TEST REPORT

Product	:	Nano G5
Trade mark	:	W-DMX
Model/Type reference	:	A40890G5-SPI
Serial Number	:	N/A
Report Number	:	EED32J00133501
FCC ID	:	2APCT-DMXG5SB
Date of Issue	:	Mar. 15, 2018
Test Standards	:	47 CFR Part 15 Subpart C
Test result	:	PASS

Prepared for:

Wireless Solution Sweden Sales AB
Stureparksvagen 7, 451 55 Uddevalla, Sweden

Prepared by:

Centre Testing International Group Co., Ltd.
Hongwei Industrial Zone, Bao'an 70 District,
Shenzhen, Guangdong, China
TEL: +86-755-3368 3668
FAX: +86-755-3368 3385

Tested By:	Tom- chen	Compiled by:	Kevin lan
	Tom chen (Test Project)		Kevin lan (Project Engineer)
Reviewed by:	Kevin Yang	Approved by:	Sheek. Luo
	Kevin yang (Reviewer)		Sheek Luo (Lab supervisor)
Date:	Mar. 15, 2018		Check No.: 2448724758

CENTRE TESTING INTERNATIONAL GROUP CO., LTD. Report Seal

2 Version

Version No.	Date	Description
00	Mar. 15, 2018	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(1)	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15 Subpart C Section 15.247 (b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15 Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

Remark:
The tested sample(s) and the sample information are provided by the client.

4 Content

1 COVER PAGE 1

2 VERSION 2

3 TEST SUMMARY 3

4 CONTENT 4

5 TEST REQUIREMENT 5

5.1 TEST SETUP 5
5.1.1 For Radiated Emissions test setup 5
5.2 TEST ENVIRONMENT 5
5.3 TEST CONDITION 5

6 GENERAL INFORMATION 6

6.1 CLIENT INFORMATION 6
6.2 GENERAL DESCRIPTION OF EUT 6
6.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 6
6.4 DESCRIPTION OF SUPPORT UNITS 7
6.5 TEST LOCATION 7
6.6 DEVIATION FROM STANDARDS 7
6.7 ABNORMALITIES FROM STANDARD CONDITIONS 7
6.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER 7
6.9 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2) 7

7 EQUIPMENT LIST 8

8 RADIO TECHNICAL REQUIREMENTS SPECIFICATION 10

Appendix A): 20dB Occupied Bandwidth 11
Appendix B): Carrier Frequency Separation 13
Appendix C): Dwell Time 15
Appendix D): Hopping Channel Number 17
Appendix E): Conducted Peak Output Power 18
Appendix F): Band-edge for RF Conducted Emissions 20
Appendix G): RF Conducted Spurious Emissions 23
Appendix H): Pseudorandom Frequency Hopping Sequence 26
Appendix I): Antenna Requirement 27
Appendix J): AC Power Line Conducted Emission 28
Appendix k): Restricted bands around fundamental frequency (Radiated) 31
Appendix L): Radiated Spurious Emissions 36

PHOTOGRAPHS OF TEST SETUP 41

PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS 43

5 Test Requirement

5.1 Test setup

5.1.1 For Radiated Emissions test setup

Radiated Emissions setup:

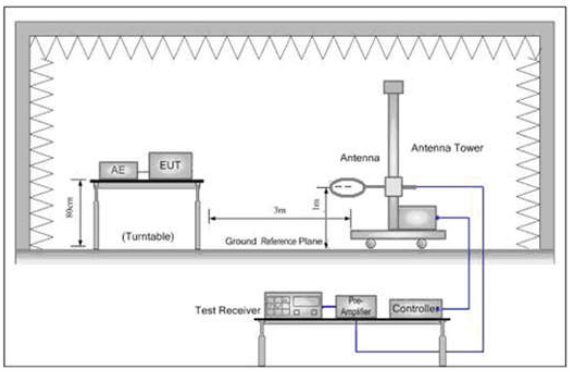


Figure 1. Below 30MHz

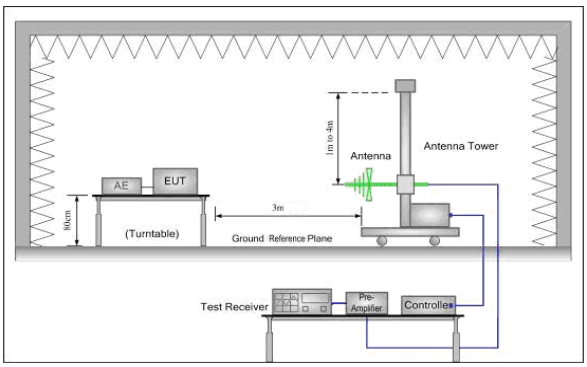


Figure 2. 30MHz to 1GHz

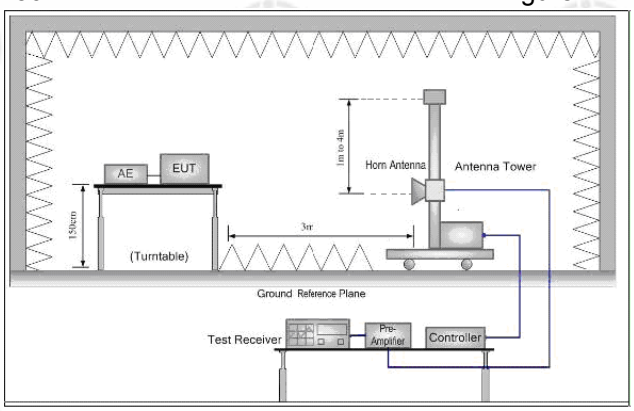


Figure 3. Above 1GHz

5.2 Test Environment

Operating Environment:	
Temperature:	23.5 °C
Humidity:	55 % RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
GFSK	2403MHz ~2478 MHz	Channel 1	Channel 38	Channel76
		2403MHz	2440MHz	2478MHz

6 General Information

6.1 Client Information

Applicant:	Wireless Solution Sweden Sales AB
Address of Applicant:	Stureparksvagen 7, 451 55 Uddevalla, Sweden
Manufacturer:	Wireless Solution Sweden Sales AB
Address of Manufacturer:	Stureparksvagen 7, 451 55 Uddevalla, Sweden
Factory:	Orbit One
Address of Factory:	Fridhemsvagen 15, Box 73, 372 38 Ronneby

6.2 General Description of EUT

Product Name:	Nano G5
Model No.(EUT):	A40890G5-SPI
Test Model No.:	A40890G5-SPI
Trade mark:	W-DMX
EUT Supports Radios application:	2403MHz~2478MHz
Power Supply:	DC 5V
Sample Received Date:	Dec 4, 2017
Sample tested Date:	Dec 4, 2017 to Mar. 12, 2018

6.3 Product Specification subjective to this standard

Operation Frequency:	2403MHz~2478MHz
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK
Number of Channel:	76
Test Power Grade:	N/A
Test Software of EUT:	N/A
Antenna Type:	Dipole Antenna
Antenna Gain:	3dBi
Test Voltage:	DC 5V

Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz

12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz		
18	2420MHz	38	2440MHz	58	2460MHz		
19	2421MHz	39	2441MHz	59	2461MHz		
20	2422MHz	40	2442MHz	60	2462MHz		

6.4 Description of Support Units

The EUT has been tested independently.

6.5 Test Location

All tests were performed at:
Centre Testing International Group Co., Ltd.
Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China 518101
Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385
No tests were sub-contracted.
FCC Designation No.: CN1164

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

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

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.31dB (30MHz-1GHz)
		0.57dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-12.75GHz)
4	Conduction emission	3.6dB (9kHz to 150kHz)
		3.2dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	2.8%
7	DC power voltages	0.025%

7 Equipment List

RF test system					
Equipment	**Manufacturer**	**Mode No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Signal Generator	Keysight	E8257D	MY53401106	03-14-2017	03-13-2018
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-14-2017	03-13-2018
Signal Generator	Keysight	N5182B	MY53051549	03-14-2017	03-13-2018
High-pass filter	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-10-2018	01-09-2019
DC Power	Keysight	E3642A	MY54426035	03-14-2017	03-13-2018
power meter & power sensor	R&S	OSP120	101374	03-14-2017	03-13-2018
RF control unit	JS Tonscend	JS0806-2	2015860006	03-14-2017	03-13-2018
Temperature / Humidity Indicator	Defu	TH128	---	07-08-2017	07-07-2018

Conducted disturbance Test					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Receiver	R&S	ESCI	100009	06-14-2017	06-13-2018
Temperature/ Humidity Indicator	TAYLOR	1451	1905	05-08-2017	05-07-2018
LISN	schwarzbeck	NNLK8121	8121-529	06-13-2017	06-12-2018

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber&Accessory Equipment	TDK	SAC-3	---	06-04-2016	06-03-2019
Spectrum Analyzer	Agilent	E4443A	MY45300910	11-16-2017	11-15-2018
Receiver	R&S	ESCI	100435	06-14-2017	06-13-2018
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-618	08-15-2017	08-14-2018
Horn Antenna	ETS-LINGREN	3117	00057407	07-20-2017	07-18-2018
Spectrum Analyzer	R&S	FSP40	100416	06-13-2017	06-12-208
Microwave Preamplifier	JS Tonscend	EMC051845SE	980380	01-19-2018	01-18-2019
Loop Antenna	ETS-LINDGREN	6502	00071730	06-22-2017	06-21-2019
Horn Antenna	ETS-LINGREN	3117	00057407	07-20-2017	07-18-2018
Double ridge horn antenna	A.H.SYSTEMS	SAS-574	6042	06-30-2015	06-28-2018
Pre-amplifier	A.H.SYSTEMS	PAP-1840-60	6041	06-30-2015	06-28-2018
Temperature/ Humidity Indicator	TAYLOR	1451	1905	05-08-2017	05-07-2018
Cable line	Fulai(7M)	SF106	5219/6A	01-11-2017	01-10-2018
Cable line	Fulai(7M)	SF106	5219/6A	01-09-2018	01-08-2019
Cable line	Fulai(6M)	SF106	5220/6A	01-11-2017	01-10-2018
Cable line	Fulai(6M)	SF106	5220/6A	01-09-2018	01-08-2019
Cable line	Fulai(3M)	SF106	5216/6A	01-11-2017	01-10-2018
Cable line	Fulai(3M)	SF106	5216/6A	01-09-2018	01-08-2019
Cable line	Fulai(3M)	SF106	5217/6A	01-11-2017	01-10-2018
Cable line	Fulai(3M)	SF106	5217/6A	01-09-2018	01-08-2019
band rejection filter	Sinoscite	FL5CX01CA09 CL12-0395-001	---	11-06-2017	11-05-2018
band rejection filter	Sinoscite	FL5CX01CA08 CL12-0393-001	---	11-06-2017	11-05-2018
band rejection filter	Sinoscite	FL5CX02CA04 CL12-0396-002	---	11-06-2017	11-05-2018
band rejection filter	Sinoscite	FL5CX02CA03 CL12-0394-001	---	11-06-2017	11-05-2018

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

Test Results List:

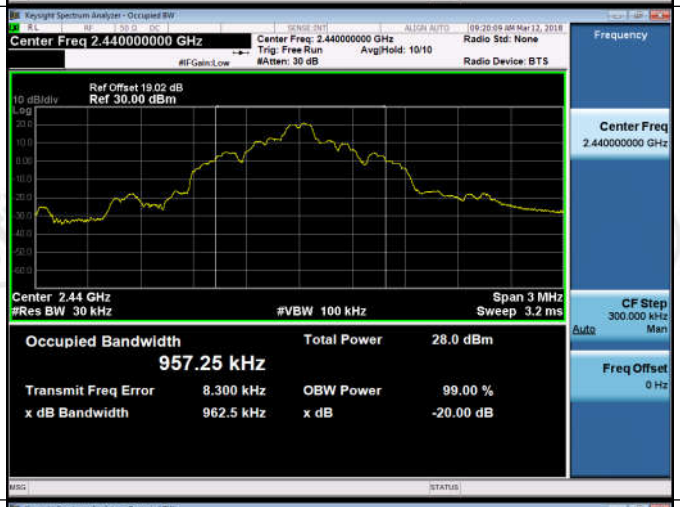
Test requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (a)(1)	ANSI 63.10	20dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Carrier Frequencies Separation	PASS	Appendix B)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Dwell Time	PASS	Appendix C)
Part15C Section 15.247 (b)	ANSI 63.10	Hopping Channel Number	PASS	Appendix D)
Part15C Section 15.247 (b)(1)	ANSI 63.10	Conducted Peak Output Power	PASS	Appendix E)
Part15C Section 15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix F)
Part15C Section 15.247(d)	ANSI 63.10	RF Conducted Spurious Emissions	PASS	Appendix G)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Pseudorandom Frequency Hopping Sequence	PASS	Appendix H)
Part15C Section 15.203/15.247 (c)	ANSI 63.10	Antenna Requirement	PASS	Appendix I)
Part15C Section 15.207	ANSI 63.10	AC Power Line Conducted Emission	N/A	Appendix J)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission)	PASS	Appendix K)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	Appendix L)

