 2019 June 27, 2019

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C AND ANSI C63.10: 2013	No non-compliance noted

FCC Standard Section	Report Section	Test Item	Result
15.247(a)	8.1	6dB BANDWIDTH	Pass
15.247(b)	8.2	MAXIMUM PEAK OUTPUT POWER	Pass
-	8.3	DUTY CYCLE	-
15.247(e)	8.4	POWER SPECTRAL DENSITY	Pass
15.247(d)	8.5	CONDUCTED SPURIOUS EMISSION	Pass
15.205(a)	8.6	RADIATED EMISSIONS	Pass
15.207(a)	8.7	POWERLINE CONDUCTED EMISSIONS	Pass

Statements of Conformity
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Approved by:

Jeter Wu
Assistant Manager

Reviewed by:

Eric Huang
Section Manager

2. EUT DESCRIPTION

2.1 DESCRIPTION OF EUT & POWER

Product Name	Sub-1G module
Model Number	PPM N1U_SB1
Brand Name	
Received Date	November 06, 2018
Reported Date	April 24, 2019
Operating Frequency Range	902MHz~928MHz
Transmit Power	26.12dBm (409.261mW)
Channel Spacing	0.75 MHz
Channel Number	36 Channels
Transmit Data Rate	BW=500k SF7➔18229.17 bps SF8➔10416.67 bps SF9➔5859.38 bps
Type of Modulation	FSK
Antenna Type	Manufacturer: Master Wave Technology Co., Ltd Type: Dipole Antenna Model: 98623ZRSX001 Gain: 2 dBi
Power Source	DC 5V (Powered by Data Collector (PPM DC1_100))
Hardware Version	Rev.04
Software Version	V0103

REMARK: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **2ARTO-PPM-N1U-SB1** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the user manual.
4. According to the customer declaration Sub-1G module (PPM N1U_SB1) and Data Collector (PPM DC1_100) for sale.

3. DESCRIPTION OF TEST MODES

The EUT is a Sub-1G module.

The RF Chip is manufactured by

The antenna peak gain 2 dBi (highest gain) were chosen for full testing.

FSK mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	902
Middle	916
High	928

FSK mode: BW=250k, SF9=5859.38 bps data rates (worst case) were chosen for full testing.

Channel Listing:

Channel / Frequency	Channel / Frequency	Channel / Frequency
Channel 1=>902.25MHz	Channel 13=>911.25MHz	Channel 25=>920.25MHz
Channel 2=>903MHz	Channel 14=>912MHz	Channel 26=>921 MHz
Channel 3=>903.75MH z	Channel 15=>912.75MHz	Channel 27=>921.75MHz
Channel 4=>904.5MHz	Channel 16=>913.5MHz	Channel 28=>922.5MHz
Channel 5=>905.25MHz	Channel 17=>914.25MHz	Channel 29=>923.25MHz
Channel 6=>906MHz	Channel 18=>915MHz	Channel 30=>923MHz
Channel 7=>906.75MH	Channel 19=>915.75MHz	Channel 31=>923.75MHz
Channel 8=>907.5MHz	Channel 20=>916.5MHz	Channel 32=>924.5MHz
Channel 9=>908.25MHz	Channel 21=>917.25MHz	Channel 33=>925.25MHz
Channel 10=>909MHz	Channel 22=>918MHz	Channel 34=>926MHz
Channel 11=>909.75MHz	Channel 23=>918.75MHz	Channel 35=>926.75MHz
Channel 12=>910.5MHz	Channel 24=>919.5MHz	Channel 36=>927.5MHz

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247 and KDB 558074.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7:1992, ANSI C63.10: 2013 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC
Japan	VCCI

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

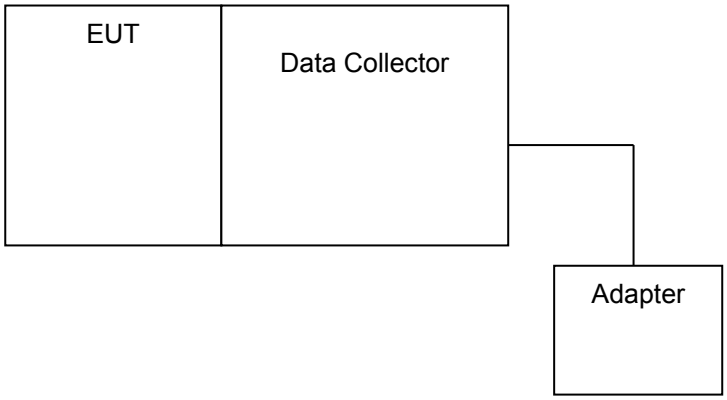
Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radiated Emission, 30 to 200 MHz Test Site : CB966	±3.1dB
Radiated Emission, 200 to 1000 MHz Test Site : CB966	±2.7dB
Radiated Emission, 1 to 6 GHz	±2.7dB
Radiated Emission, 6 to 18 GHz	±2.7dB
Radiated Emission, 18 to 26.5 GHz	±2.7dB
Radiated Emission, 26 to 40 GHz	±3.7dB
Power Line Conducted Emission	±2.0dB

This measurement uncertainty is confidence of approximately 95%, k=2

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT



7.2 SUPPORT EQUIPMENT

For EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	BATTERY	B.B	BP7-12	N/A	N/A
2	Data Collector	DELTA	PPM DC1_100	N/A	N/A
3	Adapter	AMIGO	AMS4-1202 000FV	N/A	Power cable, unshd, 1.0m INPUT: 100-240Vac OUTPUT: 12Vdc

No.	Signal cable description	
A	AC Power Cable	Unshielded, 1.8m 1 pcs

For RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Data Collector	DELTA	PPM DC1_100	N/A	N/A
2	Adapter	DVE	DSA-20P-10	N/A	Power cable, unshd, 1.7m INPUT: 100-240Vac OUTPUT: 12Vdc

No.	Signal cable description	
A	Power Cable	Unshielded, 1.7m 1 pcs

Note:

1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3) shd. = shielded; unshd. = unshielded

7.3 EUT OPERATING CONDITION

RF Setup

1. Set up a whole system as the setup diagram.
2. Turn on power.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6dB BANDWIDTH

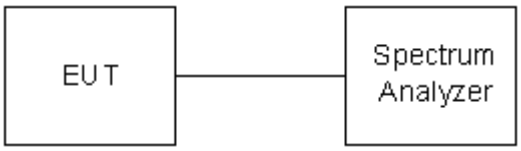
LIMIT

§ 15.247(a) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020

TEST SETUP



TEST PROCEDURE

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST RESULTS

No non-compliance noted.

Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

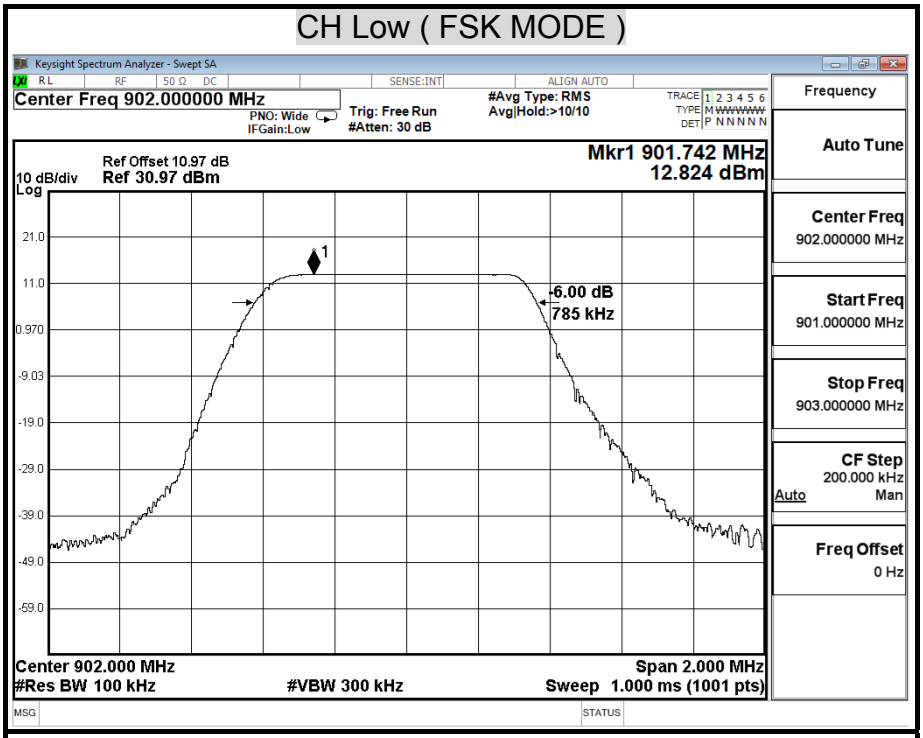
FSK mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	902	785	500	PASS
Middle	916	779	500	PASS
High	928	772	500	PASS

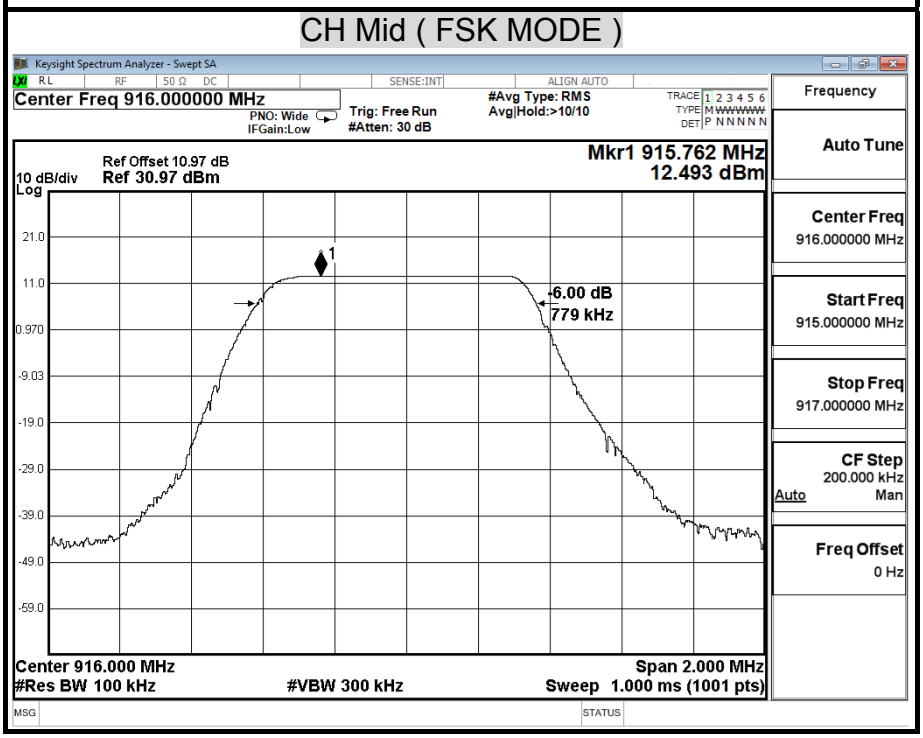
NOTE : 1. At finial test to get the worst-case emission at BW=250k, SF9=5859.38 bps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

6dB BANDWIDTH (FSK MODE)

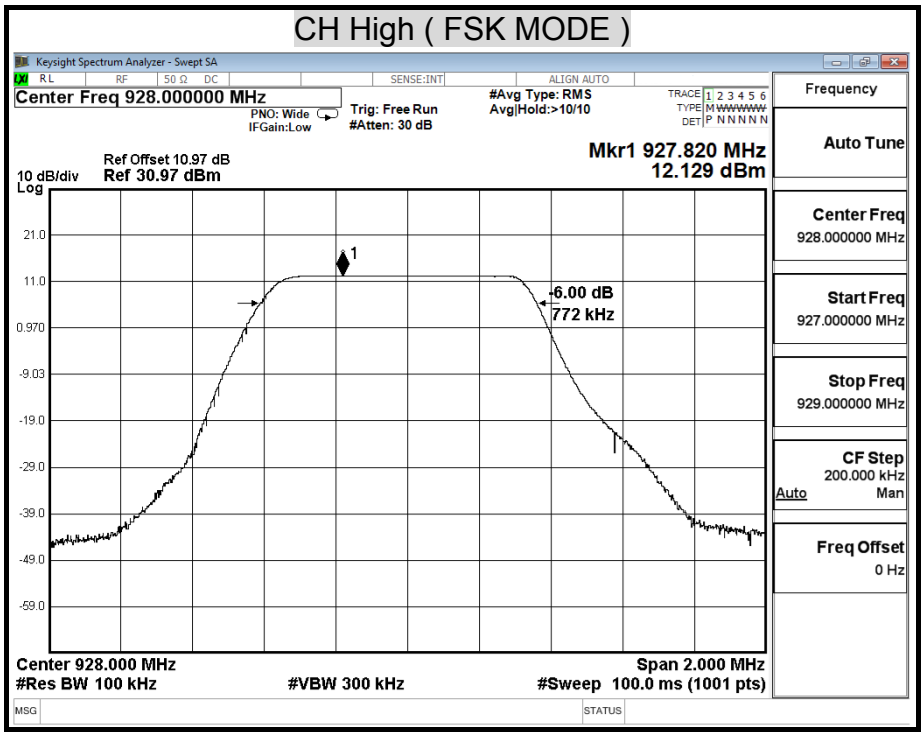
CH Low (FSK MODE)



CH Mid (FSK MODE)



CH High (FSK MODE)



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST EQUIPMENTS

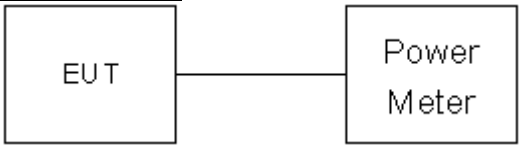
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

For Peak Power

For Average Power



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 9.1.1

9.1.1 Measurement Procedure PK2:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.

TEST RESULTS

No non-compliance noted.

Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

FSK mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	902	26.12	30.00	PASS
Middle	916	25.82	30.00	PASS
High	928	25.70	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at BW=250k, SF9=5859.38 bps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Average Power Data

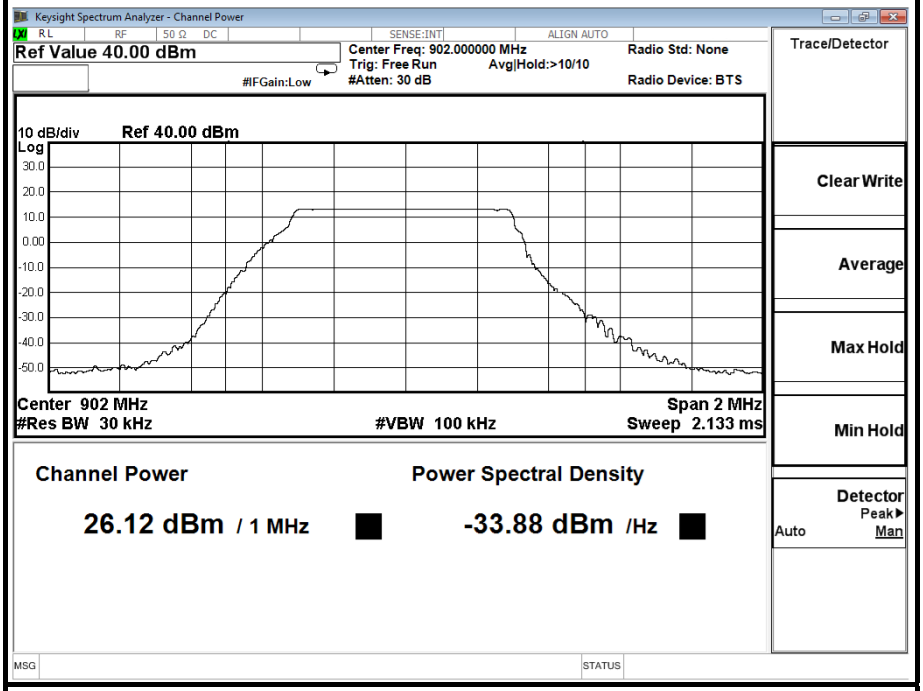
Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

FSK mode

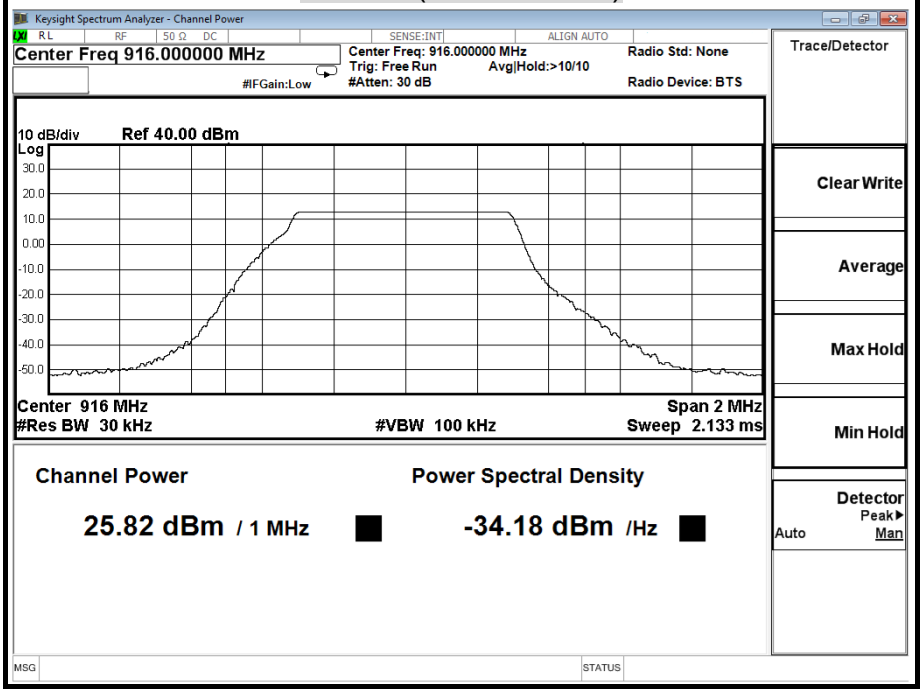
Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	902	13.14
Middle	916	12.83
High	928	12.70

MAXIMUM PEAK OUTPUT POWER (FSK MODE)

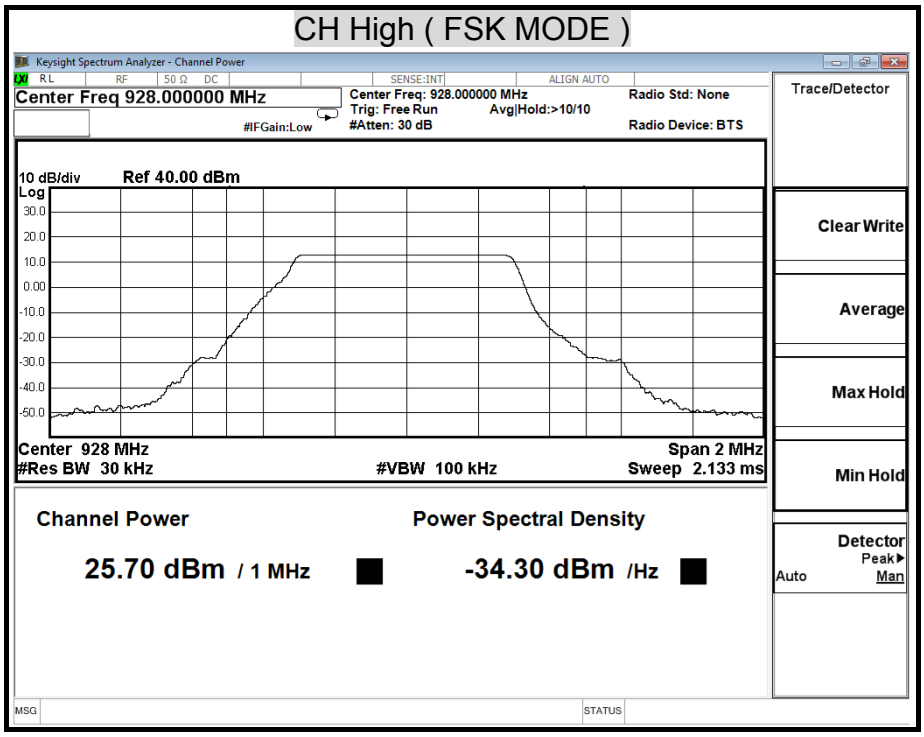
CH Low (FSK MODE)



CH Mid (FSK MODE)



CH High (FSK MODE)



8.3 DUTY CYCLE

LIMIT

Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

No non-compliance noted.

Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

FSK Mode

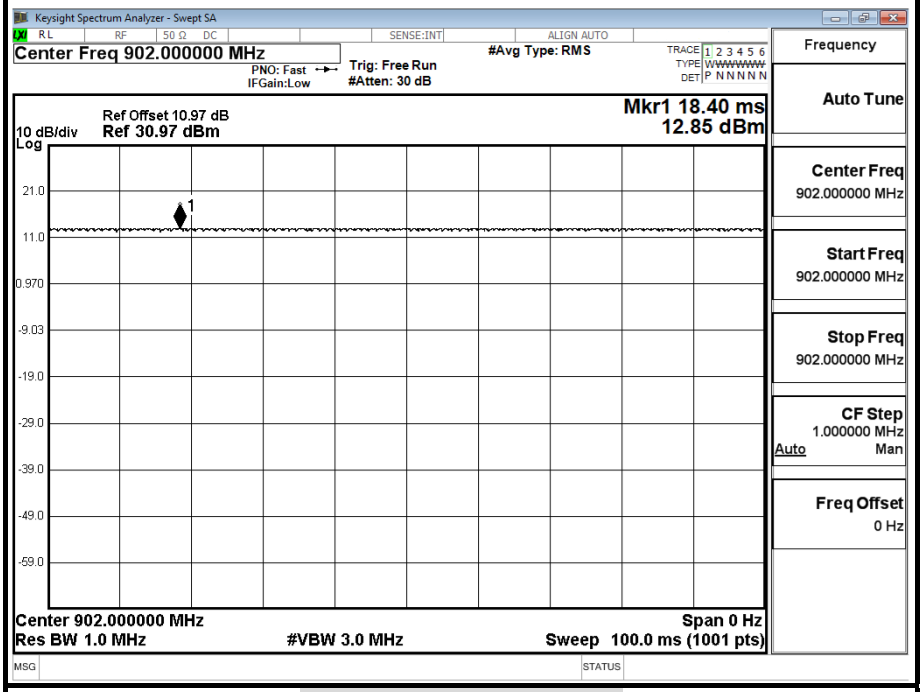
	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000	
Ton2		0	0	
Ton3			0	100
Tp				100

Ton	100
Tp(Ton+Toff)	100
Duty Cycle	1
Duty Factor	0

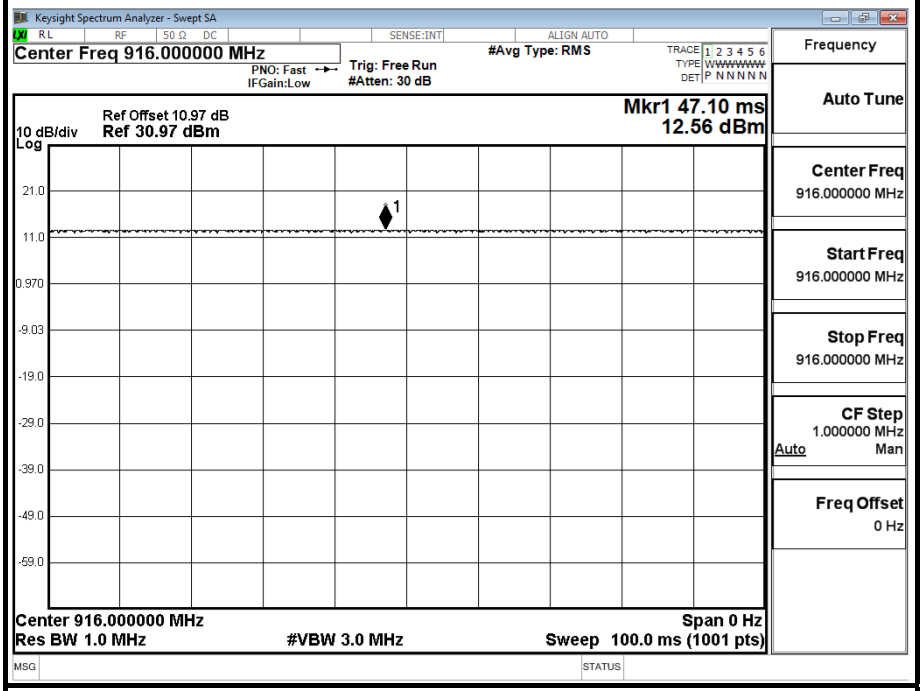
TEST PLOT

Duty Cycle

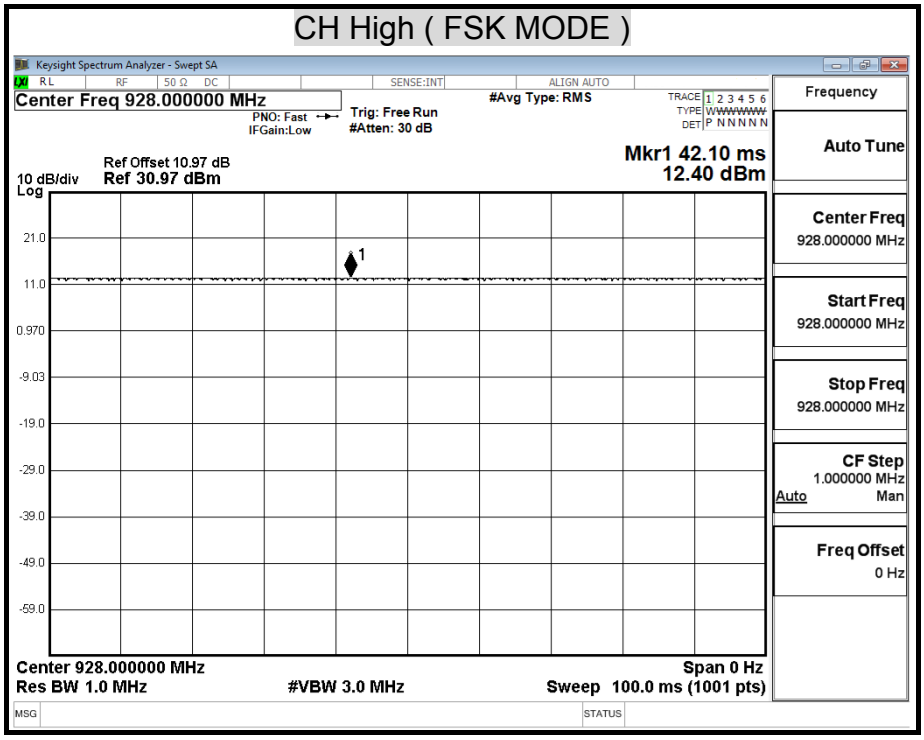
CH Low (FSK MODE)



CH Mid (FSK MODE)



CH High (FSK MODE)



8.4 POWER SPECTRAL DENSITY

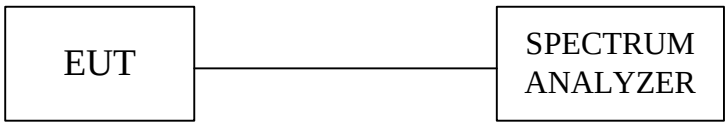
LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with 558074 D01 15.247 Meas Guidance v05

10.2 Method PKPSD (peak PSD):

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST RESULTS

No non-compliance noted.

Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

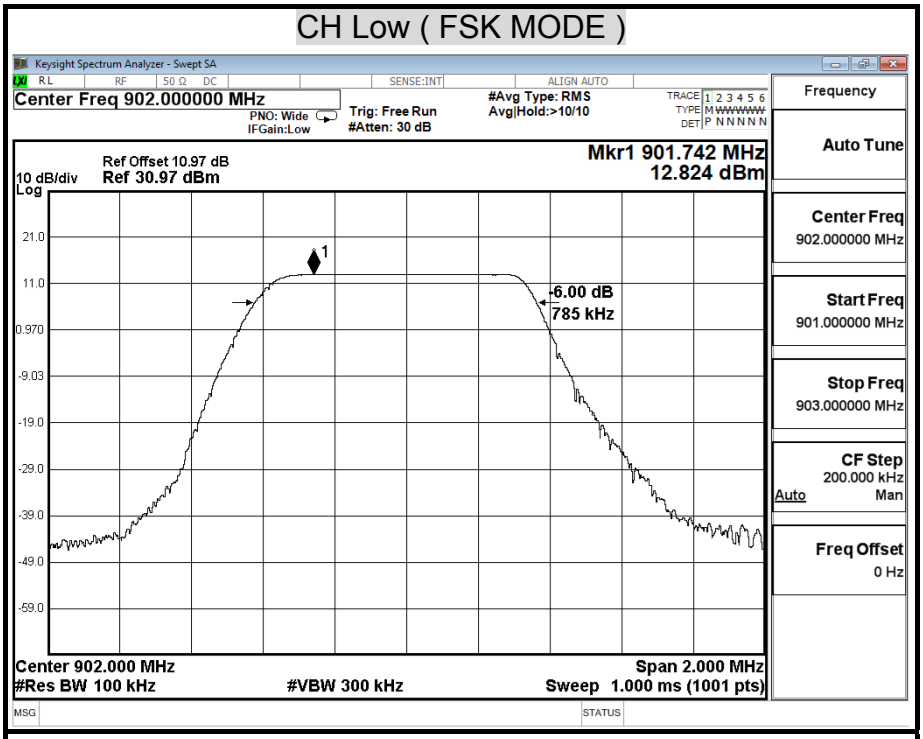
FSK mode

Channel	Frequency (MHz)	PPSD/100kHz (dBm)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Result
Low	902	12.824	-2.40	8.00	-10.40	PASS
Middle	916	12.493	-2.74	8.00	-10.74	PASS
High	928	12.129	-3.10	8.00	-11.10	PASS

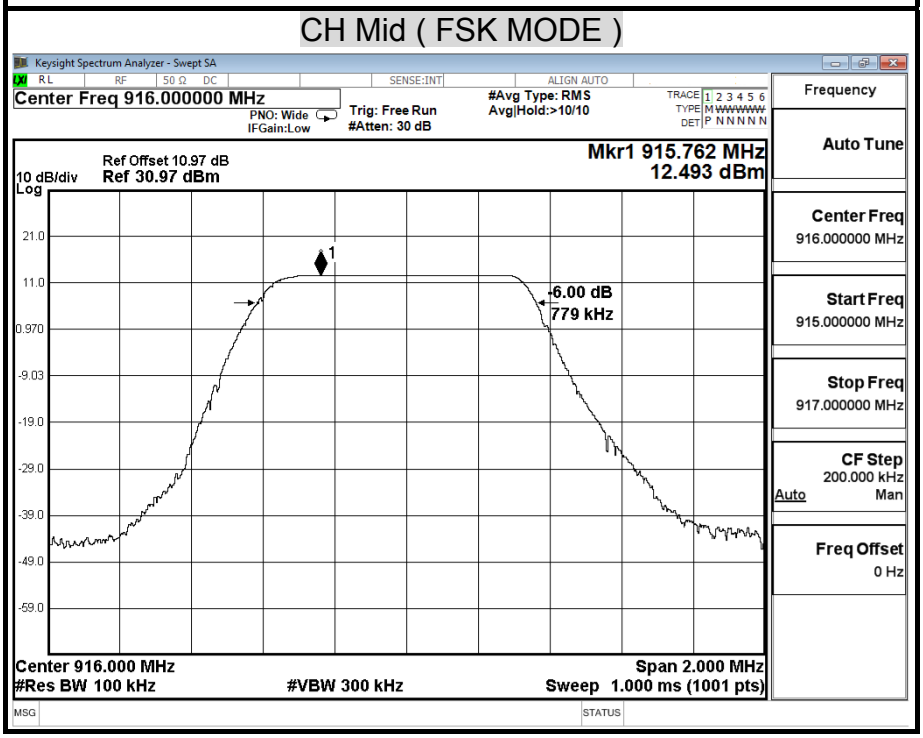
NOTE : 1. At finial test to get the worst-case emission at BW=250k, SF9=5859.38 bps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

POWER SPECTRAL DENSITY (FSK MODE)

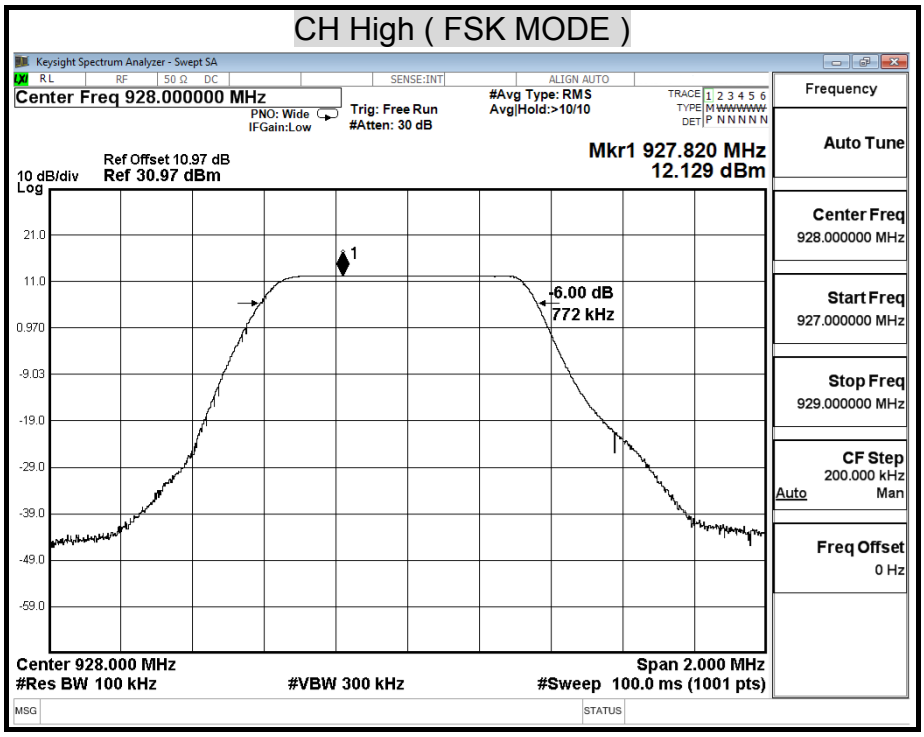
CH Low (FSK MODE)



CH Mid (FSK MODE)



CH High (FSK MODE)



8.5 CONDUCTED SPURIOUS EMISSION

LIMITS

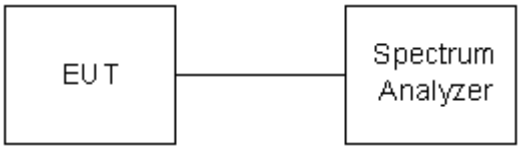
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

TEST RESULTS

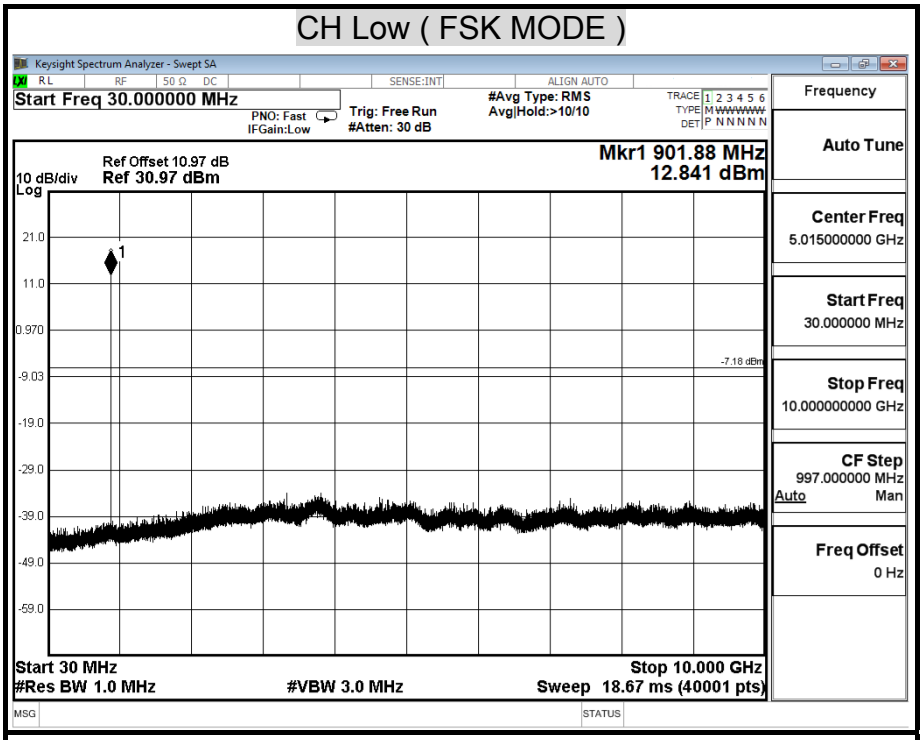
No non-compliance noted.

TEST DATA

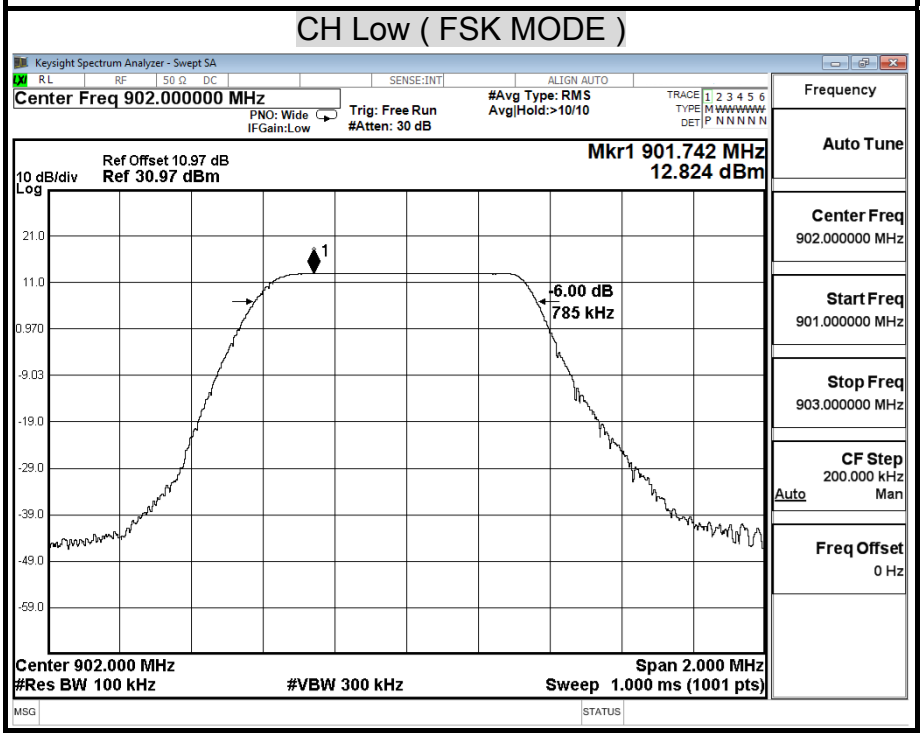
Model Name	PPM N1U_SB1	Test By	Ted Huang
Temp & Humidity	25.8°C, 54%	Test Date	2019/4/17

OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

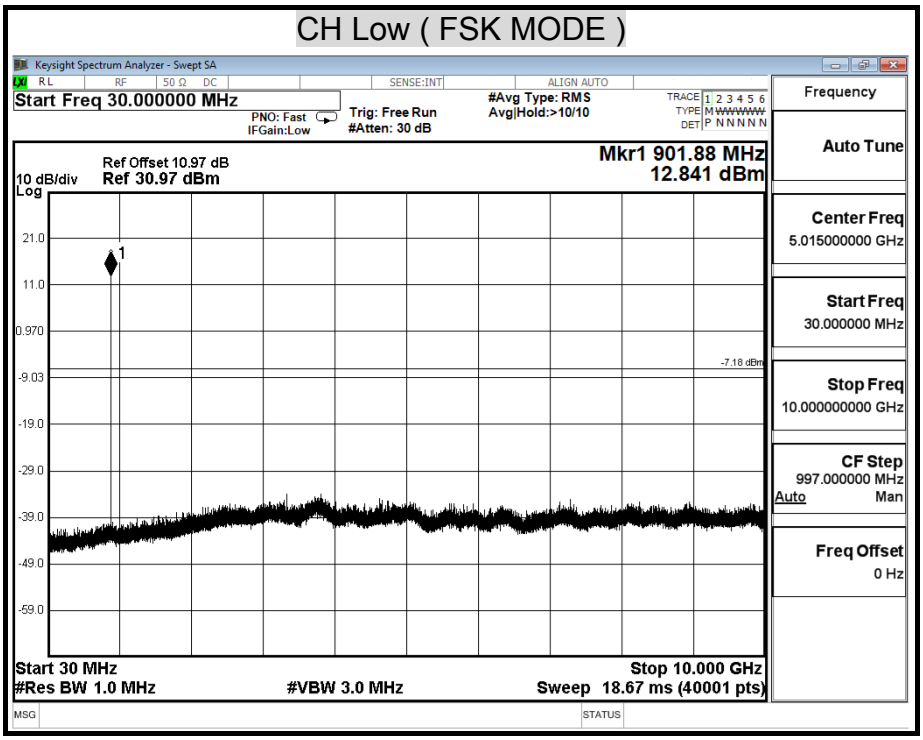
CH Low (FSK MODE)



