

# EMC

## TEST REPORT

**Report No.** : 150500374TWN-001  
**Model No.** : WS-20  
**Issued Date** : Jun. 18, 2015

**Applicant:** Microsoft Mobile Oy  
Keilalahdentie 4, 02150 Espoo, Finland

**Test Method/ Standard:** 47 CFR FCC Part 15.247 & ANSI C63.10 2009  
KDB 558074 D01 v03r03  
KDB 662911 D01 v02r01

**Test Site:** 93910  
**Test By:** Intertek Testing Services Taiwan Ltd.  
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,  
Shiang-Shan District, Hsinchu City, Taiwan

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**The test report was prepared by:**



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**These measurements were taken by:**



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**The test report was reviewed by:**

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### Revision History

Report No.	Issue Date	Revision Summary
150500374TWN-001	Jun. 18, 2015	Original report

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## 1. Summary of Test Data

Test Requirement	Applicable Rule (Section 15.247)	Result
Minimum 6 dB Bandwidth	15.247(a)(2) KDB 558074 D01 v03r03	Pass
Maximum Peak Conducted Output Power	15.247(b)(3) KDB 558074 D01 v03r03 KDB 662911 D01 v02r01	Pass
Power Spectral Density	15.247(e)	Pass
Emissions In Non-Restricted Frequency Bands	15.247(d)	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass
Emission On The Band Edge	15.247(d), 15.205	Pass
AC Power Line Conducted Emission	15.207	N/A
Antenna Requirement	15.203	Pass

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## 2. General Information

### 2.1 Identification of the EUT

Product:	Treasure Tag Plus
Model No:	WS-20
FCC ID:	PYAWS-20
Operating Frequency:	2402 MHz ~ 2480 MHz
Channel Number:	40 channels
Frequency of Each Channel:	2402+2 k MHz, k=0~39
Access scheme:	GFSK
Rated Power:	DC 3V
Power Cord:	N/A
Sample Received:	Jun. 01, 2015
Sample condition:	Workable
Test Date(s):	Jun. 01, 2015 ~ Jun. 08, 2015

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Note 2: When determining the test conclusion, the Measurement Uncertainty of test has been considered.

## 2.2 Description of EUT

Modulation mode	Transmit path
	Chain 0 / Main
BT4.0	V

Product SW/HW version : V4.0 / V03  
 Radio SW/HW version : V4.0 / V03  
 Test SW Version : cust\_prod\_test\_38K4P04P05.hex

## 2.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2.41 dBi  
 Antenna Type : PIFA antenna  
 Connector Type : Fixed

## 2.4 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Notebook PC	DELL	Latitude D610	N/A	Micro USB 1 meter × 1

## 2.5 Operation mode

The EUT was supplied with DC 3V from battery

We execute “Prodtest.exe” to set EUT in TX-Mode, and select different frequency by different command.

## 2.6 Applied test modes and channels

Test items	Mode	Channel	Antenna
Minimum 6 dB Bandwidth	BT4.0	Low , Middle , High	Chain0
Maximum peak conducted output power	BT4.0	Low , Middle , High	Chain0
Power Spectral Density	BT4.0	Low , Middle , High	Chain0
RF Antenna Conducted Spurious	BT4.0	Low , Middle , High	Chain0
Radiated spurious Emission 30MHz~1GHz	BT4.0	Low	Chain0
Radiated Spurious Emission 1GHz~10th Harmonic	BT4.0	Low , Middle , High	Chain0
Emission on the Band Edge	BT4.0	Low , High	Chain0

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**2.7 Duty cycle of EUT**

Mode	Channel	Frequency (MHz)	Signal on time(ms)	Total signal transmit time(ms)	Duty cycle	Duty Cycle factor
BT4.0	Low	2402	1	1	1.000	0.000
	Middle	2442	1	1	1.000	0.000
	High	2480	1	1	1.000	0.000



