TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247
TEST REPORT

For

CHENGDU JOUAV DA PENG TECH CO., LTD

6A-7F, Jingrong Innovation Hub, No. 200 5th TianFu St., Hi-tech District, Chengdu, 610000 China

FCC ID: 2AVXCGCS-202

Report Type:	**Product Type:**
Original Report	Ground Control Station

Test Engineer:	Jack Jiao
Report Number:	RSHA200310003-00E
Report Date:	2020-08-03
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION **3**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 3
OBJECTIVE 3
RELATED SUBMITTAL(S)/GRANT(S) 3
TEST METHODOLOGY 3
MEASUREMENT UNCERTAINTY 4
TEST FACILITY 4
SYSTEM TEST CONFIGURATION **5**
DESCRIPTION OF TEST CONFIGURATION 5
EUT EXERCISE SOFTWARE 6
SPECIAL ACCESSORIES 6
EQUIPMENT MODIFICATIONS 6
SUMMARY OF TEST RESULTS **7**
TEST EQUIPMENT LIST **8**
FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE) **9**
FCC §15.203 – ANTENNA REQUIREMENT **11**
APPLICABLE STANDARD 11
ANTENNA INFORMATION 11
FCC §15.247(a) (1)-CHANNEL SEPARATION TEST **12**
APPLICABLE STANDARD 12
TEST PROCEDURE 12
TEST DATA 12
FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH **15**
APPLICABLE STANDARD 15
TEST PROCEDURE 15
TEST DATA 15
FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST **18**
APPLICABLE STANDARD 18
TEST PROCEDURE 18
TEST DATA 18
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME) **20**
APPLICABLE STANDARD 20
TEST PROCEDURE 20
TEST DATA 20
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT **22**
APPLICABLE STANDARD 22
TEST PROCEDURE 22
TEST DATA 22
FCC §15.247(d) - BAND EDGES TESTING **25**
APPLICABLE STANDARD 25
TEST PROCEDURE 25
TEST DATA 25

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	CHENGDU JOUAV DA PENG TECH CO., LTD
Tested Model:	GCS-202
Product Type:	Ground Control Station
Power Supply:	DC 12.6 V
RF Function:	SRD
Operating Band/Frequency:	2401.6-2477.6 MHz
Channel Number:	76
Channel Separation:	1 MHz and 2 MHz
Modulation Type:	GFSK
Antenna Type:	Omni Antenna
Maximum Antenna Gain:	3.0 dBi

**All measurement and test data in this report was gathered from production sample serial number: 20200310003. (Assigned by the BACL). The EUT supplied by the applicant was received on 2020-03-10.*

Objective

This test report is prepared on behalf of *CHENGDU JOUAV DA PENG TECH CO., LTD* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AVXCGCS-202.
FCC Part 15.247 DSS submissions with FCC ID: 2AVXCCW-007.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliant Testing of Unlicensed Wireless Devices and FCC 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Bay Area Compliant Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel list for FHSS (GFSK) Modulation:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2401.6	31	2431.6
2	2402.6	32	2432.6
3	2403.6	33	2433.6
4	2404.6	34	2434.6
5	2405.6	35	2435.6
6	2406.6	36	2436.6
7	2407.6	37	2437.6
8	2408.6	38	2438.6
9	2409.6	39	2439.6
10	2410.6	40	2440.6
11	2411.6	41	2441.6
12	2412.6	42	2442.6
13	2413.6	43	2443.6
14	2414.6	44	2444.6
15	2415.6	45	2445.6
16	2416.6	46	2446.6
17	2417.6	47	2447.6
18	2418.6	48	2448.6
19	2419.6	49	2449.6
20	2420.6	50	2450.6
21	2421.6	51	2451.6
22	2422.6	52	2452.6
23	2423.6	53	2453.6
24	2424.6	54	2454.6
25	2425.6	55	2455.6
26	2426.6	56	2456.6
27	2427.6	57	2457.6
28	2428.6	58	2458.6
29	2429.6	59	2459.6
30	2430.6	60	2461.6

Channel	Frequency (MHz)	Channel	Frequency (MHz)
61	2462.6	69	2470.6
62	2463.6	70	2471.6
63	2464.6	71	2472.6
64	2465.6	72	2473.6
65	2466.6	73	2474.6
66	2467.6	74	2475.6
67	2468.6	75	2476.6
68	2469.6	76	2477.6

EUT was tested with Channel 1, 39 and 76.