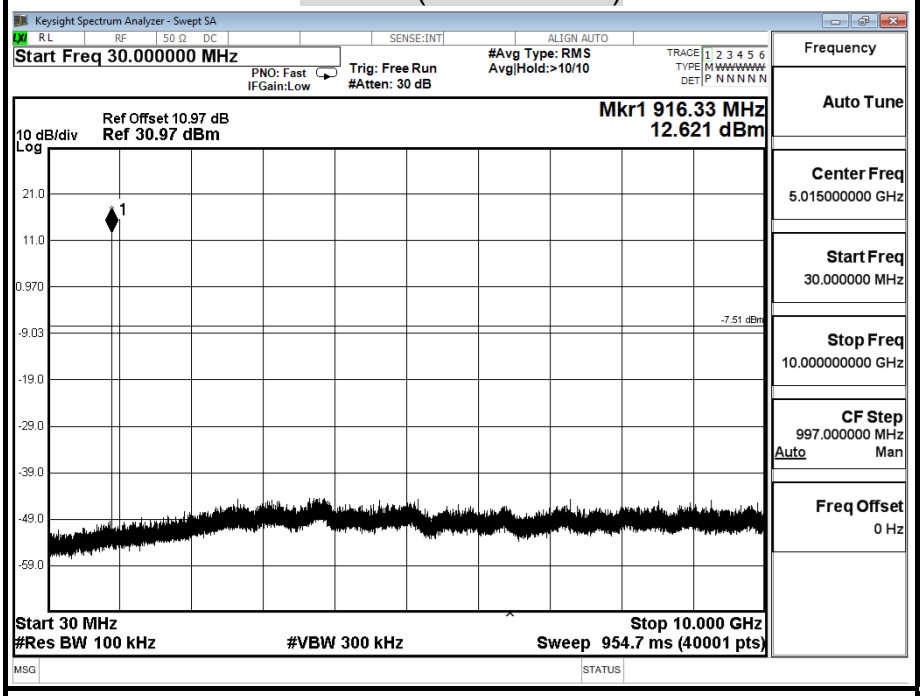
CH Low (FSK MODE)



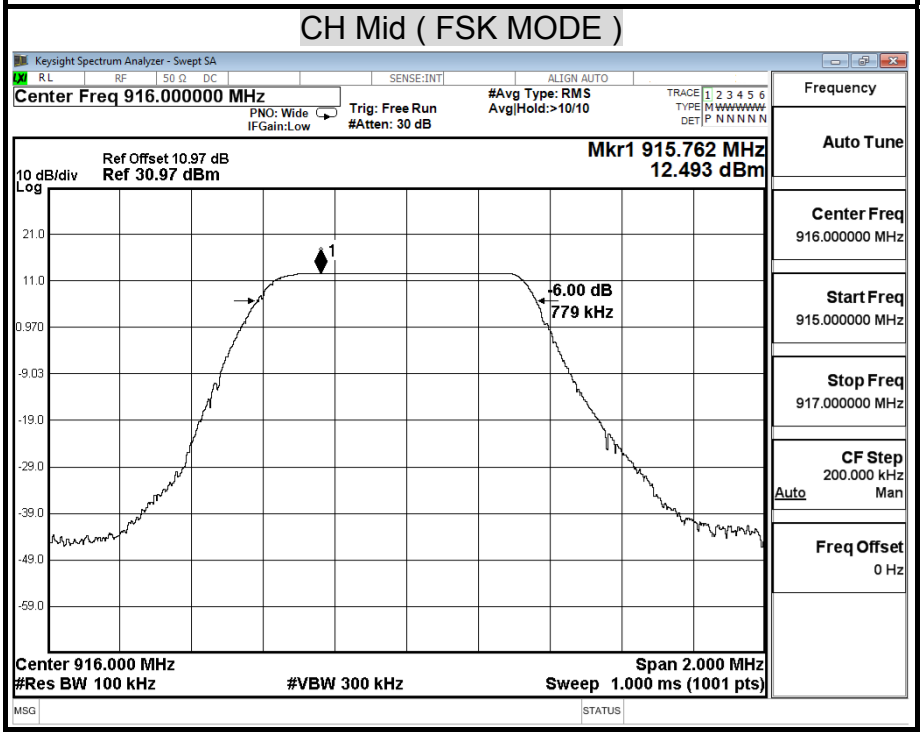
CH Low (FSK MODE)



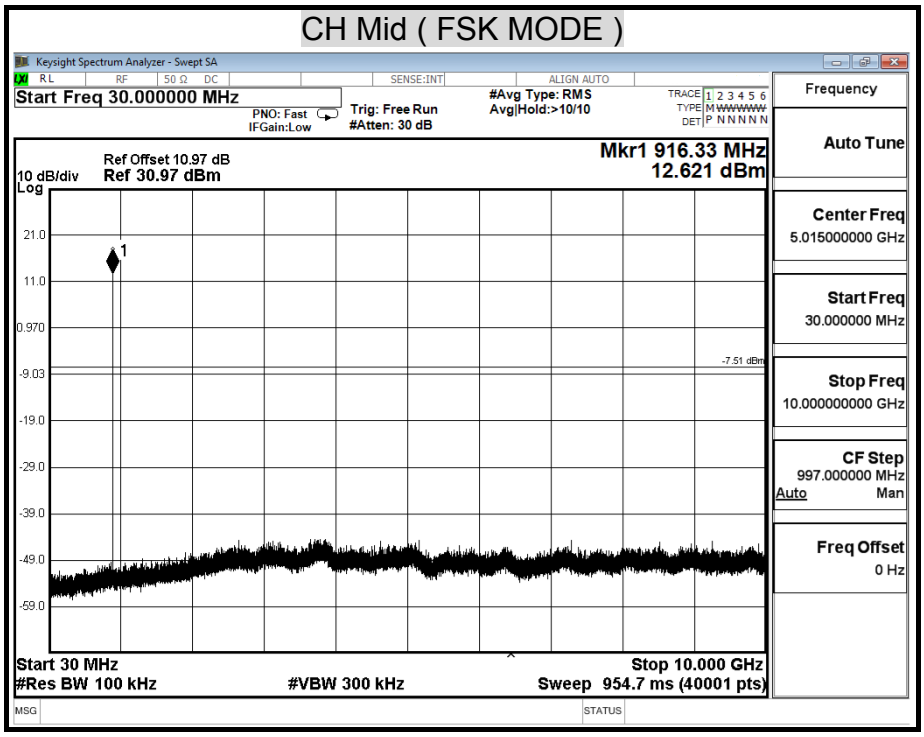
CH Mid (FSK MODE)



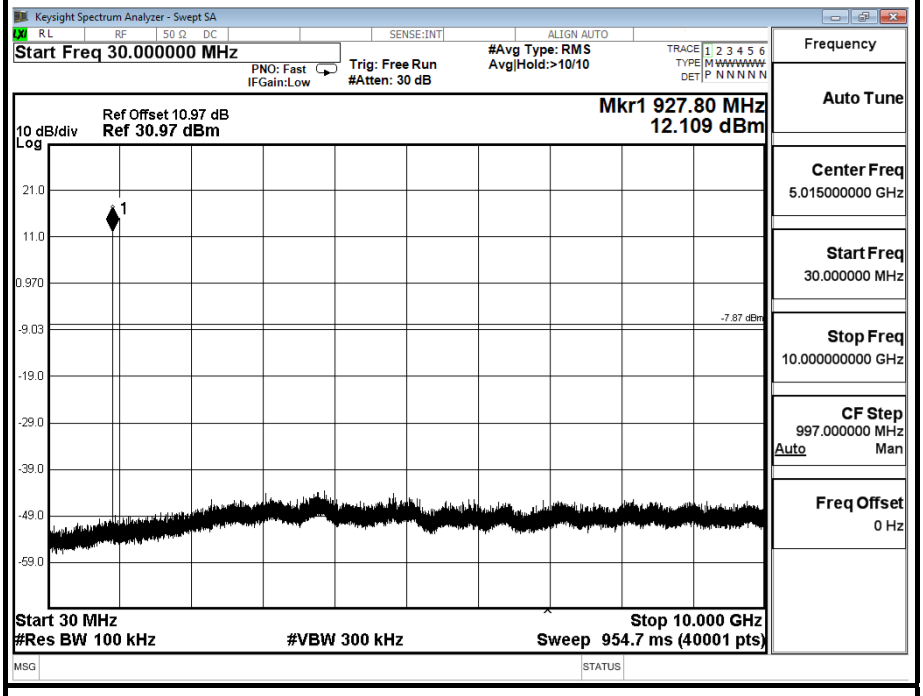
CH Mid (FSK MODE)



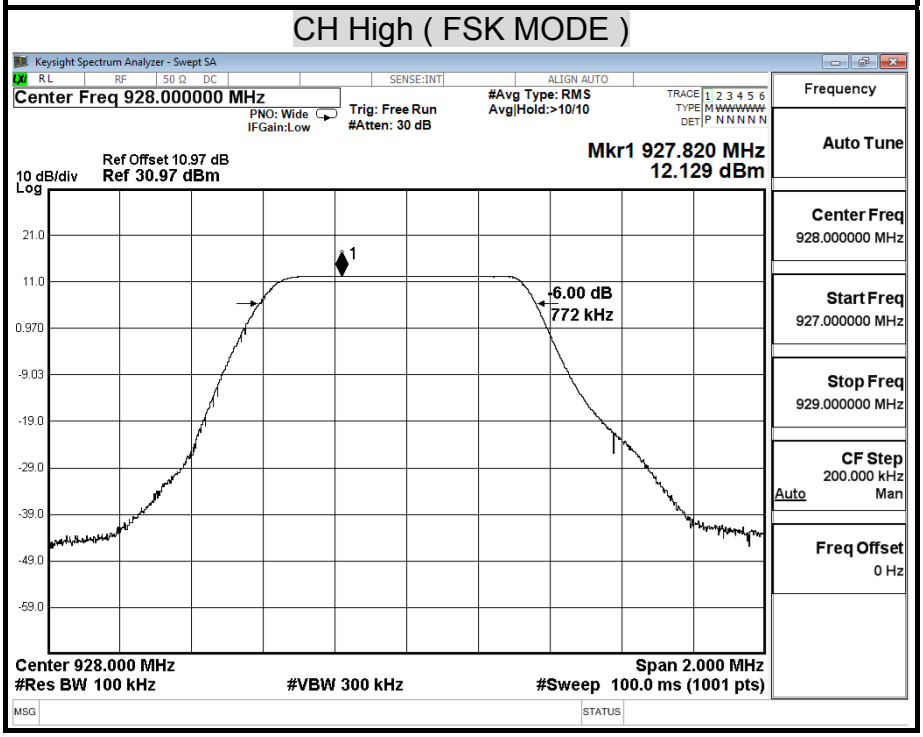
CH Mid (FSK MODE)



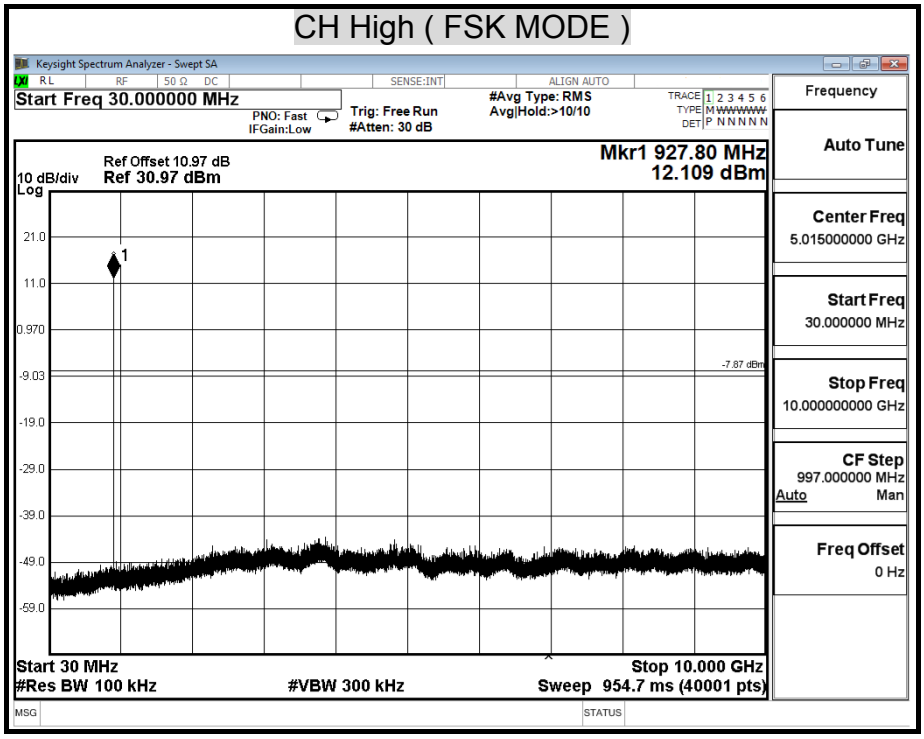
CH High (FSK MODE)



CH High (FSK MODE)



CH High (FSK MODE)



8.6 RADIATED EMISSIONS

8.6.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (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 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§ 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 (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST EQUIPMENTS

The following test equipments are utilized in making the measurements contained in this report.