Appendix A): 20dB Occupied Bandwidth

Test Result

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict	Remark
GFSK	LCH	1.0440	0.98264	PASS	Peak detector
GFSK	MCH	0.9625	0.95725	PASS	
GFSK	HCH	0.7843	0.77525	PASS	

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

Appendix B): Carrier Frequency Separation

Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.008	PASS
GFSK	MCH	0.980	PASS
GFSK	HCH	1.000	PASS

Test Graph

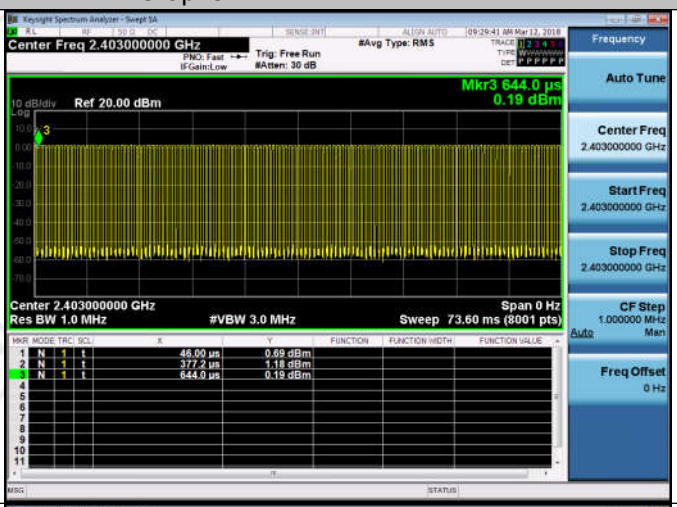
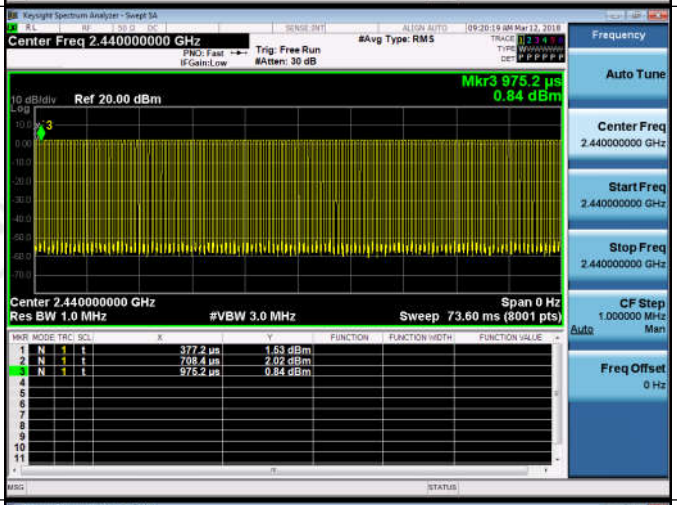
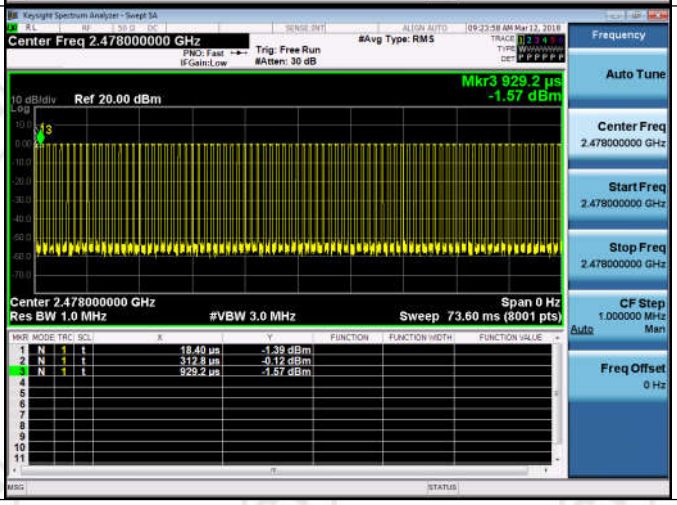
Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

Appendix C): Dwell Time

Result Table

Mode	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Duty Cycle [%]	Verdict
GFSK	LCH	0.3312	106.7	0.035	0.55	PASS
GFSK	MCH	0.3312	106.7	0.035	0.55	PASS
GFSK	HCH	0.2944	106.7	0.031	0.32	PASS

Test Graph

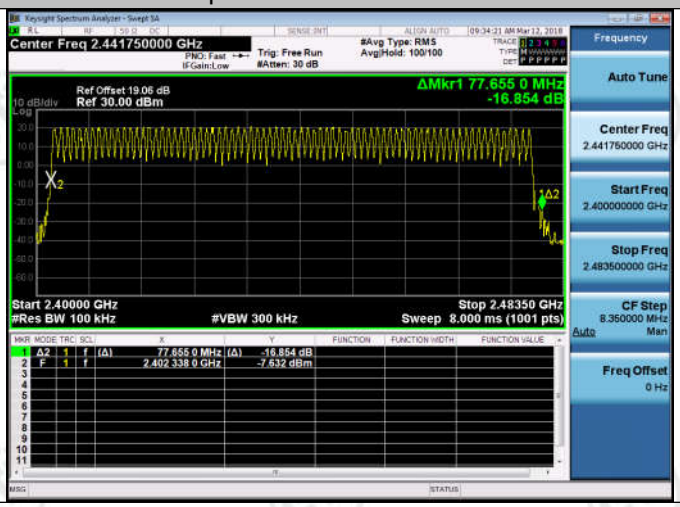
Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

Appendix D): Hopping Channel Number

Result Table

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	76	PASS

Test Graph

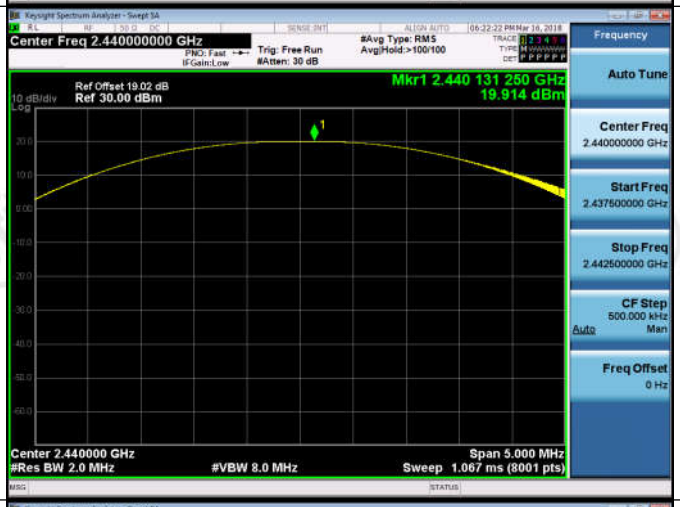
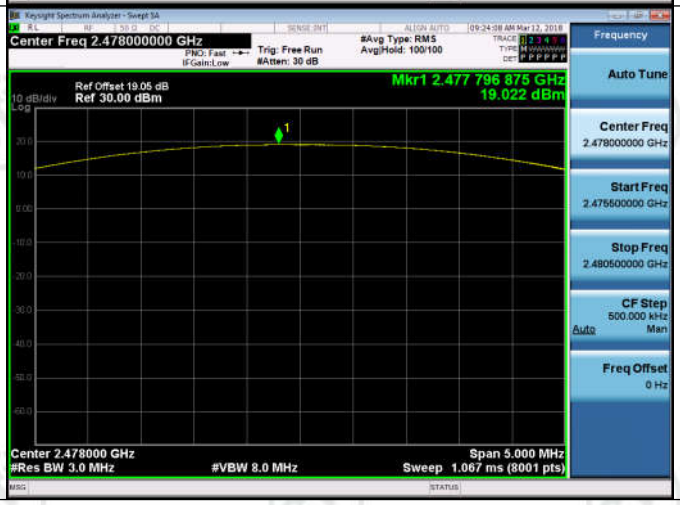
Graphs		
GFSK/Hop		

Appendix E): Conducted Peak Output Power

Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	20.332	PASS
GFSK	MCH	19.914	PASS
GFSK	HCH	19.022	PASS

Test Graph

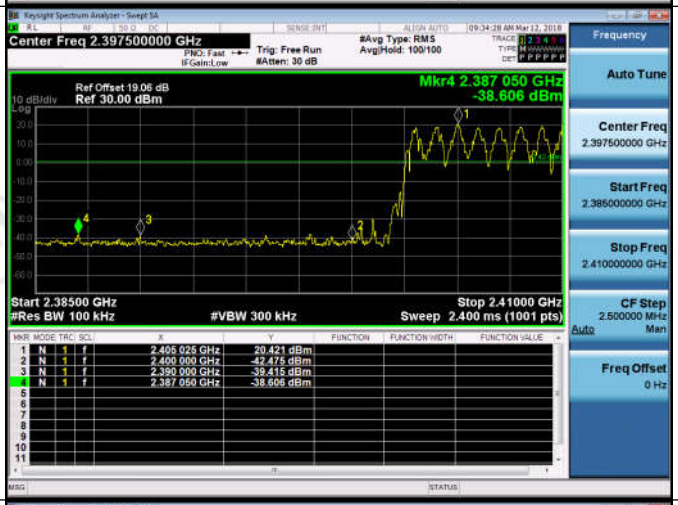
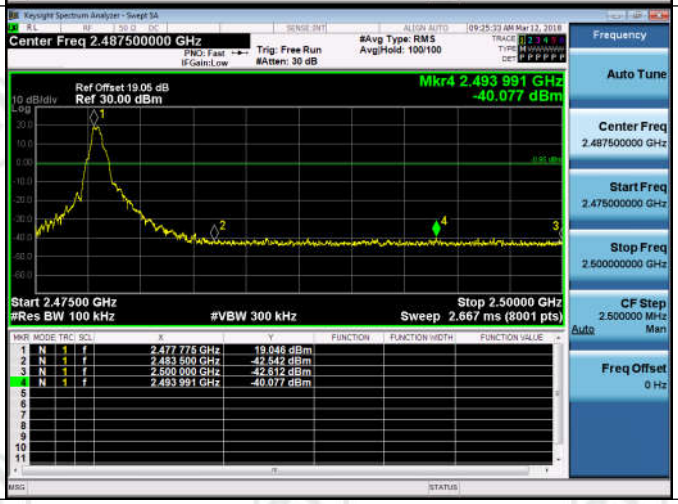
Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

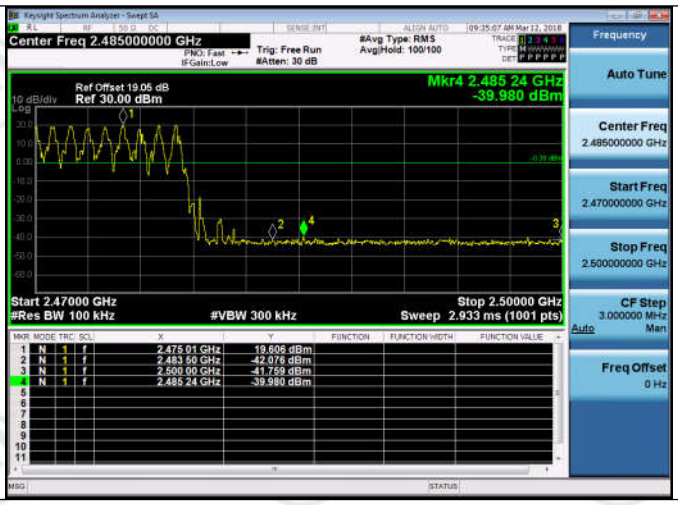
Appendix F): Band-edge for RF Conducted Emissions

