



Certificate Number: 5055.02

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# TEST REPORT FOR BLUETOOTH TESTING

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Report No.: SRTC2019-9004(F)-19101501(D)

Product Name: Mobile Phone

Product Model: HLTE220E

Applicant: Hisense International Co., Ltd.

Manufacturer: Hisense Communications Co., Ltd.

Specification: FCC Part 15, Subpart C (2019)

FCC ID: 2ADOBHLTE220E

The State Radio\_monitoring\_center Testing Center (SRTC)  
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## 1. GENERAL INFORMATION

### 1.1 Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio\_monitoring\_center Testing Center (SRTC). The test results relate only to individual items of the samples which have been tested. The certification and accreditation identifiers used in this report shall not be applicable to the tested or calibrated samples thereof. The manufacturer shall not mark the tested samples or items (or a separate part of the item) with the identifiers of certification and accreditation to mislead relevant parties about the tested samples or items.

### 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
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### 1.3 Applicant's details

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Country or Region:	China
Contacted person:	Geng Ruifeng
Tel:	+86-532-80877742
Fax:	---
Email:	gengruifeng@hisense.com

### 1.4 Manufacturer's details

Company:	Hisense Communications Co., Ltd.
Address:	No.218 Qianwangang Road, Economic & Technological Development Zone, Qingdao, China
City:	Qingdao
Country or Region:	China
Contacted person:	Song Haibin
Tel:	+86-532-55753700
Fax:	---
Email:	songhaibin@hisense.com

## 1.5 Test Environment

Date of Receipt of test sample at SRTC:	2019-10-15
Testing Start Date:	2019-10-15
Testing End Date:	2019-10-31

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

Normal Supply Voltage (V d.c.):	3.80
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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, π/4DQPSK, 8DPSK
Duplex Mode	TDD
Channel Spacing	1MHz
Data Rate	1Mbps, 2 Mbps, 3 Mbps
Power Supply	Battery/Charger
Hardware Version	YK680--MB-V0.1
Software Version	Hisense_HLTE220E_MX02_L201.01_20190926
IMEI	863501040484886
Antenna type	Refer to Note
Antenna connector	Refer to Note

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

Brand	Model	Antenna gain	Frequency range(GHz)	Antenna type	Connector Type
N/A	N/A	-1.3dBi	2.402GHz~2.480GHz	Fixed Internal Antenna	N/A

Manufacturers ensure that their designs will not be modified by the user or third parties arbitrary antenna parameters and performance.

Note: The equipments have two supplies, is different on the supplier of CTP/Earphone/Camera/Data cable.

Main Supply

Part Name	Model	Supplier(Brand)	Description
Camera	ST-CFKS816-5MFF-V2.0/ ST-CFKS816-30WFF-V2.0/	Union Image	Front CAM
Camera	ST-CFKS816BF-V2.0	Union Image	Rear CAM
CTP	CCF11700-6.0	Jiangxi Holitech Technology Co.,Ltd	CTP
Data cable	KLKS816AUSB	Dongguan Keling Electronic Technology Co., Ltd.	
Earphone	KLKS816A	Shenzhen Jinchuangju Electronic Technology Co.,Ltd.	

Secondary Supply

Part Name	Model Name	supplier	Remark
Camera	HTP1157/HTV1155	JIXIHOLITECH TECHNOLOGY CO.LTD	Front CAM
Camera	HTV1156	JIXIHOLITECH TECHNOLOGY CO.LTD	Rear CAM
CTP	Y152073B2-D-X	Dongguan Yuye Communication Technology CO.,ted	CTP
Data cable	A106-0022-S	SHENZHEN KOAR ELECTRIC CO.,LTD	
Earphone	W1G513A06S	Shenzhen Jinchuangju Electronic Technology Co.,Ltd.	

