



Certificate Number: 5055.02

TEST REPORT FOR BLUETOOTH TESTING

Report No.: SRTC2020-9004(F)-20052105(E)

Product Name: SMB Gateway

Product Model: GW-1000-NWE

Applicant: Honeywell (Beijing) Technology Solutions Lab Co., Ltd.

Manufacturer: Honeywell (Beijing) Technology Solutions Lab Co., Ltd.

Specification: FCC Part 15, Subpart C (2019)

FCC ID: 2ARTN-00001

The State Radio_monitoring_center Testing Center (SRTC) 15th Building, No.30Shixing Street, Shijingshan District, Beijing, P.R.China Tel: 86-10-57996183 Fax: 86-10-57996388



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1. GENERAL INFORMATION

1.1 Notes of the test report

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1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
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1.3 Applicant's details

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1.4 Manufacturer's details

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City:	Beijing		
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Email:	John.Zhang@Honeywell.com		



1.5 Test Environment

Date of Receipt of test sample at SRTC:	2020-05-21
Testing Start Date:	2020-05-21
Testing End Date:	2020-09-24

Environmental Data:	Temperature (°C)	Humidity (%)	
Ambient	25	30	

Normal Supply Voltage (V d.c.):	24.0
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2 DESCRIPTION OF THE DEVICE UNDER TEST

2.1Final Equipment Build Status

Frequency Range	2.402GHz~2.480GHz		
Number of Channel	40		
Modulation Type	GFSK		
Equipment Class	DTS		
Channel Spacing	2MHz		
Data Rate	1Mbps		
Power Supply	Charger or DC Power Supply		
Hardware Version	201001		
Software Version	1.1.2.0		
Original Sample	Sample 8#		
Variant Sample	GATEWAY-DV2EE-02		
Antenna type	Refer to Note		
Antenna connector	Refer to Note		

Note: EUT shares the same RF chip with the certified device (FCC ID: 2ARTN-00001), and it verified that no hardware or software changed on RF chip. Thus, we re-use all results for conducted signal test, see report No.: SRTC2018-9004(F)-18102401(E).

Note: Antenna requirement (FCC part 15.203)

Professional installed device, only the approved antenna by the manufacturer permitted to be used.

Note: The antenna provides to the EUT, please refer to the following table:

SN	Model	Antenna gain(dBi)	Frequency band (GHz) Antenna type		Connecter Type		
Ant1	N/A	2.90	2.4GHz~2.4835GHz	Fixed External Antenna	N/A		
Ant2	N/A	2.57	2.4GHz~2.4835GHz	Fixed External Antenna	N/A		
Ant3	Ant3 N/A -0.31 2.4GHz~2.4835GHz Fixed External Antenna N/A						
All antennas considered during Test, only worst-case results reported.							



2.2Description of Test Modes

40 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

2.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
EUT CONFIGURE MODE	RE ≥ 1G	RE<1G	PLC	APCM	-
GFSK					-

Where

 $RE \ge 1G$: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0,19,39	GFSK	1



Radiated Emission Test (Below 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0,19,39	GFSK	1

Power Line Conducted Emission Test:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	19	GFSK	1

Antenna Port Conducted Measurement:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

2.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered. Duty cycle = 59.4%Correction factor = $10^* \log (1/duty cycle) = 10^* \log (1/0.594) = 2.26 dB$

2.4 EUT Operating conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

2.5 Support Equipment

The following support equipment was used to exercise the DUT during testing:

NO.	Name	Model	Manufacturer
1	Laptop	Latitude 5490	DELL
2	Laptop	Latitude 5490	DELL



<u>3 REFERENCE SPECIFICATION</u>

Specification	Version	Title
FCC part15 Subpart C	2019	Intentional radiators
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074D01 V05r02	April 2, 2019	Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

4 KEY TO NOTES AND RESULT CODES

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.



5 RESULT SUMMARY

No.	Test case	Reference	Verdict
1	Transmitter Output Power	15.247(b)(3))	Pass*
2	Spurious Radiated Emissions	15.205/15.209/15.247(d)	Pass
3	AC Power line Conducted Emission	15.207	Pass
4	Antenna requirement	15.203	Pass(refer to section 2.1)

Note: Pass*, it verified that the power is identical with original device, no increase.

This Test Report Is Issued by:	Checked by:
Mr. Peng Zhen	Mr. Li Bin 🔄 👔
影板	(A 7RA)
Tested by:	Issued date:
Mr. He Dengshun (157273 1)	20201130



<u>6 TEST RESULT</u>

6.1 Transmitter Output Power

6.1.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

6.1.2 Test limit

Part15.247(b)(3) The maximum permissible conducted output power is 1 Watt.