Result Table

Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2403	20.455	Off	-37.328	0.45	PASS
			20.421	On	-38.606	0.42	PASS
GFSK	HCH	2478	19.046	Off	-40.077	-0.95	PASS
			19.606	On	-39.980	-0.39	PASS

Test Graph

Graphs			
GFSK/LCH/No Hop			
GFSK/LCH/Hop			
GFSK/HCH/No Hop			

GFSK/HCH/Hop			

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.485000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
09:35:07 AM Mar 12, 2018
Frequency
Auto Tune
Center Freq
2.485000000 GHz
Start Freq
2.470000000 GHz
Stop Freq
2.500000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz
Ref Offset 19.05 dB
10 dB/div
Ref 30.00 dBm
Mkr4 2.485 24 GHz
-39.980 dBm
Start 2.47000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.933 ms (1001 pts)
1 N 1 f 2.475 01 GHz 19.606 dBm
2 N 1 f 2.483 50 GHz -42.076 dBm
3 N 1 f 2.500 00 GHz -41.759 dBm
4 N 1 f 2.485 24 GHz -39.980 dBm
MSG
STATUS

Appendix G): RF Conducted Spurious Emissions

Result Table

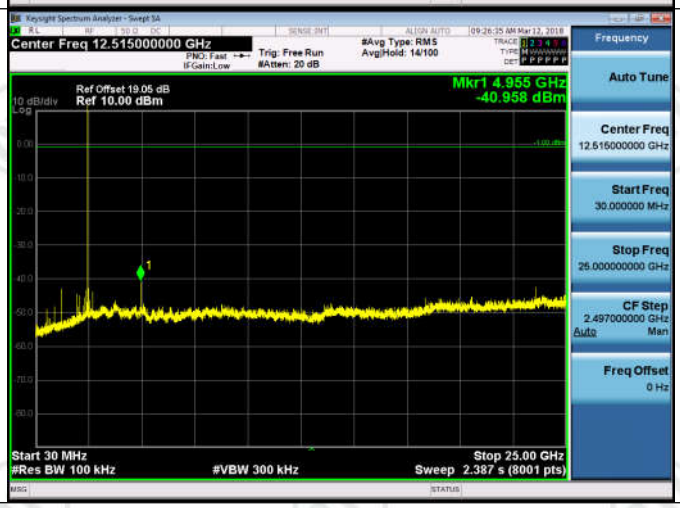
Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	20.212	<Limit	PASS
GFSK	MCH	19.785	<Limit	PASS
GFSK	HCH	18.999	<Limit	PASS

Test Graph

GFSK_LCH_Graphs			
Pref			
Puw			

GFSK_MCH_Graphs			
Pref			

Puw	

GFSK_HCH_Graphs		
Pref		
Puw		

Appendix H): Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1) requirement:
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.	
EUT Pseudorandom Frequency Hopping Sequence	
This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule. This device uses a propriety radio (W-DMX) which operates in 2400-2483.5 MHz band. The used radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 76 bands (1 MHz each; centered from 2403 to 2478 MHz) in the range 2400-2483.5 MHz. The transmitter switches hop frequencies 1661 times per second to assure a high degree of data security. All receivers connected to a transmitter are synchronized to the frequency-hopping channel for the transmitter. The frequency hopping sequence is sent to the receivers during linking and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the transmitter's internal clock. Therefore, all connected receivers must know the frequency hopping sequence and synchronize their clocks with the transmitters clock. Adaptive Frequency Hopping (AFH) was introduced to provide an effective way for the radio system to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the radio signal, or where the W-DMX signal is interfering with another device. The AFH-enabled W-DMX transmitter will then communicate with the receivers to share details of any identified "bad" channels. The transmitter will then switch to a subset of the original frequency hopping signal where the "bad" signal are avoided.	
EUT Pseudorandom Frequency Hopping Sequence	
Pseudorandom Frequency Hopping Sequence Table as below: Channel: 13, 29, 62, 21, 51, 76, 11, 39, 60, 22, 49, 74, 7, 30, 69, 16, 52, 10, 41, 63, 18, 55, 3, 31, 68, 17, 45,1, 32, 65, 25, 50, 72, 2, 35, 58, 24, 53, 5, 34, 57, 20, 44, 71, 9, 36, 66, 23, 43, 73, 4, 38, 64, 27, 48, 75, 12, 40, 61, 26, 46,6, 37, 59, 19, 47, 8, 33, 67, 15, 54, 13, 29, 62, …	
The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.	

Appendix I): Antenna Requirement

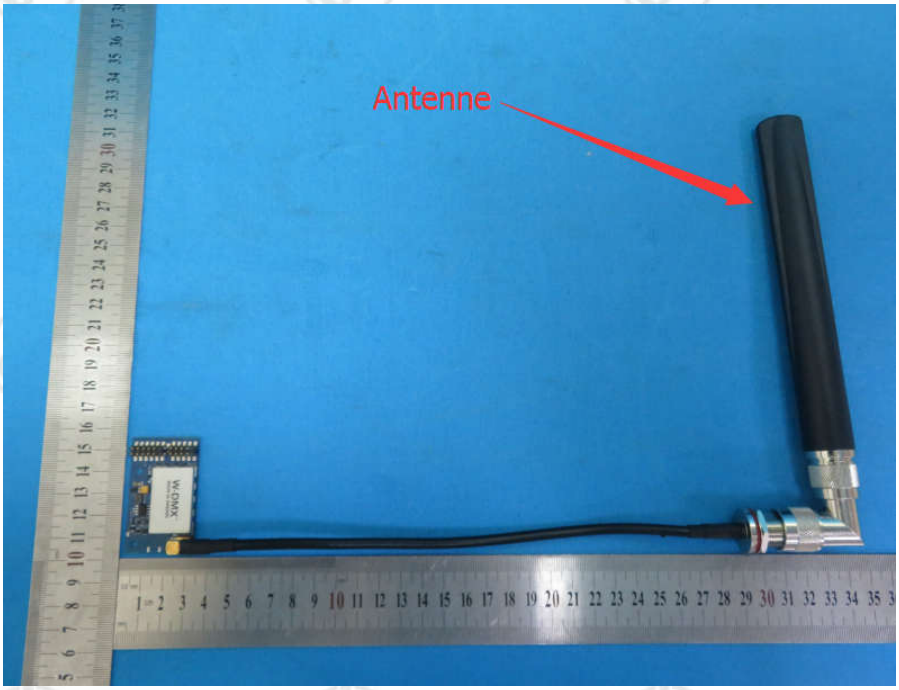
15.203 requirement:

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, 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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (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.

EUT Antenna:



The antenna is Dipole antenna and no consideration of replacement. The best case gain of the antenna is 3dBi.

Appendix J): AC Power Line Conducted Emission

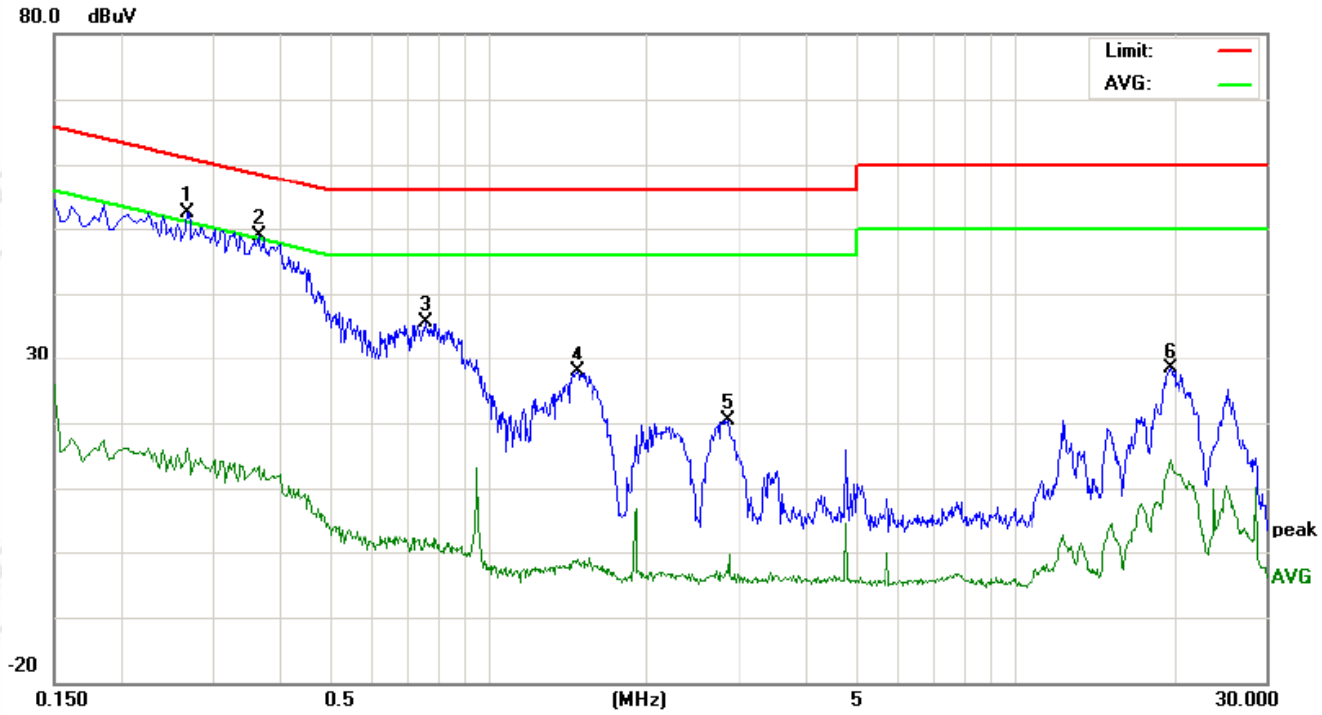
<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1)The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3)The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBμV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

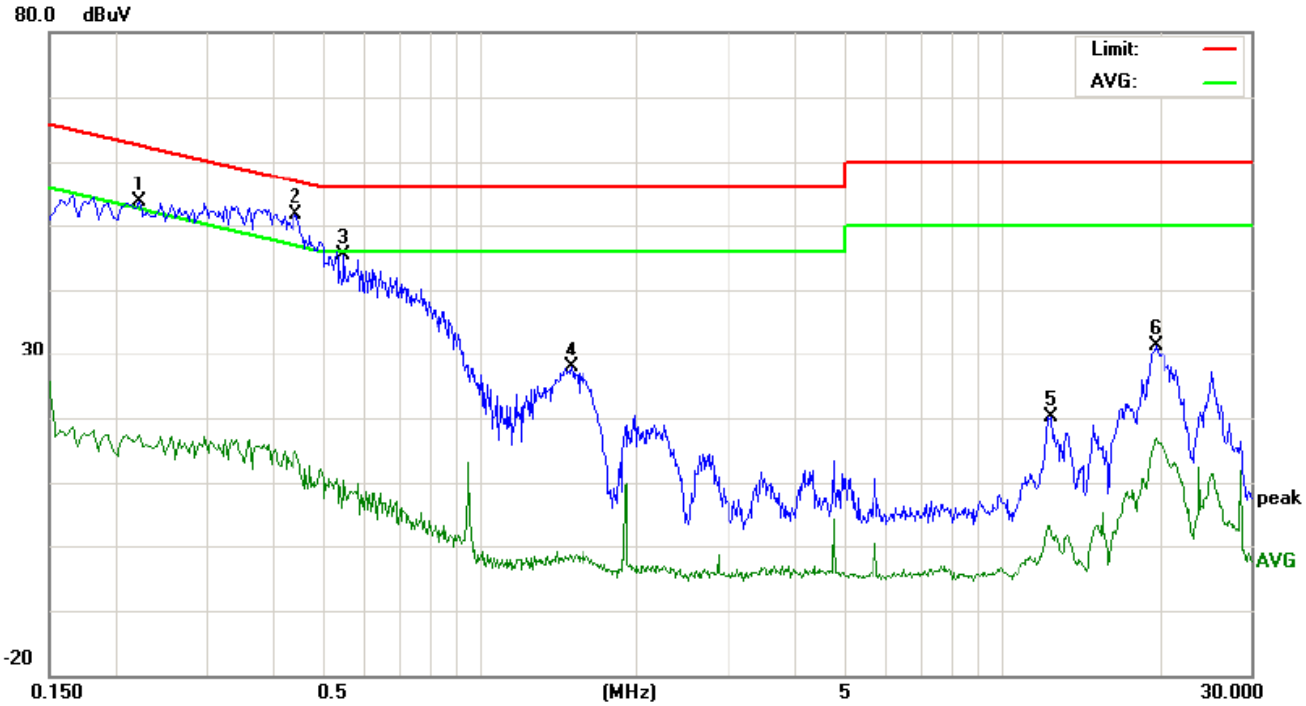
Quasi-Peak and Average measurement were performed at the frequencies with maximized peake mission were detected.

