

Prüfbericht-Nr.: <i>Test report No.:</i>	60388048 001	Auftrags-Nr.: <i>Order No.:</i>	168264726	Seite 1 von 16 <i>Page 1 of 16</i>
Kunden-Referenz-Nr.: <i>Client reference No.:</i>	N/A	Auftragsdatum: <i>Order date.:</i>	13.05.2020	
Auftraggeber: <i>Client:</i>	Xiamen R&T Plumbing Technology Co.,LTD. No.18, HouXiang Road, HaiCang District,Xiamen,361028, China			
Prüfgegenstand: <i>Test item:</i>	Touchless Flush Mechanism (Sensor modeule)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	D7020 (Trademark: R&T)			
Auftrags-Inhalt: <i>Order content:</i>	FCC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.249 CFR47 FCC Part 15: Subpart C Section 15.209			
Wareneingangsdatum: <i>Date of receipt:</i>	09.06.2020	Please refer to photo documents		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A002836143-003~004			
Prüfzeitraum: <i>Testing period:</i>	11.06.2020 - 19.06.2020			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
 20.07.2020 Ryan Yang / Assistant Project Manager		 20.07.2020 Winnie Hou / Technical Certifier		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
Sonstiges / Other:				
FCC ID: 2AW23-7020-02				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>		
* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend
	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)		5 = mangelhaft
Legend:	1 = very good	2 = good	3 = satisfactory	4 = sufficient
	P(ass) = passed a.m. test specifications(s)	F(ail) = failed a.m. test specifications(s)		5 = poor
			N/A = nicht anwendbar	N/T = nicht getestet
			N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Test Report No.

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Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 FUNDAMENTAL & HARMONICS RADIATED EMISSION

RESULT: Pass

5.1.3 20dB BANDWIDTH

RESULT: Pass

5.1.4 RADIATED SPURIOUS EMISSION & BAND EDGE

RESULT: Pass

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of General 2.4GHz.

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China

FCC Registration No.: CN1260

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Shenzhen) Co., Ltd.

Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	19.08.2020
Signal Analyzer	R&S	FSV 40	101439	21.08.2020
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	21.08.2020
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	20.08.2020
Amplifier	R&S	SCU-18F	180070	20.08.2020
Amplifier	R&S	SCU40A	100475	20.09.2020
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	02.09.2020
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	02.09.2020
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	02.09.2020
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	01.09.2020
Wideband Ridged Horn Antenna (12-18 GHz)	Steatite	QMS-00208	18313	02.09.2020
Test software	R&S	EMC32 (V10.50.40)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	06.07.2020

Radiated Emission (3m chamber)				
Equipment	Manufacturer	Model No.	Serial No.	Cali. until
3m SAC	ETS	SAC3	CT001632-Q1362	23.08.2021
EMI Test Receiver	R&S	ESR7	102111	04.01.2021
Horn Antenna	R&S	HF907	102706	01.09.2020
Preamplifier	FIT	SCU-18F	180077	19.08.2020
Active magnetic loop antenna	SCHWARZBECK	FMZB1519B	00080	19.08.2020

Trilog-Broadband antenna	SCHWARZBECK	VULB9168	0945	12.09.2020
Switching Controller Interface	R&S	OSP 120	102039	N/A
EMC32 test software	R&S	EMC32(Ver.10.50.01)	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Guangdong) Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at 362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a sensor module of one of the Touchless Flush Mechanism, which operating in 2460MHz.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Touchless Flush Mechanism (Sensor modeule)
Type Designation	D7020
Trademark	R&T
FCC ID	2AW23-7020-02
Operating Voltage	DC 4.5V via alkaline batteries (1.5V*3)
Testing Voltage	Fully charged battery
Operating Frequency	2460 MHz
Type of Modulation	GFSK
Channel Number	1 channel
Antenna Type	PCB layout antenna
Antenna Gain	-2 dBi

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, General 2.4GHz wireless transmitting mode
- B. On, Normal operation mode
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Rating Label
- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

According to clause 3.1, all tests were performed on model D7020 (Sensor modeule) in this report.