EUT Exercise Software

The EUT was tested in the engineering mode; EUT can be setup for fixed channel mode and hopping mode.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant*
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant*
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

Compliant*: Refer to report no. RSHA200310003-00D.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2019-08-05	2020-08-04
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
JOUAV	RF Cable	JOUAV C01	C01	Each Time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Chengdu) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
2.4G Wi-Fi 802.11b	2412~2462	3.0	2.00	17.50	56.23	20	**0.0224**	1.0
2.4G Wi-Fi 802.11g		3.0	2.00	16.50	44.67	20	0.0178	1.0
2.4G Wi-Fi 802.11 n-HT20		3.0	2.00	16.50	44.67	20	0.0178	1.0
2.4G Wi-Fi 802.11 n-HT40	2422~2452	3.0	2.00	17.50	56.23	20	0.0224	1.0
SRD	2401.6~2477.6	3.0	2.00	17.00	50.12	20	**0.0199**	1.0

Note:
(1) The Tune-up output power was declared by the Manufacturer.
(2) Wi-Fi & SRD can transmit simultaneously; the worst condition is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0224+0.0199= 0.0423 < 1.0$$

Conclusion: The device meets MPE at distance 20cm.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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. 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.

Antenna Information

The EUT has an Omni antenna and the antenna gain is 3.0 dBi, which use a unique type of connector to attach to the EUT, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Jack Jiao on 2020-08-01.

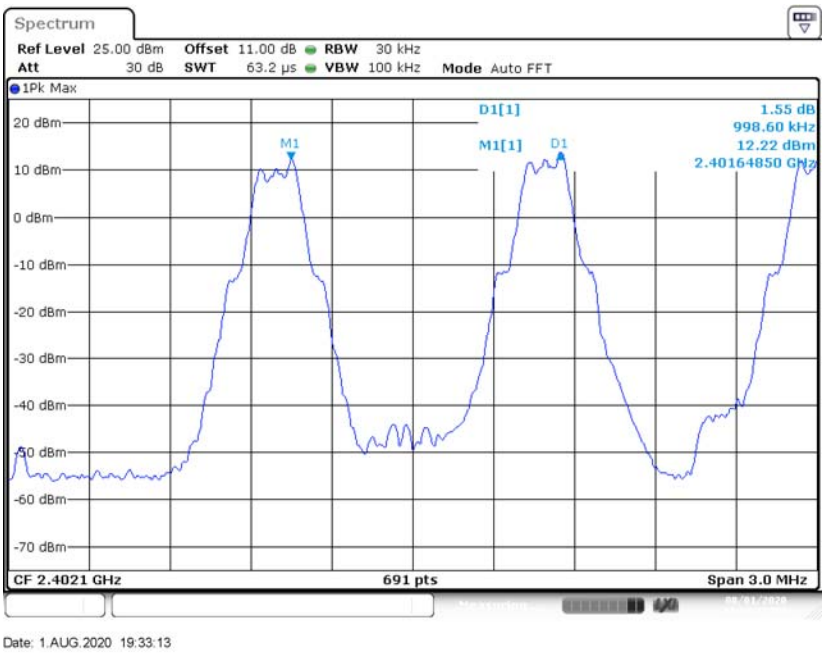
EUT operation mode: Hopping

Test Result: Compliant.

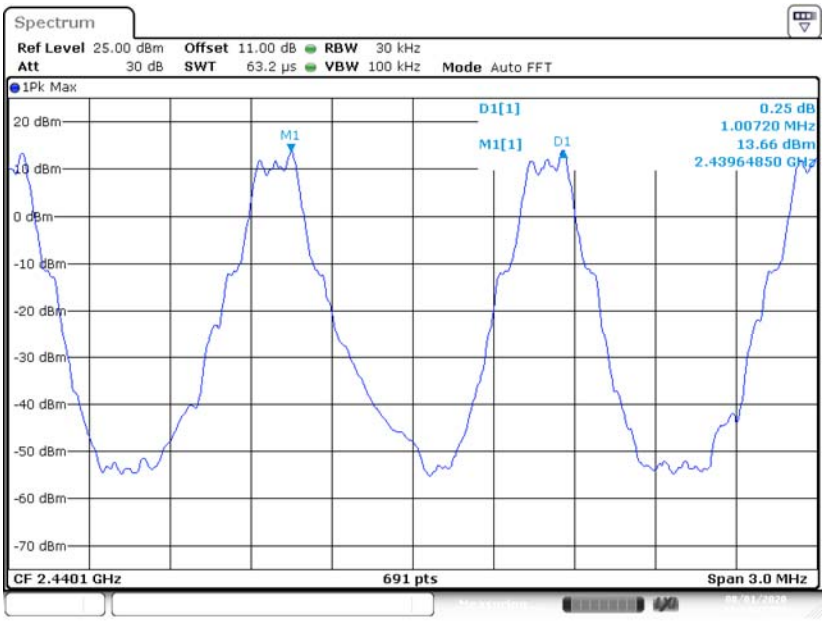
Modulation	Channel	Frequency (MHz)	Channel Separation (kHz)	Limit (kHz)	Result
GFSK	Low	2401.6	998.60	212.70	Pass
	Adjacent	2402.6			
	Middle	2439.6	1007.20	212.70	Pass
	Adjacent	2440.6			
	High	2477.6	994.20	212.70	Pass
	Adjacent	2476.6			