Live line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.2700	42.71	38.23	6.49	9.76	52.47	47.99	16.25	61.12	51.12	-13.13	-34.87	P	
2	0.3660	39.09	35.29	3.66	9.76	48.85	45.05	13.42	58.59	48.59	-13.54	-35.17	P	
3	0.7620	25.86	20.67	-7.73	9.74	35.60	30.41	2.01	56.00	46.00	-25.59	-43.99	P	
4	1.4780	18.23	14.33	-10.9	9.72	27.95	24.05	-1.23	56.00	46.00	-31.95	-47.23	P	
5	2.8540	10.66	7.11	-12.7	9.69	20.35	16.80	-3.05	56.00	46.00	-39.20	-49.05	P	
6	19.8420	18.29	13.55	4.39	10.06	28.35	23.61	14.45	60.00	50.00	-36.39	-35.55	P	

Neutral line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.2220	43.86	38.45	7.59	9.73	53.59	48.18	17.32	62.74	52.74	-14.56	-35.42	P	
2	0.4460	41.89	36.21	5.13	9.73	51.62	45.94	14.86	56.95	46.95	-11.01	-32.09	P	
3	0.5500	35.55	29.54	0.57	9.73	45.28	39.27	10.30	56.00	46.00	-16.73	-35.70	P	
4	1.4980	18.09	14.32	-11.4	9.72	27.81	24.04	-1.70	56.00	46.00	-31.96	-47.70	P	
5	12.4860	10.30	6.98	-7.85	9.90	20.20	16.88	2.05	60.00	50.00	-43.12	-47.95	P	
6	19.6500	21.20	16.47	6.91	10.06	31.26	26.53	16.97	60.00	50.00	-33.47	-33.03	P	

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

Appendix k): Restricted bands around fundamental frequency (Radiated)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna 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 polarizations 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 rotatable 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. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel

Above 1GHz test procedure as below:

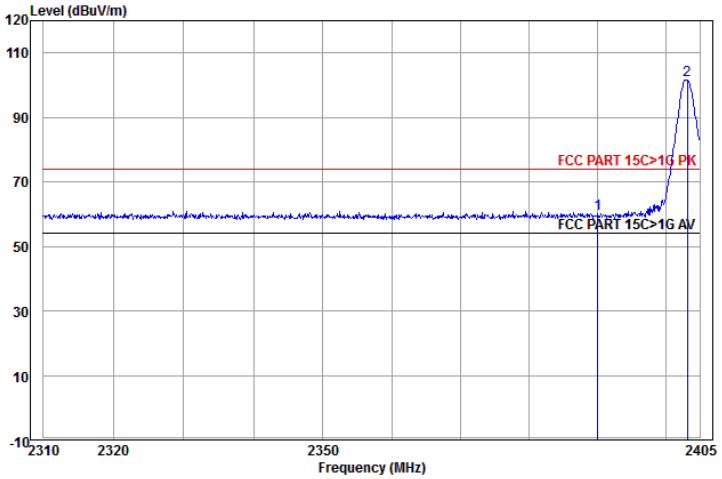
g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
h. b. Test the EUT in the lowest channel , the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

Limit:

Frequency	Limit (dBμV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

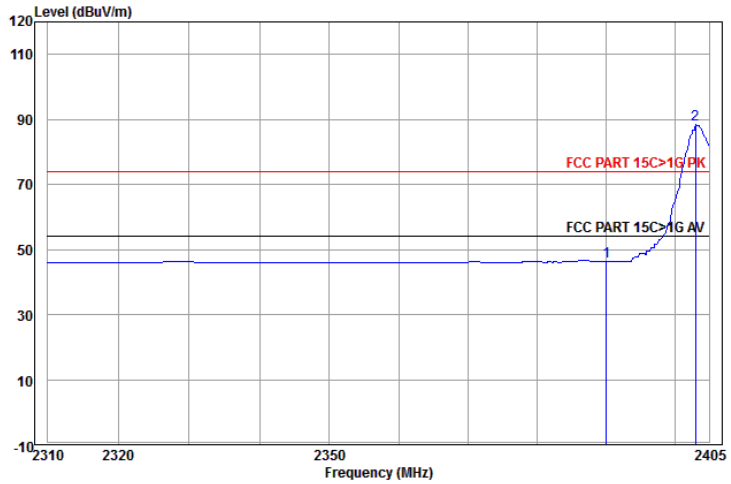
Test plot as follows:

Frequency: 2403MHz	Test channel: Lowest	Polarization: Horizontal	Remark: Peak



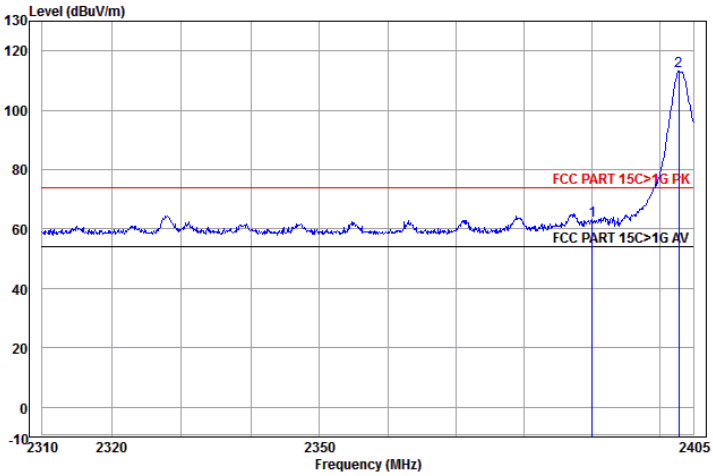
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	2390.000	32.53	3.07	24.49	60.09	74.00	-13.91	Horizontal	
2 pp	2403.159	32.56	3.08	65.94	101.58	74.00	27.58	Horizontal	

Frequency: 2403MHz	Test channel: Lowest	Polarization: Horizontal	Remark: Average



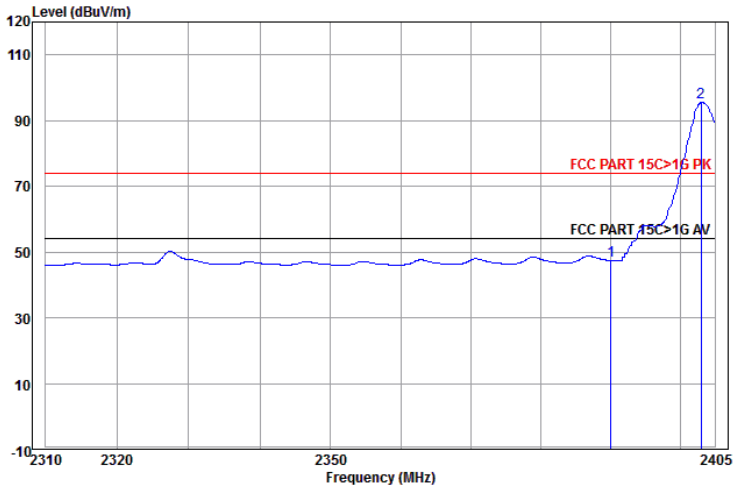
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	2390.000	32.53	3.07	10.63	46.23	54.00	-7.77	Horizontal	Average
2 pp	2403.062	32.56	3.08	52.69	88.33	54.00	34.33	Horizontal	Average

Frequency: 2403MHz	Test channel: Lowest	Polarization: Vertical	Remark: Peak



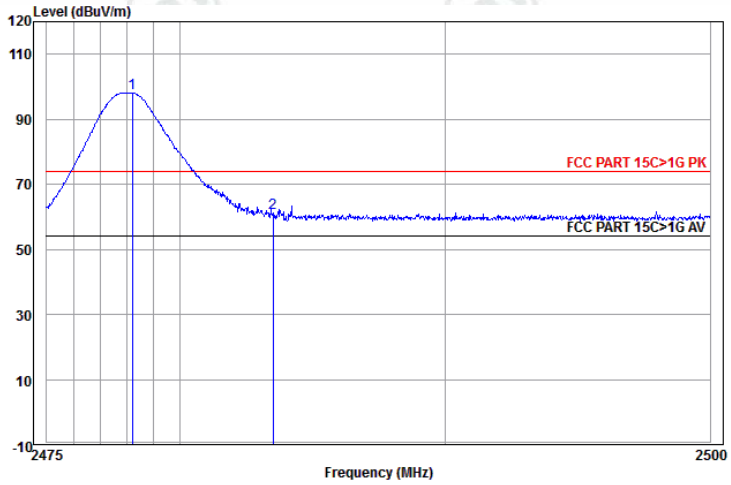
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	2390.000	32.53	3.07	27.27	62.87	74.00	-11.13	Vertical	
2 pp	2402.869	32.56	3.08	77.39	113.03	74.00	39.03	Vertical	

Frequency: 2403MHz	Test channel: Lowest	Polarization: Vertical	Remark: Average



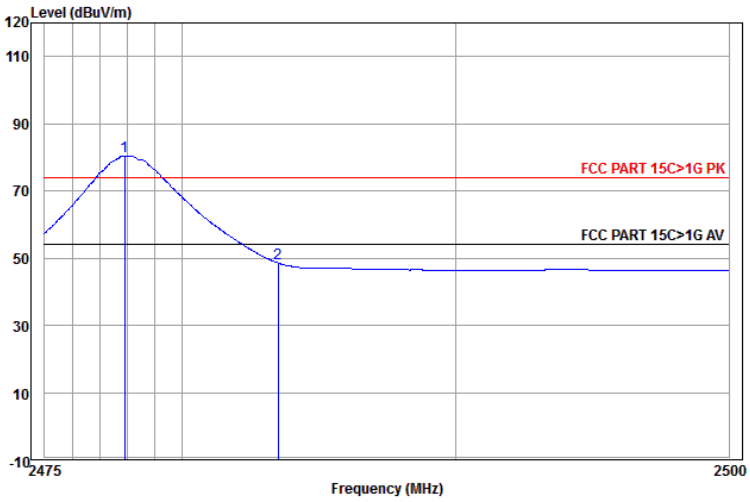
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	2390.000	32.53	3.07	11.82	47.42	54.00	-6.58	Vertical	Average
2 pp	2403.062	32.56	3.08	59.91	95.55	54.00	41.55	Vertical	Average

Frequency: 2478MHz	Test channel: Highest	Polarization: Horizontal	Remark: Peak



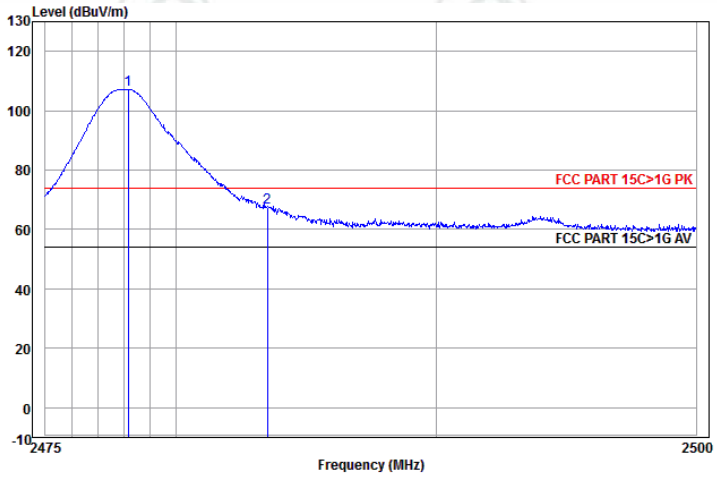
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1 pp	2478.211	32.70	3.11	62.31	98.12	74.00	24.12	Horizontal	
2	2483.500	32.71	3.12	25.49	61.32	74.00	-12.68	Horizontal	