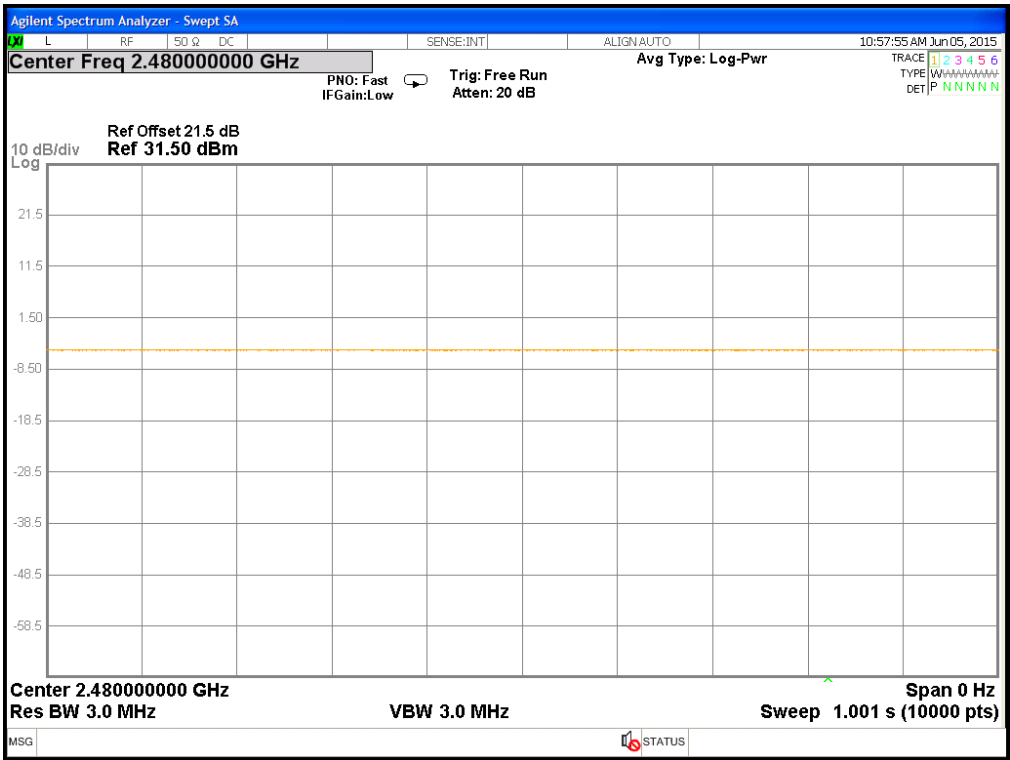
Duty Cycle @ GFSK mode Low Channel



Duty Cycle @ GFSK mode Middle Channel



Duty Cycle @ GFSK mode High Channel



### 3. Minimum 6 dB Bandwidth

#### 3.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(a)(2) KDB 558074 D01 v03r03	

#### 3.2 Limit for minimum 6dB bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

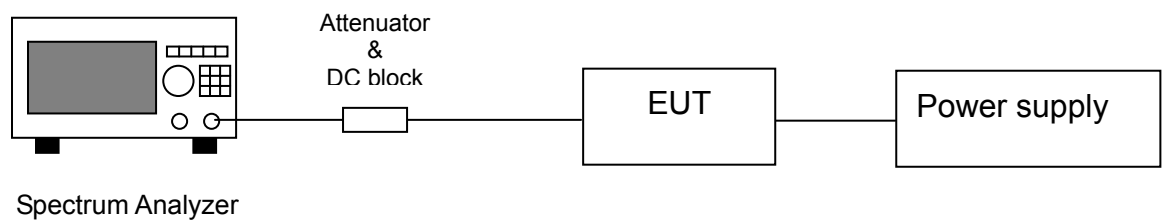
#### 3.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Between two times and five times the occupied bandwidth
Attenuation	Auto

#### 3.4 Test procedure

1. The transmitter output was connected to the spectrum analyzer.
2. Test was performed in accordance with clause 8.1 option1 of KDB 558074 D01
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

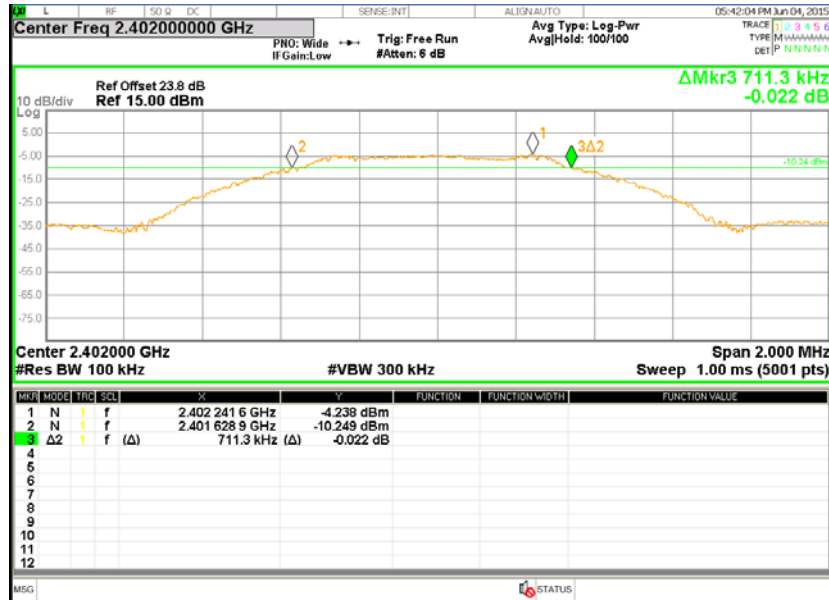
### 3.5 Test diagram



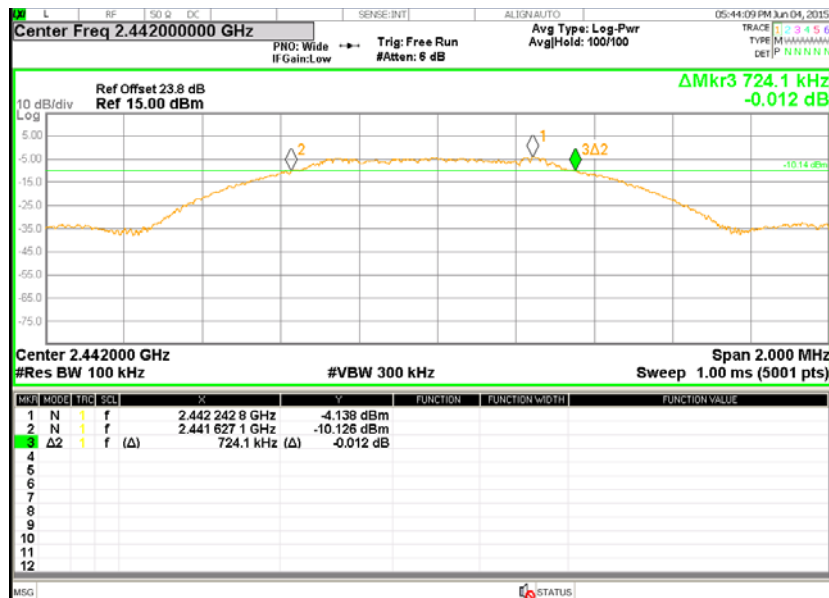
### 3.6 Test results

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
BT4.0	Low	2402	0.711	0.5	Pass
	Middle	2442	0.724	0.5	Pass
	High	2480	0.725	0.5	Pass

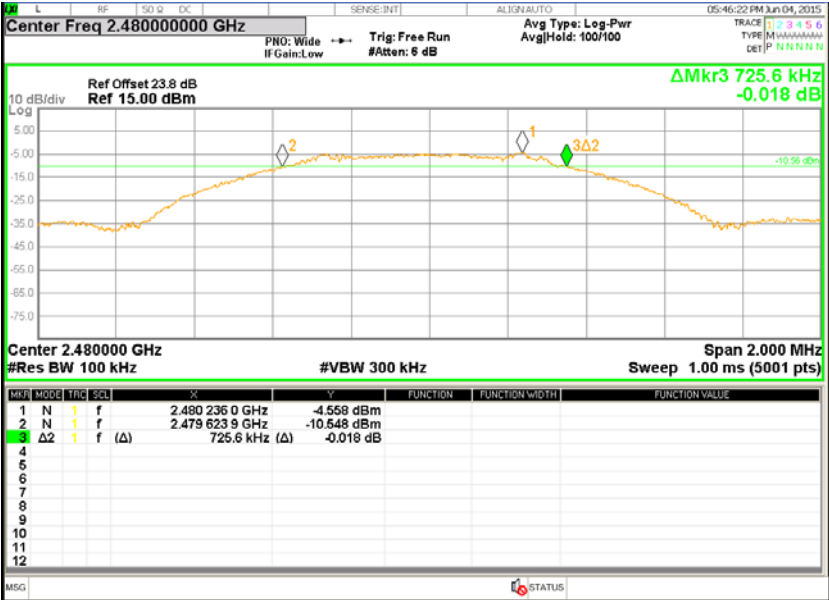
Chain0 : 6dB Bandwidth @ GFSK mode Ch Low