The limit = 20dB Bandwidth

Low Channel

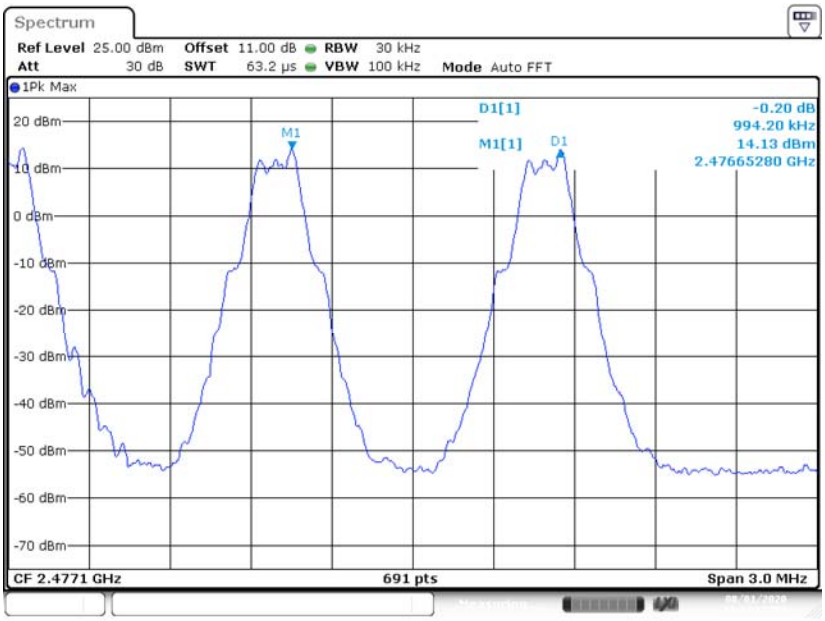


Middle Channel



Date: 1.AUG.2020 19:34:11

High Channel



Date: 1.AUG.2020 19:34:57

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

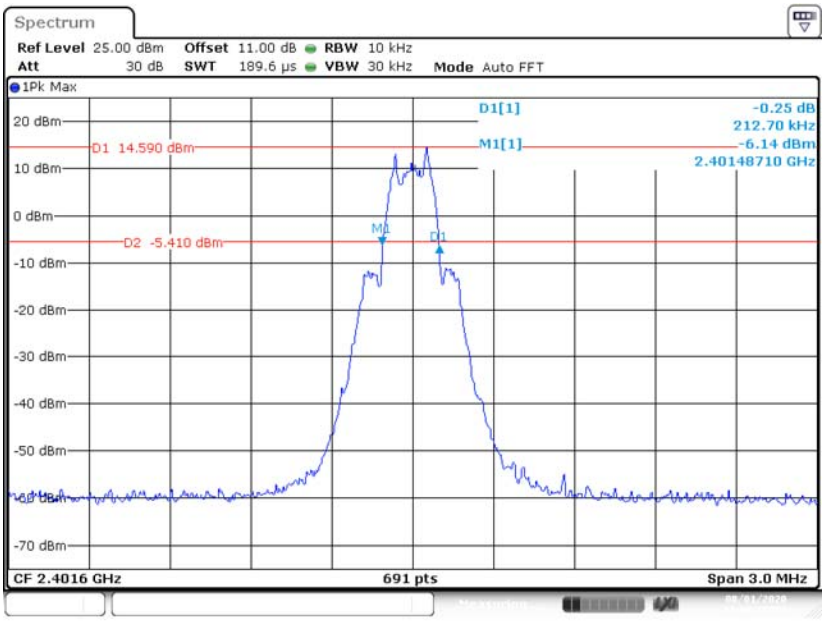
The testing was performed by Jack Jiao on 2020-08-01.