Frequency: 2478MHz	Test channel: Highest	Polarization: Horizontal	Remark: Average



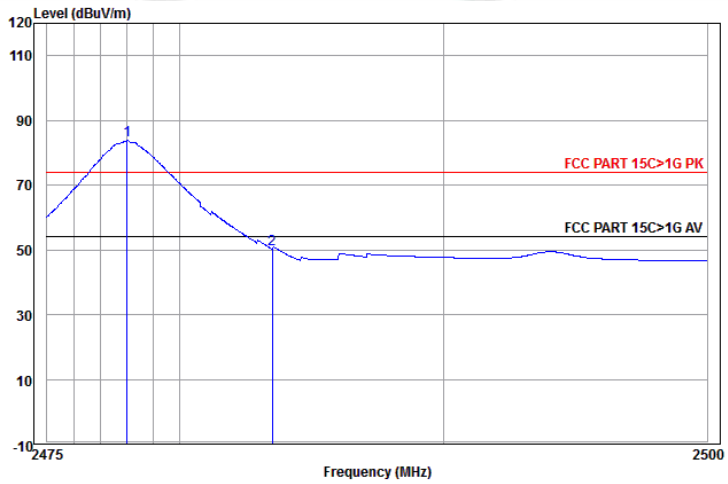
	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1 pp	2477.912	32.70	3.11	44.53	80.34	54.00	26.34	Horizontal	Average
2	2483.500	32.71	3.12	12.68	48.51	54.00	-5.49	Horizontal	Average

Frequency: 2478MHz	Test channel: Highest	Polarization: Vertical	Remark: Peak



	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1 pp	2478.161	32.70	3.11	71.34	107.15	74.00	33.15	Vertical	
2	2483.500	32.71	3.12	31.56	67.39	74.00	-6.61	Vertical	

Frequency: 2478MHz	Test channel: Highest	Polarization: Vertical	Remark: Average



	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1 pp	2478.012	32.70	3.11	48.03	83.84	54.00	29.84	Vertical	Average
2	2483.500	32.71	3.12	14.40	50.23	54.00	-3.77	Vertical	Average

Note:The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier.

The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading -Correct Factor

Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

Appendix L): Radiated Spurious Emissions

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower.
c. The antenna 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 polarizations 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable 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 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

Limit:

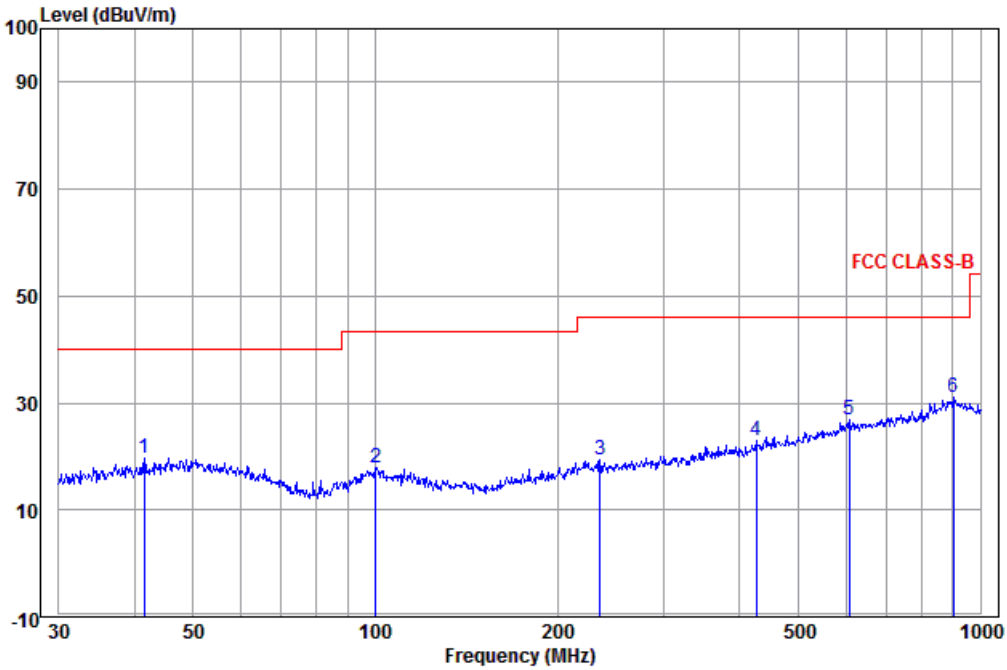
Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Radiated Spurious Emissions test Data:

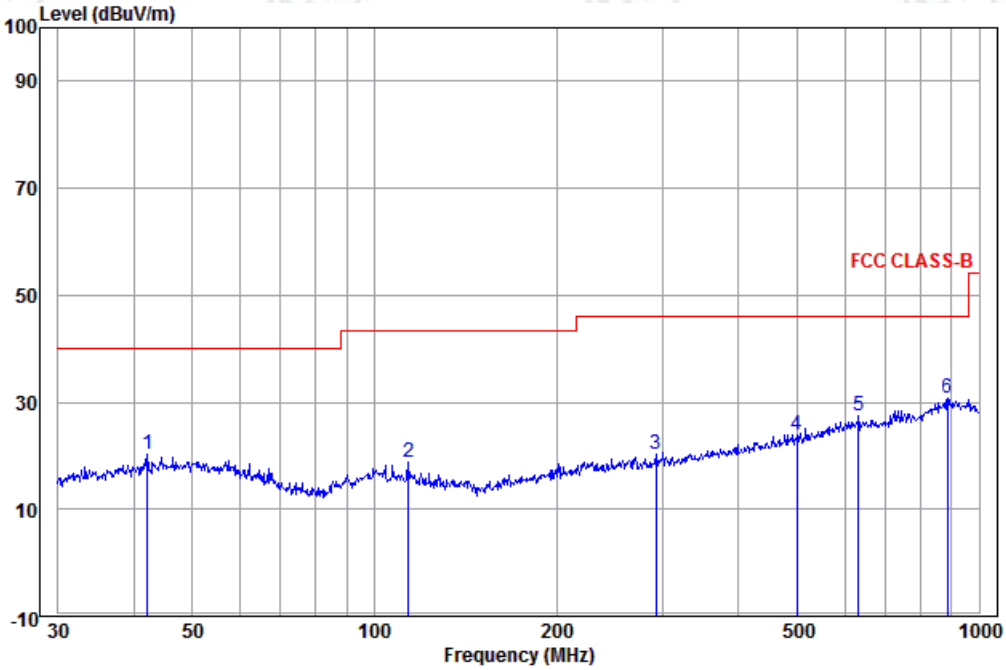
Radiated Emission below 1GHz

30MHz~1GHz (QP)		
Test mode:	Transmitting	Vertical



	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	41.567	13.94	0.06	5.55	19.55	40.00	-20.45	Vertical	
2	100.229	12.48	0.59	4.90	17.97	43.50	-25.53	Vertical	
3	234.991	12.29	1.27	5.69	19.25	46.00	-26.75	Vertical	
4	426.521	15.75	1.40	5.70	22.85	46.00	-23.15	Vertical	
5	607.787	18.73	1.83	6.20	26.76	46.00	-19.24	Vertical	
6 pp	903.309	22.09	2.48	6.40	30.97	46.00	-15.03	Vertical	

Test mode:	Transmitting	Horizontal



	Freq	Ant Factor	Cable Loss	Read Level	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	42.154	13.99	0.06	6.07	20.12	40.00	-19.88	Horizontal	
2	113.714	11.33	0.60	6.87	18.80	43.50	-24.70	Horizontal	
3	292.058	13.28	1.11	5.75	20.14	46.00	-25.86	Horizontal	
4	499.425	16.89	1.52	5.57	23.98	46.00	-22.02	Horizontal	
5	631.688	18.83	1.83	6.78	27.44	46.00	-18.56	Horizontal	
6 pp	887.610	21.91	2.48	6.41	30.80	46.00	-15.20	Horizontal	

Transmitter Emission above 1GHz

Worse case mode:		GFSK		Test channel:		Lowest	Remark: Peak		
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Result	Antenna Polaxis
1179.935	30.18	1.83	44.41	48.81	36.41	74.00	-37.59	Pass	H
1577.198	31.01	2.38	43.91	47.92	37.40	74.00	-36.60	Pass	H
4806.000	34.69	5.98	44.60	49.49	45.56	74.00	-28.44	Pass	H
5821.207	35.77	7.26	44.52	49.17	47.68	74.00	-26.32	Pass	H
7209.000	36.42	6.97	44.78	48.15	46.76	74.00	-27.24	Pass	H
9612.000	37.89	6.98	45.58	45.89	45.18	74.00	-28.82	Pass	H
1270.334	30.39	1.97	44.29	48.27	36.34	74.00	-37.66	Pass	V
1791.273	31.38	2.63	43.69	48.52	38.84	74.00	-35.16	Pass	V
4806.000	34.69	5.98	44.60	52.29	48.36	74.00	-25.64	Pass	V
6577.752	36.20	7.29	44.56	49.09	48.02	74.00	-25.98	Pass	V
7209.000	36.42	6.97	44.78	48.16	46.77	74.00	-27.23	Pass	V
9612.000	37.89	6.98	45.58	45.71	45.00	74.00	-29.00	Pass	V

Worse case mode:		GFSK		Test channel:		Middle	Remark: Peak		
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Result	Antenna Polaxis
1267.104	30.38	1.96	44.29	47.97	36.02	74.00	-37.98	Pass	H
1814.218	31.42	2.65	43.67	48.18	38.58	74.00	-35.42	Pass	H
4880.000	34.85	6.13	44.60	47.57	43.95	74.00	-30.05	Pass	H
5821.207	35.77	7.26	44.52	50.34	48.85	74.00	-25.15	Pass	H
7320.000	36.43	6.85	44.87	46.82	45.23	74.00	-28.77	Pass	H
9760.000	38.05	7.12	45.55	47.17	46.79	74.00	-27.21	Pass	H
1170.959	30.16	1.81	44.43	48.49	36.03	74.00	-37.97	Pass	V
1732.967	31.29	2.57	43.75	48.08	38.19	74.00	-35.81	Pass	V
4880.000	34.85	6.13	44.60	47.85	44.23	74.00	-29.77	Pass	V
5806.408	35.76	7.25	44.52	48.88	47.37	74.00	-26.63	Pass	V
7320.000	36.43	6.85	44.87	46.94	45.35	74.00	-28.65	Pass	V
9760.000	38.05	7.12	45.55	46.99	46.61	74.00	-27.39	Pass	V

Worse case mode:		GFSK		Test channel:		Highest	Remark: Peak		
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Result	Antenna Polaxis
1299.773	30.46	2.01	44.25	49.03	37.25	74.00	-36.75	Pass	H
1755.164	31.32	2.59	43.73	48.33	38.51	74.00	-35.49	Pass	H
4956.000	35.01	6.28	44.60	48.15	44.84	74.00	-29.16	Pass	H
5986.509	35.89	7.43	44.50	48.76	47.58	74.00	-26.42	Pass	H
7434.000	36.45	6.74	44.96	45.73	43.96	74.00	-30.04	Pass	H
9912.000	38.21	7.25	45.52	46.76	46.70	74.00	-27.30	Pass	H
1273.572	30.40	1.97	44.28	48.53	36.62	74.00	-37.38	Pass	V
1805.005	31.40	2.64	43.68	48.49	38.85	74.00	-35.15	Pass	V
4956.000	35.01	6.28	44.60	46.23	42.92	74.00	-31.08	Pass	V
6172.197	35.99	7.39	44.52	48.84	47.70	74.00	-26.30	Pass	V
7434.000	36.45	6.74	44.96	47.87	46.10	74.00	-27.90	Pass	V
9912.000	38.21	7.25	45.52	47.97	47.91	74.00	-26.09	Pass	V

Note:

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

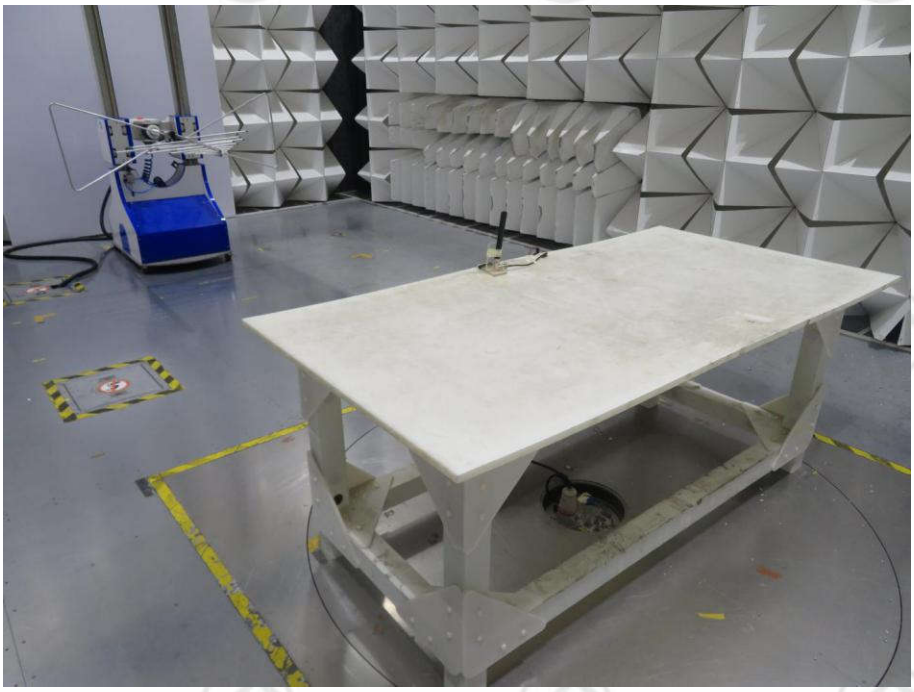
Final Test Level =Receiver Reading -Correct Factor

Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

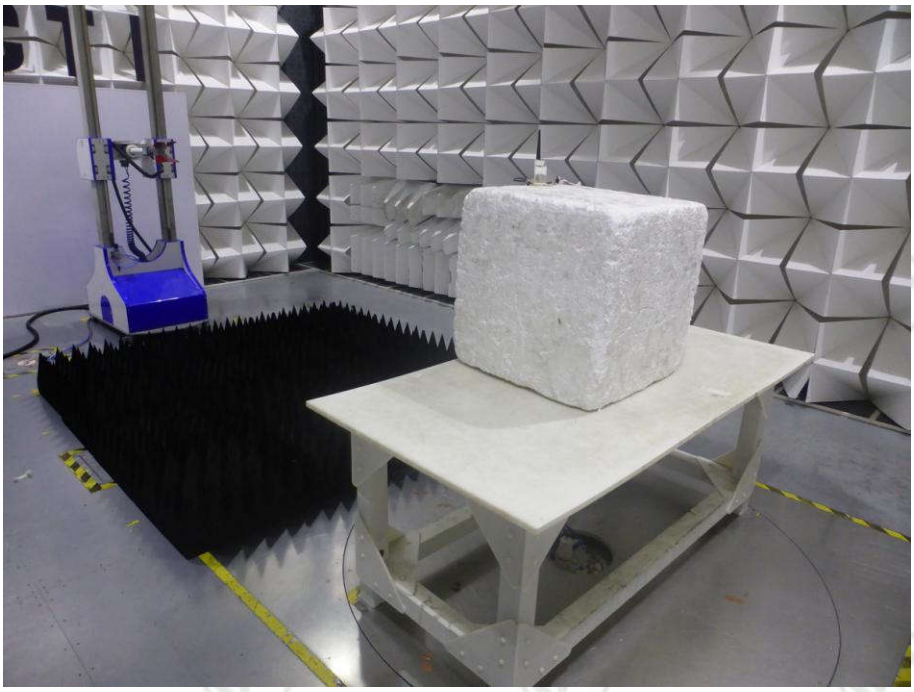
2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

PHOTOGRAPHS OF TEST SETUP

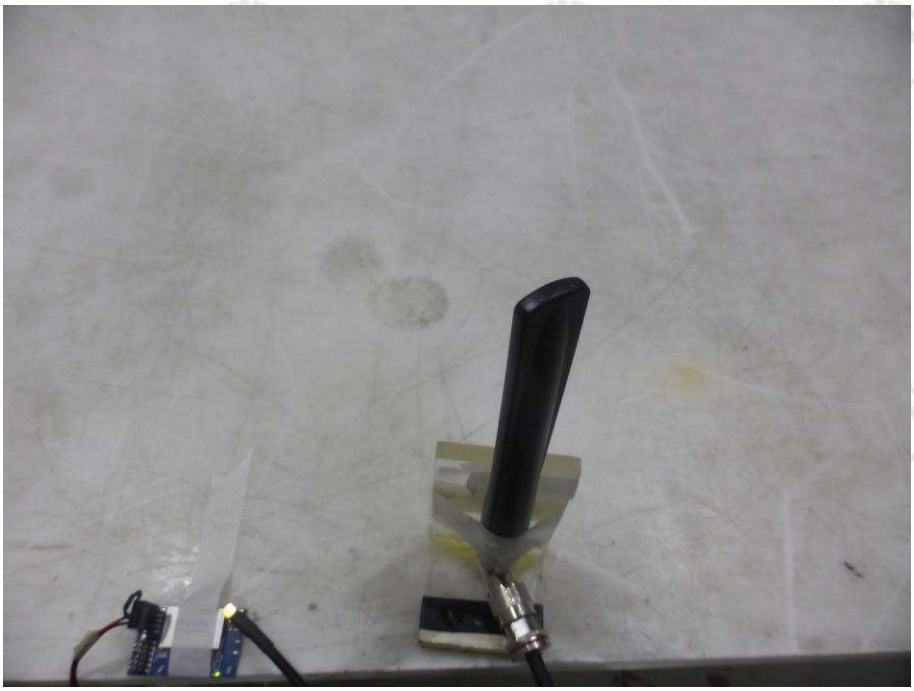
Test model No.: A40890G5-SPI



Radiated spurious emission Test Setup-1(Below 1G)



Radiated spurious emission Test Setup-2(Above 1G)

