
TEST REPORT FOR BLUETOOTH TESTING

Report No.: SRTC2020-9004(F)-20052103(D)

Product Name: Smart IO

Product Model: IO-10MIXR-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-00003

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)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
City:	Beijing
Country or Region:	P.R.China
Contacted person:	Liu Jia
Tel:	+86 10 57996183
Fax:	+86 10 57996388
Email:	liujiaf@srtc.org.cn

1.3 Applicant's details

Company:	Honeywell (Beijing) Technology Solutions Lab Co., Ltd.
Address:	A1 Building, C&W Industry Zone, No.14 Jiuxianqiao Road, Chaoyang District, Beijing, 100015, P.R. China
City:	Beijing
Country or Region:	China
Contacted person:	Zhang John
Tel:	010 56696736
Fax:	---
Email:	John.Zhang@Honeywell.com

1.4 Manufacturer's details

Company:	Honeywell (Beijing) Technology Solutions Lab Co., Ltd.
Address:	A1 Building, C&W Industry Zone, No.14 Jiuxianqiao Road, Chaoyang District, Beijing, 100015, P.R. China
City:	Beijing
Country or Region:	China
Contacted person:	Zhang John
Tel:	010 56696736
Fax:	---
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:	2020-07-29

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

2.1 Final Equipment Build Status

Frequency Range	2.402GHz~2.480GHz
Number of Channel	79
Modulation Type	GFSK, $\pi/4$ DQPSK, 8DPSK
Duplex Mode	TDD
Channel Spacing	1MHz
Data Rate	1Mbps, 2 Mbps, 3 Mbps
Power Supply	Charger or DC Power Supply
Hardware Version	100
Software Version	1.0.0.0
Original Sample	Sample 8#
Variant Sample	IO Sample 2#
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(D).

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	Connector 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	N/A	-0.31	2.4GHz~2.4835GHz	Fixed External Antenna	N/A
All antennas considered during Test, only worst-case results reported.					

2.2 Description of Test Modes

79 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	16	2418	32	2434	48	2450	64	2466
1	2403	17	2419	33	2435	49	2451	65	2467
2	2404	18	2420	34	2436	50	2452	66	2468
3	2405	19	2421	35	2437	51	2453	67	2469
4	2406	20	2422	36	2438	52	2454	68	2470
5	2407	21	2423	37	2439	53	2455	69	2471
6	2408	22	2424	38	2440	54	2456	70	2472
7	2409	23	2425	39	2441	55	2457	71	2473
8	2410	24	2426	40	2442	56	2458	72	2474
9	2411	25	2427	41	2443	57	2459	73	2475
10	2412	26	2428	42	2444	58	2460	74	2476
11	2413	27	2429	43	2445	59	2461	75	2477
12	2414	28	2430	44	2446	60	2462	76	2478
13	2415	29	2431	45	2447	61	2463	77	2479
14	2416	30	2432	46	2448	62	2464	78	2480
15	2417	31	2433	47	2449	63	2465		

2.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	-
GFSK, π /4DQPSK, 8DPSK	√	√	√	√	-

Where

RE $\geq$ 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 78	0, 39, 78	GFSK, π /4DQPSK, 8DPSK	1Mbps, 2 Mbps, 3 Mbps

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 78	0, 39, 78	GFSK, $\pi/4$ DQPSK, 8DPSK	1Mbps, 2 Mbps, 3 Mbps

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 78	39	GFSK	1Mbps

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 78	0, 39, 78	GFSK, $\pi/4$ DQPSK, 8DPSK	1Mbps, 2 Mbps, 3 Mbps

2.3 Duty Cycle of Test Signal

Modulation Type	Duty Cycle
GFSK(DH1)	30.56%
GFSK(DH3)	43.57%
GFSK(DH5)	46.10%
$\pi/4$ DQPSK(DH1)	30.61%
$\pi/4$ DQPSK(DH3)	43.62%
$\pi/4$ DQPSK(DH5)	46.08%
8DPSK(DH1)	31.02%
8DPSK(DH3)	43.71%
8DPSK(DH5)	46.22%

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:
NA

3 REFERENCE SPECIFICATION

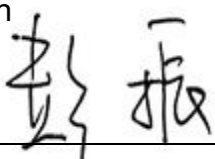
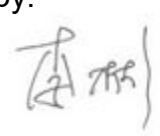
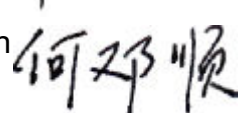
Specification	Version	Title
FCC part15 Subpart C	2019	Intentional radiators
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074D01 V05r02	April 2, 2019	Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum 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	Peak Transmitter Output Power	15.247(b)(1)	Pass
2	Spurious Radiated Emissions	15.205/15.209	Pass
3	AC Power line Conducted Emission	15.207	Pass
4	Antenna requirement	15.203	Pass (refer to section 2.1)

This Test Report Is Issued by: Mr. Peng Zhen 	Checked by: Mr. Li Bin 
Tested by: Mr. He Dengshun 	Issued date: 20201027

6 TEST RESULT

6.1 Peak Transmitter Output Power

6.1.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

6.1.2 Test limit

FCC Part15.247(b)(1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band:1watt.

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW) →

Modulation type	GFSK	$\pi/4$ DQPSK	8DPSK
Maximum Output Power	30.0dBm	30.0dBm	30.0dBm

For all other frequency hopping systems in the 2400-2483.5 MHz band:0.125 watts.

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW) →

Modulation type	GFSK	$\pi/4$ DQPSK	8DPSK
Maximum Output Power	21.0dBm	21.0dBm	21.0dBm

6.1.3 Test Procedure Used

ANSI C63.10-2013 – Section 7.8.5

ANSI C63.10-2013 – Section 11.9.2.3.2 method AVGPM-G

6.1.4 Test Settings

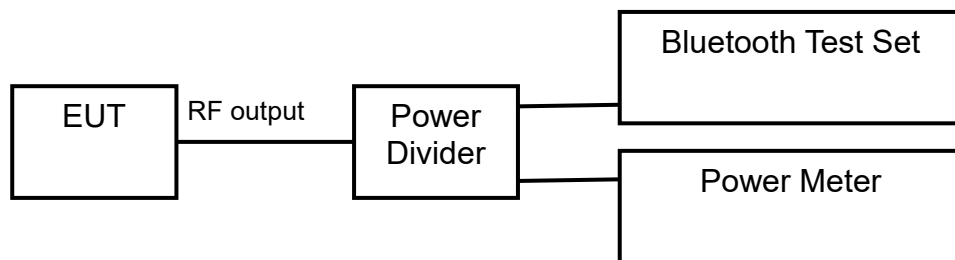
Peak Power Measurement

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 the occupied bandwidth.