Chain0 : 6dB Bandwidth @ GFSK mode Ch Middle



Chain0 : 6dB Bandwidth @ GFSK mode Ch High



## 4. Maximum Peak Conducted Output Power

### 4.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(b)(3) KDB 558074 D01 v03r03 KDB 662911 D01 v02r01	

### 4.2 Limit for maximum peak conducted output power

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

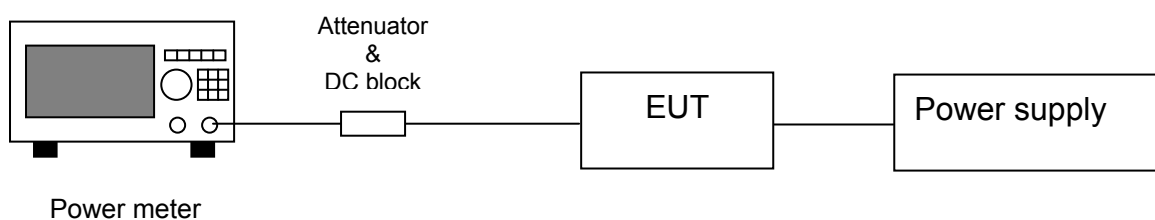
### 4.3 Measuring instrument setting

Power meter	
Power meter	Setting
Bandwidth	65MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

### 4.4 Test procedure

Test procedures refer to clause 9.1.3 peak power meter method and clause 9.2.3.2 measurement using a gated RF average power meter of KDB 558074 D01.

### 4.5 Test diagram



#### 4.6 Test result

Mode	Channel	Frequency (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum (PK) (dBm)	Maximum (PK) (mW)	Limit (dBm)	Margin (dB)
BT4.0	Low	2402	-3.05	0.50	1.42	1.387	30	-28.58
	Middle	2442	-3.13	0.49	1.74	1.493	30	-28.26
	High	2480	-3.65	0.43	1.84	1.528	30	-28.16



## 5. Power Spectral Density

### 5.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(e) KDB 558074 D01 v03r03 KDB 662911 D01 v02r01	

### 5.2 Limit for power spectrum density

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

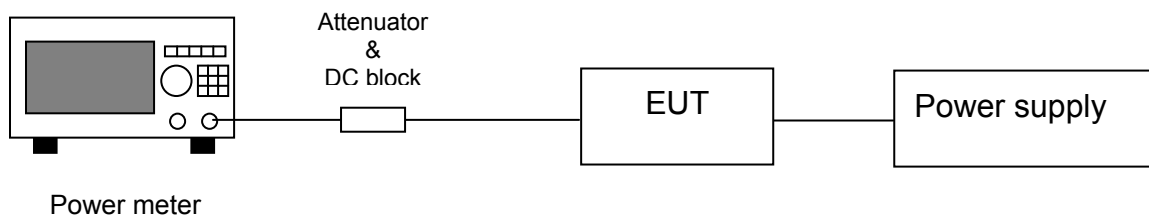
### 5.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	$\geq 3$ kHz
VBW	$\geq 3 \times$ RBW
Sweep	Auto couple
Trace	Max hold
Span	1.5 times x 6dB bandwidth
Attenuation	Auto

## 5.4 Test procedure

1. Test procedure refer to clause 10.2 method PKPSD (peak PSD) of KDB 558074 D01 and clause E) 2) b) measure and sum spectral maxima across the outputs of KDB 662911
2. Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Use the peak marker function to determine the maximum amplitude level within the RBW.

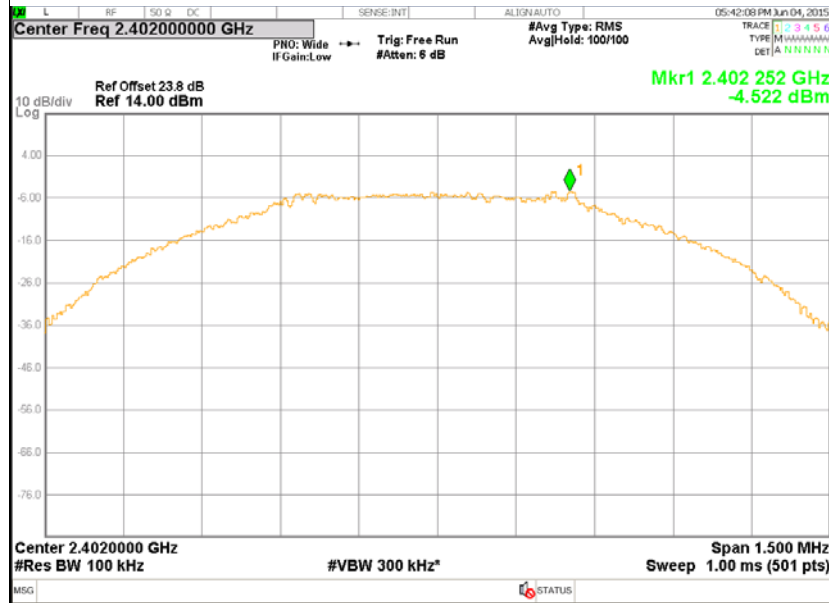
## 5.5 Test diagram



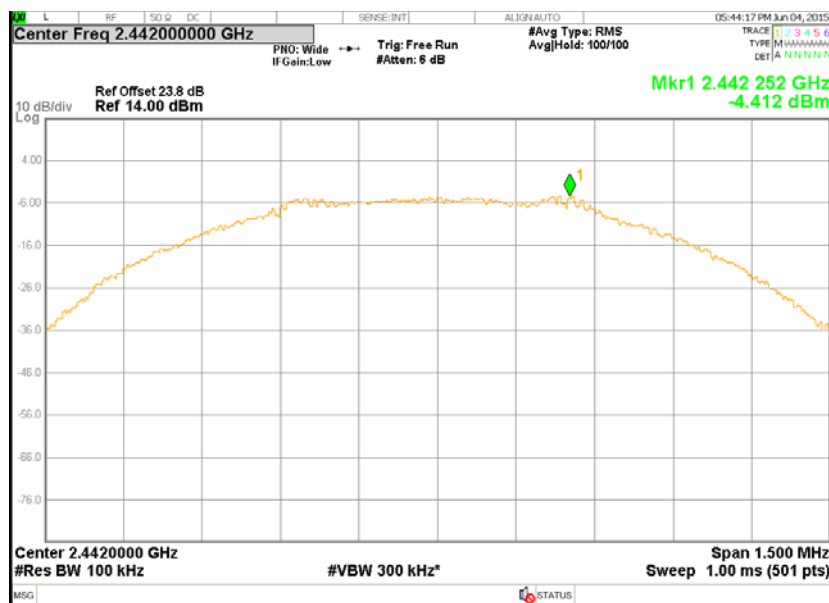
## 5.6 Test results

Mode	Channel	Frequency (MHz)	PSD		Limit (dBm)	Margin (dB)
			(dBm)	(mw)		
BT4.0	Low	2402	-4.52	0.35	8	-12.52
	Middle	2442	-4.41	0.36	8	-12.41
	High	2480	-4.68	0.34	8	-12.68