## 2.2 Description of Test Modes

79 channels are provided to this EUT:

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 **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	39	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	39	GFSK, π/4DQPSK, 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, π/4DQPSK, 8DPSK	1Mbps, 2 Mbps, 3 Mbps

#### 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, π/4DQPSK, 8DPSK	1Mbps, 2 Mbps, 3 Mbps

## 2.3 Duty Cycle of Test Signal

Modulation Type	Duty Cycle
GFSK(DH1)	30.07%
GFSK(DH3)	43.49%
GFSK(DH5)	46.06%
$\pi/4$ DQPSK(DH1)	30.24%
$\pi/4$ DQPSK(DH3)	43.56%
$\pi/4$ DQPSK(DH5)	46.03%
8DPSK(DH1)	30.40%
8DPSK(DH3)	43.47%
8DPSK(DH5)	46.13%

## 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:

Equipment	Battery
Manufacturer	Shenzhen Tianjin New Energy Technology Co.,Ltd;
Model Number	KS816
Serial Number	---

Equipment	Charger
Manufacturer	Shenzhen Tianyin Electronics Co., Ltd
Model Number	TPA-97050100VU
Serial Number	---

Equipment	USB Cable1
Manufacturer	SHENZHEN KOAR ELECTIC CO.,LTD
Model Number	A106-0022-S
Serial Number	---

Equipment	USB Cable2
Manufacturer	Dongguan Keling Electronic Technology Co., Ltd.
Model Number	KLKS816AUSB
Serial Number	---

### 3 REFERENCE SPECIFICATION

Specification	Version	Title
15.35	2019	Measurement detector functions and bandwidths.
15.209	2019	Radiated emission limits; general requirements.
15.247	2019	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz.
15.203	2019	Antenna requirement
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

### 4 KEY TO NOTES AND RESULT CODES

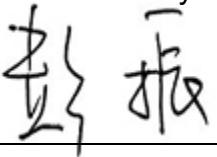
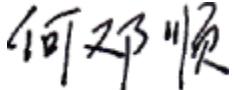
Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.
NTC	Nominal voltage, Normal Temperature
HV	High voltage, Normal Temperature
LV	Low voltage, Normal Temperature
HTHV	high voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature

## 5 RESULT SUMMARY

No.	Test case	Reference	Verdict
1	Occupied Bandwidth	15.247(a)(1)	Pass
2	Channel Separation	15.247(a)(1)	Pass
3	Output Power	15.247(b)(1)	Pass
4	Dwell Time	15.247(a)(1)(iii)	Pass
5	Number of Hopping Frequencies	15.247(a)(1)(iii)	Pass
6	Conducted out of band emission measurement	15.247(d)	Pass
7	Band-edge	15.247(d)	Pass
8	Spurious Radiated Emissions	15.247(d)/15.35(b)/15.209	Pass
9	AC Power line Conducted Emission	15.207	Pass
10	Antenna requirement	15.203	Pass (refer to section 2.1)

Note: The device is designed according to specifications of SIG, So it has a full support to Medium access protocol and fully compliant with the KDB558074 standard.

The device is compliant Pseudorandom hopping, Equal hopping frequency, receiver bandwidth synchronize and have same bandwidth with transmitted signal. And the ability to have adaptive hopping when encountering other signals.

This Test Report Is Issued by: Mr. Peng Zhen 	Checked by: Mr. Li Bin 
Tested by: Mr. He Dengshun 	Issued date: 20191101

## **6 TEST RESULT**

### **6.1 Occupied Bandwidth**

#### **6.1.1 Ambient condition**

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

#### **6.1.2 Test Description**

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer and Bluetooth test set via a power splitter with a known loss which connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

#### **6.1.3 Test limit**

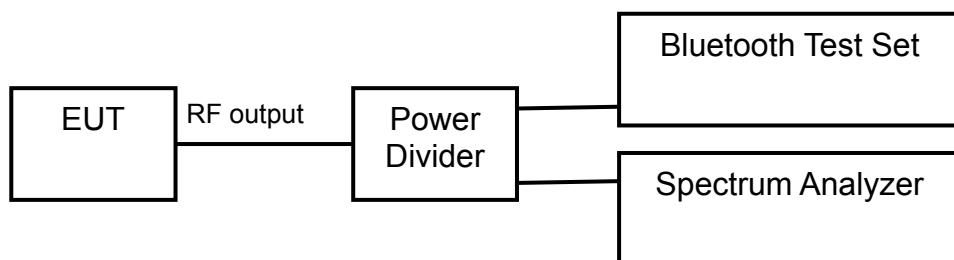
FCC Part15.247 (a)