Method AVGPM-G (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.

6.1.5 Test Setup



6.1.6 Test 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 [$\mu\text{V/m}$]	Measured 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

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 $\mu\text{V/m}$) = 20 log (Limit ($\mu\text{V/m}$)/1 $\mu\text{V/m}$)

Frequency [MHz]	Detector	Unit (dB $\mu\text{V/m}$)
30~88	Quasi-peak	40.0
88~216	Quasi-peak	43.5
216~960	Quasi-peak	46.0
960~1000	Quasi-peak	54.0
1000~5th harmonic of the highest frequency or 40GHz, whichever is lower	Average	54.0
	Peak	74.0

Conversion Radiated limits

6.2.4 Test Procedure Used

ANSI C63.10-2013 – Section 11.13

For Radiated emission below 30MHz

- 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.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Both X and Y axes of the antenna are set to make the measurement.
- 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.
- The test-receiver system was set to Quasi-Peak Detect Function and recorded the reading with Maximum Hold Mode.

NOTE:

- 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

- The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 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.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- 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.
- 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 120 kHz 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

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

Peak Field Strength Measurements

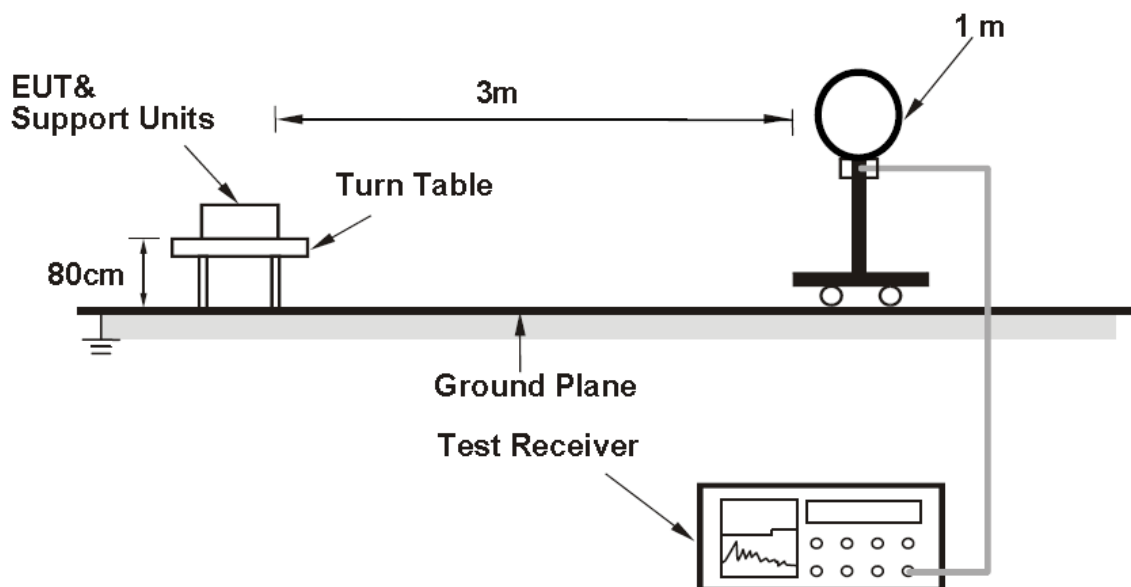
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in following table

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

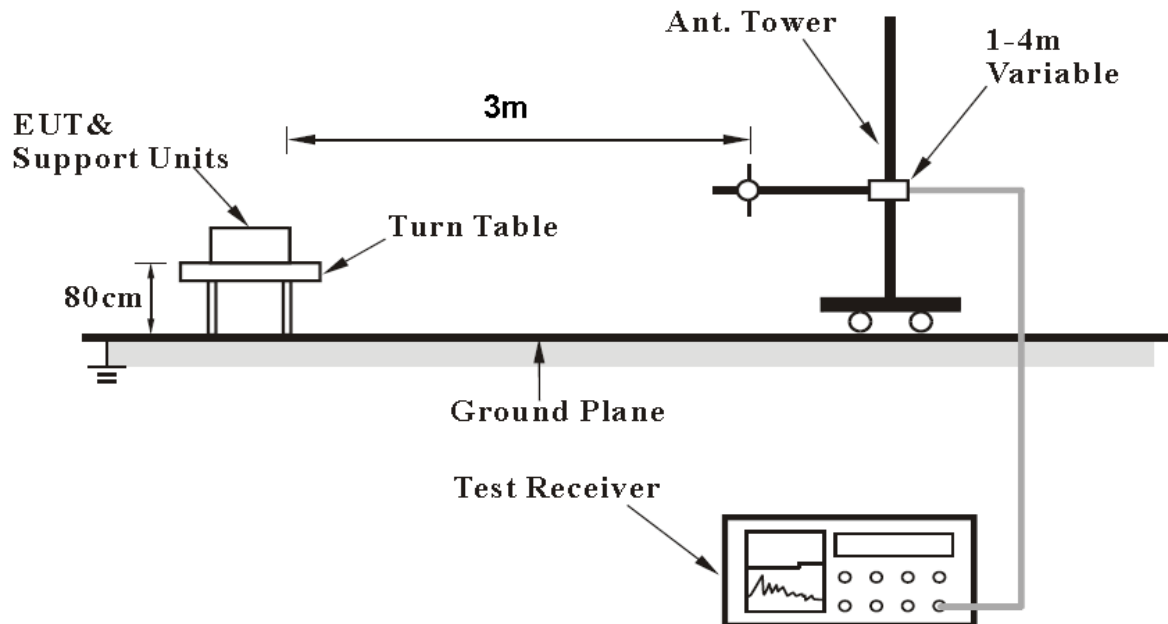
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.2.6 Test Setup