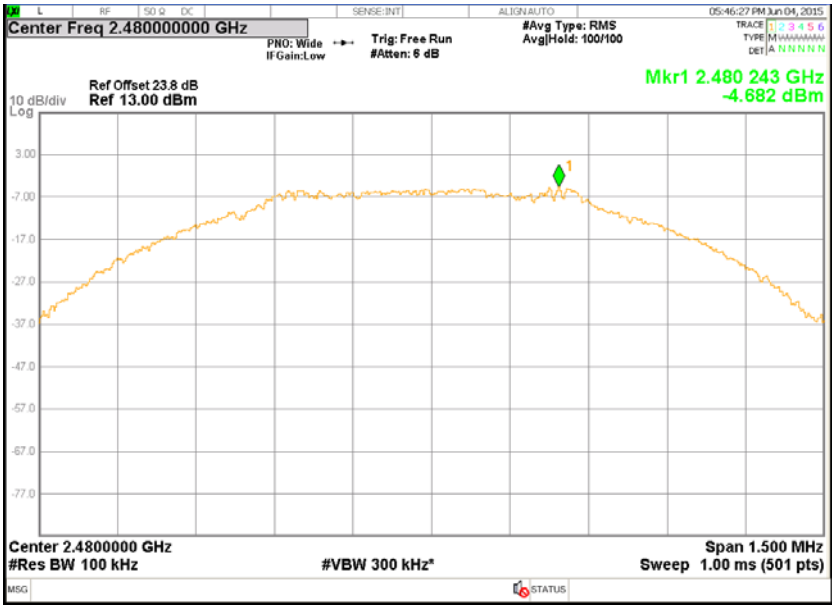
Chain0 : Power Spectral Density @ GFSK mode Ch Low



Chain0 : Power Spectral Density @ GFSK mode Ch Middle



Chain0 : Power Spectral Density @ GFSK mode Ch High



## 6. Emissions In Non-Restricted Frequency Bands

### 6.1 Operating environment

Temperature:	20	°C
Relative Humidity:	55	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d)	

### 6.2 Limit for emissions in non-restricted frequency bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

### 6.3 Measuring instruments setting

#### Reference level measurement

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	$\geq 100$ kHz
VBW	$\geq 3 \times$ RBW
Sweep	Auto couple
Trace	Max hold
Span	$\geq 1.5$ time 6dB bandwidth
Attenuation	Auto

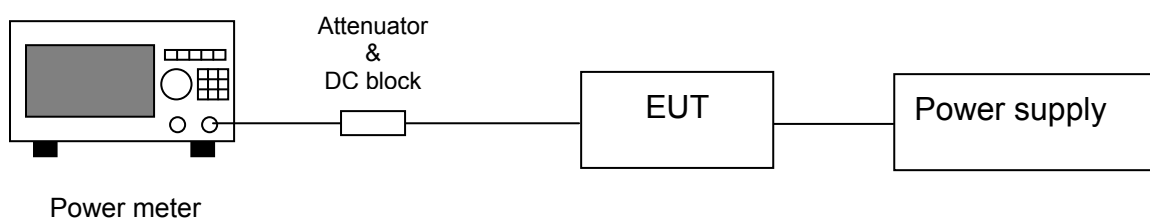
## Emission level measurement

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	$\geq 100$ kHz
VBW	$\geq 3 \times$ RBW
Sweep	Auto couple
Trace	Max hold
Attenuation	Auto

### 6.4 Test procedure

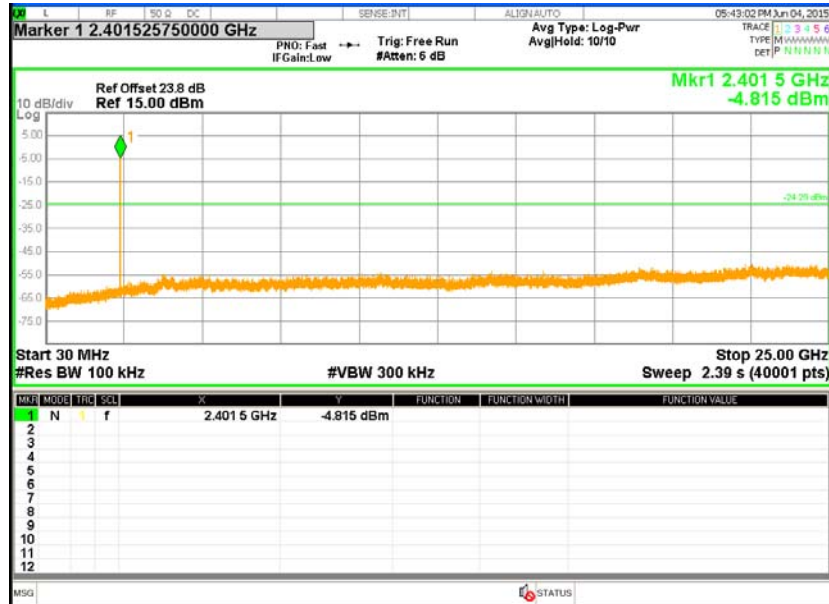
1. The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
2. Set instrument center frequency to center frequency
3. Use the parameter configured in clause 6.3 to measure
4. Use the peak marker function to determine the maximum amplitude level.