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

#### **6.1.4 Test settings**

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 30dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

#### **6.1.5 Test Setup**



#### **6.1.6 Test result**

The test results are shown in Appendix A .

## 6.2 Channel Separation

### 6.2.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.2.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the channel separation measurements. The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

### 6.2.3 Test limit

FCC Part15.247 (a)(1)

Measurement is made with EUT operating in hopping mode. The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.

### 6.2.4 Test Settings

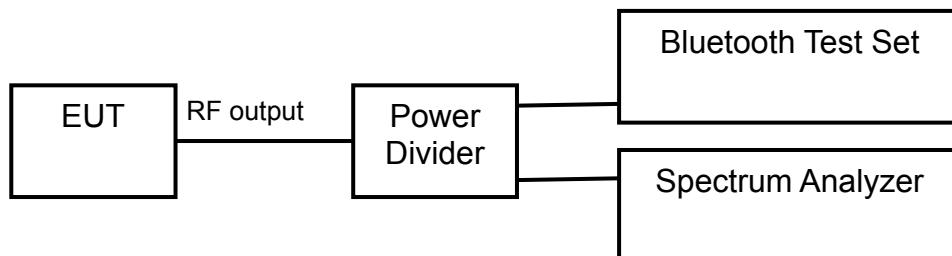
ANSI C63.10-2013 Section 7.8.2

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: Wide enough to capture the peaks of two adjacent channels.
- b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- c) Video (or average) bandwidth (VBW)  $\geq$  RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

### 6.2.5 Test Setup



### 6.2.6 Test result

The test results are shown in Appendix A.

## 6.3 Output Power

### 6.3.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.3.2 Test Description

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below were measured using a spectrum analyzer with a Bluetooth signalling test set used only to maintain a Bluetooth link with the EUT.

### 6.3.3 Test limit

FCC Part 15.247(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:1 watt.

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) →

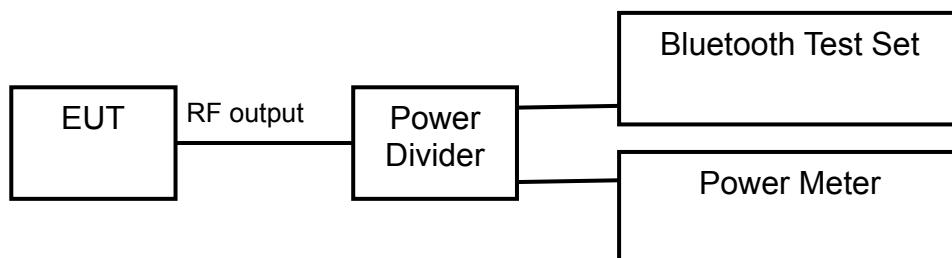
Modulation type	GFSK	$\pi/4$ DQPSK	8DPSK
Maximum Output Power	21.0dBm	21.0dBm	21.0dBm

### 6.3.4 Test Settings

ANSI C63.10-2013 Section 7.8.5

The transmitter output is connected to a wideband peak and average power meter.

### 6.3.5 Test Setup



### 6.3.6 Test result

The test results are shown in Appendix A .

