FCC Test Report

Report No.: AGC02764190301FE02

FCC ID	:	2ASTXNDB1793S02
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Block Robot
BRAND NAME	:	N/A
MODEL NAME	:	NDB1793S02, NDB1793SXX
CLIENT	:	Shanghai whales bot technology co., ltd.
DATE OF ISSUE	:	May 21, 2019
STANDARD(S)	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 21, 2019	Valid	Initial Release

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1. VERIFICATION OF COMPLIANCE

Applicant	Shanghai whales bot technology co., ltd.
Address	5th floor, Block A, Mapletree business city, 2337 Gudai Road, Shanghai
Manufacturer	Shanghai whales bot technology co., ltd.
Address	5th floor, Block A, Mapletree business city, 2337 Gudai Road, Shanghai
Factory	Shanghai whales bot technology co., ltd.
Address	5th floor, Block A, Mapletree business city, 2337 Gudai Road, Shanghai
Product Designation	Block Robot
Brand Name	N/A
Test Model	NDB1793S02
Series Model	NDB1793SXX
Difference description	All the same except for the model name.
Date of test	Mar. 21, 2019 to May 21, 2019
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BLE/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC part 15.247.

Tested By	Donjon Huang(Huang Dongyang)	May 21, 2019
Reviewed By	Max Zhang(Zhang Yi)	May 21, 2019
Approved By	Forrest Lei(Lei Yonggang) Authorized Officer	May 21, 2019

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2.GENERAL INFORMATION

2.1PRODUCT DESCRIPTION

The EUT is designed as a “Block Robot”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480GHz
RF Output Power	-0.87dBm(Max)
Bluetooth Version	V 5.0
Modulation	BR ☐GFSK, EDR ☐π /4-DQPSK, ☐8DPSK BLE ☒GFSK 1Mbps ☐GFSK 2Mbps
Number of channels	40 Channel
Antenna Designation	PCB Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain	1.6dBi
Hardware Version	HW V1.0
Software Version	SW V1.0
Power Supply	DC 9.0V

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	0	2402MHZ
	1	2404MHZ
	:	:
	38	2478 MHZ
	39	2480 MHZ

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2.3 RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **FCC ID: 2ASTXNDB1793S02** filing to comply with the FCC Part 15.247 requirements.

2.4TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.5 SPECIAL ACCESSORIES

Refer to section 2.2.

2.6 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted, Uc = ±0.8dB
- Uncertainty of RF power density, conducted, Uc = ±2.6dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %

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4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX

Note:
1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

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5. SYSTEM TEST CONFIGURATION

5.1 CONFIGURATION OF TESTED SYSTEM

EUT

5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Block Robot	NDB1793S02	2ASTXNDB1793S02	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(3)	Peak Output Power	Compliant
15.247 (a)(2)	6 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.247 (e)	Maximum Conducted Output Power Density	Compliant
15.209	Radiated Emission	Compliant
15.207	Conducted Emission	N/A

NOTE: N/A stands for not applicable. The device can not use the BT function with charging.

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2018	Jun. 11, 2019
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 20, 2018	Dec. 19, 2019
2.4GHz Fliter	Micro-tronics	087	N/A	Jun. 12, 2018	Jun. 11, 2019
Attenuator	Weinachel Corp	58-30-33	N/A	Jun. 12, 2018	Jun. 11, 2019
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2017	Sep. 20, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 25, 2018	Oct. 24, 2019
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep. 28, 2017	Sep. 27, 2019

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

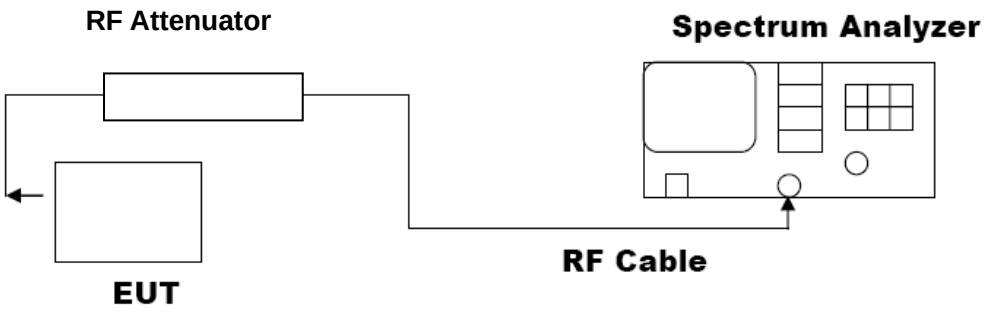
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. RBW≥DTS bandwidth
3. VBW≥3*RBW.
4. SPAN≥VBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



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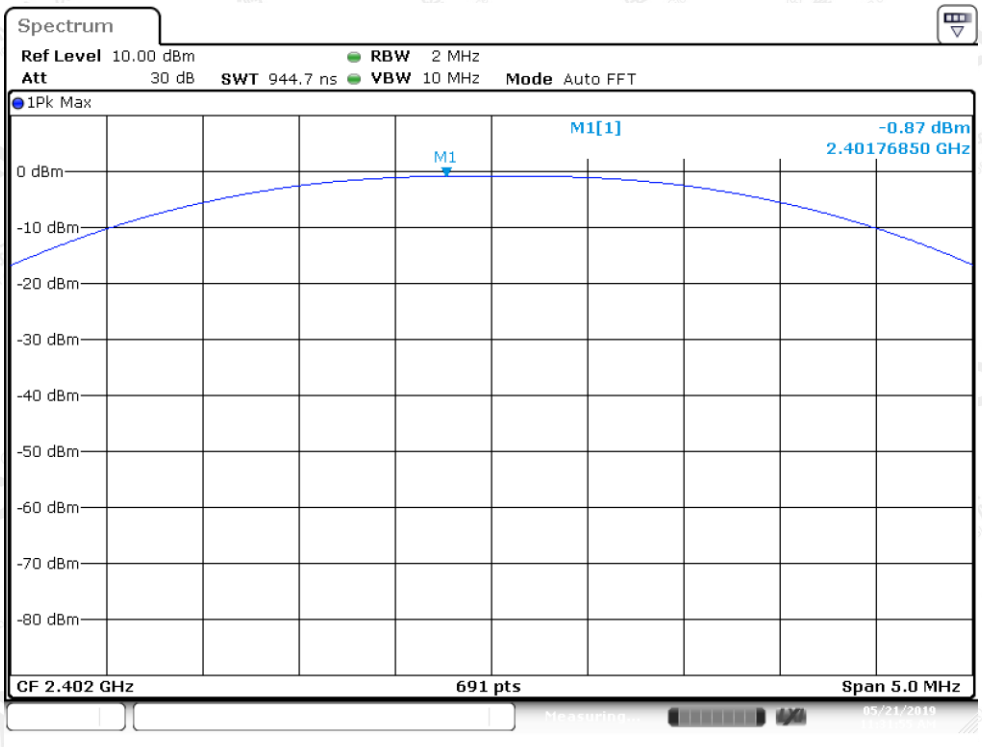
7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-0.87	30	Pass
2.440	-1.35	30	Pass
2.480	-1.80	30	Pass