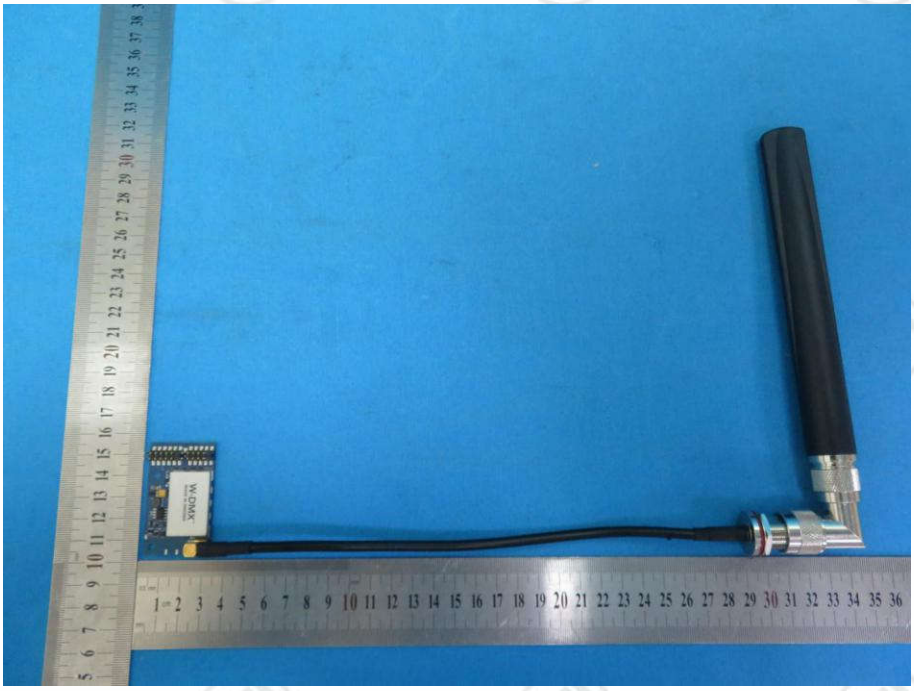


Radiated spurious emission Test Setup for close-up

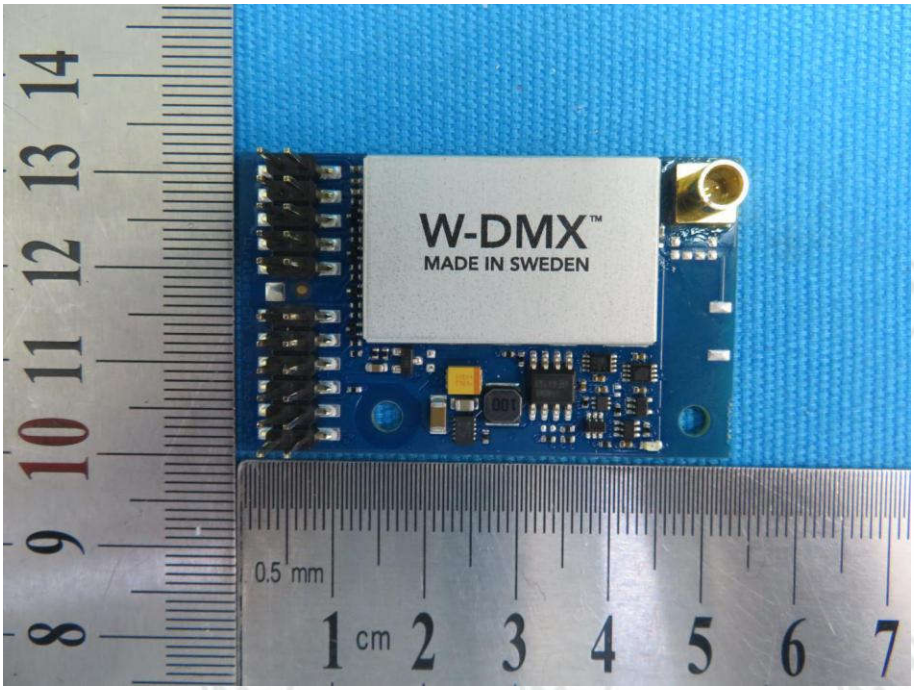
Conducted emission Test Setup

PHOTOGRAPHS OF EUT Constructional Details

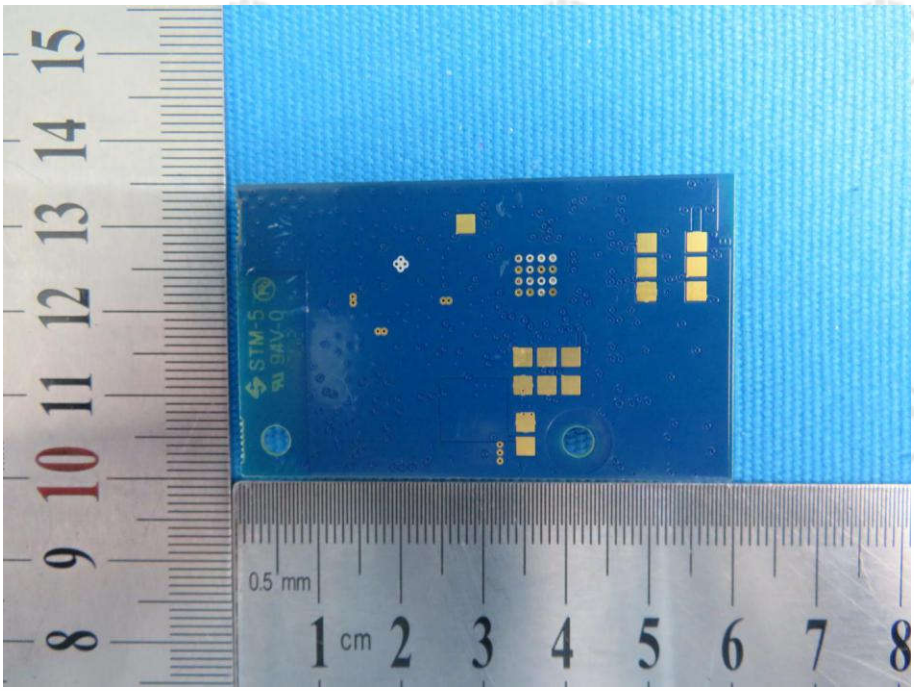
Test model No.: A40890G5-SPI



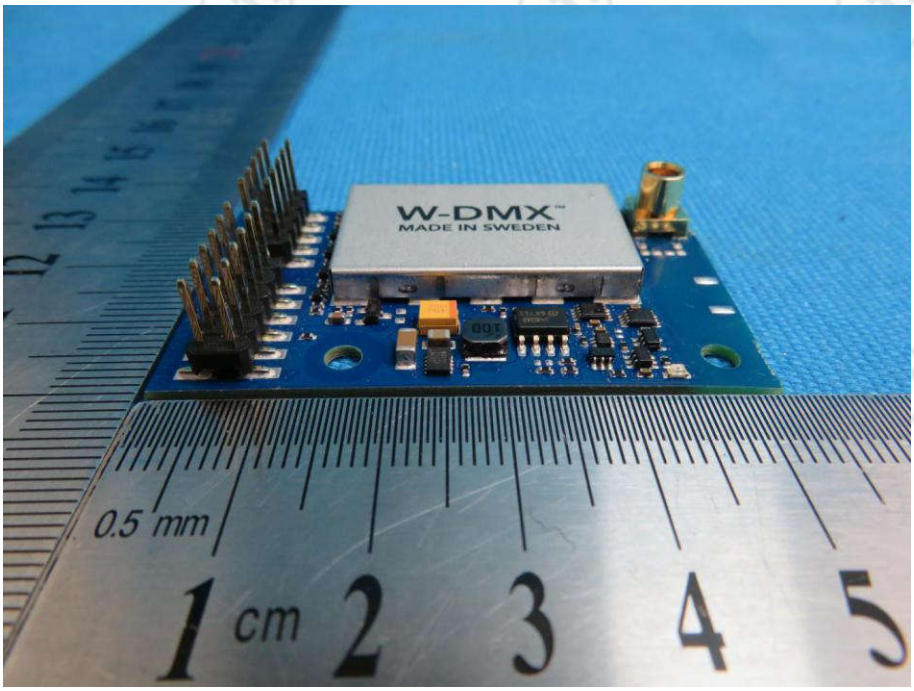
View of Product-1



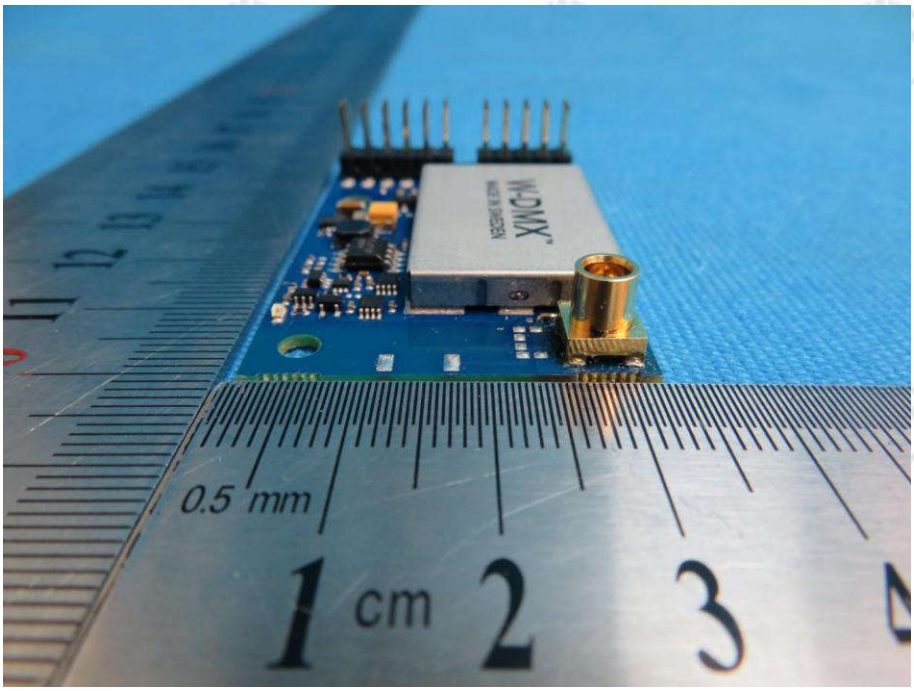
View of Product-2



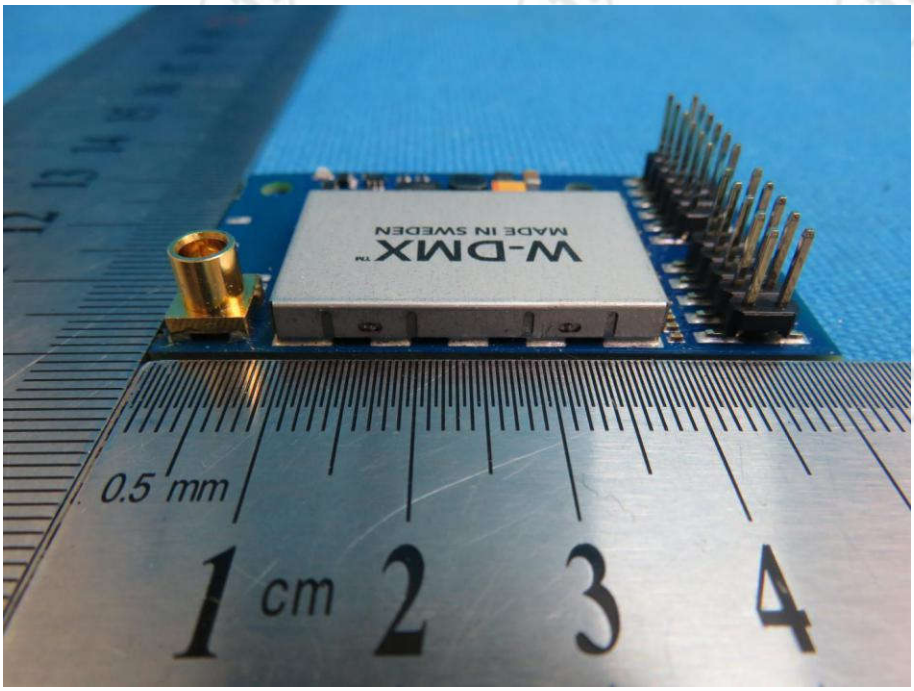
View of Product-3



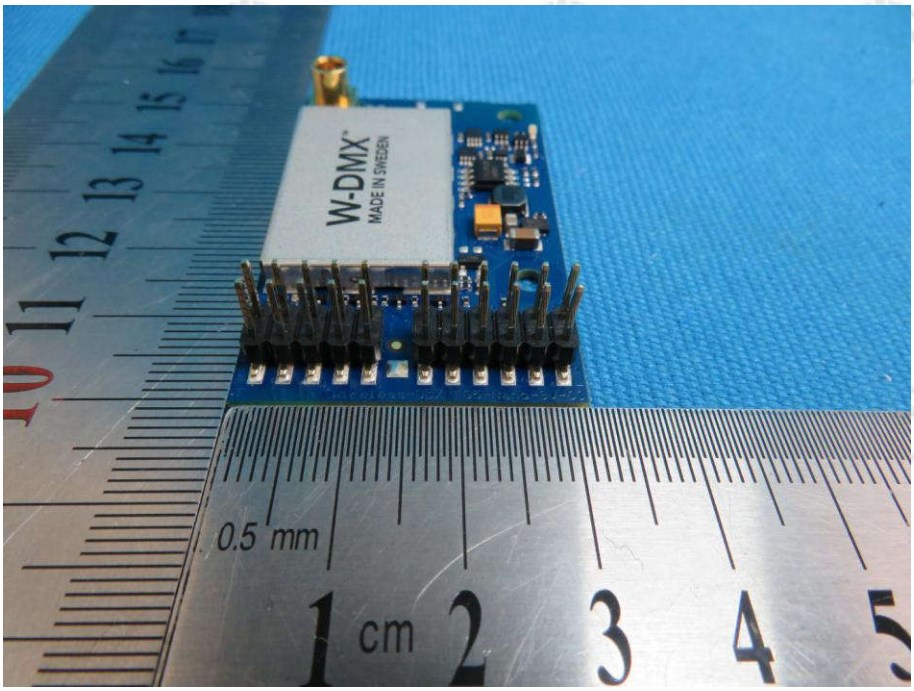
View of Product-4



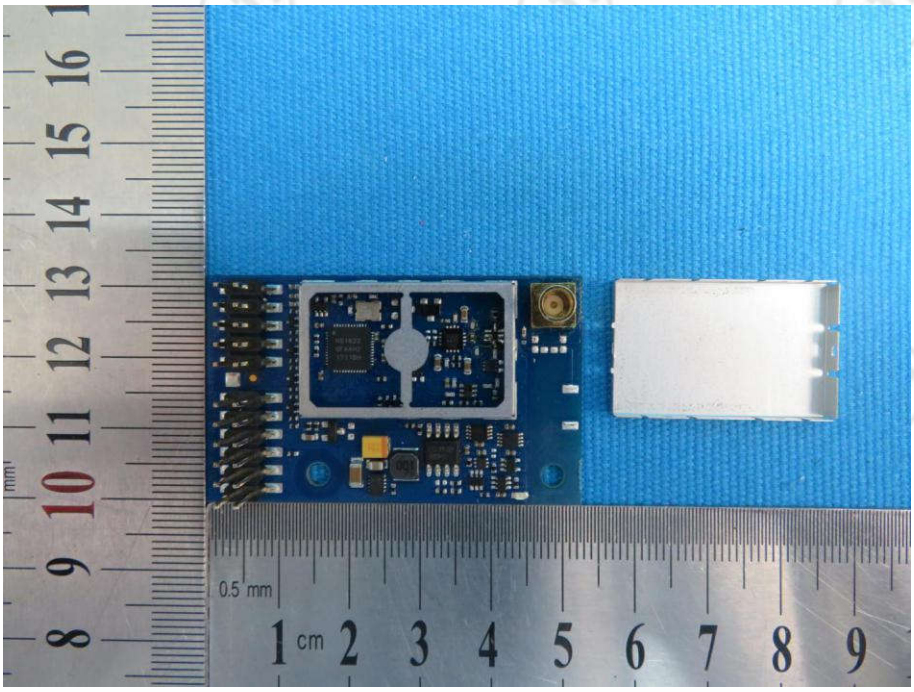
View of Product-5