EUT operation mode: Transmitting

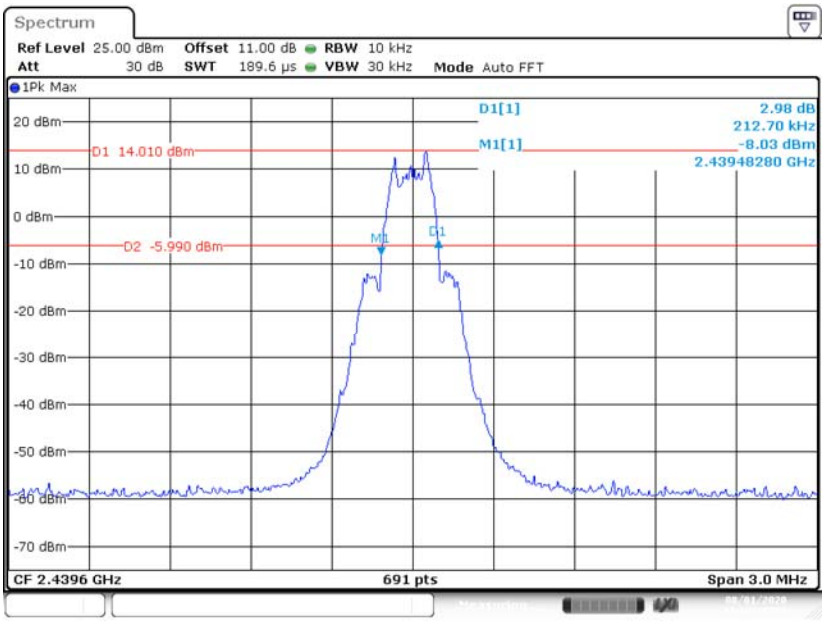
Test Result: Compliant.

Modulation	Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)
GFSK	Low	2401.6	212.70
	Middle	2439.6	212.70
	High	2477.6	212.70

Low Channel

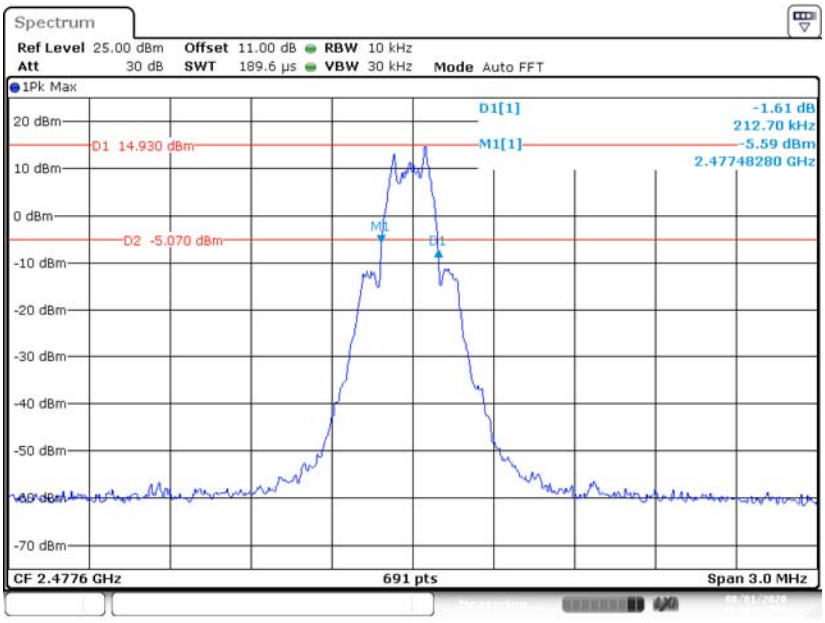


Middle Channel



Date: 1.AUG.2020 19:19:36

High Channel



Date: 1.AUG.2020 19:09:21

FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the max-hold function record the quantity of the channel.

Test Data

Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

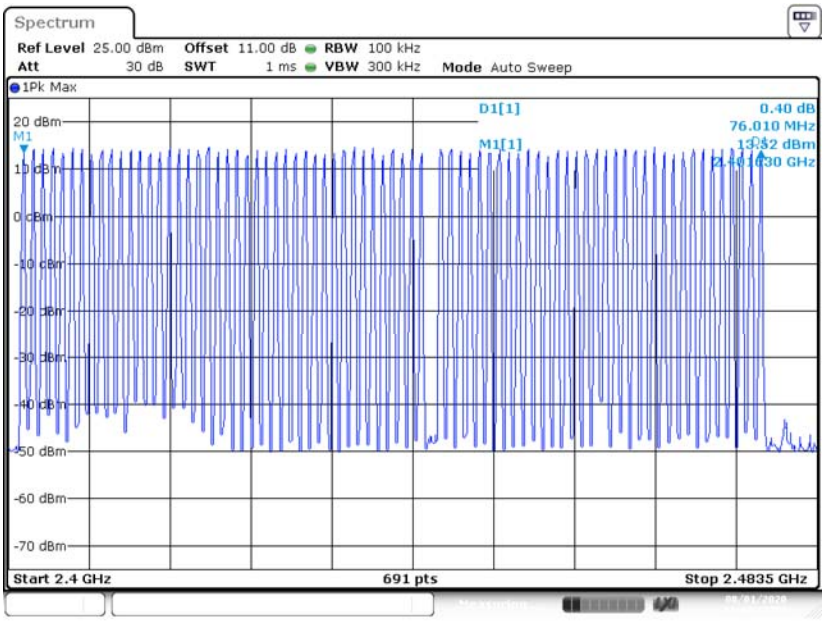
The testing was performed by Jack Jiao on 2020-08-01.