### 6.5 Test diagram

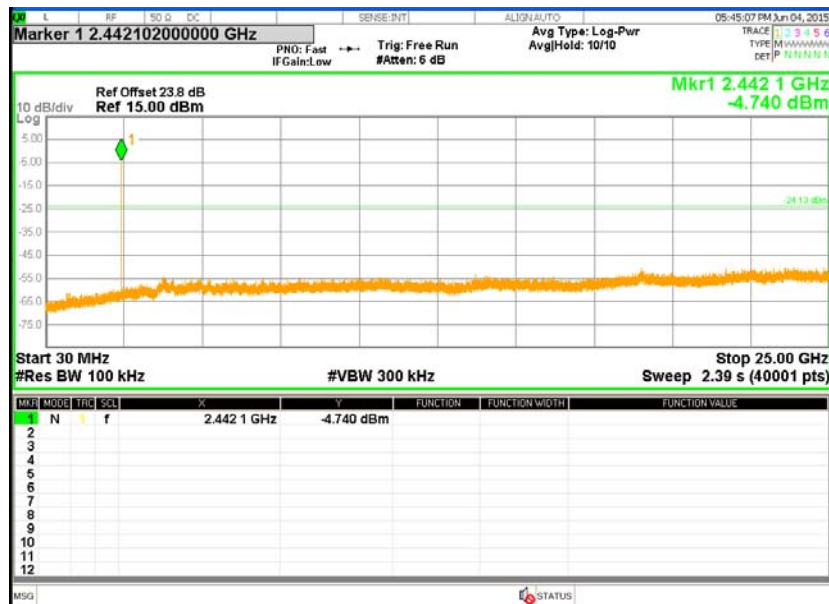


## 6.6 Test results

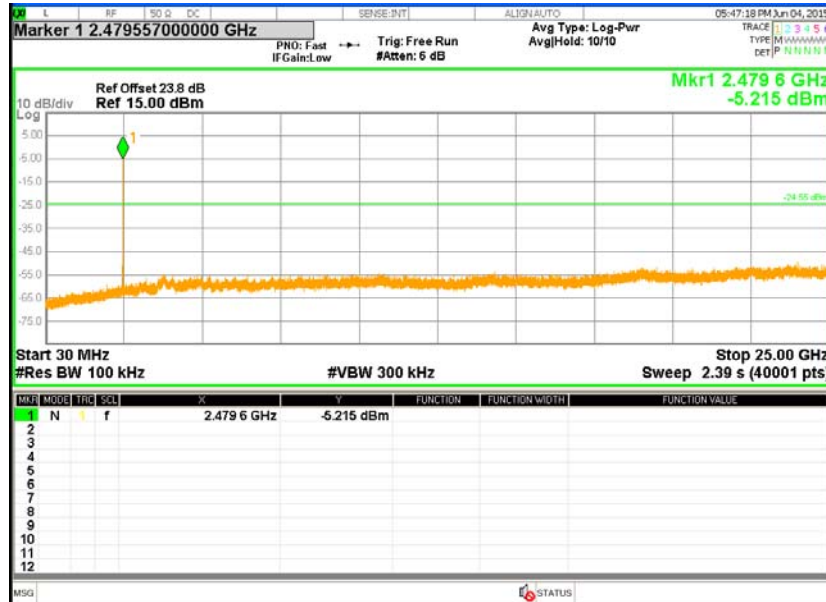
### Chain0 : Conducted Spurious @ GFSK mode Ch Low



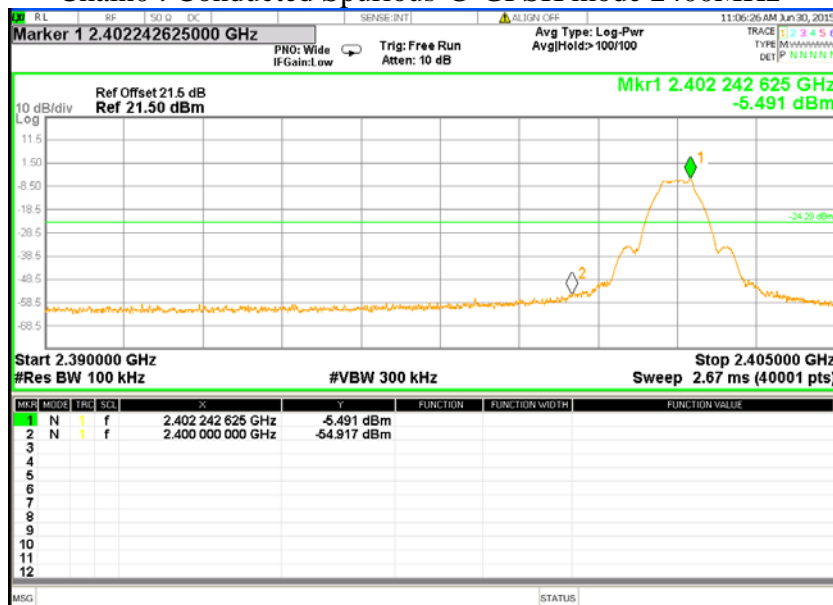
### Chain0 : Conducted Spurious @ GFSK mode Ch Middel



Chain0 : Conducted Spurious @ GFSK mode Ch High

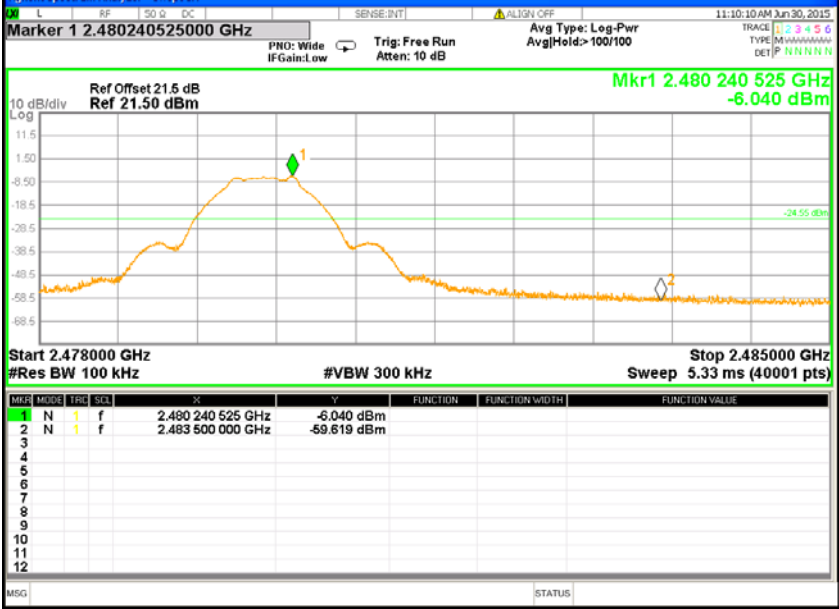


Chain0 : Conducted Spurious @ GFSK mode 2400MHz





Chain0 : Conducted Spurious @ GFSK mode 2483.5MHz



## 7. Emissions In Restricted Frequency Bands (Radiated emission measurements)

### 7.1 Operating environment

Temperature:	20	°C
Relative Humidity:	55	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d), 15.205, 15.209	

### 7.2 Limit for emission in restricted frequency bands (Radiated emission measurement)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	2400/F(kHz)	30
1.705~30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

### 7.3 Measuring instrument setting

#### Below 1GHz measurement

Receiver settings	
Receiver function	Setting
Detector	QP
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Attenuation	Auto

#### Above 1GHz measurement

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	1MHz
VBW	3MHz for Peak; 10Hz for Average
Sweep	Auto couple
Start Frequency	1GHz
Stop Frequency	Tenth harmonic
Attenuation	Auto

## **7.4 Test procedure**

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The 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 companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization
4. If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
5. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

## 7.5 Test diagram

The signal is maximized through rotation and placement in the two orthogonal axes.