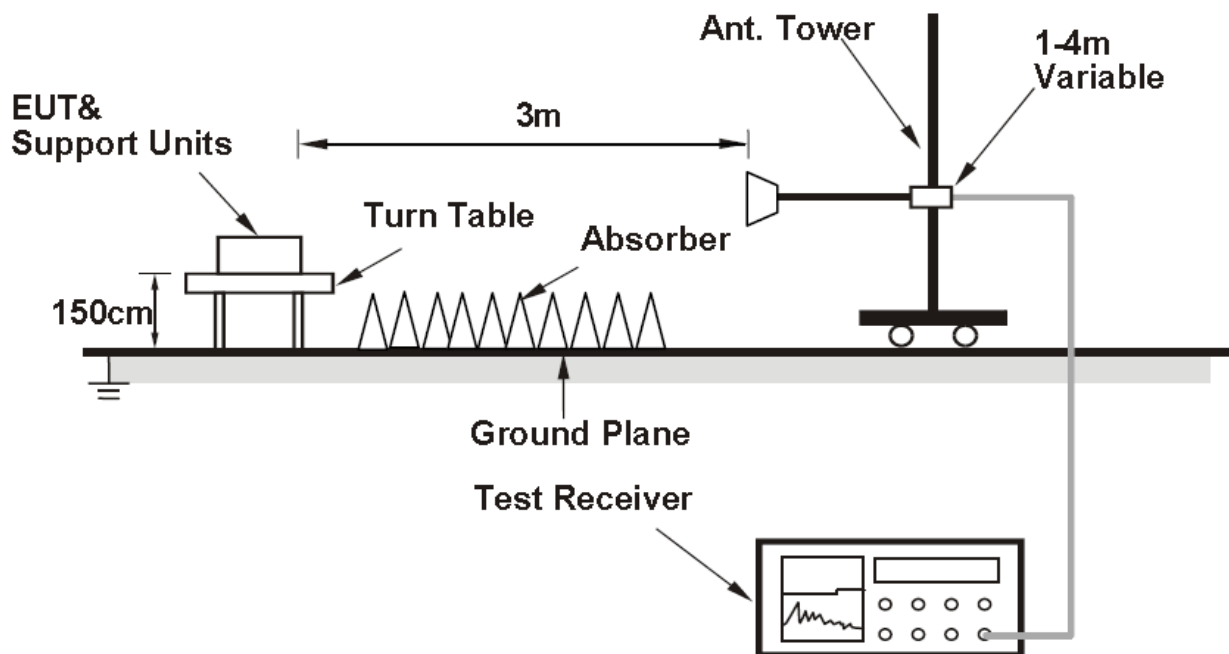
For Radiated emission below 30MHz



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

FCC Part15.207

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

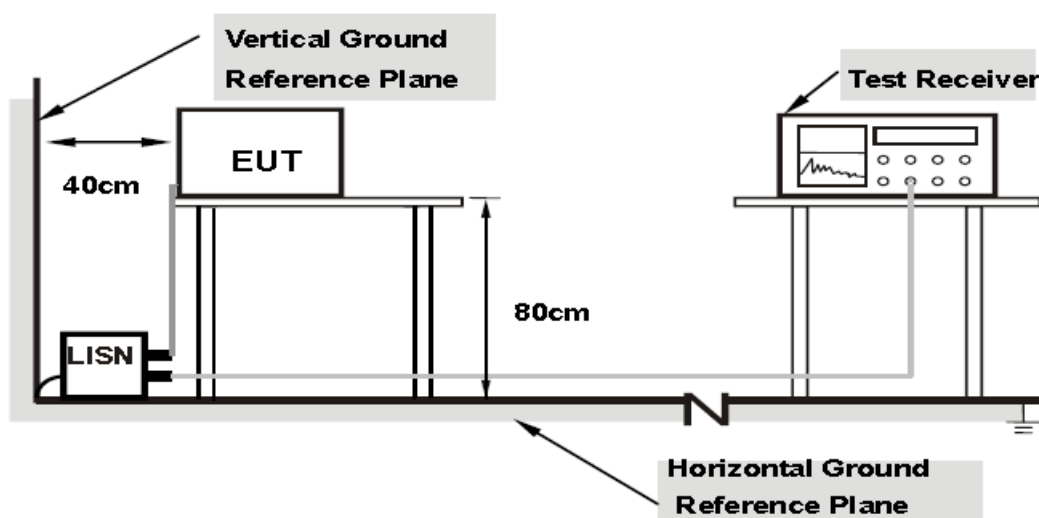
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150 kHz 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	
Spurious emissions	30MHz~1GHz	2.83dB
	1GHz~12.75GHz	2.50dB
	12.75GHz~25GHz	2.75dB

8 TEST EQUIPMENTS

No.	Name/ Model	Manufacturer	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	2019.08.20	2020.08.19
8.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2019.08.20	2020.08.19
9.	ESI 40 EMI test receiver	R&S	100015	2019.08.20	2020.08.19
10.	ESCS30 EMI test receiver	R&S	100029	2019.08.20	2020.08.19
11.	HL562 Receive antenna	R&S	100167	2019.08.20	2020.08.19
12.	ENV216 AMN	R&S	3560.6550.12	2019.08.20	2020.08.19

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

Peak Power Output

Antenna gain=2.9dBi

Modulation type	Peak Power Output (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	5.77	6.57	6.61
$\pi/4$ DQPSK	3.83	4.12	3.88
8DPSK	3.87	4.22	3.93

Modulation type	Average Power Output (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	2.38	3.17	3.20
$\pi/4$ DQPSK	-1.96	-1.61	-1.92
8DPSK	-1.98	-1.60	-1.92

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: (94.75 dBuV/m) = (60.75 dBμV) + (8.90 dB) + (25.10 dB), the corresponding frequency is 2402MHz.