EUT operation mode: Hopping

Test Result: Compliant.

Modulation	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2400-2483.5	76	⩾15

Number of Hopping Channels



Date: 1.AUG.2020 19:42:47

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Data

Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

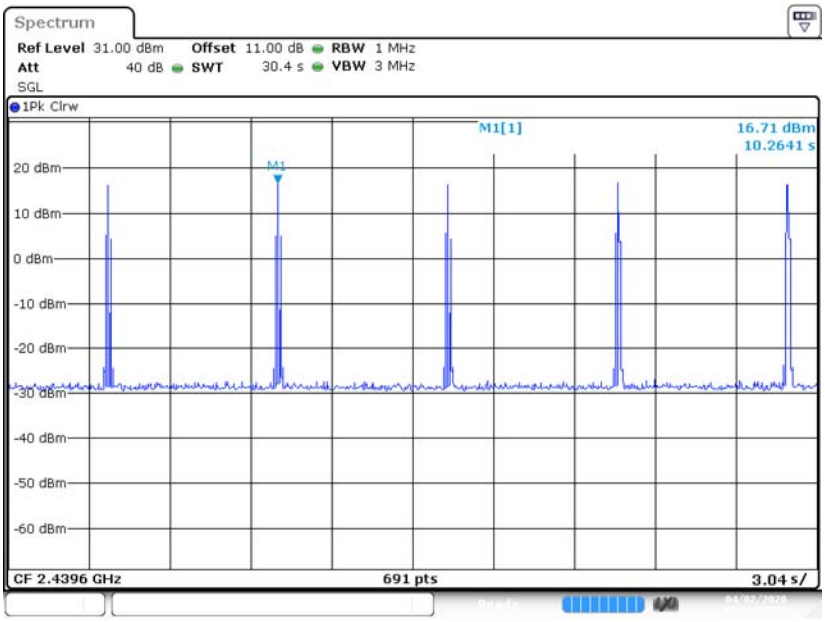
The testing was performed by Jack Jiao on 2020-08-01.

EUT operation mode: Hopping

Test Result: Compliant.

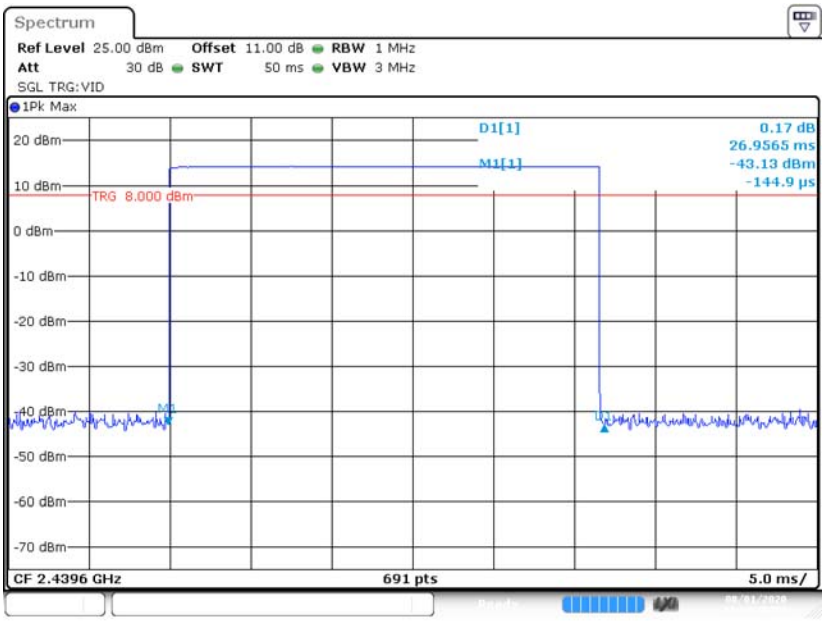
Modulation	Channel	Pulse Width	Pulse Number	Dwell Time	Limit	Result
		(ms)		(s)	(s)	
GFSK	Middle	26.957	5	0.135	≤0.4	Pass
	Note:Dwell time = Pulse time*N Observed time = 0.4s* hopping number= 0.4s*76=30.4s					