## 6.4 Dwell Time

### 6.4.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.4.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the dwell time measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

The time slot length is measured of three different packet types which are available in the Bluetooth technology. Those are DH1, DH3 and DH5 packets. The dwell time is calculated by:

Dwell time = time slot length \* hop rate \* 31.6/ number of hopping channels with:

- hop rate=1600/2 \* 1/s for DH1 packets =800
- hop rate=1600/4 \* 1/s for DH3 packets =400
- hop rate=1600/6 \* 1/s for DH5 packets =266.67
- number of hopping channels=79
- 31.6 s=0.4 seconds multiplied by the number of hopping channels=0.4s \* 79

### 6.4.3 Test limit

FCC Part 15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 6.4.4 Test Settings

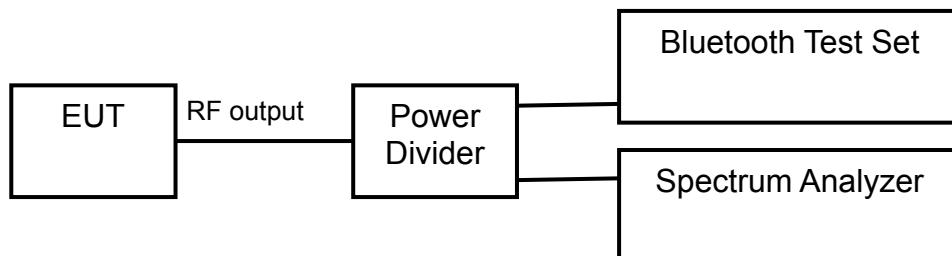
ANSI C63.10-2013 Section 7.8.4

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: Zero span, centered on a hopping channel.
- b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- d) Detector function: Peak.
- e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

## 6.4.5 Test Setup



## 6.4.6 Test result

The test results are shown in Appendix A .

## 6.5 Number of Hopping Frequencies

### 6.5.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.5.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the number of hopping frequencies measurement. The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

### 6.5.3 Test limit

FCC Part15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

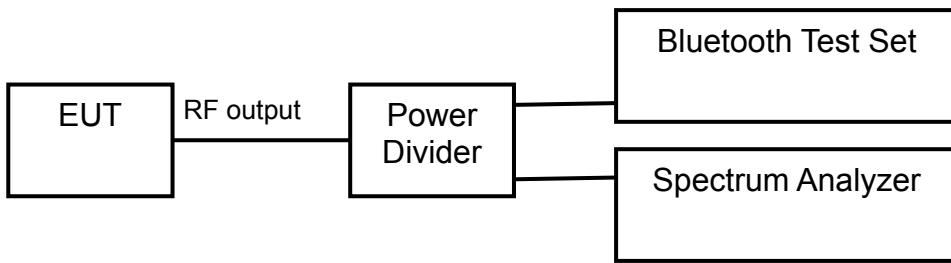
### 6.5.4 Test Settings

ANSI C63.10-2013 Section 7.8.3

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c) VBW  $\geq$  RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

## 6.5.5 Test Setup



## 6.5.6 Test result

The test results are shown in Appendix A.

## 6.6 Conducted out of band emission measurement

### 6.6.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.6.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements. The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

### 6.6.3 Test limit

FCC Part15.247(d)

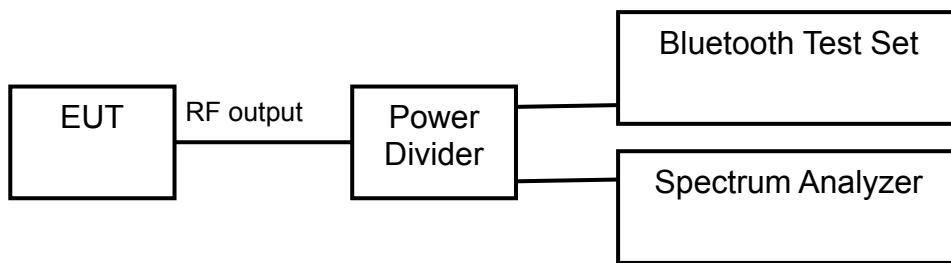
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 6.6.4 Test Settings

ANSI C63.10-2013 Section 7.8.8

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

## 6.6.5 Test Setup



## 6.6.6 Test result

The test results are shown in Appendix A .