X-plane



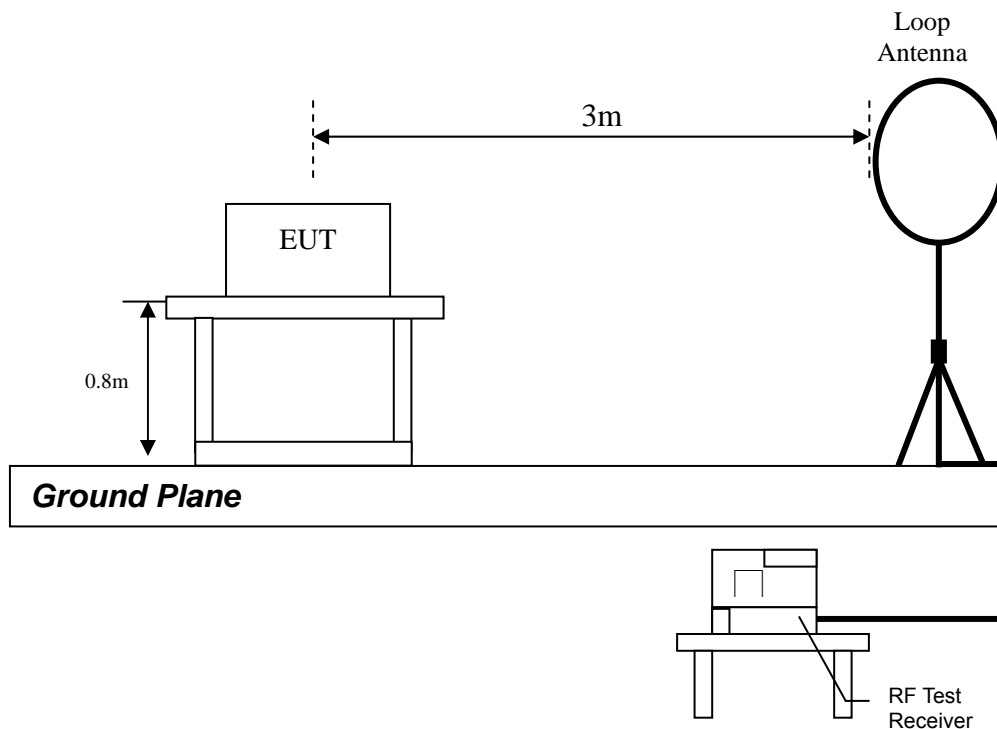
Y-plane



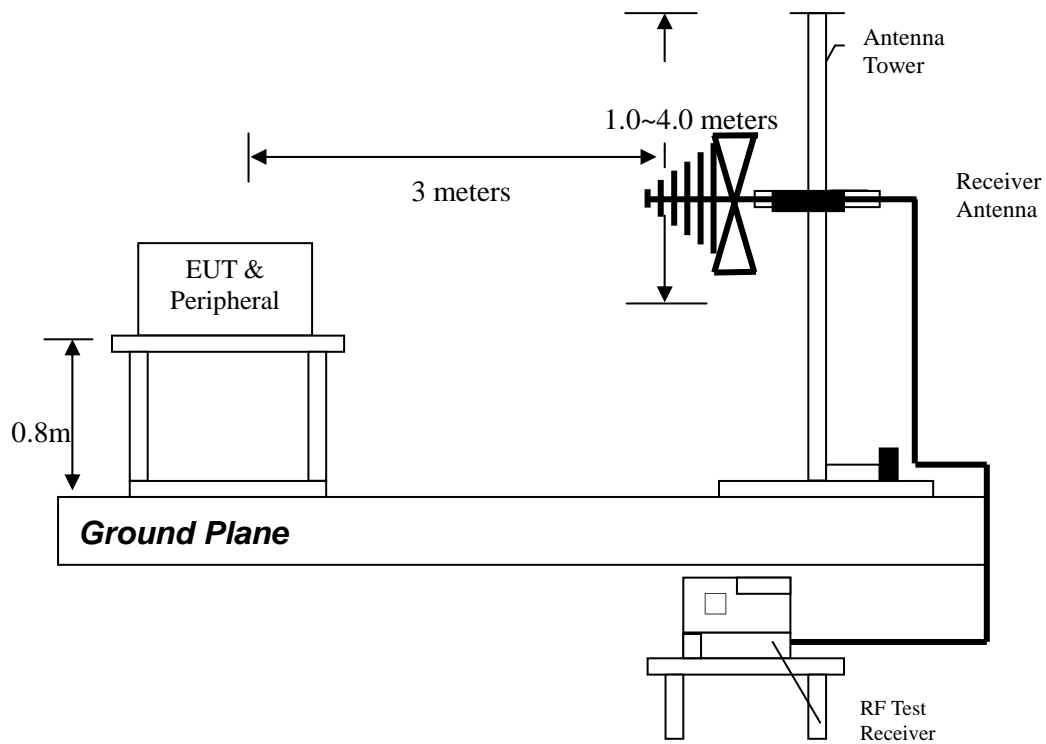
After verifying two axes, we found the maximum electromagnetic field was occurred at Y-plane configuration. The final test data was executed under this configuration.