CH0



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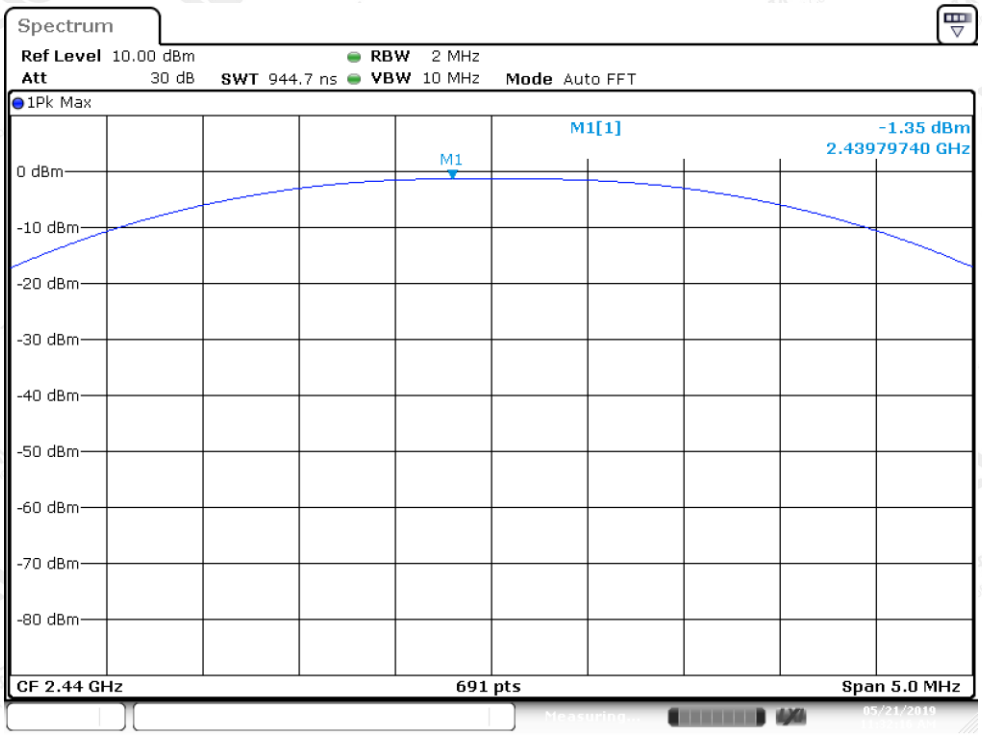
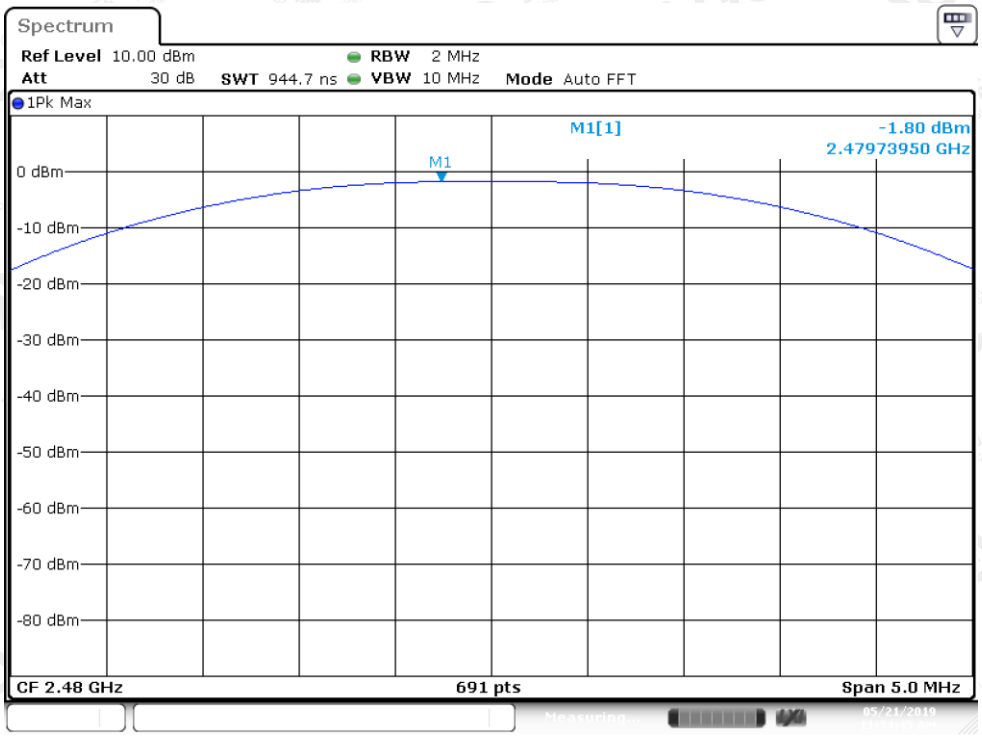
CH19



CH39



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8. 6 DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW⩾3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

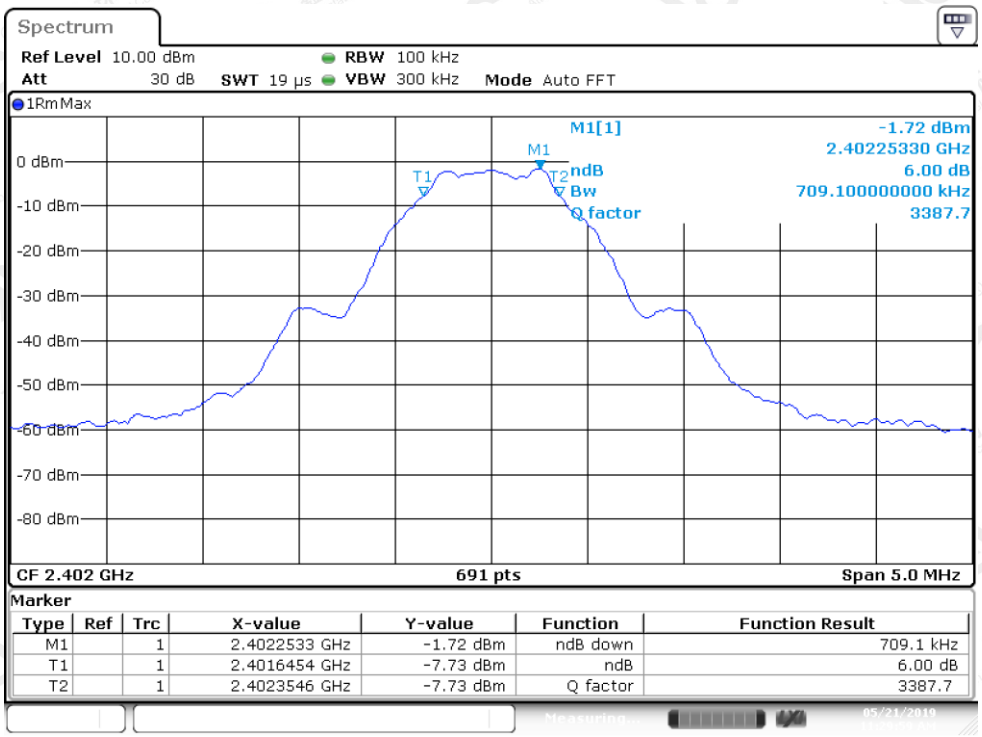
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