4.3 Special Accessories and Auxiliary Equipment

N/A

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

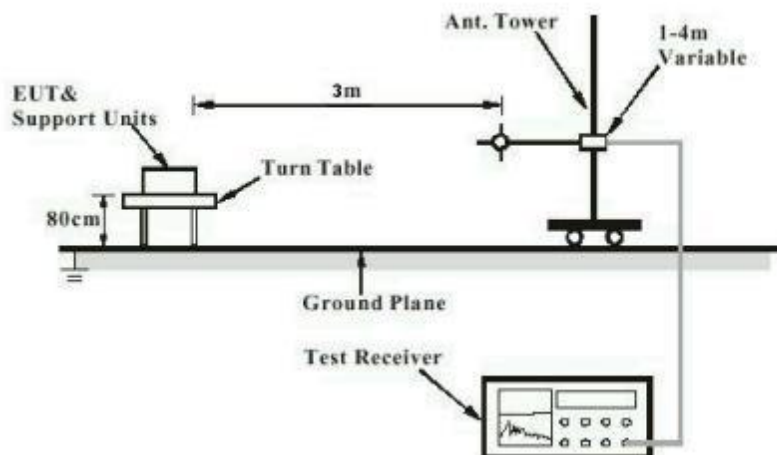


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

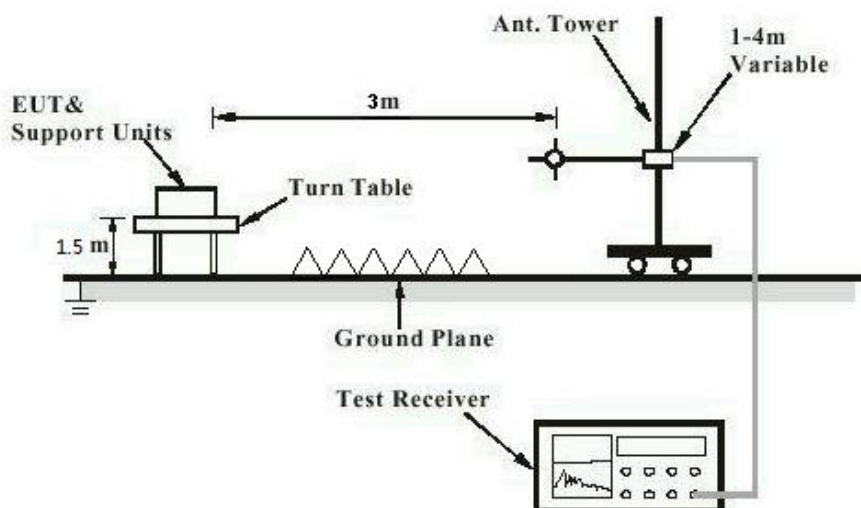


Diagram of Measurement Configuration for Mains Conduction Measurement

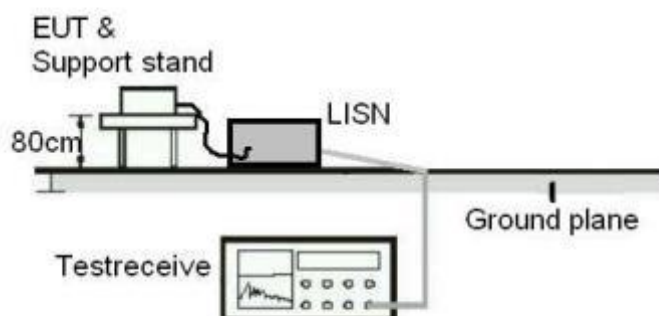
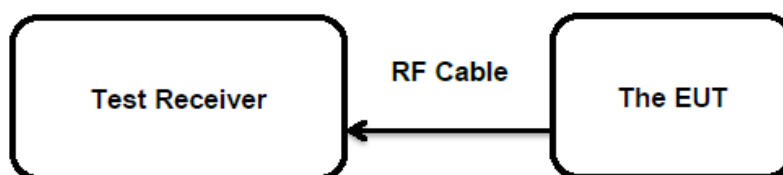


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is -2 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Fundamental & Harmonics Radiated Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.249(a)
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to FCC Part 15.209(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test result
Input voltage	: Fully charged battery
Operation mode	: A
Ambient temperature	: 24 °C
Relative humidity	: 45 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

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5.1.3 20dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.215
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 18.06.2020
Input voltage : Fully charged battery
Operation mode : A
Ambient temperature : 24 °C
Relative humidity : 45 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

5.1.4 Radiated Spurious Emission & Band Edge

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.249 (d) & FCC Part 15.205
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test result
Input voltage	: Fully charged battery
Operation mode	: A
Ambient temperature	: 24 °C
Relative humidity	: 45 %
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

7 List of Tables

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Appendix B: Test Results of General 2.4GHz

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APPENDIX B.3: TEST RESULTS OF RADIATED EMISSIONS IN RESTRICTED BANDS.....	7

Note: Testing was carried out within frequency range 9kHz to the tenth harmonics. The measurement results below 30MHz and 18GHz -26.5GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported.