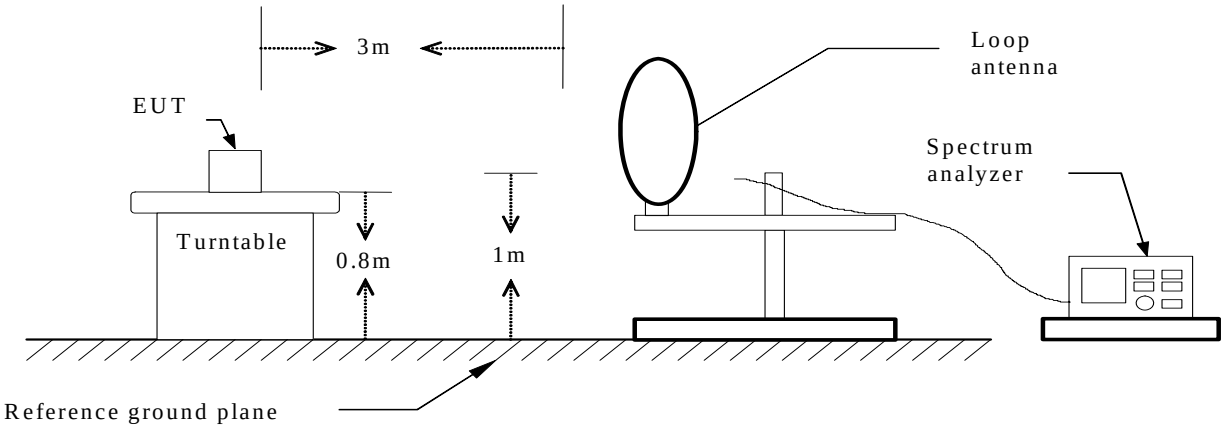
Chamber Room #966					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	07/20/2017	07/19/2019
Amplifier	HP	8447F	2443A01671	01/25/2019	01/24/2020
Bi-Log Antenna	Sunol	JB1	A070506-2	02/09/2019	02/08/2020
Cable	Rosnol+Suhner	SUCOFLEX 104PEA	SN25737 /4PEA	01/27/2019	01/26/2020
Double Ridged Guide Horn Antenna	ETS-LINDGREN	3116	00078900	03/29/2019	03/28/2021
EMI Test Receiver	R&S	ESCI	100960	11/07/2018	11/06/2019
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/05/2018	07/04/2019
Horn Antenna	Com-Power	AH-118	071032	04/30/2019	04/29/2020
Pre-Amplifier	EMCI	EMC012645	980098	01/25/2019	01/24/2020
Pre-Amplifier	MITEQ	AMF-6F-18004000-37-8P	985646	06/18/2019	06/17/2020
Hi-Pass Filter	MICRO-TRONICS	BRM50702-01	018	N.C.R	N.C.R

Remark: *1. Each piece of equipment is scheduled for calibration once a year.*

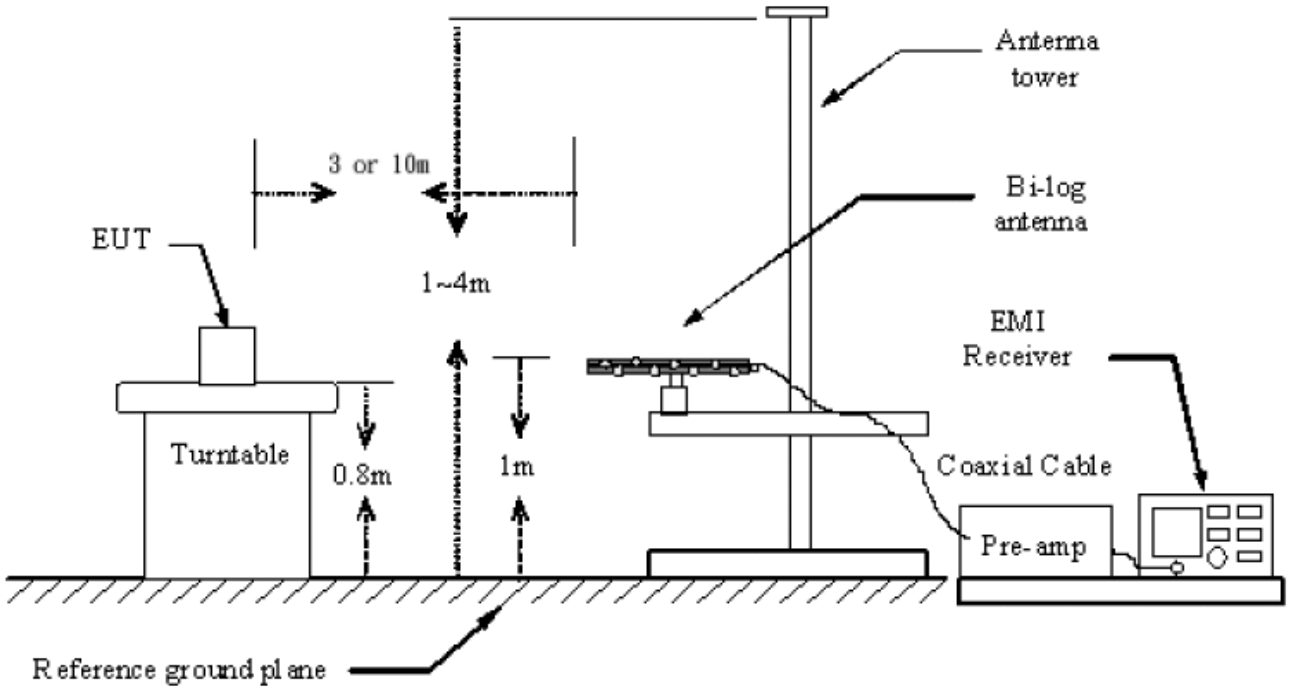
TEST SETUP

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

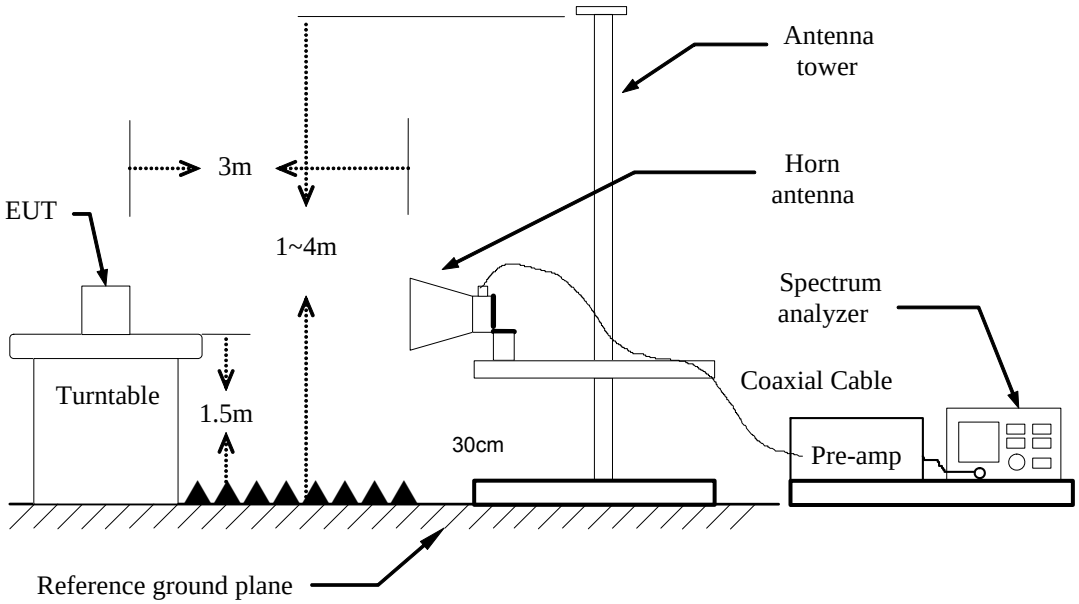
9kHz ~ 30MHz



30MHz ~ 1GHz



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



TEST PROCEDURE

a. The EUT was placed on the top of a rotating table 0.8/1.5 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. White measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. White measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The tests were performed in accordance with 558074 D01 15.247 Meas Guidance v05r02

NOTE：

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

4. No emission is found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)

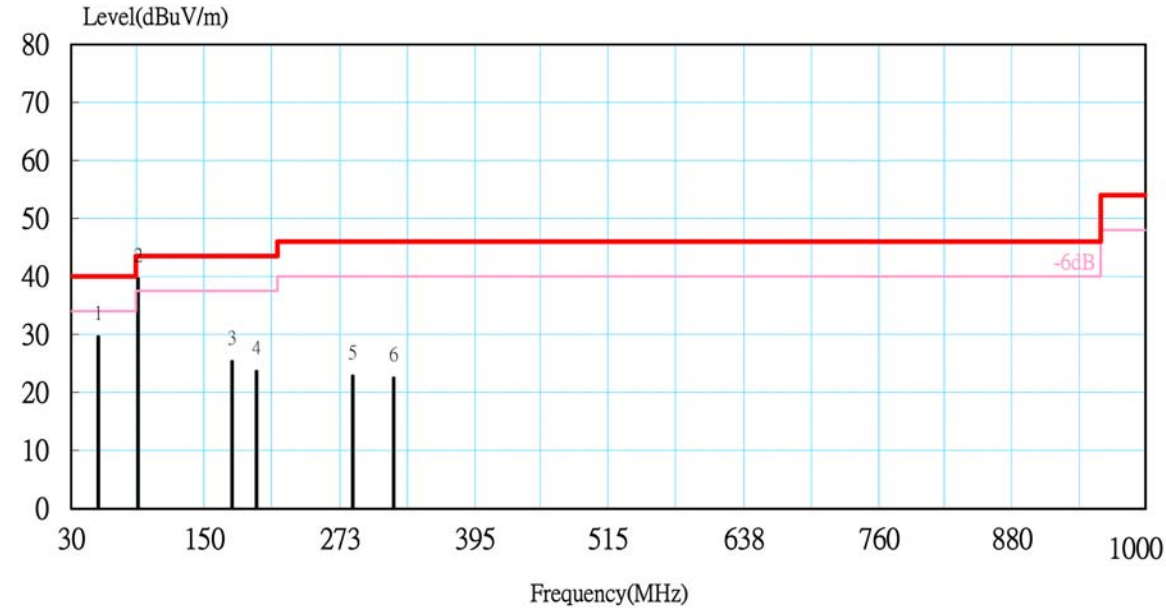
TEST RESULTS

No non-compliance noted.

8.6.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

Product Name	Sub-1G module	Test Date	2019/04/17
Model Name	PPM N1U_SB1	Test By	Ted Huang
Test Mode	TX	Temp & Humidity	26.5°C, 54%

Vertical



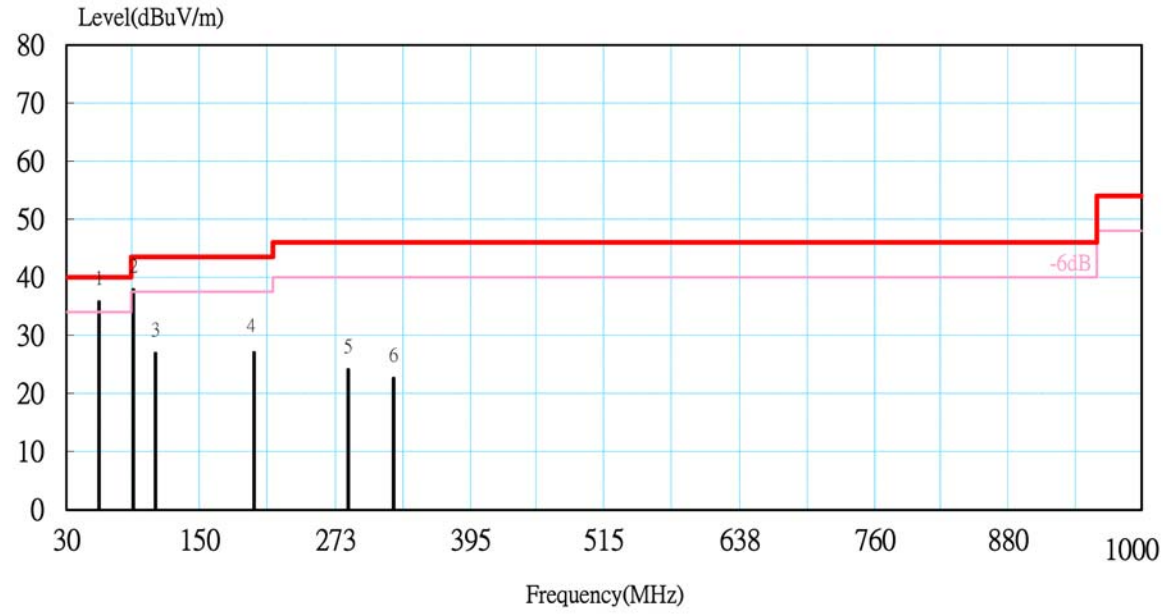
No.	Freq-Uency (MHz)	Meter Reading at 3 m Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission at 3 m Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Detector Mode PK/QP
1	54.25	20.35	8.30	0.97	29.63	40.00	**-10.38**	QP
2	90.62	30.48	7.87	1.29	39.64	43.50	**-3.86**	QP
3	175.50	11.68	11.73	1.98	25.39	43.50	**-18.11**	QP
4	197.33	8.52	12.95	2.19	23.67	43.50	**-19.83**	QP
5	284.62	6.42	13.54	2.90	22.86	46.00	**-23.14**	QP
6	321.00	4.86	14.44	3.20	22.50	46.00	**-23.50**	QP