8.3. LIMITS AND MEASUREMENT RESULTS

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (kHz)		Criteria
>500KHZ	Low Channel	709.1	PASS
	Middle Channel	716.4	PASS
	High Channel	759.8	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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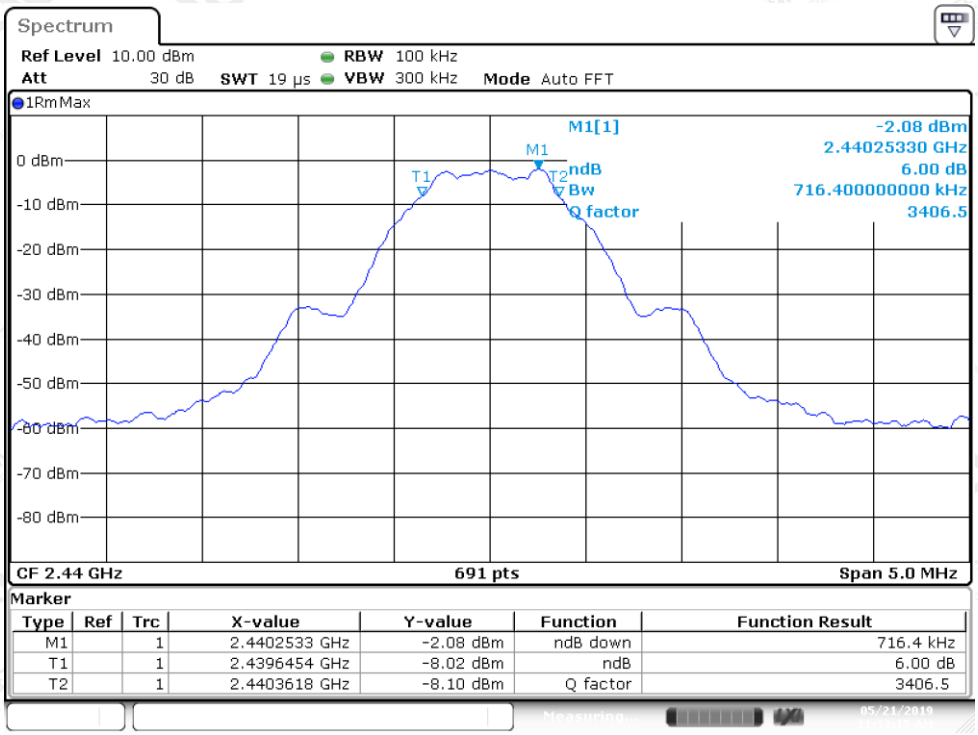
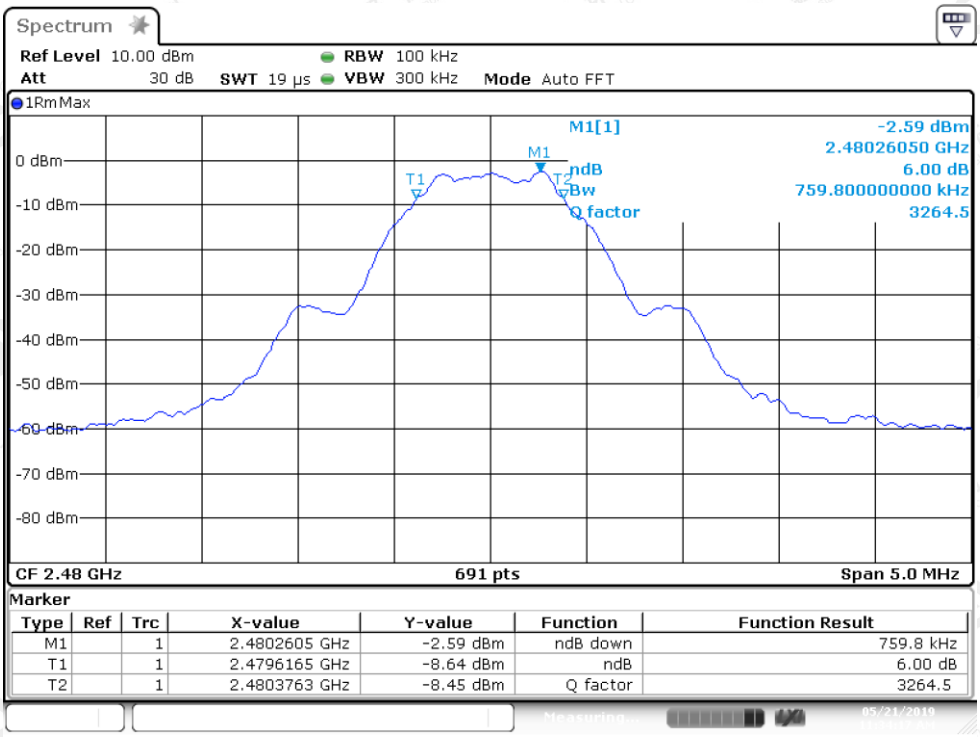
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4402533 GHz	-2.08 dBm	ndB down	716.4 kHz
T1		1	2.4396454 GHz	-8.02 dBm	ndB	6.00 dB
T2		1	2.4403618 GHz	-8.10 dBm	Q factor	3406.5

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4802605 GHz	-2.59 dBm	ndB down	759.8 kHz
T1		1	2.4796165 GHz	-8.64 dBm	ndB	6.00 dB
T2		1	2.4803763 GHz	-8.45 dBm	Q factor	3264.5

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9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS PASS

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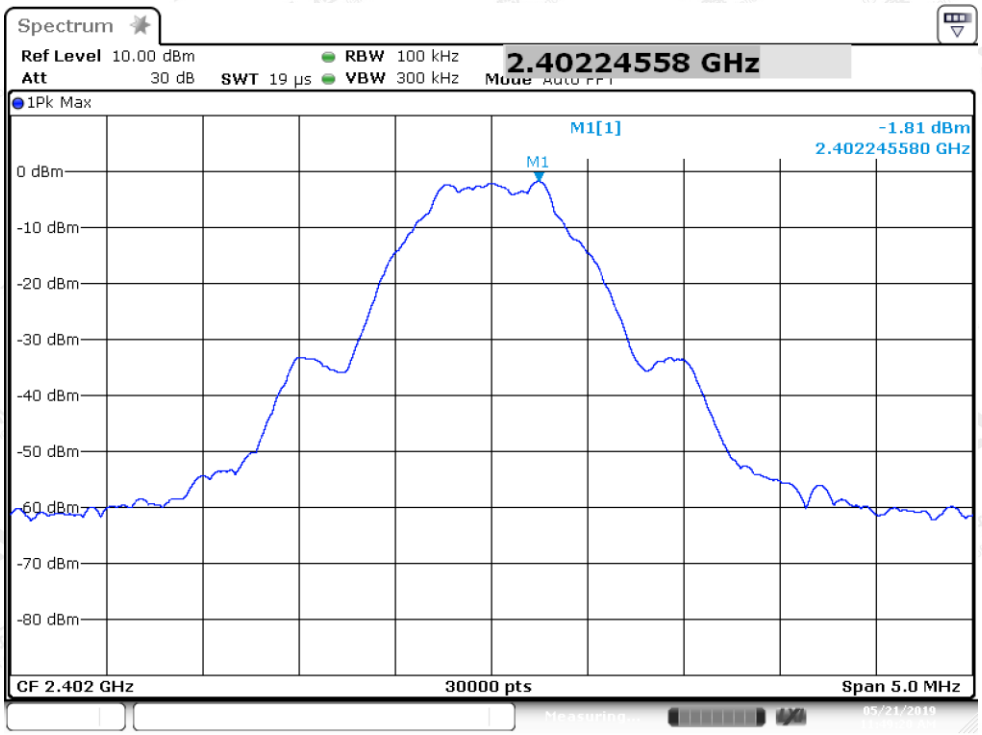
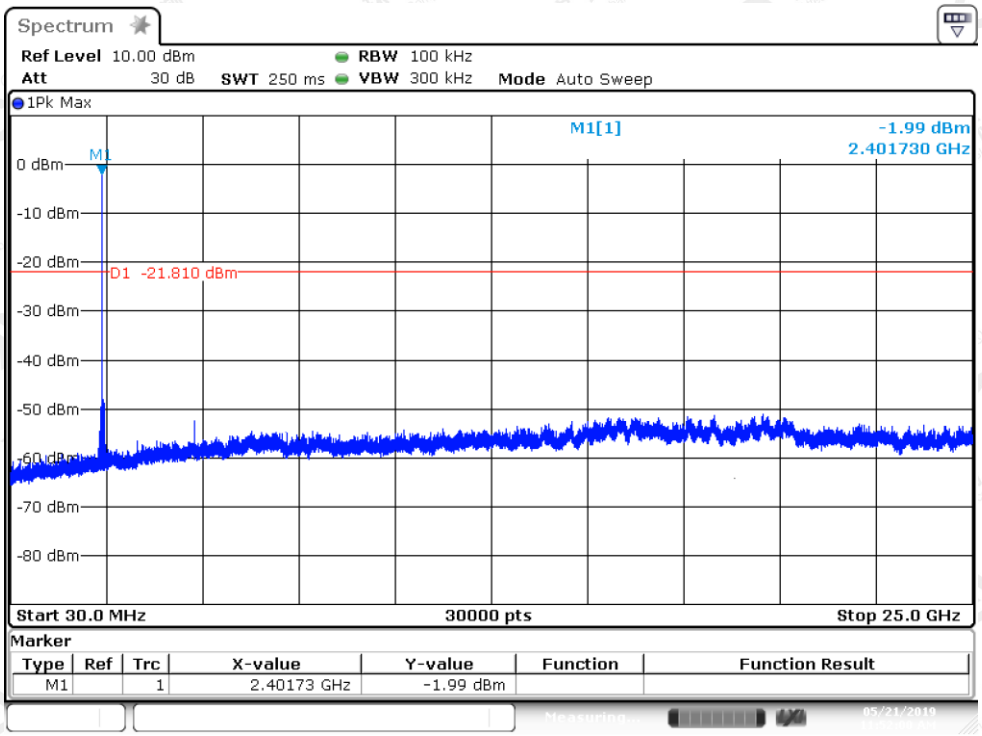
TEST RESULT FOR ENTIRE FREQUENCY RANGE