Appendix B.1: Fundamental & Harmonics Radiated Emission

30MHz - 1GHz

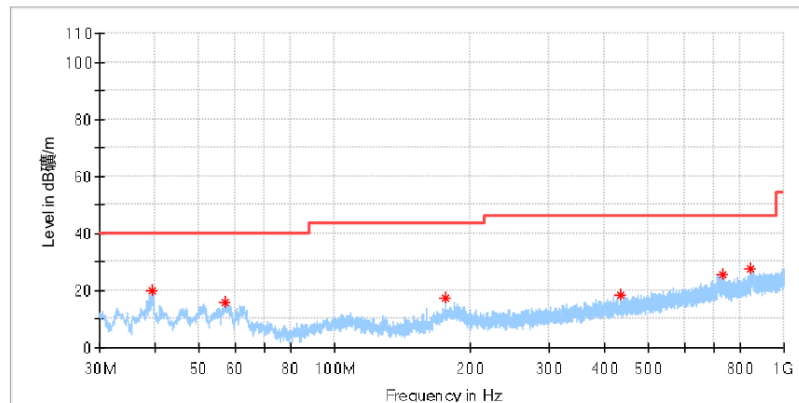
EMI Auto Test(1)

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Test Report

EUT Information

EUT Name:	Touchless Flush Mechanism (sensor module)
Model:	D7020
Test Mode:	TX
Test Voltage::	DC 4.5V From Battery
Remark:	Temp 24 Humi:45%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.409000	20.00	---	40.00	20.00	100.0	H	222.0	-20.6
56.917500	15.82	---	40.00	24.18	100.0	H	331.0	-18.9
176.470000	17.14	---	43.50	26.36	100.0	H	95.0	-21.1
432.113500	18.18	---	46.00	27.82	100.0	H	331.0	-13.6
728.400000	25.60	---	46.00	20.40	100.0	H	80.0	-7.9
844.848500	27.44	---	46.00	18.56	100.0	H	80.0	-6.0

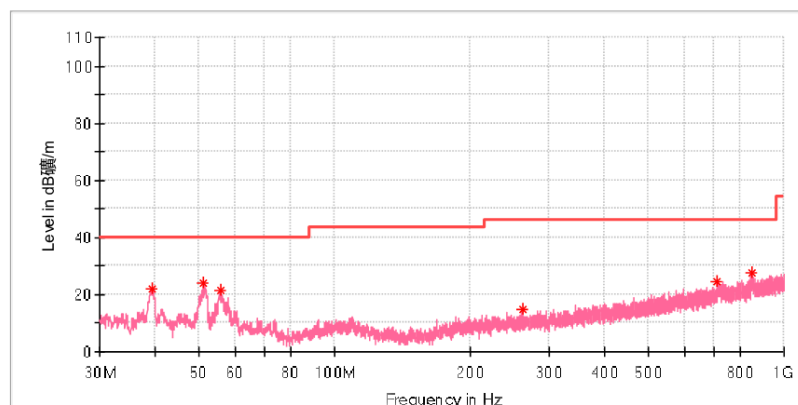
EMI Auto Test(1)

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Test Report

EUT Information

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Model:	D7020
Test Mode:	TX
Test Voltage::	DC 4.5V From Battery
Remark:	Temp 24 Humi:45%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
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Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.409000	22.01	---	40.00	17.99	100.0	V	144.0	-20.6
51.049000	23.95	---	40.00	16.05	100.0	V	0.0	-18.6
55.802000	21.60	---	40.00	18.40	100.0	V	72.0	-18.8
263.139500	14.62	---	46.00	31.38	100.0	V	242.0	-17.4
709.339500	24.66	---	46.00	21.34	100.0	V	253.0	-8.3
846.303500	27.55	---	46.00	18.45	100.0	V	0.0	-6.0