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: GFSK

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	94.35	60.35	N/A	N/A	8.90	25.10
2	2390	40.91	6.91	-33.09	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: GFSK

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	89.84	55.84	N/A	N/A	8.90	25.10
2	2390	36.96	2.96	-37.04	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: GFSK

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	81.05	47.05	N/A	N/A	8.90	25.10
2	2390	29.64	-4.36	-24.36	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: GFSK

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	78.27	44.27	N/A	N/A	8.90	25.10
2	2390	28.91	-5.09	-25.09	54.00	8.90	25.10

Carrier frequency (MHz): 2480
Channel No.:78
Test Mode: GFSK
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	95.88	61.88	N/A	N/A	8.90	25.10
2	2483.5	43.35	9.35	-30.65	74.00	8.90	25.10

Carrier frequency (MHz): 2480
Channel No.:78
Test Mode: GFSK
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	89.61	55.61	N/A	N/A	8.90	25.10
2	2483.5	36.49	2.49	-37.51	74.00	8.90	25.10

Carrier frequency (MHz): 2480
Channel No.:78
Test Mode: GFSK
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	79.94	45.94	N/A	N/A	8.90	25.10
2	2483.5	29.63	-4.37	-24.37	54.00	8.90	25.10

Carrier frequency (MHz): 2480
Channel No.:78
Test Mode: GFSK
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	77.53	43.53	N/A	N/A	8.90	25.10
2	2483.5	28.63	-5.37	-25.37	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: $\pi/4$ DQPSK

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	93.66	59.66	N/A	N/A	8.90	25.10
2	2390	40.51	6.51	-33.49	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: $\pi/4$ DQPSK

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	87.91	53.91	N/A	N/A	8.90	25.10
2	2390	36.71	2.71	-37.29	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: $\pi/4$ DQPSK

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	81.74	47.74	N/A	N/A	8.90	25.10
2	2390	28.35	-5.65	-25.65	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: $\pi/4$ DQPSK

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	75.25	41.25	N/A	N/A	8.90	25.10
2	2390	29.00	-5.00	-25.00	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: $\pi/4$ DQPSK

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	93.17	59.17	N/A	N/A	8.90	25.10
2	2483.5	41.74	7.74	-32.26	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: $\pi/4$ DQPSK

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	88.78	54.78	N/A	N/A	8.90	25.10
2	2483.5	37.15	3.15	-36.85	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: $\pi/4$ DQPSK

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	80.78	46.78	N/A	N/A	8.90	25.10
2	2483.5	29.23	-4.77	-24.77	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: $\pi/4$ DQPSK

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	78.43	44.43	N/A	N/A	8.90	25.10
2	2483.5	27.33	-6.67	-26.67	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: 8DPSK

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	94.87	60.87	N/A	N/A	8.90	25.10
2	2390	42.57	8.57	-31.43	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: 8DPSK

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	87.69	53.69	N/A	N/A	8.90	25.10
2	2390	38.64	4.64	-35.36	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: 8DPSK

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	82.06	48.06	N/A	N/A	8.90	25.10
2	2390	29.37	-4.63	-24.63	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: 8DPSK

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	77.18	43.18	N/A	N/A	8.90	25.10
2	2390	27.35	-6.65	-26.65	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: 8DPSK

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	94.11	60.11	N/A	N/A	8.90	25.10
2	2483.5	40.87	6.87	-33.13	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: 8DPSK

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	88.55	54.55	N/A	N/A	8.90	25.10
2	2483.5	35.69	1.69	-38.31	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: 8DPSK

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	82.82	48.82	N/A	N/A	8.90	25.10
2	2483.5	29.03	-4.97	-24.97	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: 8DPSK

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	77.82	43.82	N/A	N/A	8.90	25.10
2	2483.5	27.30	-6.70	-26.70	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:

$$\text{Result} = P_{\text{mea}} + A_{Rpl}$$

Sample calculation: (22.64 dBμV/m) = (40.74 dBμV) + (-18.1 dB/m), the corresponding frequency is 40.633000MHz.

The worst case attitude: The mobile lay down.

For GFSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
40.633000	22.64	-18.1	40.74	Vertical	40.00
48.070500	23.98	-17.3	41.28	Vertical	40.00
168.199000	26.83	-20.7	47.53	Vertical	43.50
215.977500	33.23	-18.0	51.23	Vertical	43.50
360.014000	31.02	-13.1	44.12	Vertical	46.00
527.978000	35.91	-8.6	44.51	Vertical	46.00

For π/4DQPSK

Channel No.:39

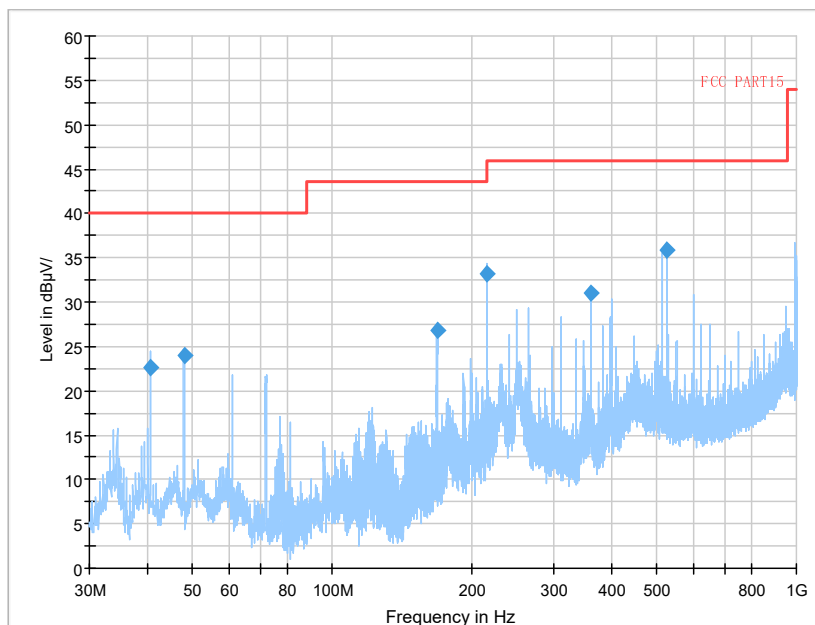
Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
168.034000	30.32	-20.8	51.12	Horizontal	43.50
216.009000	35.82	-18.0	53.82	Horizontal	46.00
311.999000	37.33	-14.7	52.03	Horizontal	46.00
411.424000	36.67	-11.4	48.07	Horizontal	46.00
527.978000	35.79	-8.6	44.39	Vertical	46.00
874.995500	34.29	-1.9	36.19	Horizontal	46.00