## 7.6 Test configuration

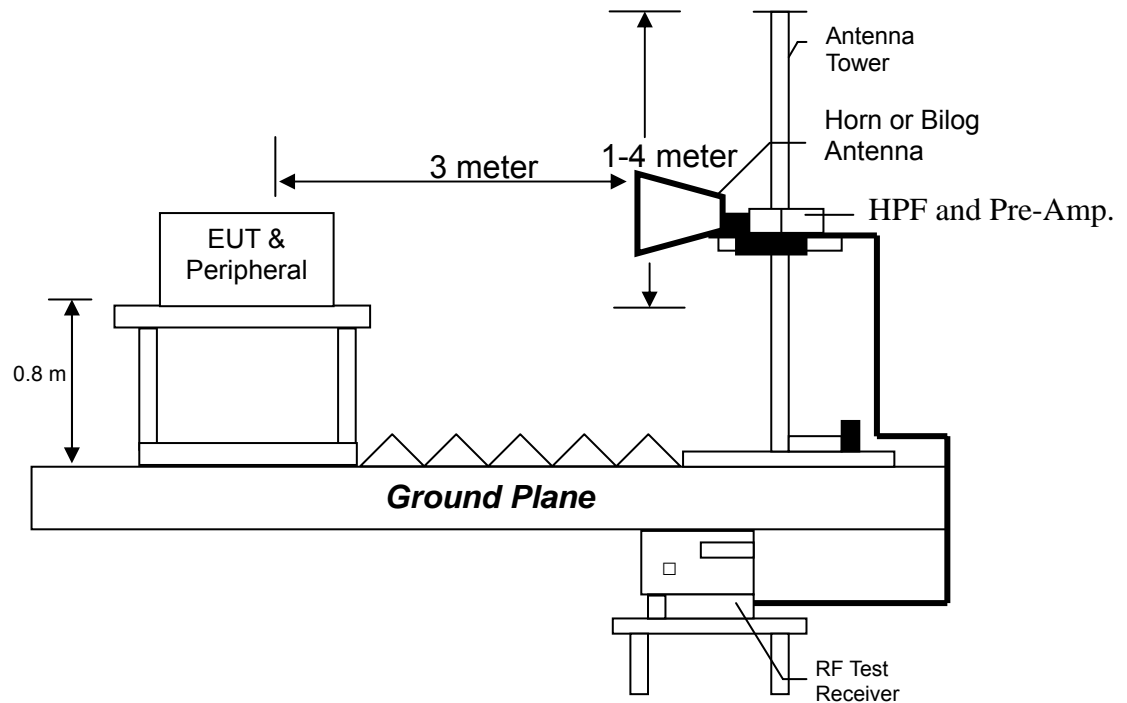
### 7.6.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



## 7.6.2 Radiated emission below 1GHz using Bilog Antenna



### 7.6.3 Radiated emission above 1GHz using Horn Antenna



## 7.7 Test result

### 7.7.1 Measurement results: frequencies 9kHz to 30MHz

EUT : WS-20  
Test mode : TX mode Low channel  
Test Voltage : DC 3 V

Polarity (circle)	Frequency (MHz)	Detection value	factor (dB/m)	Reading (dBμV)	value (dBμV/m)	Limit @ 3m (dBμV/m)	Tolerance (dB)
Plane	0.02	QP	91.56	16.99	108.55	121.58	-13.04
Plane	0.04	QP	84.18	22.35	106.53	115.56	-9.04
Plane	0.07	QP	66.09	17.12	83.21	110.70	-27.49
Coaxial	0.02	QP	91.56	16.33	107.89	121.58	-13.70
Coaxial	0.04	QP	84.18	19.47	103.65	115.56	-11.92
Coaxial	0.07	QP	66.09	19.00	85.09	110.70	-25.61
Remark: Corr. Factor = Antenna Factor + Cable Loss - PreAmplifier Gain							



## 7.7.2 Measurement results: frequencies below 1 GHz

The test was performed on EUT under GFSK continuously transmitting mode. The worst case occurred at Tx Low channel

EUT : WS-20  
Worst Case : GFSK at Tx Low channel  
Test Voltage : DC 3 V

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Level (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	224.38	QP	14.76	0.38	15.14	46.00	-30.86
Vertical	643.33	QP	24.66	0.85	25.51	46.00	-20.49
Vertical	864.12	QP	28.19	0.31	28.50	46.00	-17.50
Horizontal	77.18	QP	14.00	0.91	14.91	40.00	-25.09
Horizontal	147.00	QP	15.23	3.47	18.70	43.50	-24.80
Horizontal	224.38	QP	16.58	4.94	21.52	46.00	-24.48
Horizontal	294.20	QP	17.81	1.42	19.23	46.00	-26.77
Horizontal	337.61	QP	18.57	0.08	18.65	46.00	-27.35
Horizontal	535.76	QP	22.05	1.49	23.54	46.00	-22.46

Remark: Corr. Factor = Antenna Factor + Cable Loss

EUT : WS-20  
Worst Case : GFSK at Tx Low channel  
Test Voltage : DC 3.3 V

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Level (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	658.42	QP	24.89	1.40	26.29	46.00	-19.71
Vertical	705.60	QP	25.79	1.27	27.06	46.00	-18.94
Vertical	790.53	QP	27.16	0.95	28.11	46.00	-17.89
Vertical	824.49	QP	27.66	0.46	28.12	46.00	-17.88
Vertical	935.84	QP	28.90	0.43	29.33	46.00	-16.67
Vertical	986.79	QP	29.47	0.55	30.02	54.00	-23.98
Horizontal	682.96	QP	25.37	0.15	25.52	46.00	-20.48
Horizontal	730.14	QP	26.21	0.48	26.69	46.00	-19.31
Horizontal	820.72	QP	27.61	0.36	27.97	46.00	-18.03
Horizontal	864.12	QP	28.19	0.85	29.04	46.00	-16.96
Horizontal	922.63	QP	28.80	0.66	29.46	46.00	-16.54
Horizontal	949.05	QP	29.01	0.81	29.82	46.00	-16.18

Remark: Corr. Factor = Antenna Factor + Cable Loss

EUT : WS-20  
Worst Case : GFSK at Tx Low channel  
Test Voltage : DC 2.5 V

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Level (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	605.58	QP	24.31	1.84	26.15	46.00	-19.85
Vertical	645.21	QP	24.68	0.77	25.45	46.00	-20.55
Vertical	747.12	QP	26.49	0.76	27.25	46.00	-18.75
Vertical	833.93	QP	27.80	0.38	28.18	46.00	-17.82
Horizontal	728.25	QP	26.17	0.31	26.48	46.00	-19.52
Horizontal	803.74	QP	27.36	0.35	27.71	46.00	-18.29
Horizontal	945.27	QP	28.98	0.07	29.05	46.00	-16.95
Horizontal	971.69	QP	29.28	0.23	29.51	54.00	-24.49