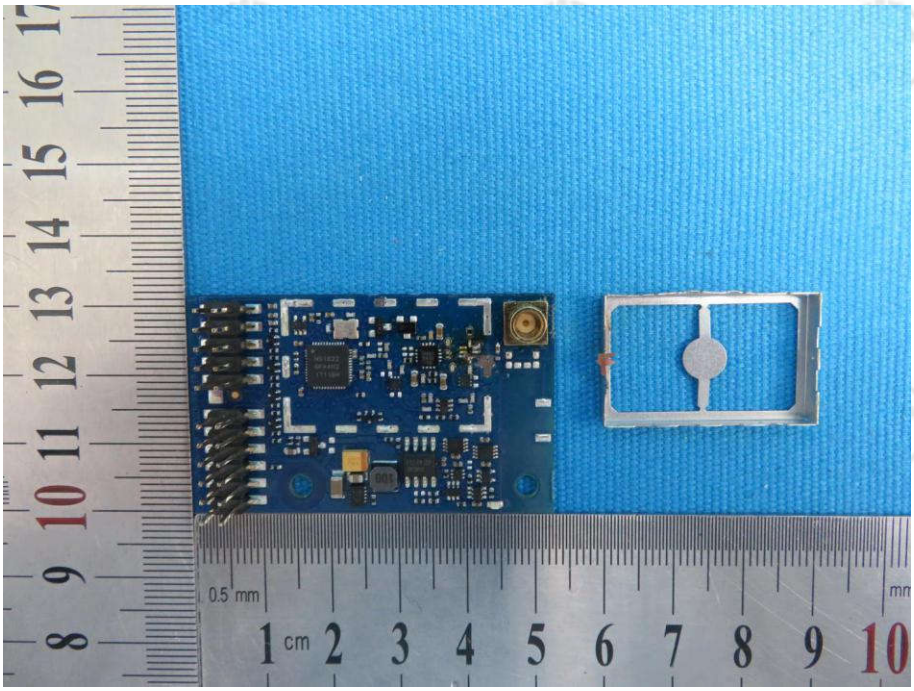
View of Product-6



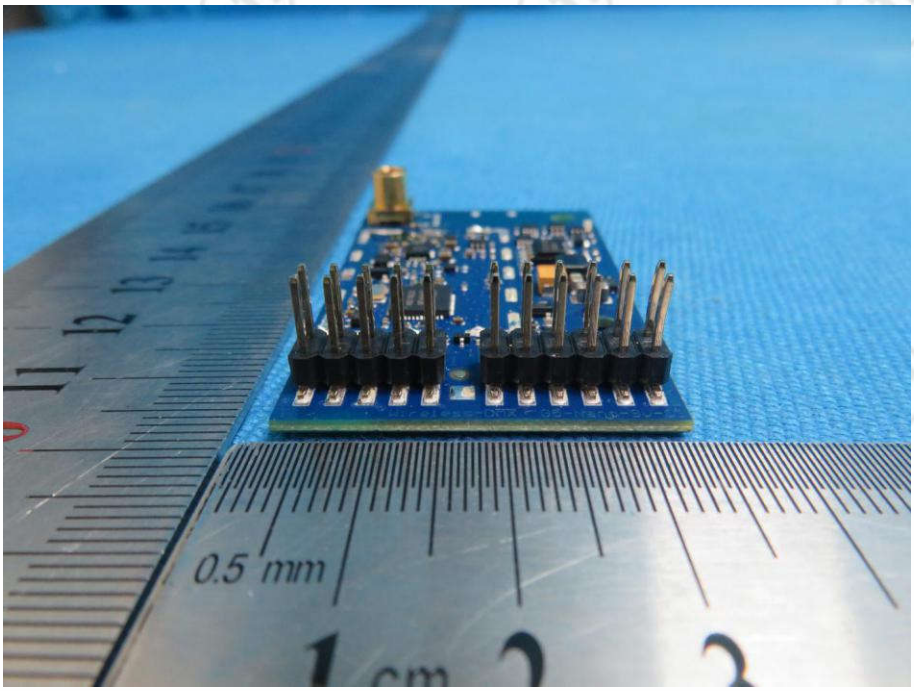
View of Product-7



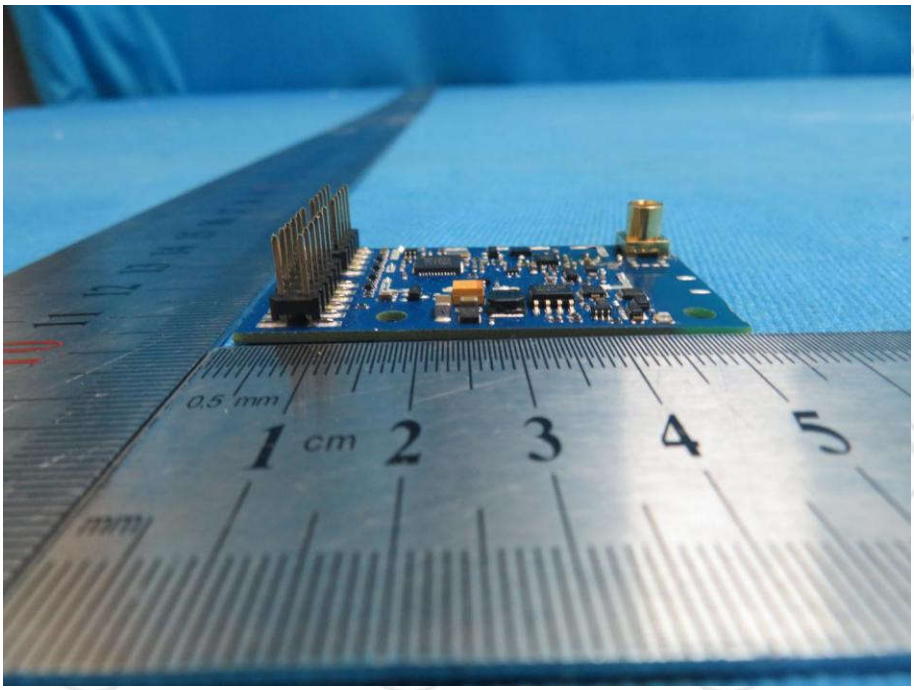
View of Product-8



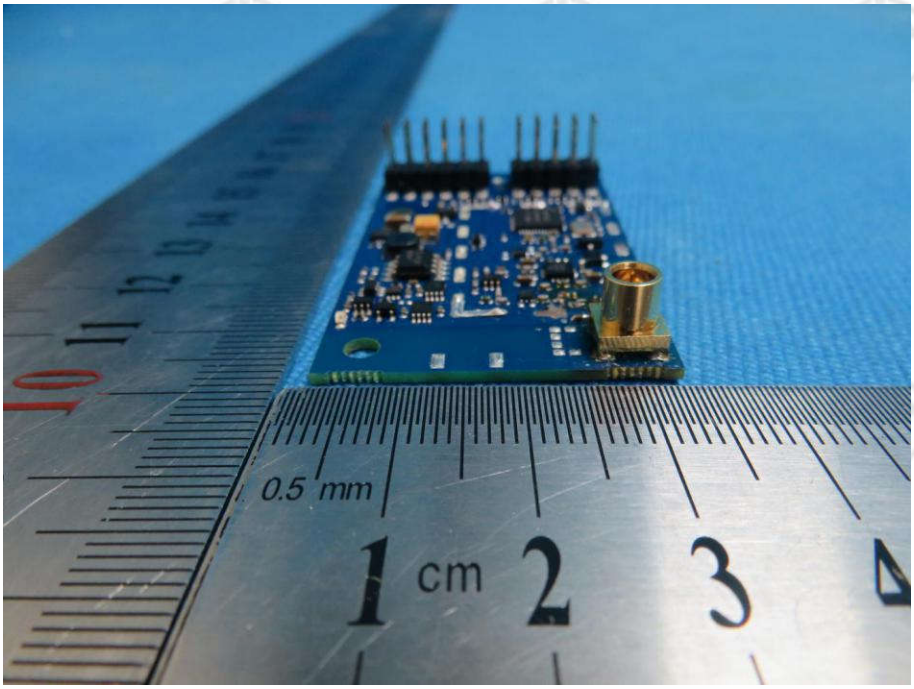
View of Product-9



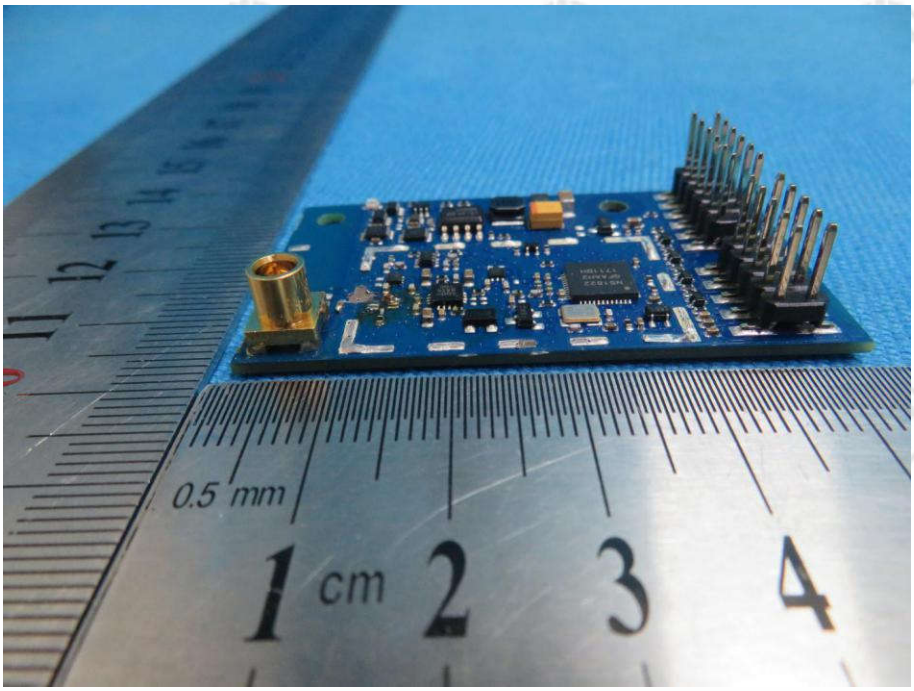
View of Product-10



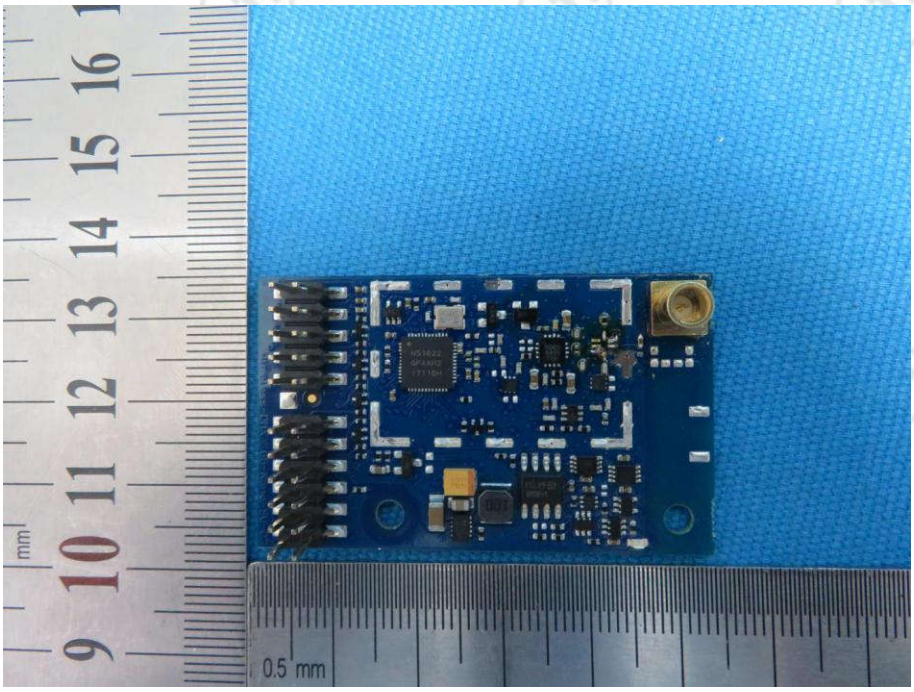
View of Product-11



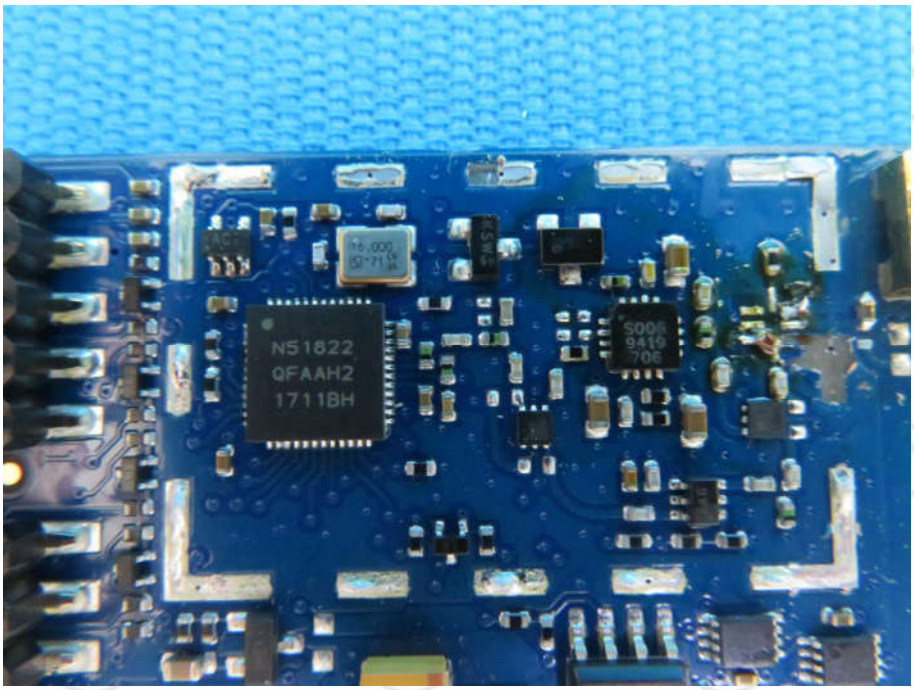
View of Product-12



View of Product-13



View of Product-14



View of Product-15

*** End of Report ***

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CTI, this report can't be reproduced except in full.