6.1.3 Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.3 ANSI C63.10-2013 – Section 11.9.2.3.2 KDB 558074 D01 v05r02 – Section 8.3.1.3

6.1.4Test Settings

Peak Power Measurement

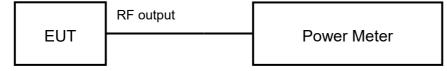
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Average Power Measurement

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

6.1.5Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.1.6Test result

The test results are shown in Appendix A.



6.2 Spurious Radiated Emissions

6.2.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

6.2.2 Test Description

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

6.2.3 Test limit

Part15.205, 15.209, 15.247(d)

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in below Table per Section 15.209. The spectrum shall be investigated from the lowest radio frequency signal generated in the device

Frequency [MHz]	Field strength	Measured Distance	
	[µV/m]	[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	
Radiated Limits			

Part15.35(b):

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit

Used conversion factor: Limit $(dB\mu V/m) = 20 \log (Limit (\mu V/m)/1\mu V/m)$

Frequency [MHz]	Detector	Únit (dBµV/m)
30~88	Quasi-peak	40.0
88~216	Quasi-peak	43.5
216~960	Quasi-peak	46.0
960~1000	Quasi-peak	54.0
1000 \sim 5th harmonic of the highest frequency	Average	54.0
or 40GHz, whichever is lower	Peak	74.0

Conversion Radiated limits



6.2.4 Test Procedure Used

KDB 558074 D01 DTS Meas Guidance v05r02r02 – Section 12.2.7

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at chamber room. 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. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case 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 Quasi-Peak Detect Function and recorded the reading with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer complied the following setting:

Frequency	RBW
9-150kHz	200-300Hz
0.15-30MHz	9-10kHz

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for $30MHz \sim 1GHz$) / 1.5 meters (for above 1GHz) above the ground in chamber room for test. 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 height of antenna 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 quasi-peak detect function and recorded the reading with Maximum Hold Mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detector and recorded the reading with Maximum Hold Mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.



For the radiated emission test above 1GHz:

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.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz. If duty cycle of test signal is < 98%, the duty factor need added to measured value.

4. All modes of operation were investigated and the worst-case emissions are reported.

6.2.5 Test Settings

Average Field Strength Measurements per Section 12.2.7 of KDB 558074 (Part 15.35)

Frequency	Detector	
<1000MHz	Quasi-peak	
>1000MHz	Peak and average	

Peak Field Strength Measurements per Section 12.2.7of KDB 558074 (Part 15.35)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW is set depending on measurement frequency, as specified in following table

Frequency	RBW
9-150kHz	200-300Hz
0.15-30MHz	9-10kHz
30-1000MHz	100-120kHz
>1000MHz	1MHz

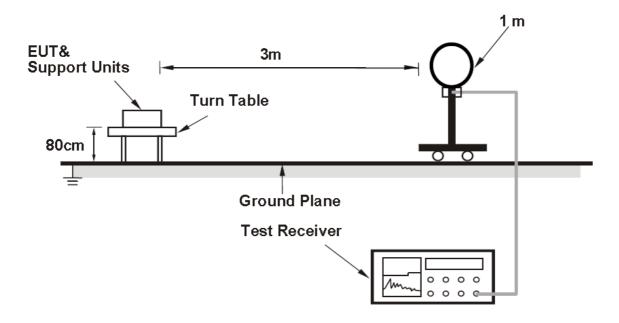
3. VBW = 3MHz

- 4. Detector = peak
- 5. Sweep time = auto couple
- 6. Trace mode = max hold
- 7. Trace was allowed to stabilize

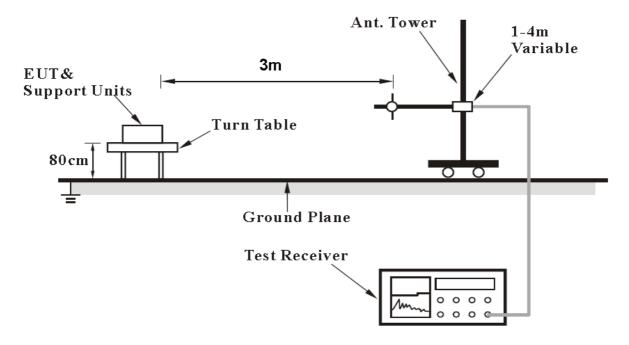


6.2.6 Test Setup

For Radiated emission below 30MHz

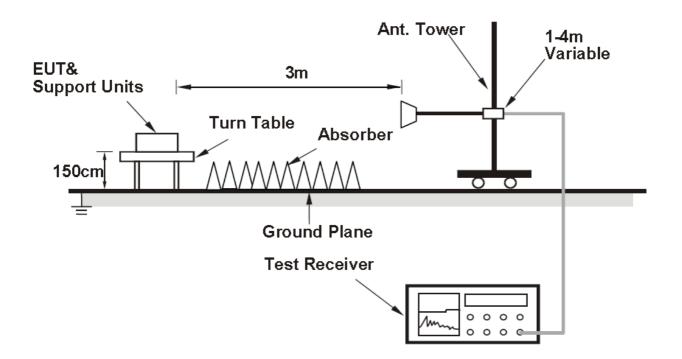


For Radiated emission 30MHz to 1GHz





For Radiated emission above 1GHz



6.2.7 Test result

The test results are shown in Appendix B.