Remark: Corr. Factor = Antenna Factor + Cable Loss

### 7.7.3 Measurement results: frequency above 1GHz

EUT : WS-20  
Test Voltage : DC 3 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Channel Low	3990	PK	V	40.38	-1.57	39.84	38.27	74.00	-35.73
	4804	PK	V	40.13	-0.10	45.20	45.10	74.00	-28.90
	4804	PK	H	40.13	-0.10	43.21	43.11	74.00	-30.89
Channel Middle	3180	PK	V	39.87	-3.75	41.39	37.64	74.00	-36.36
	3990	PK	V	40.38	-1.57	39.67	38.10	74.00	-35.90
	4884	PK	V	39.99	0.16	45.04	45.20	74.00	-28.80
	4884	PK	H	39.99	0.16	42.90	43.06	74.00	-30.94
Channel High	3990	PK	V	40.38	-1.57	40.53	38.96	74.00	-35.04
	4960	PK	V	39.84	0.41	42.57	42.98	74.00	-31.02
	4960	PK	H	39.84	0.41	39.68	40.09	74.00	-33.91

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss -  
Pre\_Amplifier Gain

EUT : WS-20  
Test Voltage : DC 3.3 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Channel Low	4804	PK	V	40.13	-0.10	45.22	45.12	74.00	-28.88
	3180	PK	H	39.87	-3.75	42.68	38.93	74.00	-35.07
	4804	PK	H	40.13	-0.10	36.71	36.61	74.00	-37.39
Channel Middle	4884	PK	V	39.99	0.16	44.53	44.69	74.00	-29.31
	4884	PK	H	39.99	0.16	35.84	36.00	74.00	-38.00
Channel High	3330	PK	V	39.95	-3.87	41.86	37.99	74.00	-36.01
	4960	PK	V	39.84	0.41	37.57	37.98	74.00	-36.02
	4960	PK	H	39.84	0.41	35.63	36.04	74.00	-37.96

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss -  
Pre\_Amplifier Gain

EUT : WS-20  
Test Voltage : DC 2.5 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Channel Low	4804	PK	V	40.13	-0.10	45.10	45.00	74.00	-29.00
	4804	PK	H	40.13	-0.10	35.46	35.36	74.00	-38.64
Channel Middle	3180	PK	V	39.87	-3.75	43.58	39.83	74.00	-34.17
	4884	PK	V	39.99	0.16	43.37	43.53	74.00	-30.47
	4884	PK	H	39.99	0.16	36.51	36.67	74.00	-37.33
Channel High	3180	PK	V	39.87	-3.75	40.58	36.83	74.00	-37.17
	4960	PK	V	39.84	0.41	38.63	39.04	74.00	-34.96
	4960	PK	H	39.84	0.41	35.14	35.55	74.00	-38.45

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss -  
Pre\_Amplifier Gain

## 8. Emission On Band Edge

### 8.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d), 15.205,	

### 8.2 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	1MHz
VBW	3MHz for Peak; 10Hz for Average
Sweep	Auto couple
Restrict bands	2310~2390MHz
	2483.5 ~2500MHz
Attenuation	Auto

### 8.3 Test procedure

The test procedure is the same as clause 7.4

## 8.4 Test results

EUT : WS-20  
Test Voltage : DC 3 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
BT4.0	2367.38	PK	V	33.74	18.75	52.49	74	-21.51	2310~2390
	2390.00	AV	V	33.85	5.41	39.26	54	-14.74	
	2483.50	PK	V	34.30	18.86	53.16	74	-20.84	2483.5~2500
	2483.50	AV	V	34.30	6.80	41.10	54	-12.90	
Remark: Correction Factor = Antenna Factor + Cable Loss									

EUT : WS-20  
Test Voltage : DC 3.3 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
BT4.0	2353.30	PK	V	33.68	18.27	51.95	74	-22.05	2310~2390
	2390.00	AV	V	33.85	5.24	39.09	54	-14.91	
	2486.97	PK	V	34.32	18.65	52.97	74	-21.03	2483.5~2500
	2483.50	AV	V	34.30	6.24	40.54	54	-13.46	
Remark: Correction Factor = Antenna Factor + Cable Loss									

EUT : WS-20  
Test Voltage : DC 2.5 V

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
BT4.0	2329.32	PK	V	33.56	18.91	52.47	74	-21.53	2310~2390
	2390.00	AV	V	33.85	5.28	39.13	54	-14.87	
	2486.66	PK	V	34.32	18.77	53.09	74	-20.91	2483.5~2500
	2483.50	AV	V	34.30	6.23	40.53	54	-13.47	
Remark: Correction Factor = Antenna Factor + Cable Loss									



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## 9. AC Power Line Conducted Emission

Since the EUT is not connected to AC source, therefore, the test can be waived.

## Appendix A: Test equipment list

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2014/12/02	2015/12/01
Spectrum Analyzer	Rohde & Schwarz	FSP30	100137	2014/06/16	2015/06/15
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2014/08/29	2017/08/27
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2014/09/16	2017/09/14
Broadband Antenna	Schwarzbeck	VULB 9168	9168-172	2013/08/08	2015/08/07
Loop Antenna	RolfHeine	LA-285	02/10033	2014/03/18	2016/03/16
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2014/09/15	2015/09/14
Power Meter	Anritsu	ML2495A	0844001	2014/11/12	2015/11/11
Power Sensor	Anritsu	MA2411B	0738452	2014/11/12	2015/11/11
Two-Line V-Network	Rohde & Schwarz	ESH3-Z5	838979/014	2014/10/05	2015/10/04
Signal Analyzer	Agilent	N9030A	MY51380492	2014/09/19	2015/09/18
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2015/05/06	2016/05/04
966-2(B) Cable	JUNFLON	SMA / J12J100880-00	AUG-26-08-002	2015/05/09	2016/05/07
RF Cable	SUHNER	SUCOFLEX 102	CB0006	2015/05/06	2016/05/04
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2015/02/24	2016/02/23
Brand		Software		Version	
ADT		Radiated test system		7.5.14	
Audix		e3		4.2004-1-12k	

## Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of  $k=2$ .

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.15 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.23 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Conducted Output power	0.86 dB
Radiated electromagnetic disturbances in the frequency range from 9kHz to 30MHz	2.92 dB
Conducted disturbance measurements at a mains port from 9 kHz to 30 MHz using a 50 $\Omega$ /50 $\mu$ H +5 $\Omega$ artificial mains network (AMN)	2.5 dB