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1GHz - 18GHz

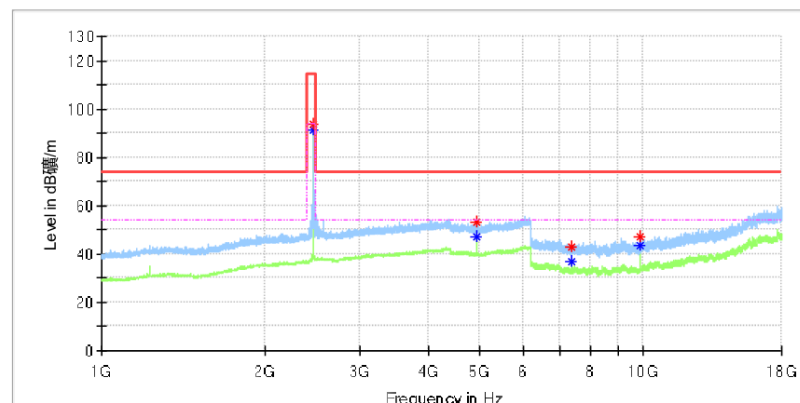
EMI Auto Test(1)

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Test Report

EUT Information

EUT Name:	Touchless Flush Mechanism (sensor module)
Model:	D7020
Test Mode:	TX
Test Voltage::	DC 4.5V From Battery
Remark:	Temp 24 Humi:45%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2459.500000	93.69	---	114.00	20.31	100.0	H	38.0	7.5
2460.000000	---	91.43	94.00	2.57	100.0	H	38.0	7.5
4919.500000	---	46.86	54.00	7.14	100.0	H	269.0	13.3
4919.500000	53.48	---	74.00	20.52	100.0	H	269.0	13.3
7379.508333	---	36.99	54.00	17.01	100.0	H	0.0	8.2
7380.983333	43.05	---	74.00	30.95	100.0	H	285.0	8.2
9839.808333	---	43.51	54.00	10.49	100.0	H	261.0	10.5
9840.300000	46.87	---	74.00	27.13	100.0	H	261.0	10.5

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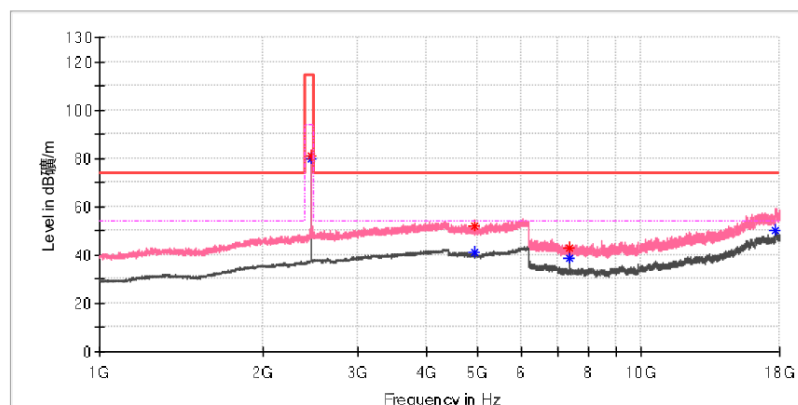
EMI Auto Test(1)

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Test Report

EUT Information

EUT Name:	Touchless Flush Mechanism (sensor module)
Model:	D7020
Test Mode:	TX
Test Voltage::	DC 4.5V From Battery
Remark:	Temp 24 Humi:45%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



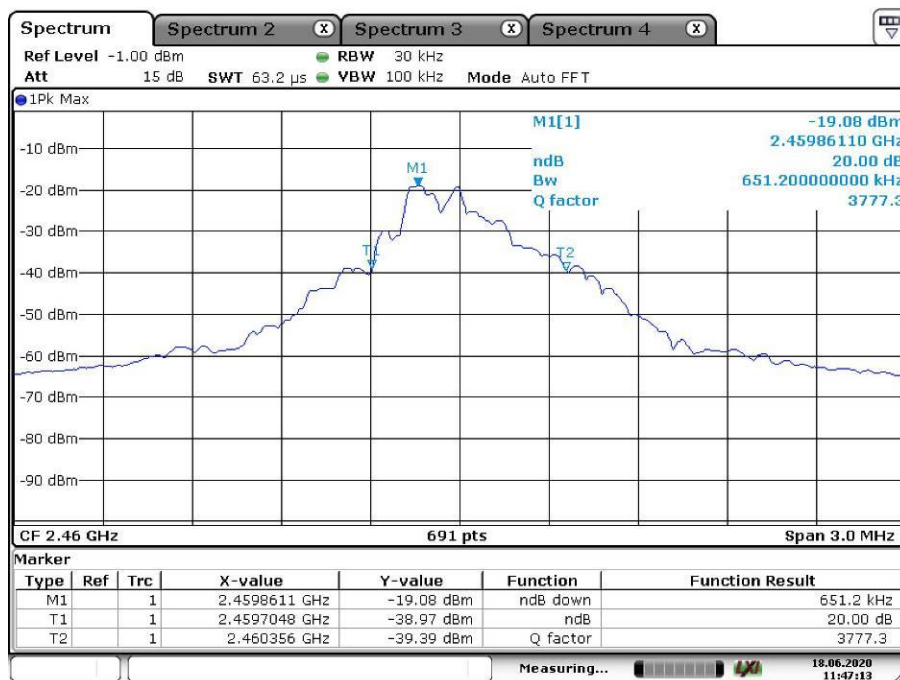
Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2460.000000	---	80.03	94.00	13.97	100.0	V	0.0	7.5
2460.000000	80.75	---	114.00	33.25	100.0	V	0.0	7.5
4918.500000	51.88	---	74.00	22.12	100.0	V	232.0	13.3
4919.500000	---	41.11	54.00	12.89	100.0	V	4.0	13.3
7380.000000	43.03	---	74.00	30.97	100.0	V	341.0	8.2
7380.000000	---	38.64	54.00	15.36	100.0	V	341.0	8.2
17699.100000	---	49.94	54.00	4.06	100.0	V	355.0	22.9