6.3 AC Power line Conducted Emission

6.3.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

6.3.2 Test limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)				
	Quasi-peak	Average			
0.15-0.5	66 to 56 *	56 to 46 *			
0.5-5	56	46			
5-30	60	50			

* Decreases with the logarithm of the frequency.

The measurement is made according to ANSI C63.10-2013

6.3.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

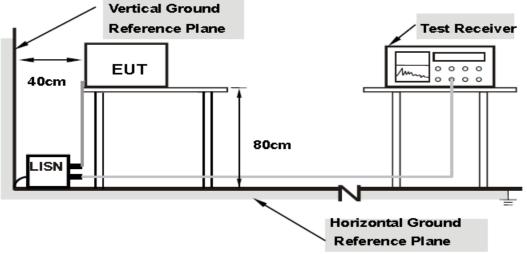
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

The EUT shall test under the power AC120V/60Hz.



6.3.4 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.3.5 Test result

The test results are shown in Appendix B.



7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty			
Occupied Bandwidth	3kHz			
Peak power output	0.67dB			
Band edge compliance	1.20dB			
	30MHz~1GHz 2.83dB			
Spurious emissions	1GHz~12.75GHz 2.50dB			
	12.75GHz \sim 25GHz	2.75dB		



8 TEST EQUIPMENTS

No.	Name/ Model Manufacturer S		S/N	Cal date	Cal Due date
1.	Power Meter E4416A	Agilent	MY52370013	2020.03.01	2021.02.29
2.	Power Sensor E9327A	Agilent	MY52420006	2020.03.01	2021.02.29
3.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA			
4.	Turn table Diameter:5m	FRANKONIA			
5.	Antenna master SAC(MA4.0)	MATURO			
6.	9.080m×5.255m×3.525m Shielding room	FRANKONIA			
7.	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2020.08.20	2021.08.19
8.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2020.08.20	2021.08.19
9.	ESI 40 EMI test receiver	R&S	100015	2020.08.20	2021.08.19
10.	ESCS30 EMI test receiver	R&S	100029	2020.08.20	2021.08.19
11.	HL562 Receive antenna	R&S	100167	2020.08.20	2021.08.19
12.	ENV216 AMN	R&S	3560.6550.12	2020.08.20	2021.08.19



APPENDIX B – TEST DATA OF RADIATED EMISSION

Spurious Radiated Emissions

The measurement results are obtained as described below: Measure Level = Reading Level + cable loss + antenna factor

Sample calculation: (92.56 dBuV/m) = (58.56 dB μ V) + (8.90 dB) + (25.10 dB), the corresponding frequency is 2402MHz.

Carrier frequency (MHz): 2402 Channel No.:0 Test Mode: GFSK (LE) Polarity: Vertical Detector: Peak

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2402	92.56	58.56	N/A	N/A	8.90	25.10
2	2390	41.60	7.60	-32.40	74.00	8.90	25.10

Carrier frequency (MHz): 2402 Channel No.:0 Test Mode: GFSK (LE) Polarity: Horizontal Detector: Peak

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2402	84.47	50.47	N/A	N/A	8.90	25.10
2	2390	37.75	3.75	-36.25	74.00	8.90	25.10

Carrier frequency (MHz): 2402 Channel No.:0 Test Mode: GFSK (LE) Polarity: Vertical Detector: Average

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2402	86.25	52.25	N/A	N/A	8.90	25.10
2	2390	28.89	-5.11	-25.11	54.00	8.90	25.10



Carrier frequency (MHz): 2402 Channel No.:0 Test Mode: GFSK (LE) Polarity: Horizontal Detector: Average

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2402	78.51	44.51	N/A	N/A	8.90	25.10
2	2390	26.20	-7.80	-27.80	54.00	8.90	25.10

Carrier frequency (MHz): 2480 Channel No.:39 Test Mode: GFSK (LE) Polarity: Vertical Detector: Peak

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2480	84.38	50.38	N/A	N/A	8.90	25.10
2	2483.5	33.35	-0.65	-40.65	74.00	8.90	25.10

Carrier frequency (MHz): 2480 Channel No.:39 Test Mode: GFSK (LE) Polarity: Horizontal Detector: Peak

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2480	78.11	44.11	N/A	N/A	8.90	25.10
2	2483.5	28.67	-5.33	-45.33	74.00	8.90	25.10