For 8DPSK

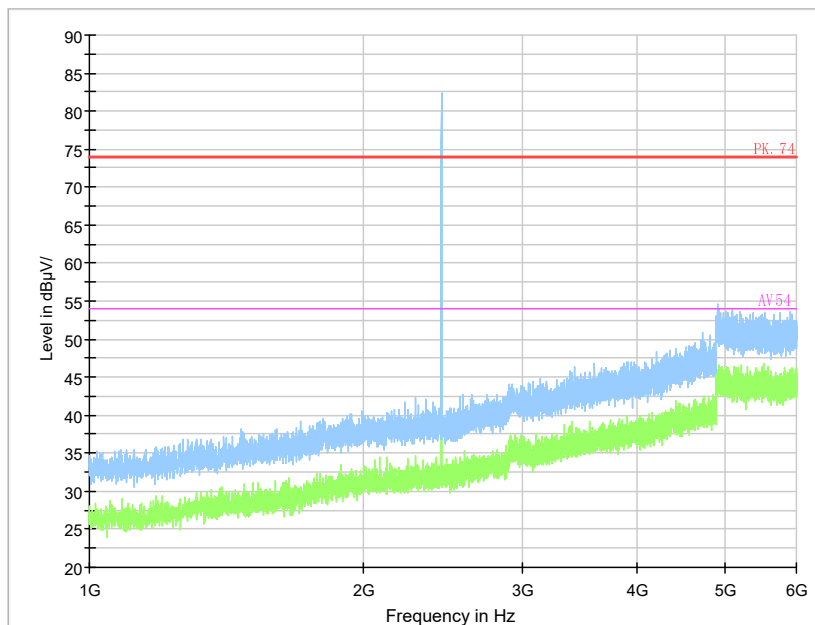
Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
168.002500	30.41	-20.8	47.45	Horizontal	43.50
216.017500	36.03	-18.0	45.41	Horizontal	46.00
311.999000	37.01	-14.7	39.38	Horizontal	46.00
399.986500	36.49	-11.7	44.81	Horizontal	46.00
514.252500	32.61	-8.9	46.49	Vertical	46.00
874.995500	34.31	-1.9	46.55	Horizontal	46.00

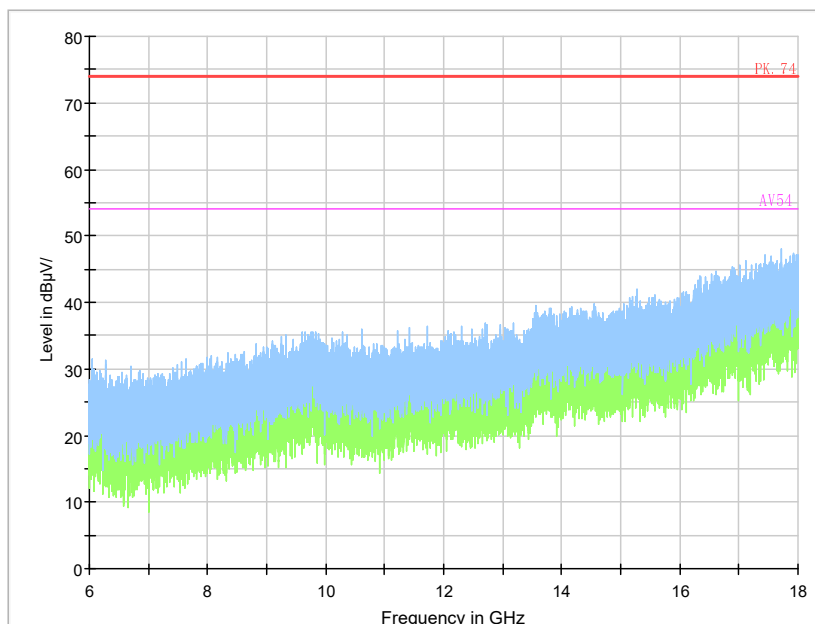
Carrier frequency (MHz): 2441
Channel No.:39