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

Product Name	Sub-1G module	Test Date	2019/04/17
Model Name	PPM N1U_SB1	Test By	Ted Huang
Test Mode	TX	Temp & Humidity	26.5°C, 54%

Horizontal



No.	Freq-Uency (MHz)	Meter Reading at 3 m Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission at 3 m Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Detector Mode PK/QP
1	59.10	26.84	7.96	1.02	35.82	40.00	**-4.18**	QP
2	90.62	28.76	7.87	1.29	37.92	43.50	**-5.58**	QP
3	110.35	12.43	13.05	1.47	26.95	43.50	**-16.55**	QP
4	199.75	11.58	13.27	2.22	27.07	43.50	**-16.44**	QP
5	284.63	7.68	13.54	2.90	24.12	46.00	**-21.88**	QP
6	325.85	4.86	14.54	3.24	22.64	46.00	**-23.36**	QP

Remark:
1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

8.6.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH Low)	TEMP& Humidity	25.8°C, 54%

Horizontal

	TX / FSK mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1803.69	64.20	28.87	2.30	45.03	0.78	51.11	74.00	-22.89	P
	1803.69	60.80	28.87	2.30	45.03	0.78	47.71	54.00	-6.29	A
*	2706.46	63.56	30.08	3.52	44.47	0.89	53.58	74.00	-20.42	P
*	2706.46	60.71	30.08	3.52	44.47	0.89	50.73	54.00	-3.27	A
*	3608.38	58.76	30.35	3.82	44.26	0.28	48.95	74.00	-25.05	P
*	3608.38	50.75	30.35	3.82	44.26	0.28	40.94	54.00	-13.06	A
*	4509.85	58.05	32.03	4.01	44.31	0.19	49.98	74.00	-24.02	P
*	4509.85	49.12	32.03	4.01	44.31	0.19	41.05	54.00	-12.95	A
*	5410.90	57.52	33.83	4.41	44.60	0.37	51.53	74.00	-22.47	P
*	5410.90	48.24	33.83	4.41	44.60	0.37	42.25	54.00	-11.75	A
	6313.34	56.97	34.99	4.74	44.63	0.24	52.31	74.00	-21.69	P
	6313.34	47.51	34.99	4.74	44.63	0.24	42.85	54.00	-11.15	A
	7215.56	55.78	38.73	5.11	43.82	0.27	56.08	74.00	-17.92	P
	7215.56	46.46	38.73	5.11	43.82	0.27	46.75	54.00	-7.25	A
*	8117.67	57.27	39.01	5.49	42.78	0.30	59.28	74.00	-14.72	P
*	8117.67	50.45	39.01	5.49	42.78	0.30	52.46	54.00	-1.54	A
*	9018.56	54.96	38.39	5.77	42.11	0.30	57.30	74.00	-16.70	P
*	9018.56	47.27	38.39	5.77	42.11	0.30	49.61	54.00	-4.39	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH Low)	TEMP& Humidity	25.8°C, 54%

Vertical

	TX / FSK mode / CH Low				Measurement Distance at 3m Vertical polarity					
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1803.89	66.29	28.87	2.30	45.03	0.78	53.21	74.00	-20.79	P
	1803.89	64.18	28.87	2.30	45.03	0.78	51.09	54.00	-2.91	A
*	2706.25	63.50	30.08	3.52	44.47	0.89	53.53	74.00	-20.47	P
*	2706.25	62.78	30.08	3.52	44.47	0.89	52.80	54.00	-1.20	A
*	3607.84	57.70	30.35	3.82	44.26	0.28	47.90	74.00	-26.10	P
*	3607.84	49.27	30.35	3.82	44.26	0.28	39.47	54.00	-14.53	A
*	4509.08	58.09	32.03	4.01	44.31	0.19	50.01	74.00	-23.99	P
*	4509.08	50.31	32.03	4.01	44.31	0.19	42.24	54.00	-11.76	A
*	5411.26	57.44	33.83	4.41	44.60	0.37	51.45	74.00	-22.55	P
*	5411.26	47.62	33.83	4.41	44.60	0.37	41.64	54.00	-12.36	A
	6314.67	56.21	34.99	4.74	44.63	0.24	51.56	74.00	-22.44	P
	6314.67	48.19	34.99	4.74	44.63	0.24	43.54	54.00	-10.46	A
	7215.84	57.69	38.73	5.11	43.82	0.27	57.99	74.00	-16.01	P
	7215.84	49.62	38.73	5.11	43.82	0.27	49.91	54.00	-4.09	A
*	8119.63	57.24	39.00	5.49	42.78	0.30	59.25	74.00	-14.75	P
*	8119.63	50.86	39.00	5.49	42.78	0.30	52.87	54.00	-1.13	A
*	9020.36	54.74	38.39	5.77	42.11	0.30	57.08	74.00	-16.92	P
*	9020.36	47.20	38.39	5.77	42.11	0.30	49.55	54.00	-4.45	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH Middle)	TEMP& Humidity	25.8°C, 54%

Horizontal

	TX / FSK mode / CH Middle				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1831.86	71.44	29.09	2.30	44.99	0.81	58.64	74.00	-15.36	P
	1831.86	62.73	29.09	2.30	44.99	0.81	49.93	54.00	-4.07	A
*	2748.44	62.08	30.10	3.55	44.45	0.87	52.16	74.00	-21.84	P
*	2748.44	58.10	30.10	3.55	44.45	0.87	48.18	54.00	-5.82	A
*	3664.18	58.65	30.43	3.83	44.25	0.27	48.92	74.00	-25.08	P
*	3664.18	50.39	30.43	3.83	44.25	0.27	40.66	54.00	-13.34	A
	4579.99	58.73	32.24	4.03	44.32	0.20	50.88	74.00	-23.12	P
*	4579.99	50.88	32.24	4.03	44.32	0.20	43.03	54.00	-10.97	A
	5495.40	57.34	33.90	4.46	44.64	0.40	51.46	74.00	-22.54	P
	5495.40	47.29	33.90	4.46	44.64	0.40	41.41	54.00	-12.59	A
	6410.80	57.59	35.20	4.78	44.55	0.24	53.26	74.00	-20.74	P
	6410.80	48.68	35.20	4.78	44.55	0.24	44.36	54.00	-9.64	A
*	7329.00	55.71	39.12	5.16	43.69	0.27	56.57	74.00	-17.43	P
*	7329.00	47.09	39.12	5.16	43.69	0.27	47.96	54.00	-6.04	A
*	8244.43	54.72	38.90	5.53	42.69	0.28	56.75	74.00	-17.25	P
*	8244.43	47.28	38.90	5.53	42.69	0.28	49.30	54.00	-4.70	A
	9160.80	53.85	38.30	5.83	42.07	0.31	56.23	74.00	-17.77	P
*	9160.80	43.97	38.30	5.83	42.07	0.31	46.35	54.00	-7.65	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH Middle)	TEMP& Humidity	25.8°C, 54%

Vertical

	TX / FSK mode / CH Middle				Measurement Distance at 3m Vertical polarity					
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1832.08	73.22	29.09	2.30	44.99	0.81	60.42	74.00	-13.58	P
	1832.08	64.77	29.09	2.30	44.99	0.81	51.98	54.00	-2.02	A
*	2748.32	65.54	30.10	3.55	44.45	0.87	55.62	74.00	-18.38	P
*	2748.32	62.76	30.10	3.55	44.45	0.87	52.84	54.00	-1.16	A
*	3663.33	58.01	30.43	3.83	44.25	0.27	48.28	74.00	-25.72	P
*	3663.33	49.86	30.43	3.83	44.25	0.27	40.13	54.00	-13.87	A
*	4580.69	58.54	32.24	4.03	44.32	0.20	50.70	74.00	-23.30	P
*	4580.69	50.21	32.24	4.03	44.32	0.20	42.36	54.00	-11.64	A
	5496.27	57.37	33.90	4.46	44.64	0.40	51.48	74.00	-22.52	P
	5496.27	48.29	33.90	4.46	44.64	0.40	42.41	54.00	-11.59	A
	6412.09	57.76	35.21	4.78	44.55	0.24	53.44	74.00	-20.56	P
	6412.09	49.55	35.21	4.78	44.55	0.24	45.23	54.00	-8.77	A
*	7327.83	56.95	39.11	5.16	43.69	0.27	57.81	74.00	-16.19	P
*	7327.83	49.46	39.11	5.16	43.69	0.27	50.32	54.00	-3.68	A
*	8244.44	57.10	38.90	5.53	42.69	0.28	59.13	74.00	-14.87	P
*	8244.44	50.88	38.90	5.53	42.69	0.28	52.91	54.00	-1.09	A
*	9158.42	53.13	38.30	5.83	42.07	0.31	55.50	74.00	-18.50	P
*	9158.42	43.54	38.30	5.83	42.07	0.31	45.92	54.00	-8.08	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH High)	TEMP& Humidity	25.8°C, 54%

Horizontal

TX / FSK mode / CH High				Measurement Distance at 3m			Horizontal polarity		
Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
1857.12	72.46	29.29	2.31	44.97	0.83	59.92	74.00	-14.08	P
1857.12	63.56	29.29	2.31	44.97	0.83	51.02	54.00	-2.98	A
2784.12	62.48	30.11	3.58	44.43	0.85	52.60	74.00	-21.40	P
2784.12	59.09	30.11	3.58	44.43	0.85	49.21	54.00	-4.79	A
3711.78	57.71	30.50	3.83	44.25	0.26	48.05	74.00	-25.95	P
3711.78	50.10	30.50	3.83	44.25	0.26	40.44	54.00	-13.56	A
4640.75	57.11	32.42	4.05	44.33	0.21	49.45	74.00	-24.55	P
4640.75	48.70	32.42	4.05	44.33	0.21	41.05	54.00	-12.95	A
5568.49	56.50	33.95	4.48	44.67	0.38	50.64	74.00	-23.36	P
5568.49	46.41	33.95	4.48	44.67	0.38	40.55	54.00	-13.45	A
6495.20	58.76	35.39	4.82	44.48	0.24	54.72	74.00	-19.28	P
6495.20	50.76	35.39	4.82	44.48	0.24	46.72	54.00	-7.28	A
7425.05	56.18	39.45	5.21	43.57	0.27	57.53	74.00	-16.47	P
7425.05	47.53	39.45	5.21	43.57	0.27	48.88	54.00	-5.12	A
8350.12	55.30	38.82	5.56	42.61	0.27	57.34	74.00	-16.66	P
8350.12	47.56	38.82	5.56	42.61	0.27	49.60	54.00	-4.40	A
9280.18	54.63	38.23	5.88	42.02	0.32	57.04	74.00	-16.96	P
9280.18	47.23	38.23	5.88	42.02	0.32	49.64	54.00	-4.36	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Product Name	Sub-1G module	Test Date	2019/4/17
Model	PPM N1U_SB1	Test By	Ted Huang
Test Mode	FSK TX (CH High)	TEMP& Humidity	25.8°C, 54%

Vertical

TX / FSK mode / CH High				Measurement Distance at 3m			Vertical polarity		
Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
1856.31	73.58	29.28	2.31	44.97	0.83	61.04	74.00	-12.96	P
1856.31	64.04	29.28	2.31	44.97	0.83	51.49	54.00	-2.51	A
2783.65	65.05	30.11	3.58	44.43	0.85	55.17	74.00	-18.83	P
2783.65	62.58	30.11	3.58	44.43	0.85	52.70	54.00	-1.30	A
3712.74	58.47	30.50	3.83	44.25	0.26	48.81	74.00	-25.19	P
3712.74	51.14	30.50	3.83	44.25	0.26	41.48	54.00	-12.52	A
4939.95	56.16	33.32	4.14	44.38	0.23	49.48	74.00	-24.52	P
4939.95	49.24	33.32	4.14	44.38	0.23	42.55	54.00	-11.45	A
5568.77	57.21	33.96	4.48	44.67	0.38	51.35	74.00	-22.65	P
5568.77	48.62	33.96	4.48	44.67	0.38	42.77	54.00	-11.23	A
6497.06	58.14	35.39	4.82	44.48	0.24	54.10	74.00	-19.90	P
6497.06	50.51	35.39	4.82	44.48	0.24	46.47	54.00	-7.53	A
7424.11	57.07	39.44	5.21	43.57	0.27	58.41	74.00	-15.59	P
7424.11	48.60	39.44	5.21	43.57	0.27	49.94	54.00	-4.06	A
8351.16	56.85	38.82	5.56	42.61	0.27	58.89	74.00	-15.11	P
8351.16	50.72	38.82	5.56	42.61	0.27	52.76	54.00	-1.24	A
9278.21	53.59	38.23	5.88	42.03	0.32	56.00	74.00	-18.00	P
9278.21	45.40	38.23	5.88	42.03	0.32	47.81	54.00	-6.19	A

REMARK:

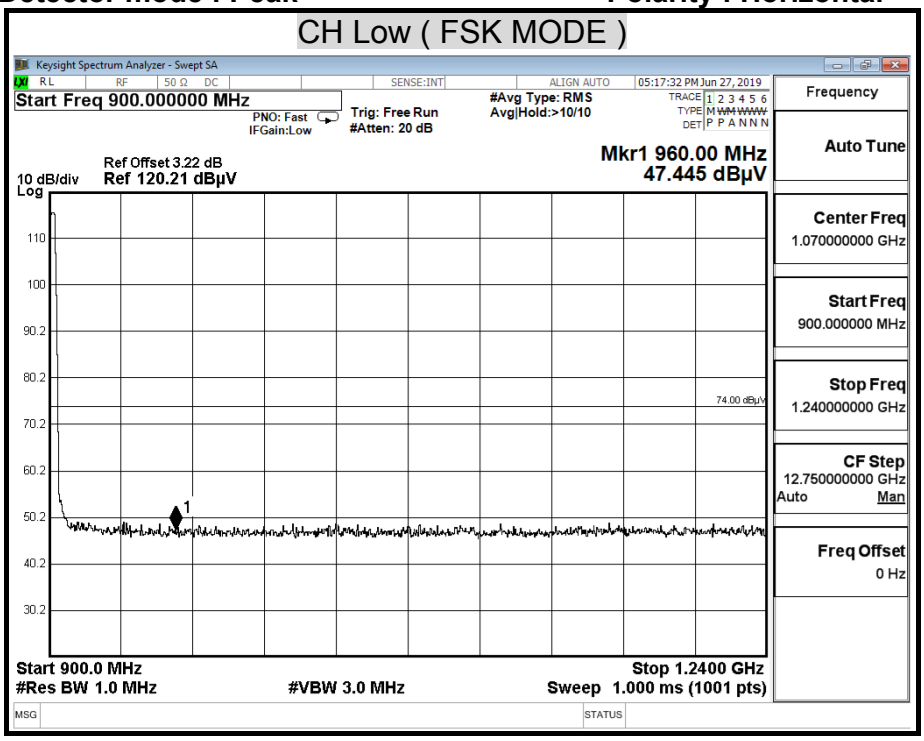
1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.
6. * = Restricted bands of operation

Report No.: T181106N03-RP1

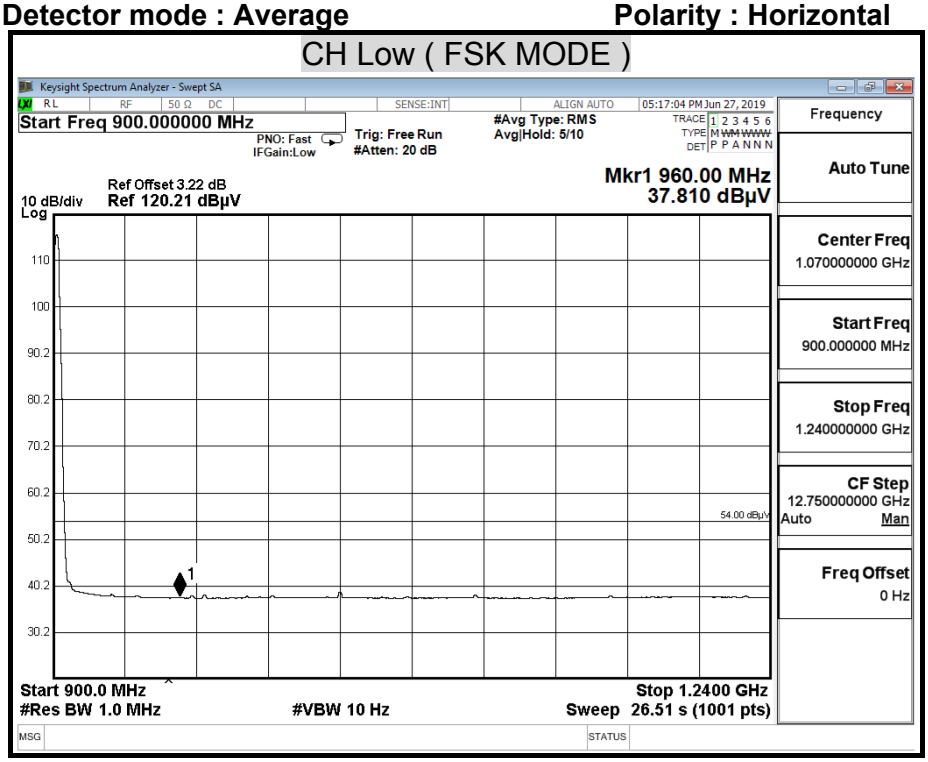
8.6.4 RESTRICTED BAND EDGES

Model Name	PPM DC1_100	Test By	Ted Huang
Temp & Humidity	26.6℃, 52%	Test Date	2019/06/27

Detector mode : Peak **Polarity : Horizontal**

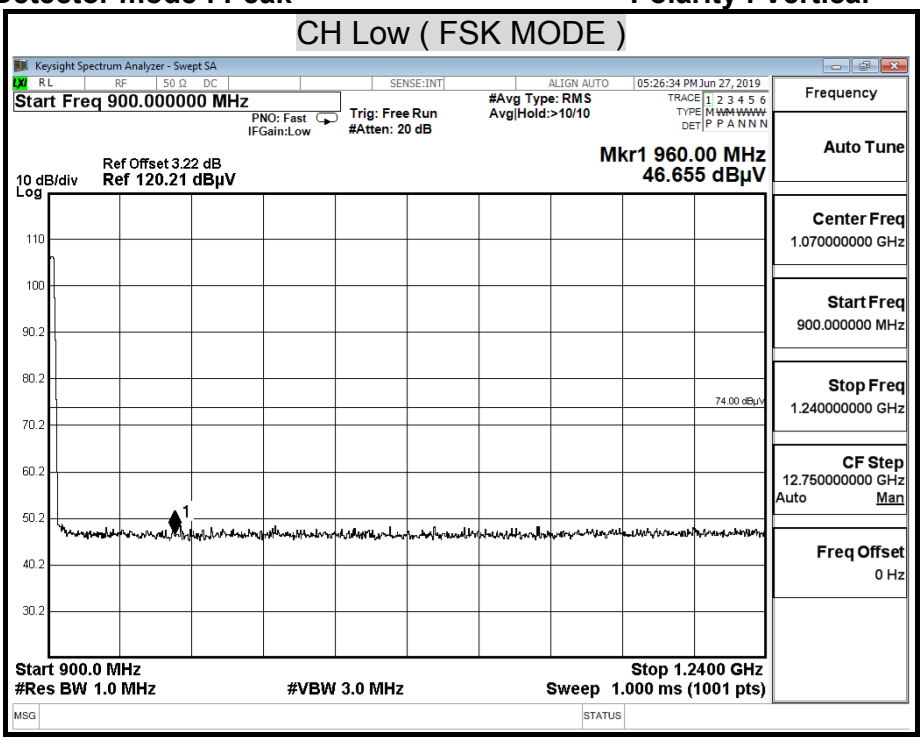


Detector mode : Average **Polarity : Horizontal**



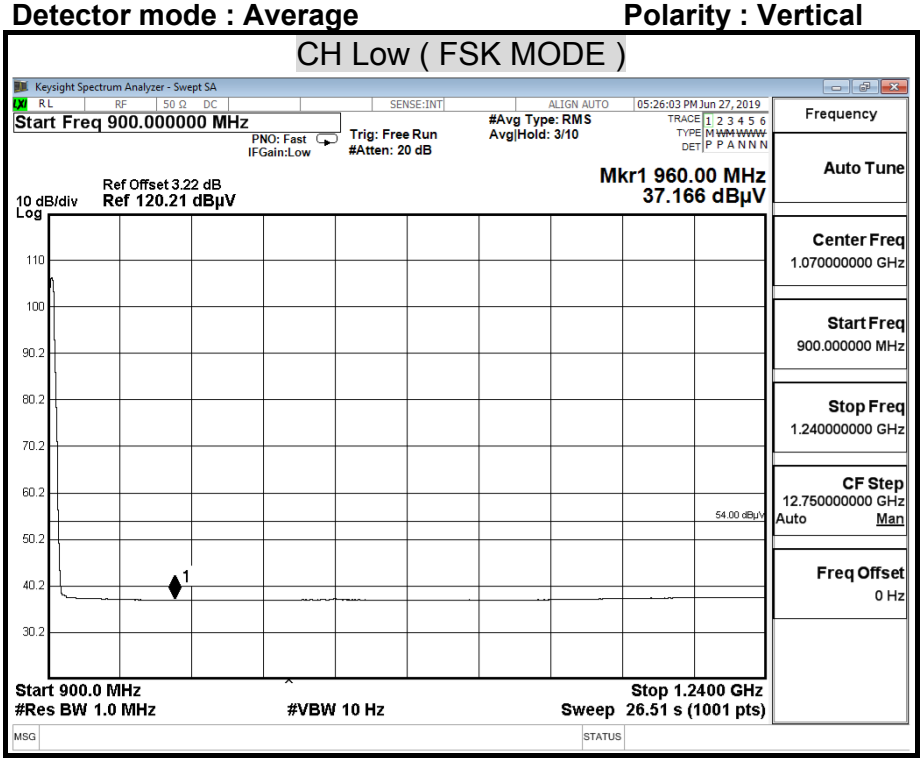
Detector mode : Peak **Polarity : Vertical**

CH Low (FSK MODE)



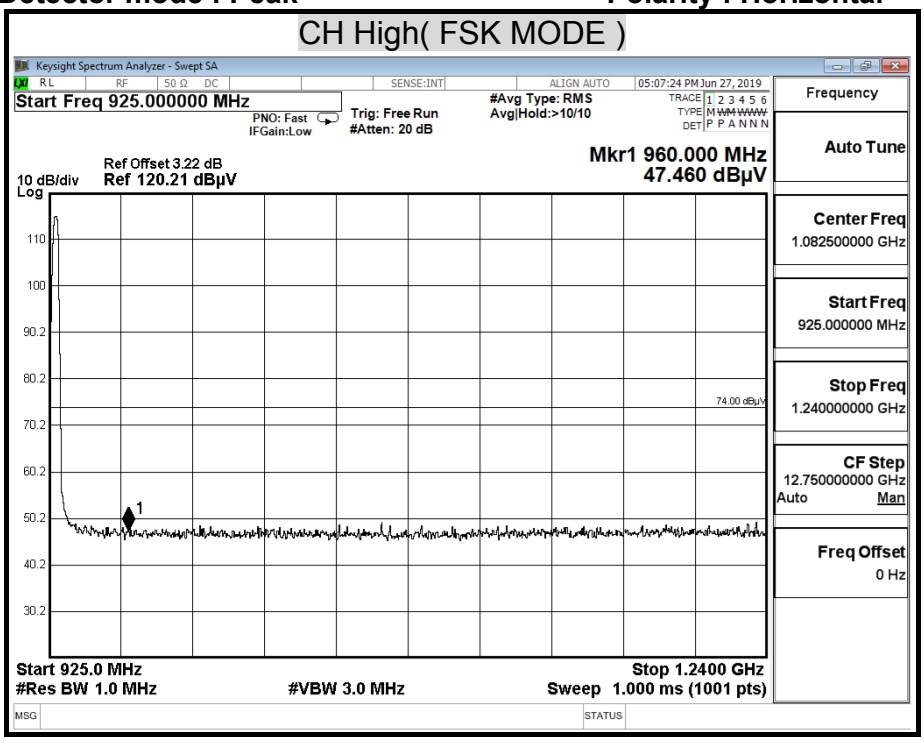
Detector mode : Average **Polarity : Vertical**

CH Low (FSK MODE)



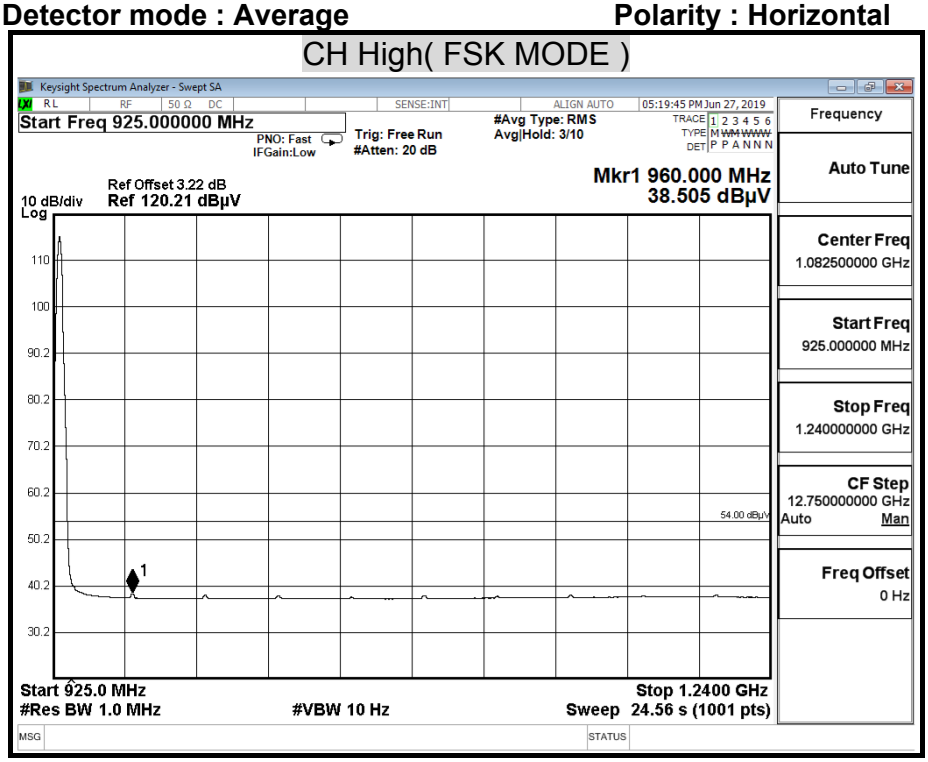
Detector mode : Peak **Polarity : Horizontal**

CH High(FSK MODE)