GFSK MODULATION IN LOW CHANNEL





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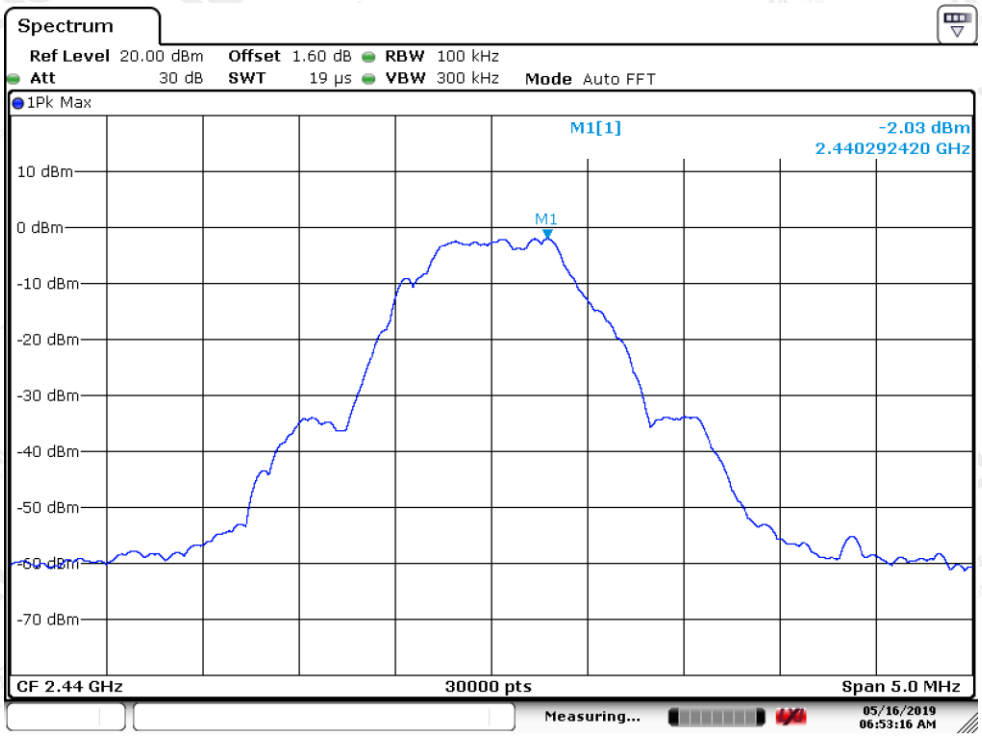
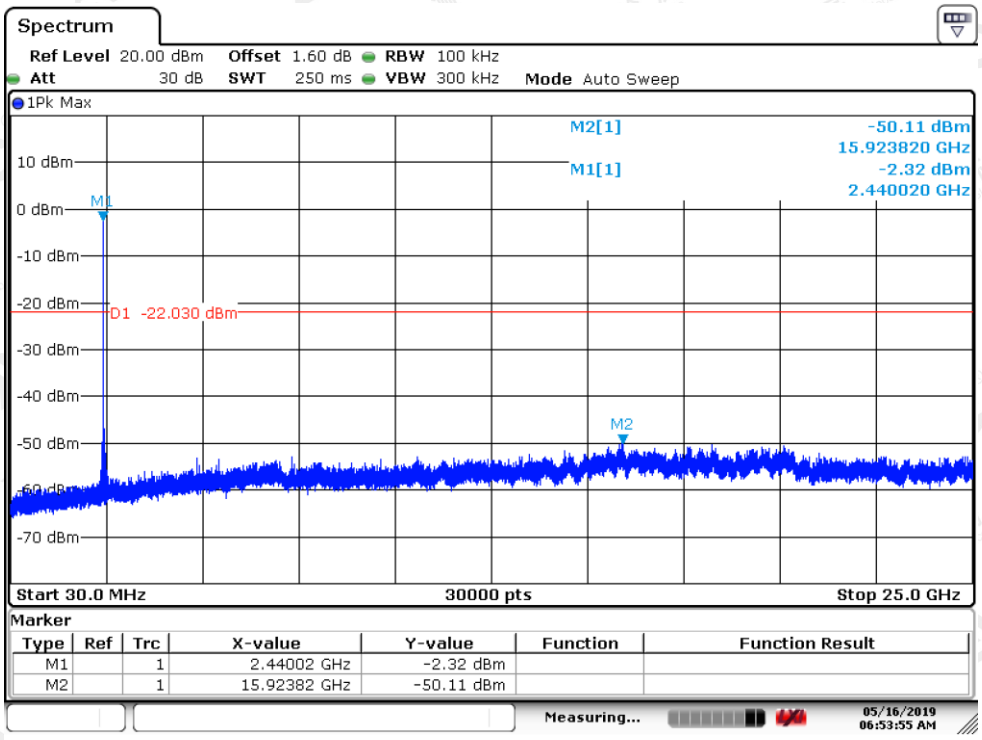
GFSK MODULATION IN MIDDLE CHANNEL





Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44002 GHz	-2.32 dBm		
M2		1	15.92382 GHz	-50.11 dBm		