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

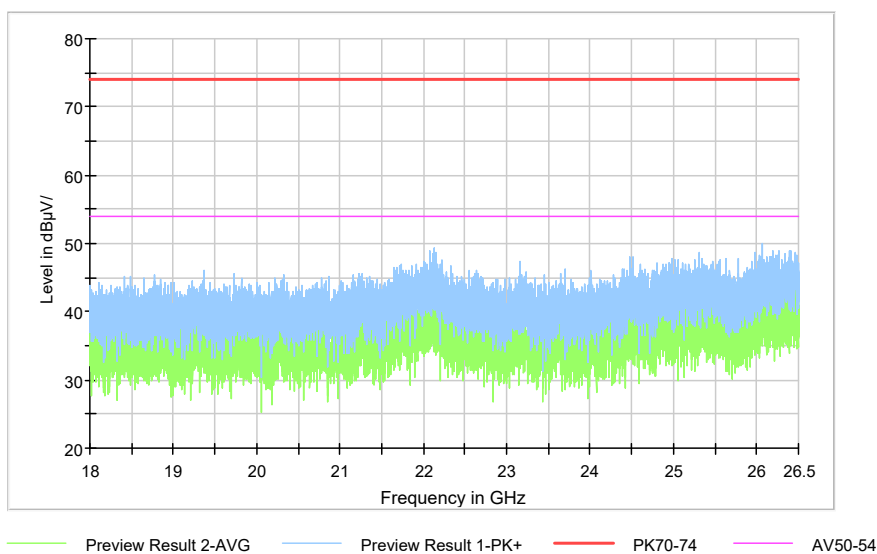


Frequency Range: 1GHz -6GHz
Detector: Av mode and PK mode
Modulation type: GFSK



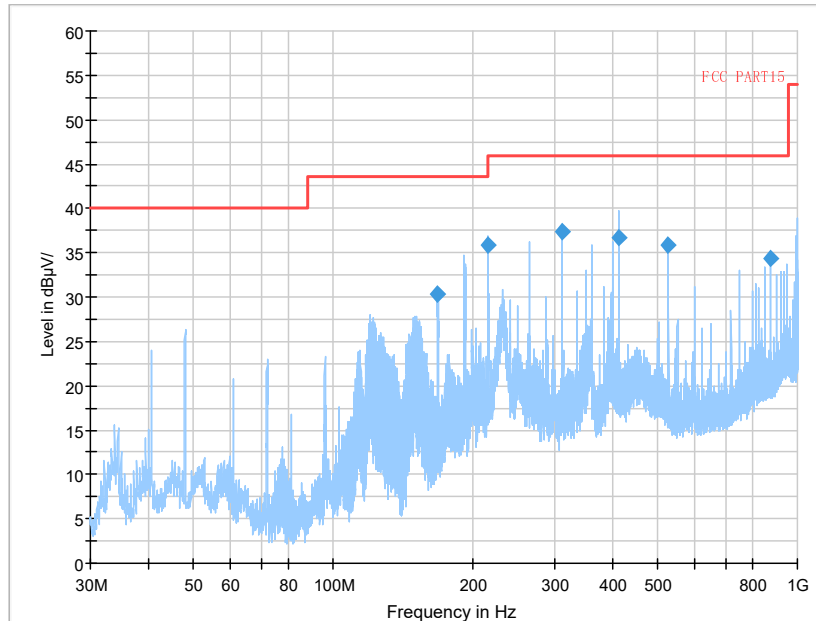
Frequency Range: 6GHz- 18GHz
Detector: Av mode and PK mode
Modulation type: GFSK

Full Spectrum

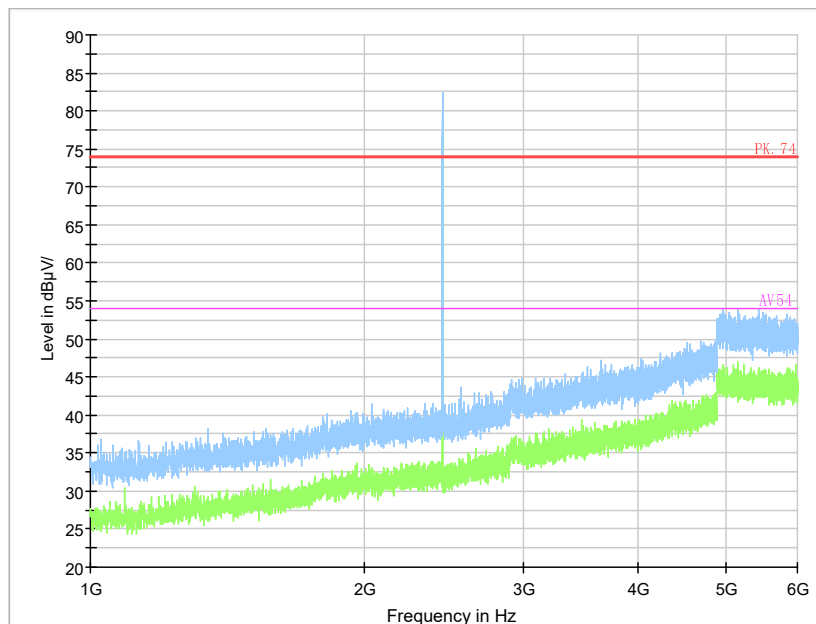


Comment

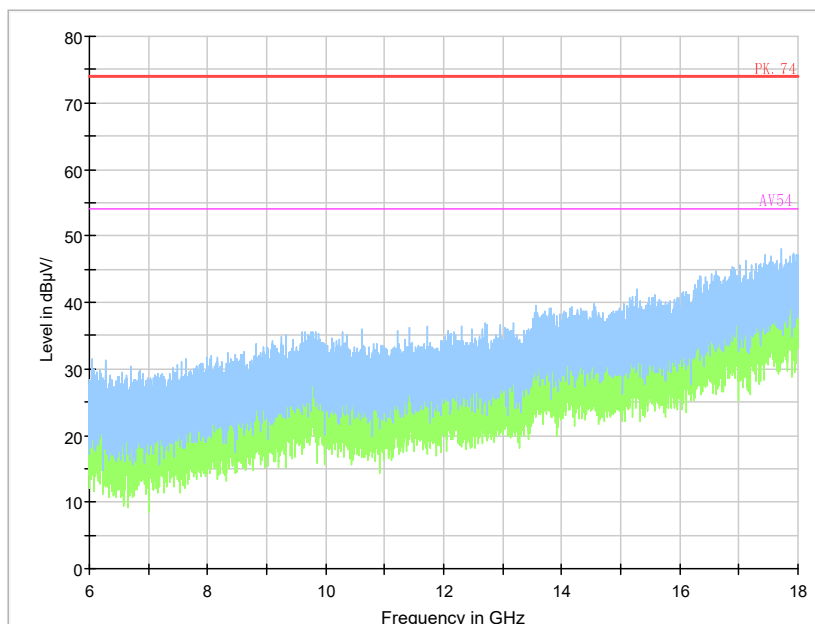
Frequency Range: 18GHz-25GHz
Detector: Av mode and PK mode
Modulation type: GFSK



Frequency Range: 30MHz-1000 MHz
Detector: QP mode
Modulation type: $\pi/4$ DQPSK

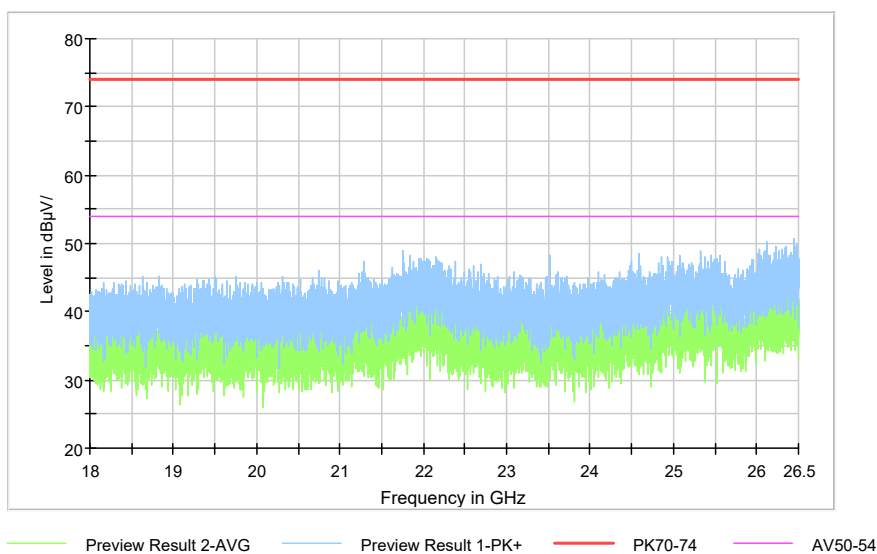


Frequency Range: 1GHz -6GHz
Detector: Av mode and PK mode
Modulation type: $\pi/4$ DQPSK