Number of Pulses



Date: 1.AUG.2020 19:37:40

Single Pulse



Date: 1.AUG.2020 19:37:40

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

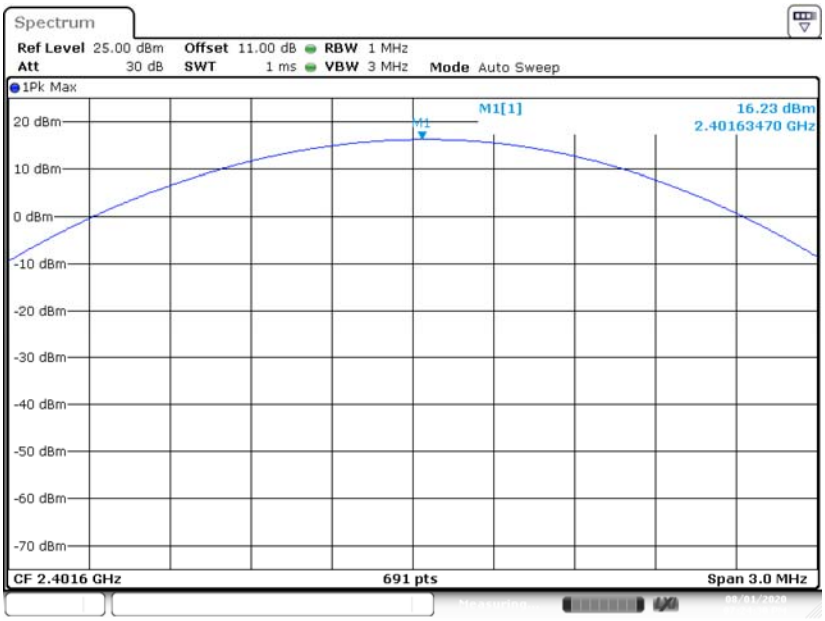
The testing was performed by Jack Jiao on 2020-08-01.

EUT operation mode: Transmitting

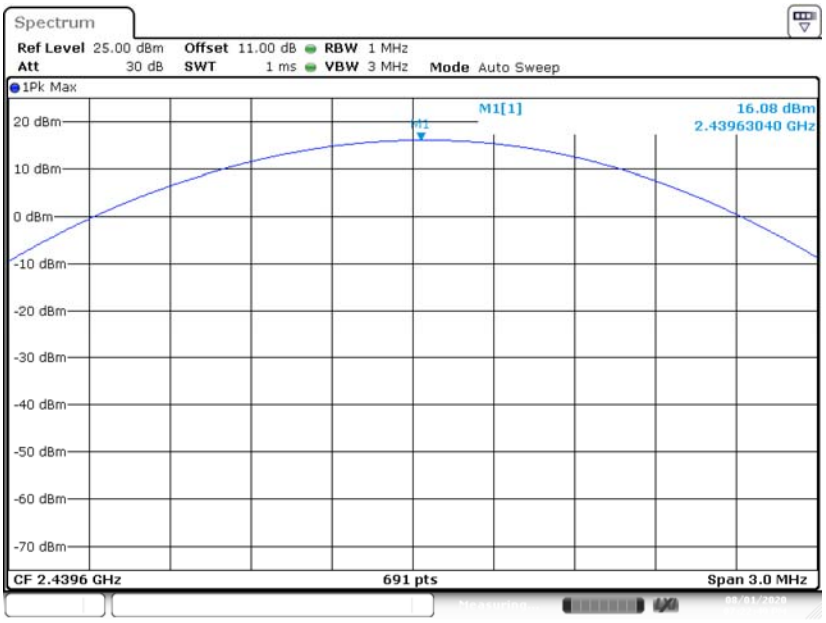
Test Result: Compliant.