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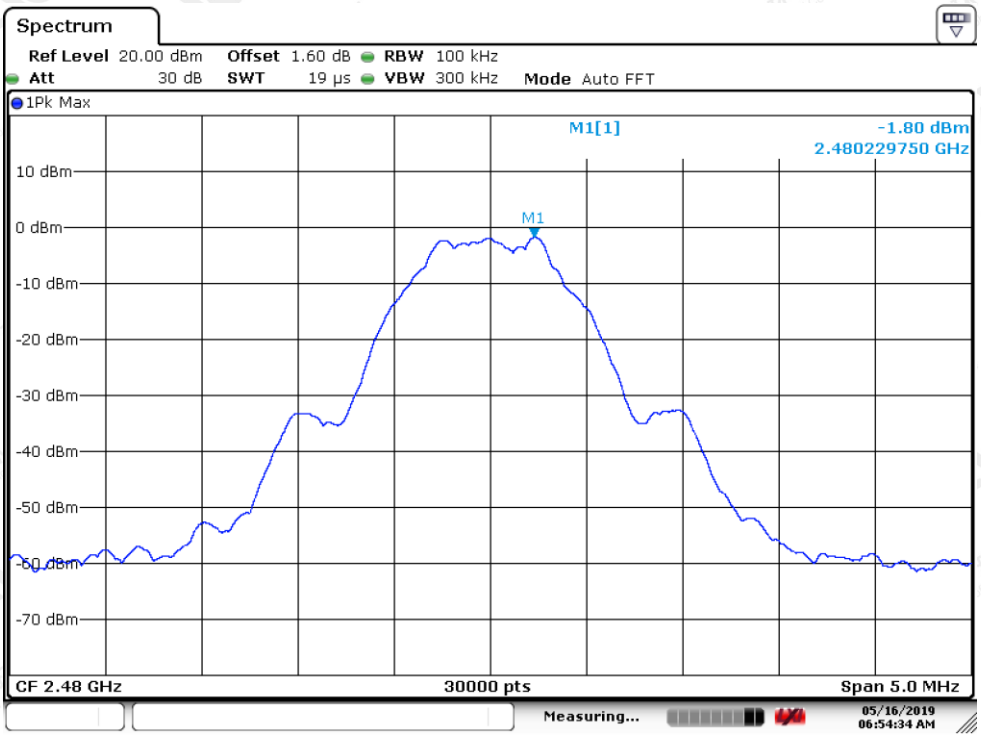
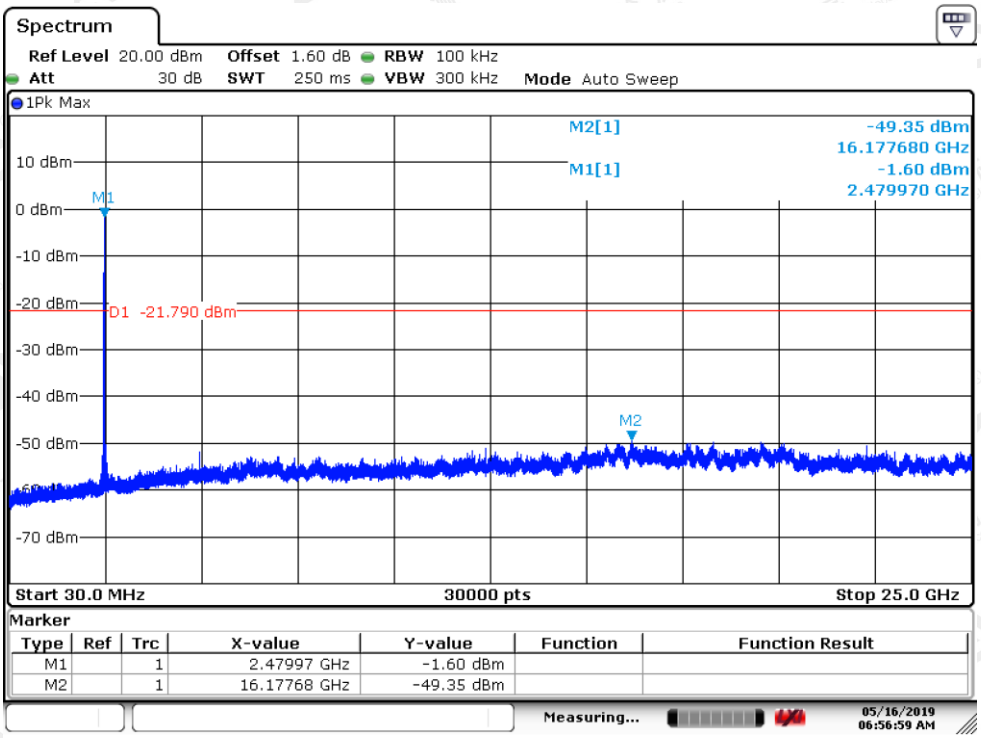
GFSK MODULATION IN HIGH CHANNEL





Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

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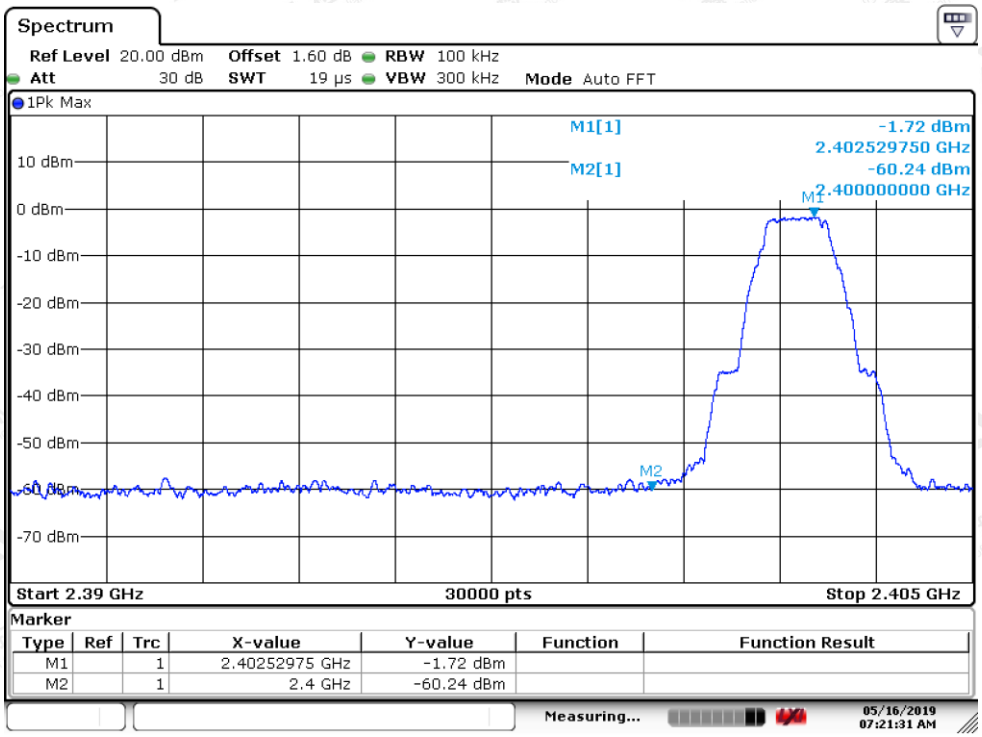
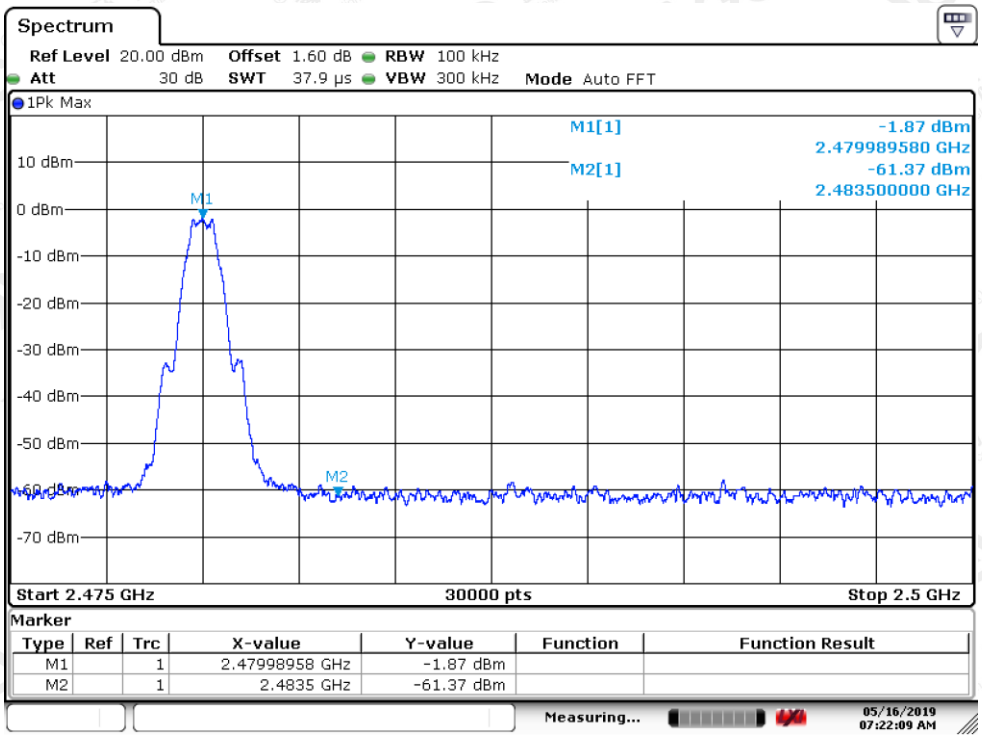
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL



GFSK MODULATION IN HIGH CHANNEL



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10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

10.1 MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
(3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 7.2.

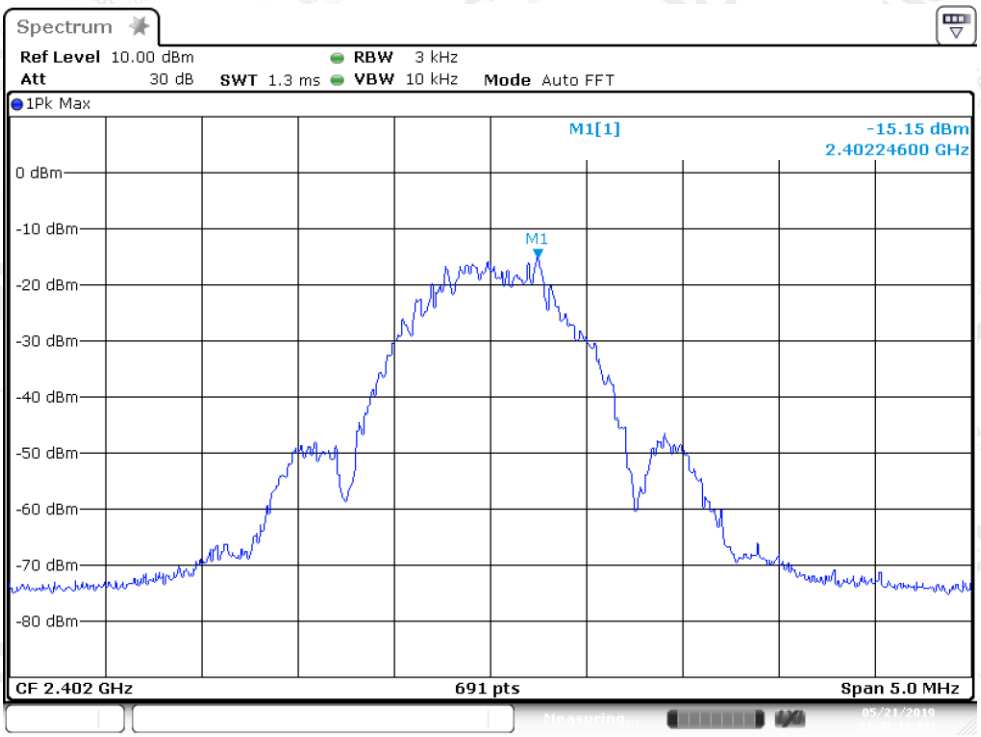
10.3 MEASUREMENT EQUIPMENT USED

Refer To Section 6.

10.4 LIMITS AND MEASUREMENT RESULT

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-15.15	8	Pass
Middle Channel	-15.11	8	Pass
High Channel	-15.25	8	Pass

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



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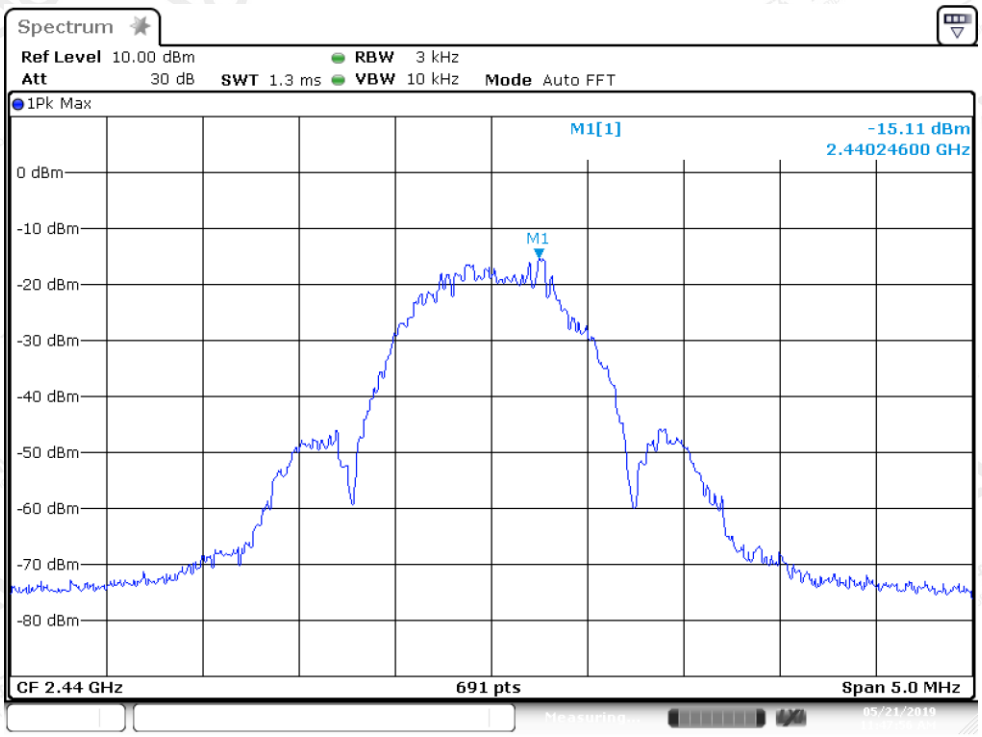
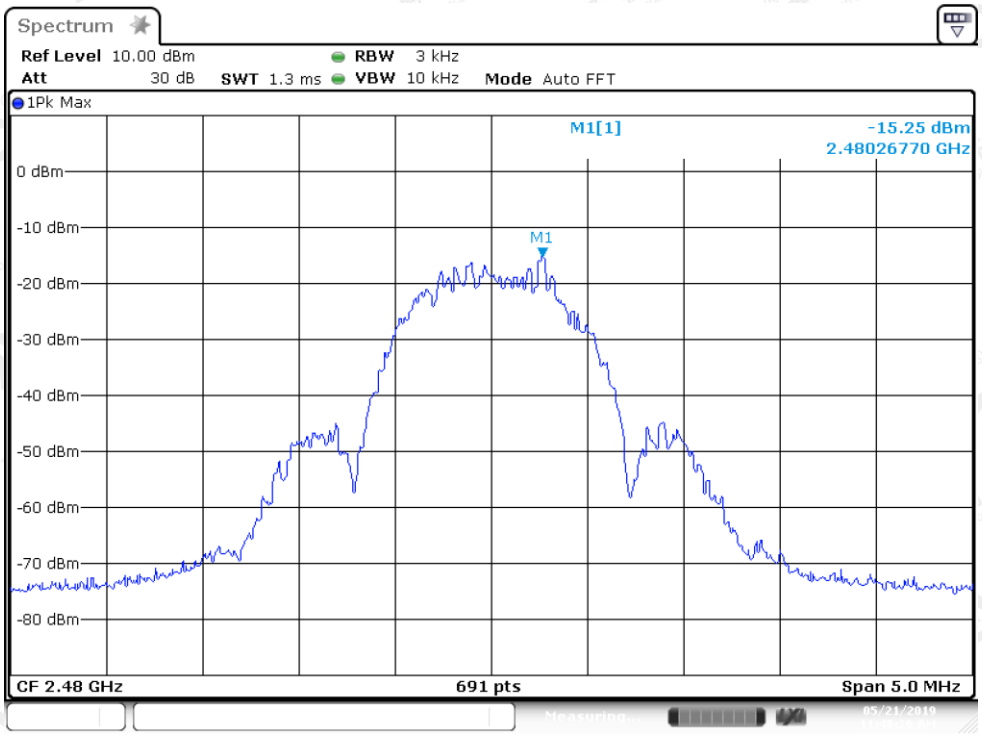
TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