Frequency Range: 6GHz-18GHz
Detector: Av mode and PK mode
Modulation type: $\pi/4$ DQPSK

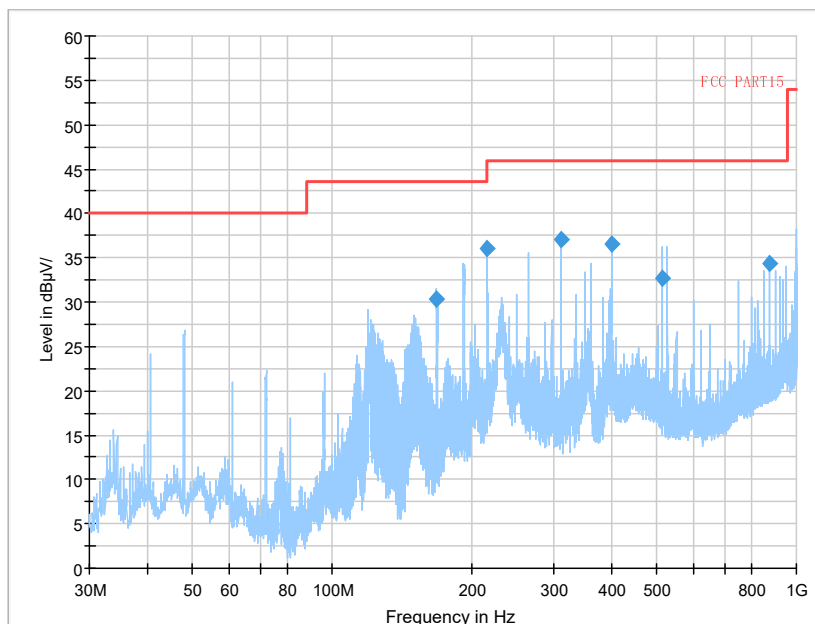
Full Spectrum



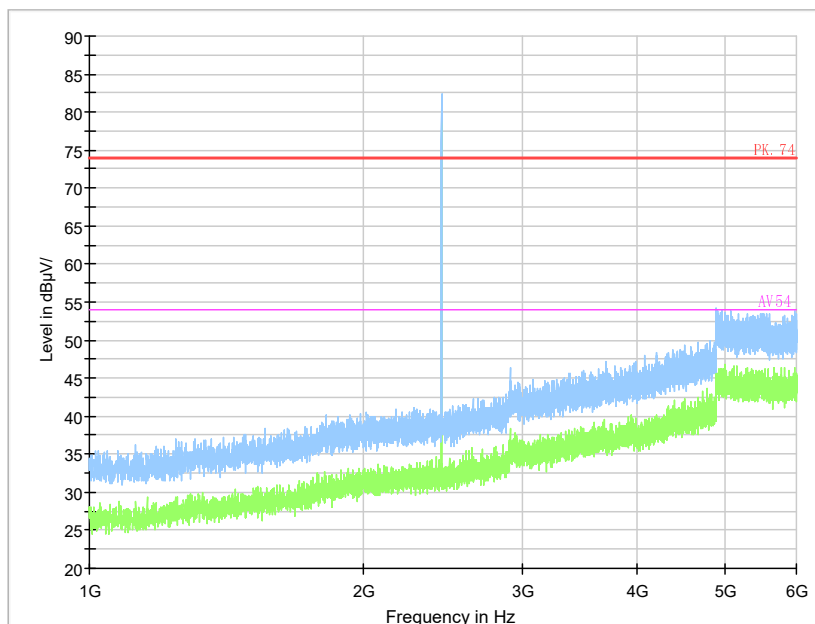
Preview Result 2-AVG Preview Result 1-PK+ PK70-74 AV50-54

Comment

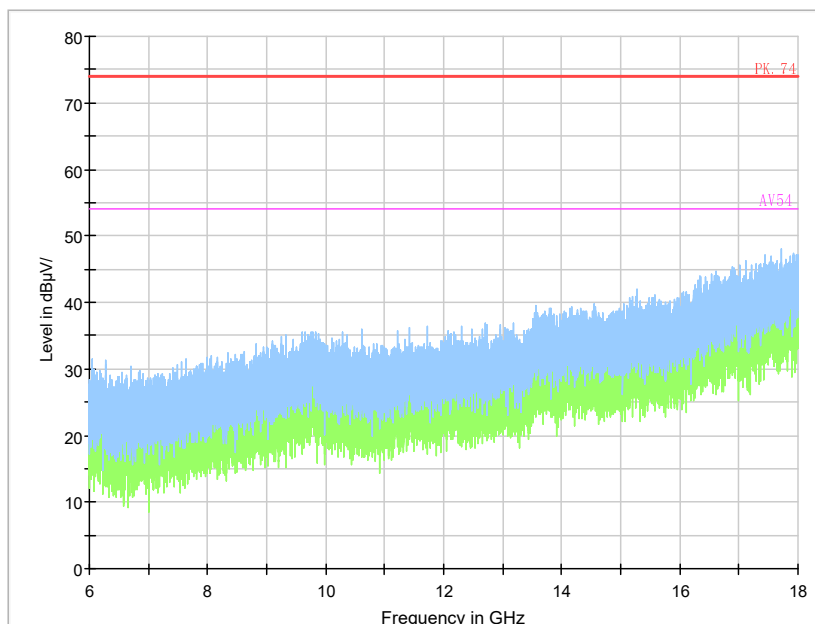
Frequency Range: 18GHz-25GHz
Detector: Av mode and PK mode
Modulation type: $\pi/4$ DQPSK