Modulation	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
GFSK	Low	2401.6	16.23	41.98	1000
	Middle	2439.6	16.08	40.55	1000
	High	2477.6	16.62	45.92	1000

Low Channel

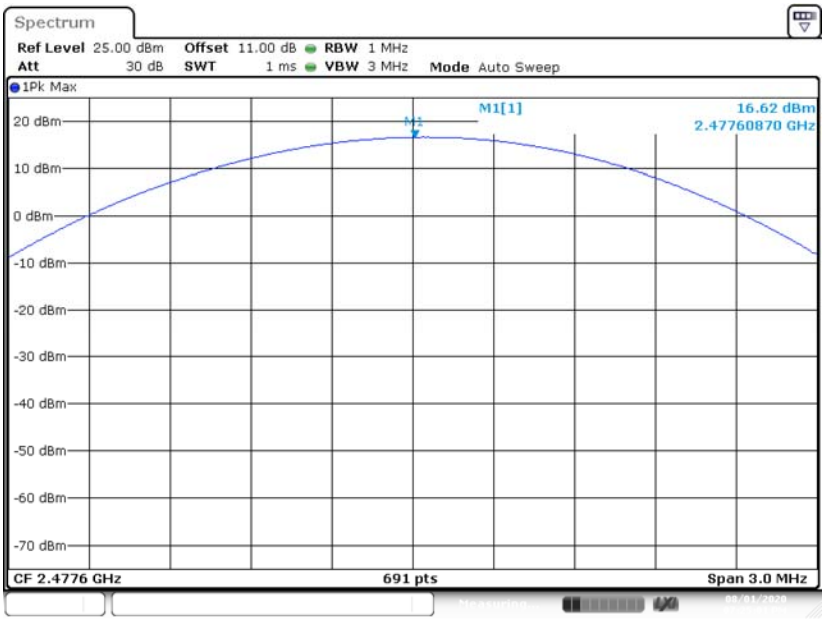


Middle Channel



Date: 1.AUG.2020 19:22:49

High Channel



Date: 1.AUG.2020 19:25:01

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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 Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

Temperature:	25.0 ℃
Relative Humidity:	50 %
ATM Pressure:	102.3 kPa

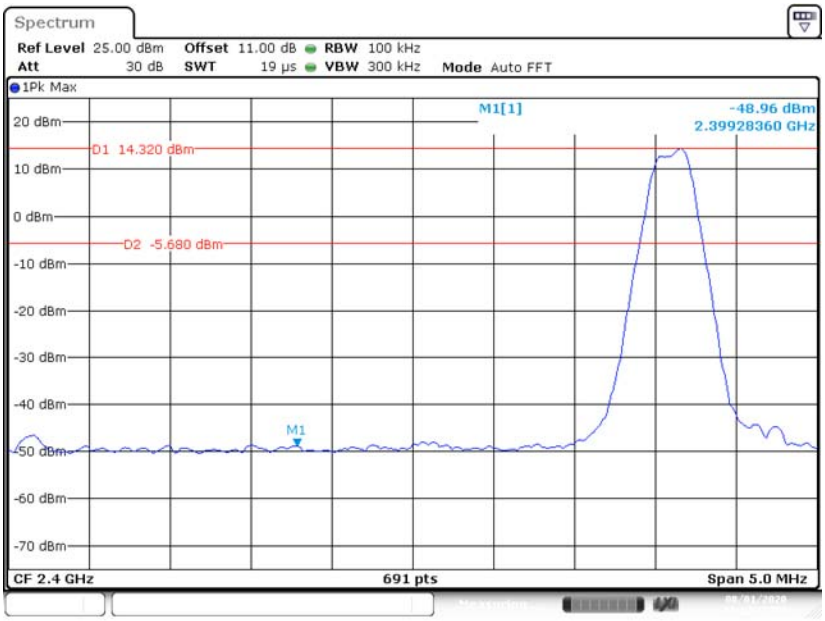
The testing was performed by Jack Jiao on 2020-08-01.

EUT operation mode: Transmitting&Hopping

Test Result: Compliant.