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11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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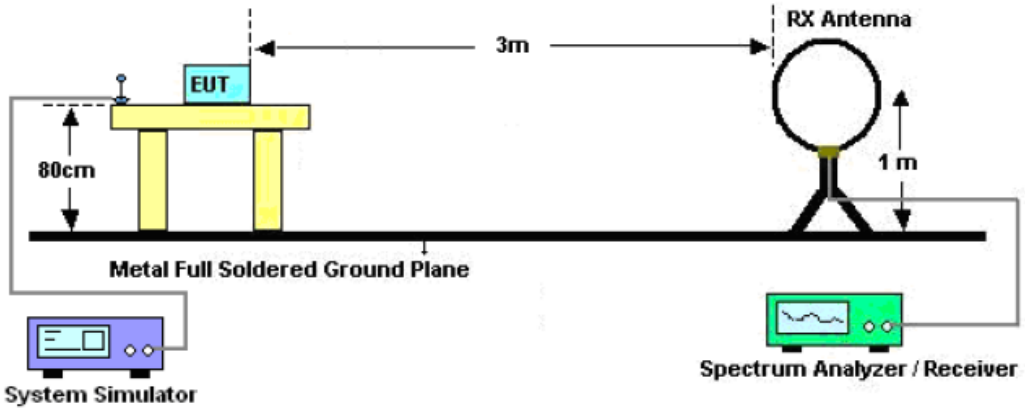
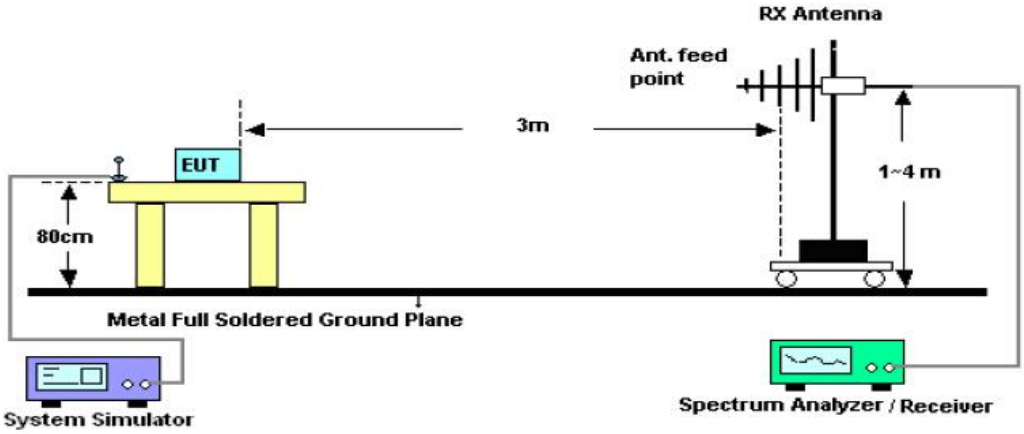
11.2. TEST SETUP

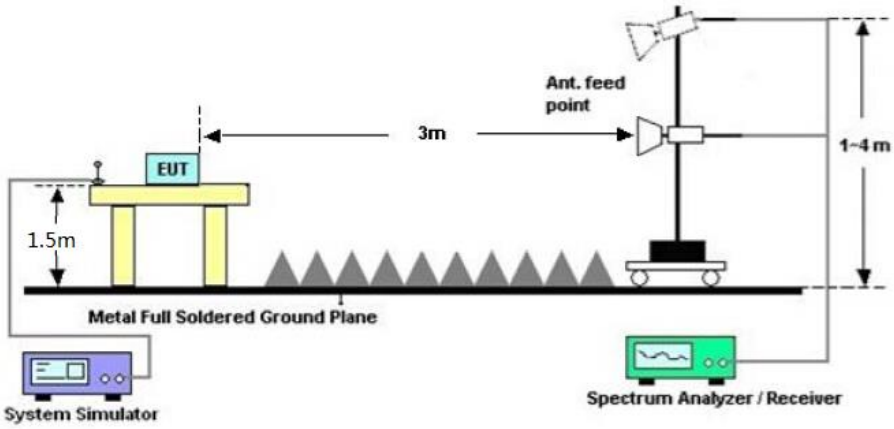
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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11.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

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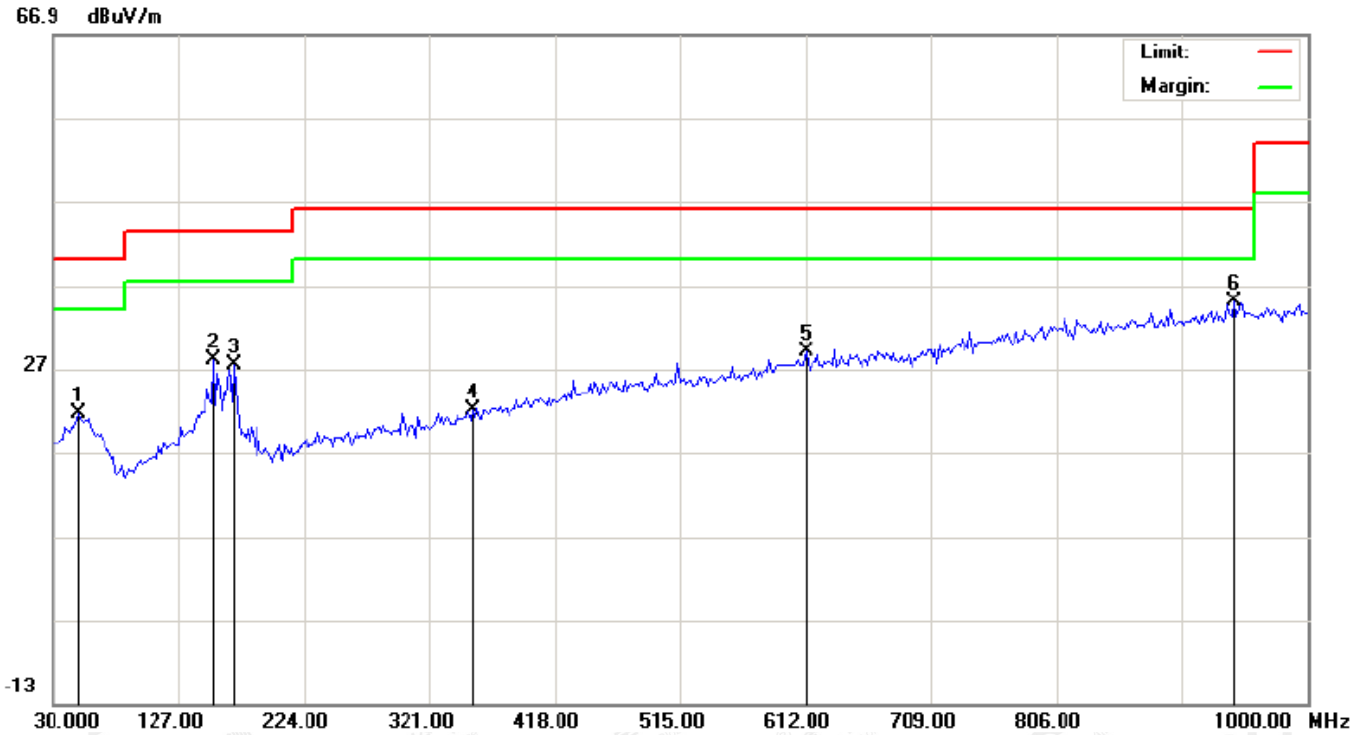
RADIATED EMISSION BELOW 1GHZ

EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		49.4000	1.76	19.75	21.51	40.00	-18.49	peak			
2		154.4833	8.82	19.20	28.02	43.50	-15.48	peak			
3		170.6500	9.34	18.09	27.43	43.50	-16.07	peak			
4		354.9500	0.54	21.40	21.94	46.00	-24.06	peak			
5		612.0000	2.01	27.09	29.10	46.00	-16.90	peak			
6	*	943.4167	2.92	32.07	34.99	46.00	-11.01	peak			

RESULT: PASS

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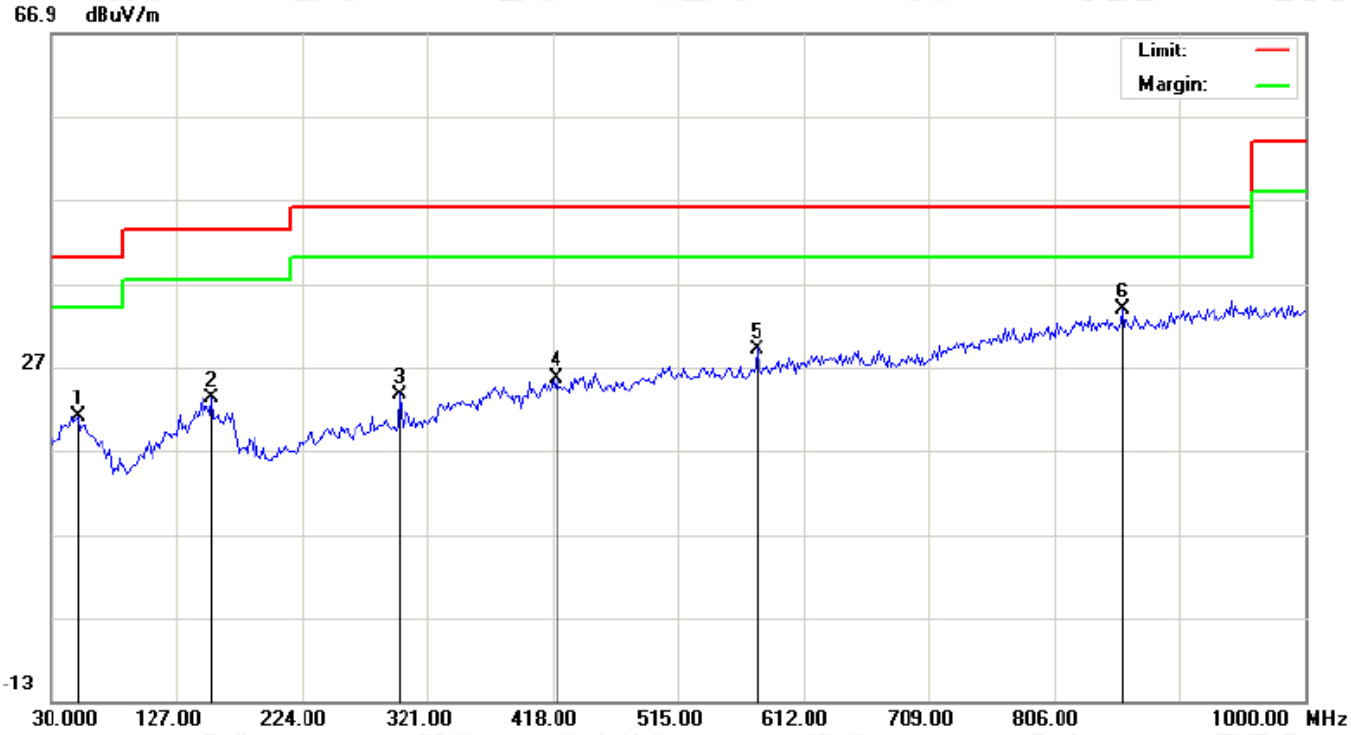
EUT	Block Robot	Model Name	NDB1793S02
Temperature	25.3°C	Relative Humidity	55.1%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		51.0167	1.44	19.64	21.08	40.00	-18.92	peak			
2		154.4833	4.02	19.20	23.22	43.50	-20.28	peak			
3		299.9833	4.23	19.47	23.70	46.00	-22.30	peak			
4		421.2333	2.24	23.41	25.65	46.00	-20.35	peak			
5		576.4333	2.61	26.49	29.10	46.00	-16.90	peak			
6	*	859.3500	2.66	31.18	33.84	46.00	-12.16	peak			

RESULT: PASS

Note:

1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
2. All test modes had been tested. The mode 1 is the worst case and recorded in the report.

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RADIATED EMISSION ABOVE 1GHZ

EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	46.53	0.08	46.61	74	-27.39	peak
4804.011	41.71	0.08	41.79	54	-12.21	AVG
7206.022	42.13	2.21	44.34	74	-29.66	peak
7206.022	36.32	2.21	38.53	54	-15.47	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	43.83	0.08	43.91	74	-30.09	peak
4804.011	40.95	0.08	41.03	54	-12.97	AVG
7206.022	41.43	2.21	43.64	74	-30.36	peak
7206.022	36.36	2.21	38.57	54	-15.43	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.005	45.63	0.14	45.77	74	-28.23	peak
4880.005	42.05	0.14	42.19	54	-11.81	AVG
7320.140	40.74	2.36	43.1	74	-30.9	peak
7320.140	35.02	2.36	37.38	54	-16.62	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.050	43.35	0.14	43.49	74	-30.51	peak
4880.050	39.11	0.14	39.25	54	-14.75	AVG
7320.080	40.63	2.36	42.99	74	-31.01	peak
7320.080	36.07	2.36	38.43	54	-15.57	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.012	46.58	0.22	46.8	74	-27.2	peak
4960.012	42.96	0.22	43.18	54	-10.82	AVG
7440.027	43.45	2.64	46.09	74	-27.91	peak
7440.027	39.09	2.64	41.73	54	-12.27	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Block Robot	**Model Name**	NDB1793S02
Temperature	25.3°C	**Relative Humidity**	55.1%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.013	44.73	0.22	44.95	74	-29.05	peak
4960.013	41.04	0.22	41.26	54	-12.74	AVG
7440.027	41.64	2.64	44.28	74	-29.72	peak
7440.027	37.38	2.64	40.02	54	-13.98	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RESULT: PASS

Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.
Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.
The “Factor” value can be calculated automatically by software of measurement system.

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