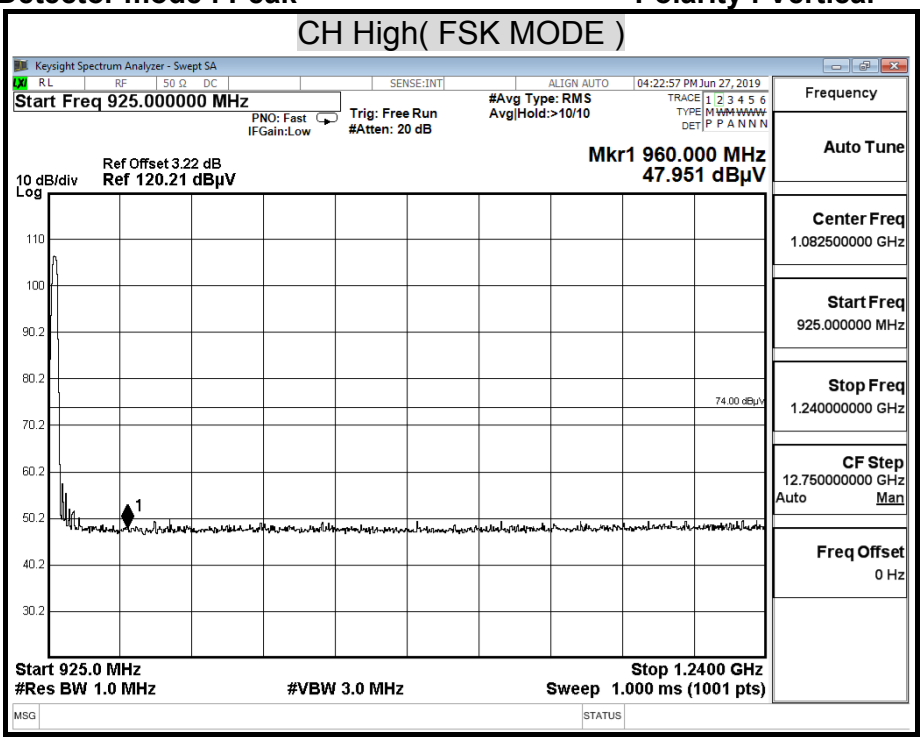
Detector mode : Average **Polarity : Horizontal**

CH High(FSK MODE)



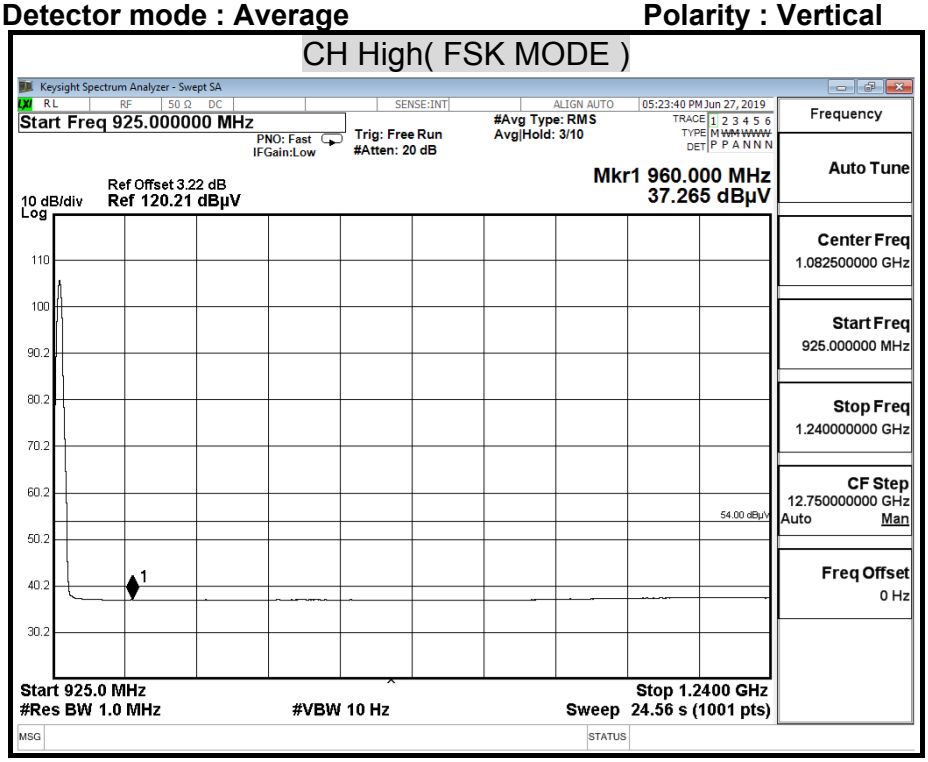
Detector mode : Peak **Polarity : Vertical**

CH High(FSK MODE)



Detector mode : Average **Polarity : Vertical**

CH High(FSK MODE)



8.7 POWERLINE CONDUCTED EMISSIONS

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

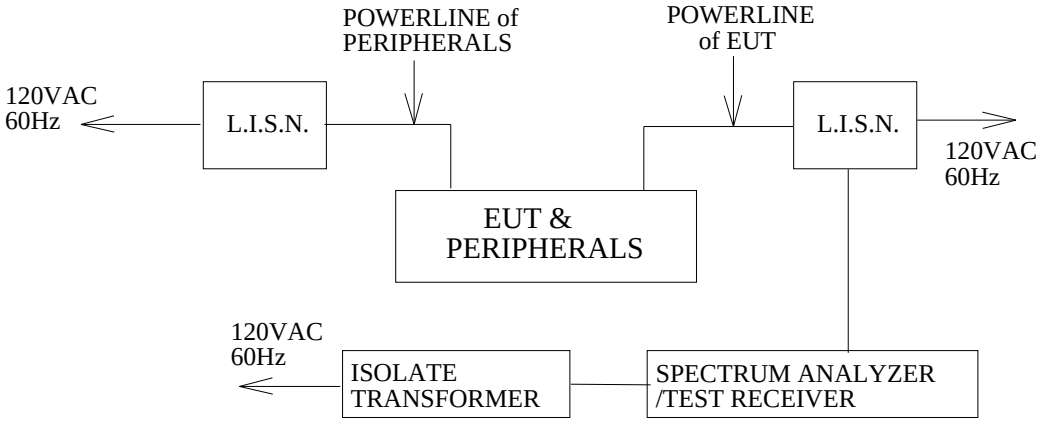
Frequency of Emission (MHz)	Conducted limit (dBμv)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

TEST EQUIPMENTS

The following test equipments are used during the conducted power line tests：

Conducted Emission room #1					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
BNC Coaxial Cable	CCS	BNC50	11	02/25/2019	02/24/2020
EMI Test Receiver	R&S	ESCS 30	100348	02/19/2019	02/18/2020
LISN	SCHWARZBECK	NNLK8130	8130124	01/02/2019	01/01/2020
LISN	FCC	FCC-LISN-50-32-2	08009	05/24/2018	05/23/2019
Pulse Limiter	R&S	ESH3-Z2	100116	02/25/2019	02/24/2020
Test S/W	e-3 (5.04211j)				

TEST SETUP



TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.10.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

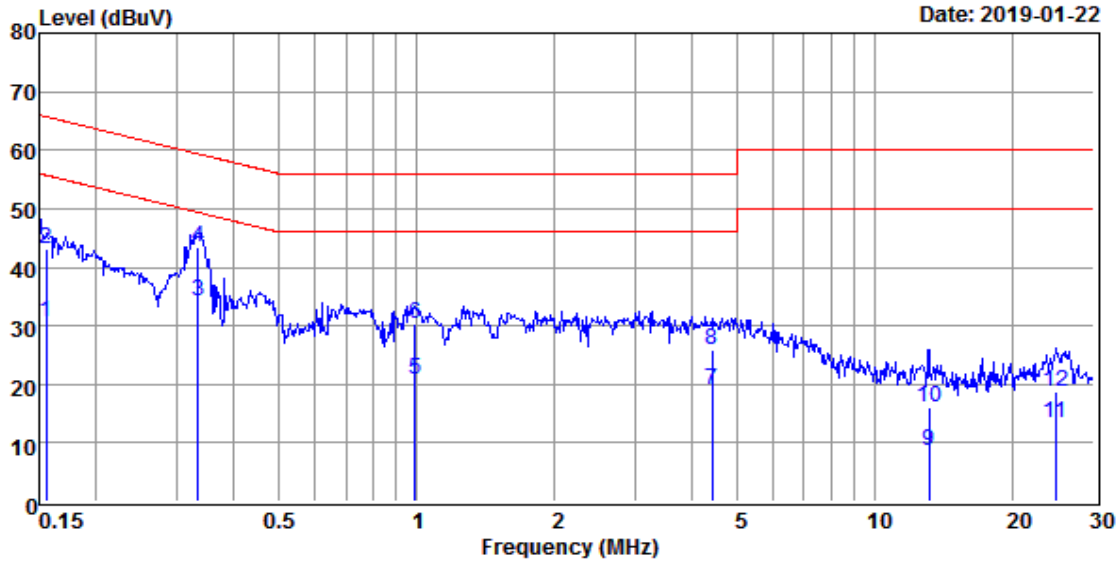
TEST RESULTS

No non-compliance noted.

Model No.	PPM N1U_SB1	Test Mode	Normal Operation
Environmental Conditions	21.6℃, 70% RH	Resolution Bandwidth	9 kHz
Tested by	Andy Yang	Remark	Powered by PPM DC1_100

LINE

(The chart below shows the highest readings taken from the final data.)



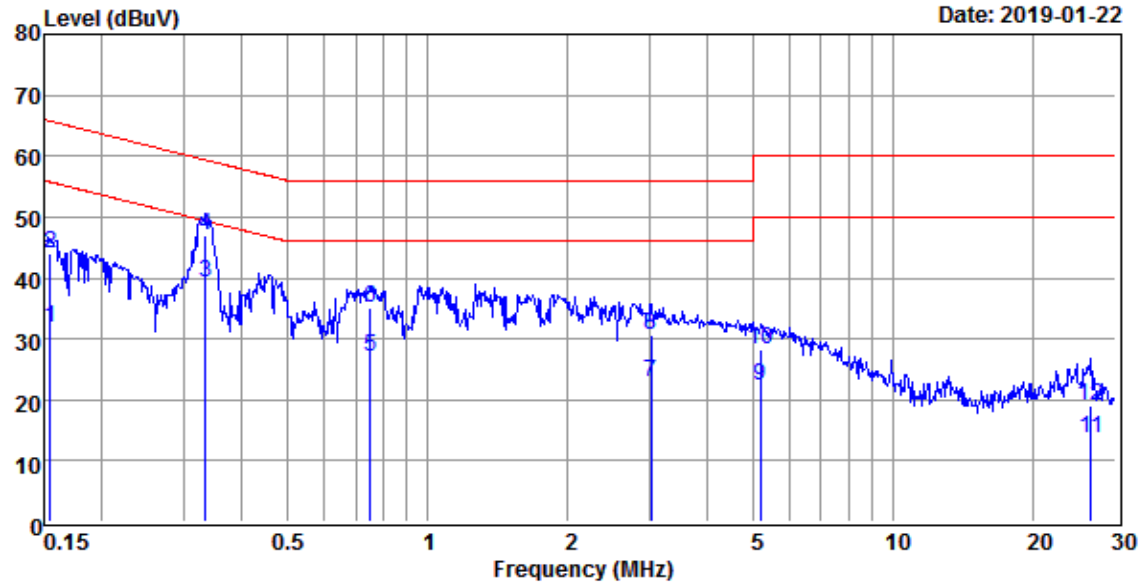
Freq	Reading Level	C.F	Result	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV	dBuV	dBuV	
0.16	21.87	8.71	30.58	55.69	-25.11	Average
0.16	34.28	8.71	42.99	65.69	-22.70	QP
0.33	25.47	8.81	34.28	49.35	-15.07	Average
0.33	34.54	8.81	43.35	59.35	-16.00	QP
0.99	11.95	8.96	20.91	46.00	-25.09	Average
0.99	21.39	8.96	30.35	56.00	-25.65	QP
4.41	9.92	9.13	19.05	46.00	-26.95	Average
4.41	16.74	9.13	25.87	56.00	-30.13	QP
13.13	-1.04	9.54	8.50	50.00	-41.50	Average
13.13	6.51	9.54	16.05	60.00	-43.95	QP
24.79	3.52	9.94	13.46	50.00	-36.54	Average
24.79	8.78	9.94	18.72	60.00	-41.28	QP

REMARKS： 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)

Model No.	PPM N1U_SB1	Test Mode	Normal Operation
Environmental Conditions	21.6℃, 70% RH	Resolution Bandwidth	9 kHz
Tested by	Andy Yang	Remark	Powered by PPM DC1_100

NEUTRAL

(The chart below shows the highest readings taken from the final data.)



Freq	Reading Level	C.F	Result	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV	dBuV	dBuV	
0.15	23.07	8.72	31.79	55.74	-23.95	Average
0.15	35.19	8.72	43.91	65.74	-21.83	QP
0.33	30.40	8.82	39.22	49.35	-10.13	Average
0.33	38.28	8.82	47.10	59.35	-12.25	QP
0.75	18.20	8.94	27.14	46.00	-18.86	Average
0.75	26.06	8.94	35.00	56.00	-21.00	QP
3.03	13.82	9.08	22.90	46.00	-23.10	Average
3.03	21.51	9.08	30.59	56.00	-25.41	QP
5.19	12.98	9.20	22.18	50.00	-27.82	Average
5.19	19.02	9.20	28.22	60.00	-31.78	QP
26.56	3.68	9.94	13.62	50.00	-36.38	Average
26.56	9.17	9.94	19.11	60.00	-40.89	QP

REMARKS： 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)

9. ANTENNA REQUIREMENT

9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2 ANTENNA CONNECTED CONSTRUCTION

Manufacturer: Master Wave Technology Co., Ltd
Type: Dipole Antenna
Model: 98623ZRSX001
Gain: 2 dBi