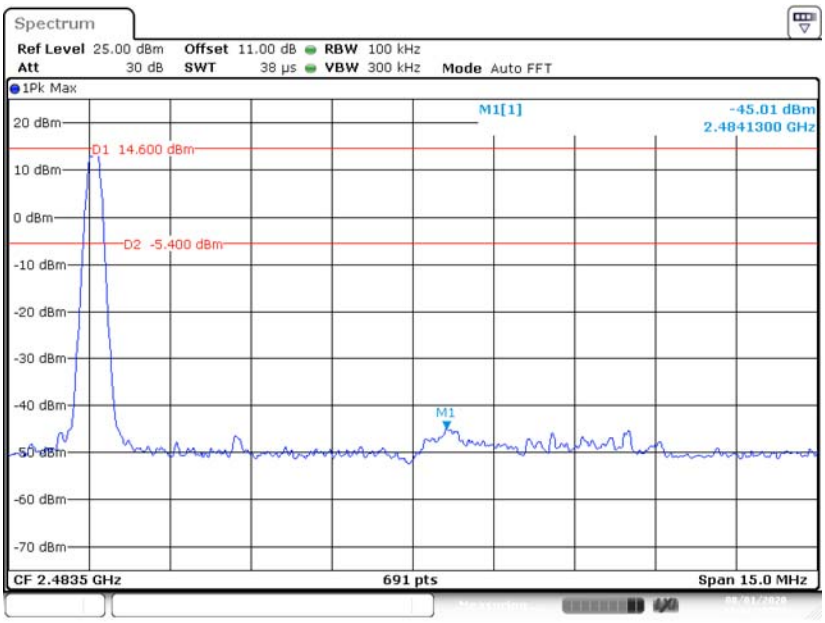
Band Edge

Left Side



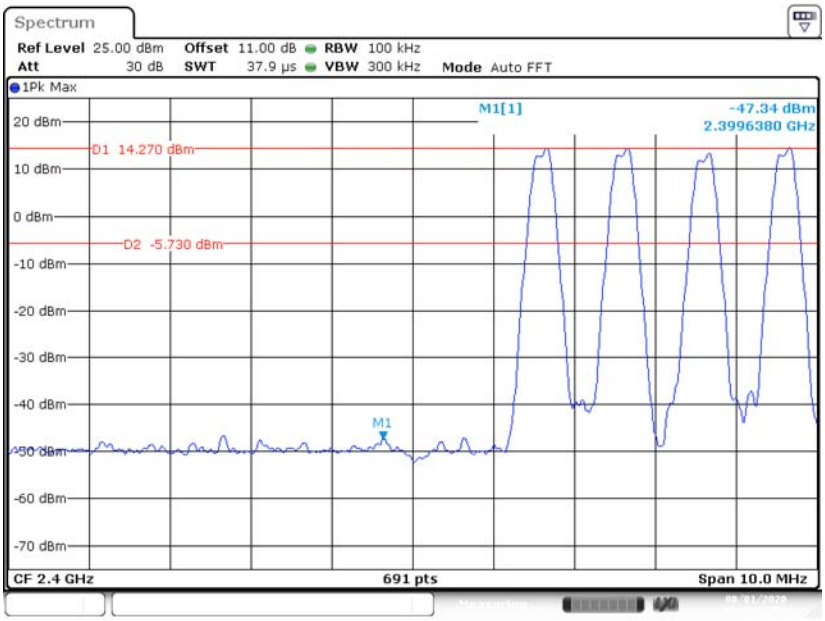
Date: 1.AUG.2020 19:12:41

Right Side



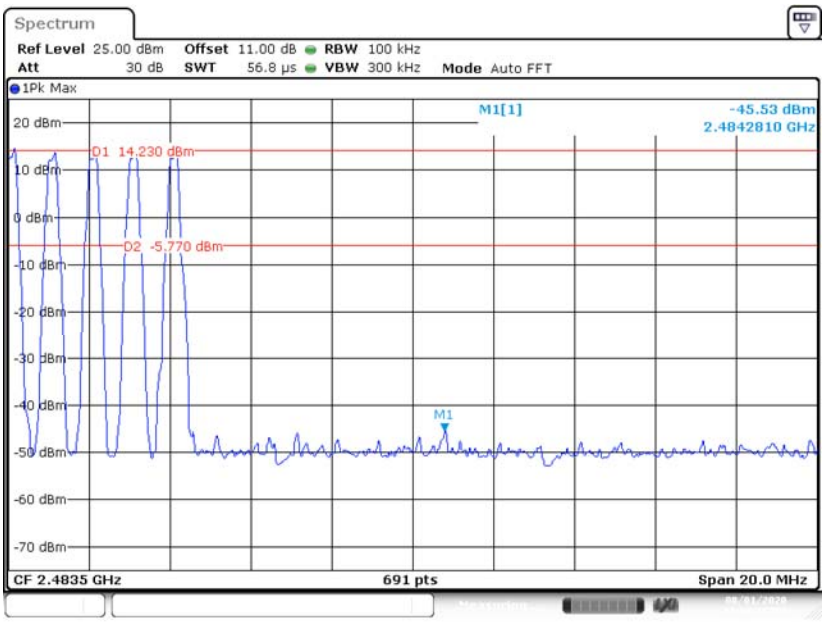
Date: 1.AUG.2020 19:11:31

Left Side-Hopping



Date: 1.AUG.2020 19:31:21

Right Side-Hopping



Date: 1.AUG.2020 19:29:16

Declarations

1: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

2: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

5: This report cannot be reproduced except in full, without prior written approval of the Company.

6: This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

******* END OF REPORT *******