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Appendix B.2: Test Results of 20dB Bandwidth



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Appendix B.3: Test Results of Radiated Emissions in Restricted Bands

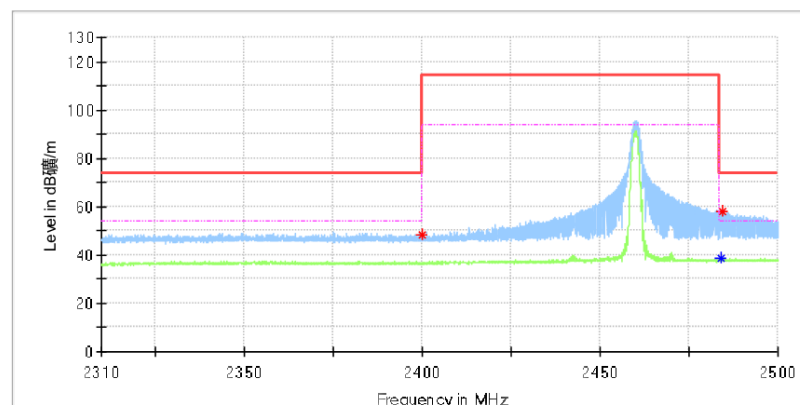
EMI Auto Test(1)

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Test Report

EUT Information

EUT Name:	Touchless Flush Mechanism (sensor module)
Model:	D7020
Test Mode:	TX
Test Voltage::	DC 4.5V From Battery
Remark:	Temp 24 Humi:45%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.250000	48.30	---	114.00	65.70	100.0	H	211.0	7.0
2483.877941	---	38.63	54.00	15.37	100.0	H	346.0	7.4
2484.464706	58.07	---	74.00	15.93	100.0	H	78.0	7.4

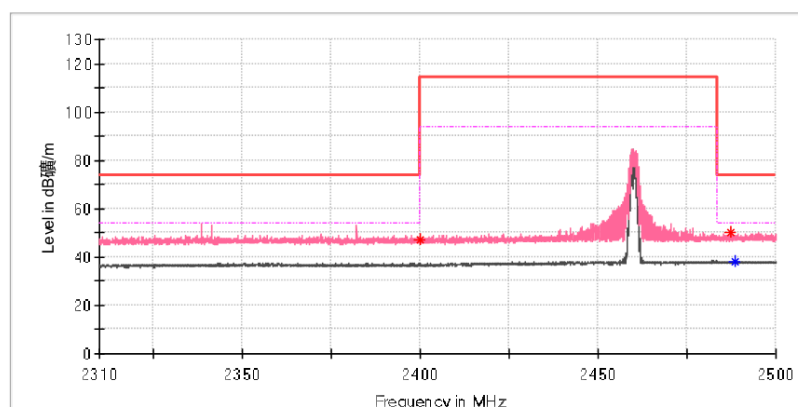
EMI Auto Test(1)

1 / 1

Test Report

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Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.082353	47.43	---	114.00	66.57	100.0	V	298.0	7.0
2487.510294	50.18	---	74.00	23.82	100.0	V	241.0	7.4
2488.376471	---	38.05	54.00	15.95	100.0	V	0.0	7.4

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