Frequency Range: 30MHz-1000 MHz
Detector: QP mode
Modulation type: 8DPSK

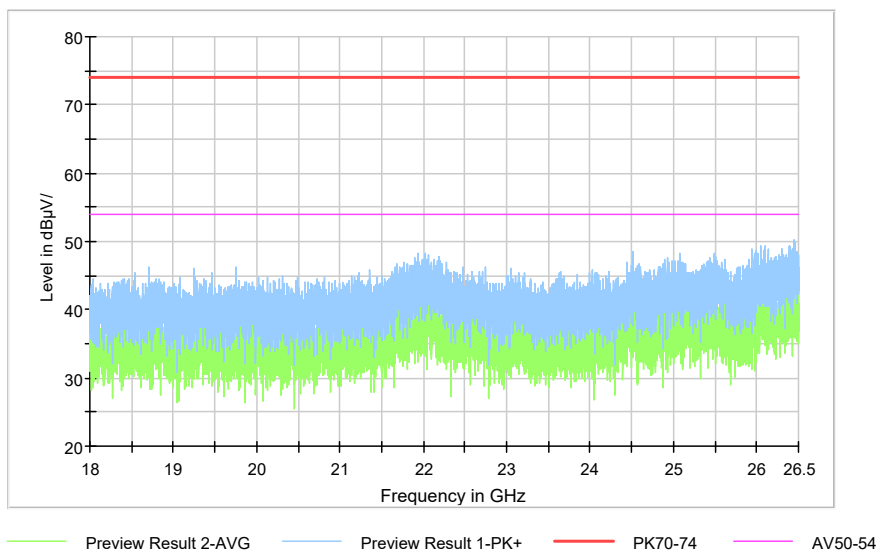


Frequency Range: 1GHz -6GHz
Detector: Av mode and PK mode
Modulation type: 8DPSK



Frequency Range: 6GHz-18GHz
Detector: Av mode and PK mode
Modulation type: 8DPSK

Full Spectrum



Preview Result 2-AVG Preview Result 1-PK+ PK70-74 AV50-54

Comment

Frequency Range: 18GHz-26.5GHz
Detector: Av mode and PK mode
Modulation type: 8DPSK

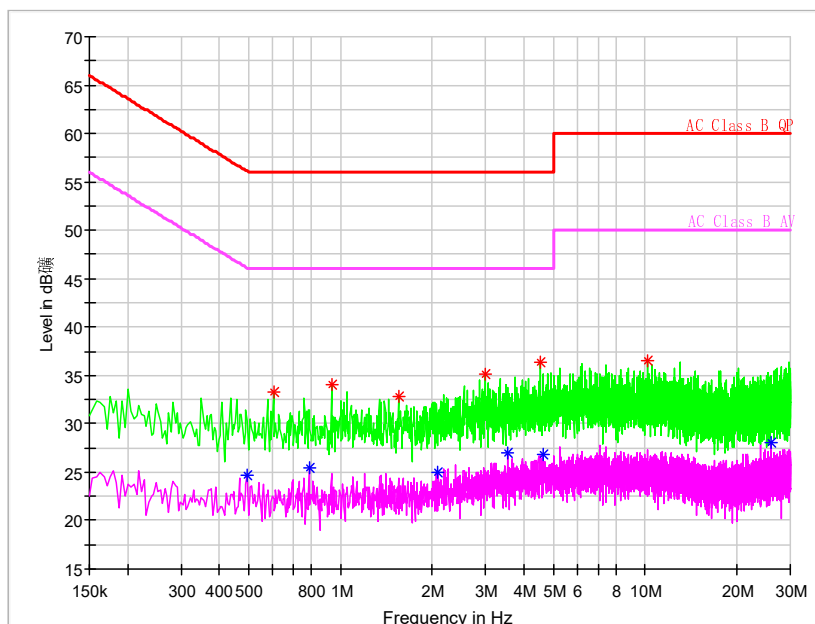
AC Power line Conducted Emission

A "reference path loss" Corr.(dB) is established and the $L_{\text{cable}} + \text{ATT} + \text{VDF}$ 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:

$$P_{\text{result}} = P_{\text{mea}} + \text{Corr. (dB)}$$

Sample calculation: $(24.61 \text{ dB}\mu\text{V}) = (-5.09 \text{ dB}\mu\text{V}) + (29.7 \text{ dB})$, the corresponding frequency is 0.495407MHz.



L+N Line

MEASUREMENT RESULT:

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)	Pmea QuasiPeak (dBμV)	Pmea Average (dBμV)
0.495407	---	24.61	46.08	21.47	L1	29.7	---	-5.09
0.602014	33.34	---	56.00	22.66	L1	29.7	3.64	---
0.789643	---	25.41	46.00	20.59	N	29.7	---	-4.29
0.934629	34.06	---	56.00	21.94	L1	29.7	4.36	---
1.548686	32.84	---	56.00	23.16	L1	29.7	3.14	---
2.094514	---	24.97	46.00	21.03	N	29.8	---	-4.83
2.990014	35.07	---	56.00	20.93	L1	29.8	5.27	---
3.527314	---	26.96	46.00	19.04	L1	29.8	---	-2.84
4.546479	36.42	---	56.00	19.58	L1	29.8	6.62	---
4.636029	---	26.80	46.00	19.20	L1	29.8	---	-3
10.171071	36.44	---	60.00	23.56	N	29.9	6.54	---
25.953193	---	28.13	50.00	21.87	N	29.9	---	-1.77

Simultaneously Transmission Worst Case (BT+WIFI5G)

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:

$$\text{Result} = P_{\text{mea}} + A_{Rpl}$$

The worst case attitude: The mobile lay down.

Frequency range:30MHz~40GHz

Note: Any emissions more than 20dB below the limits not reported.

Frequency (MHz)	Result(dBuV/m)	ARpl(dB)	Pmea(dBuV/m)	Polarity	Limit (dBuV/m)
40.633000	22.64	-18.1	40.74	Vertical	40.00
48.070500	23.98	-17.3	41.28	Vertical	40.00
168.199000	26.83	-20.7	47.53	Vertical	43.50
215.977500	33.23	-18.0	51.23	Vertical	43.50
360.014000	31.02	-13.1	44.12	Vertical	46.00
527.978000	35.91	-8.6	44.51	Vertical	46.00

Frequency (MHz)	Result(dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
30.522000	7.47	-21.0	28.47	Vertical	40.00
132.161000	27.23	-21.5	48.73	Horizon	43.50
250.016000	30.47	-16.3	46.77	Horizon	46.00
400.018000	37.53	-11.7	49.23	Horizon	46.00
527.978000	37.53	-8.6	46.13	Horizon	46.00
750.011000	37.71	-4.4	42.11	Horizon	46.00

---End of Test Report---