Carrier frequency (MHz): 2480 Channel No.:39 Test Mode: GFSK (LE) Polarity: Vertical Detector: Average

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2480	79.82	45.82	N/A	N/A	8.90	25.10
2	2483.5	20.39	-13.61	-33.61	54.00	8.90	25.10



Carrier frequency (MHz): 2480 Channel No.:39 Test Mode: GFSK (LE) Polarity: Horizontal Detector: Average

No	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	cable loss (dB)	antenna factor (dB)
1	2480	74.76	40.76	N/A	N/A	8.90	25.10
2	2483.5	18.26	-15.74	-35.74	54.00	8.90	25.10

Sample Calculations

Determining Spurious Emissions Levels

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

The measurement results are obtained as described below:

Result= Pmea + ARpl

Sample calculation: $(35.07 \text{ dB}\mu\text{V/m}) = (51.37 \text{ dB}\nu\text{V}) + (-16.3 \text{ dB/m})$, the corresponding frequency is 250.016MHz.

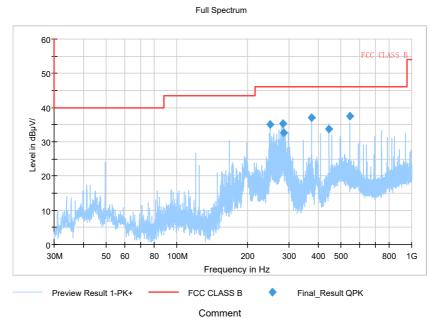
The worst case attitude: The mobile lay down.

Channel No.:19

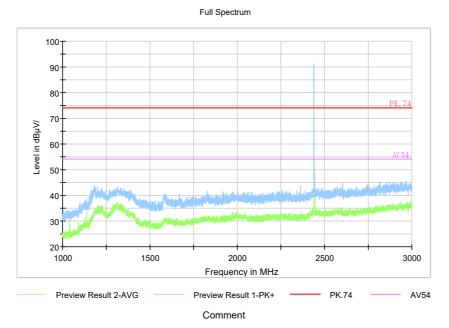
Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
250.016	35.07	-16.3	51.37	Vertical	46.00
283.684	35.19	-15.6	50.79	Vertical	46.00
285.147	32.66	-15.6	48.26	Vertical	46.00
375.001	36.95	-12.6	49.55	Vertical	46.00
445.471	33.83	-10.6	44.43	Vertical	46.00
544.468	37.49	-8.1	45.59	Vertical	46.00



Channel No.:19



Frequency Range: 30MHz-1000 MHz Detector: QP mode Modulation type: GFSK (LE)

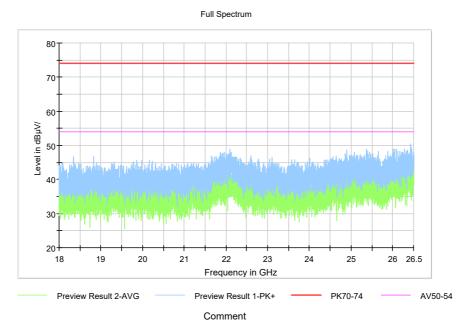


Frequency Range: 1GHz -3GHz Detector: Av mode and PK mode Modulation type: GFSK (LE)



Full Spectrum 80 PK 70 60 50 Level in dBµV/ 40 30 20 10 0. 5G 10G 3G 6 7 8 9 18G Frequency in Hz Preview Result 2-AVG Preview Result 1-PK+ PK.74 AV54 Comment

Frequency Range: 3GHz-18GHz Detector: Av mode and PK mode Modulation type: GFSK (LE)



Frequency Range: 18GHz-25GHz Detector: Av mode and PK mode Modulation type: GFSK (LE)

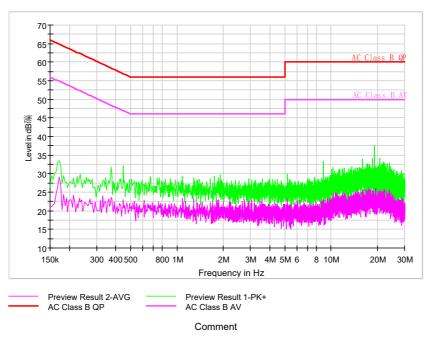


AC Power line Conducted Emission

A "reference path loss" Corr.(dB) is established and the L_{cable} +ATT+VDF is the attenuation of " reference path loss", and including the cable loss, the attenuation of the attenuator, the voltage division factor of AMN.

The measurement results are obtained as described below:

Presult=Pmea+ Corr.(dB)



L+N Line

MEASUREMENT RESULT:

QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)	Pmea QuasiPeak (dBµV)	Pmea Average (dBµV)

---End of Test Report---