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

## 6.7 Band-edge measurement

### 6.7.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.7.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements. The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

### 6.7.3 Test limit

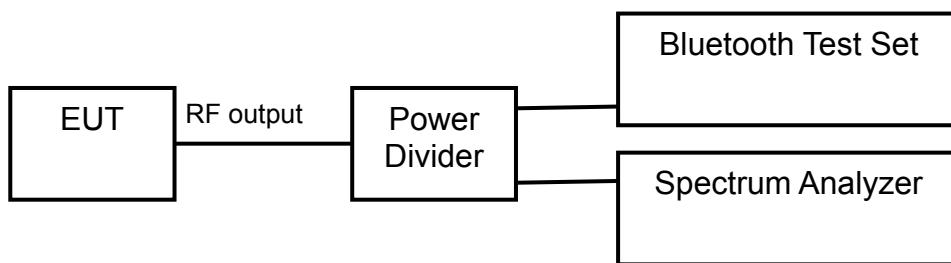
FCC Part15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 6.7.4 Test Settings

ANSI C63.10-2013 Section 6.10.4

### 6.7.5 Test Setup



## 6.7.6 Test result

The test results are shown in Appendix A .

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

## 6.8 Spurious Radiated Emissions

### 6.8.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.8.2 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. The measurements shall be repeated with orthogonal polarization of the test antenna. The results shall be showed the worst case of the three orthogonal axes of EUT.

### 6.8.3 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.

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

Frequency [MHz]	Detector	Unit ( $\text{dB}\mu\text{V/m}$ )
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

#### 6.8.4 Test Procedure Used

ANSI C63.10-2013 Section 6.3&6.5&6.6

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

#### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter 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 Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

#### For Radiated emission above 30MHz

- a. 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 at 3 meter 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 specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth 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:

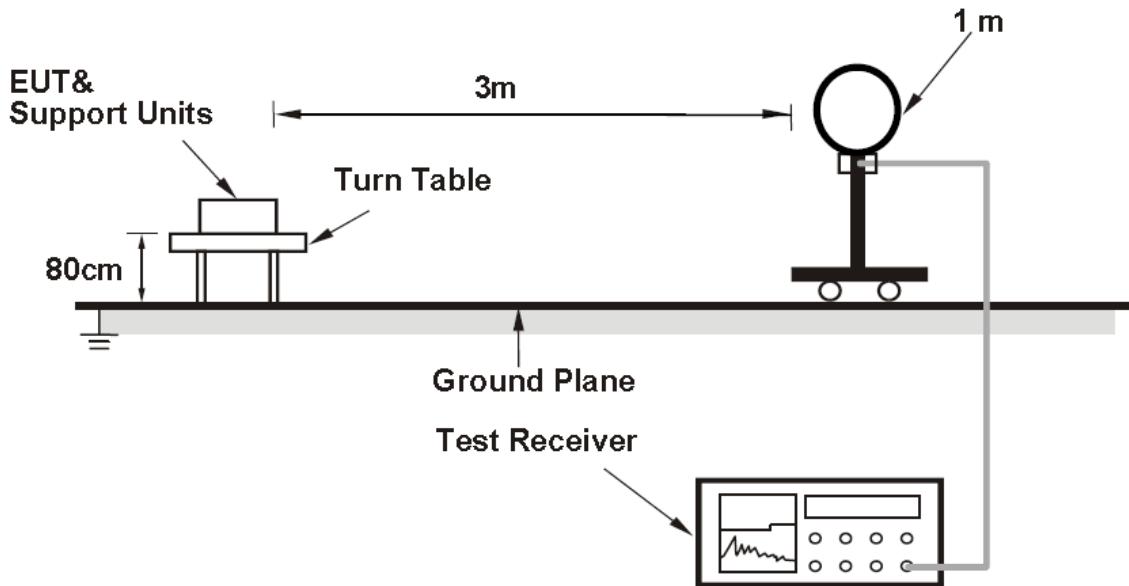
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. 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:

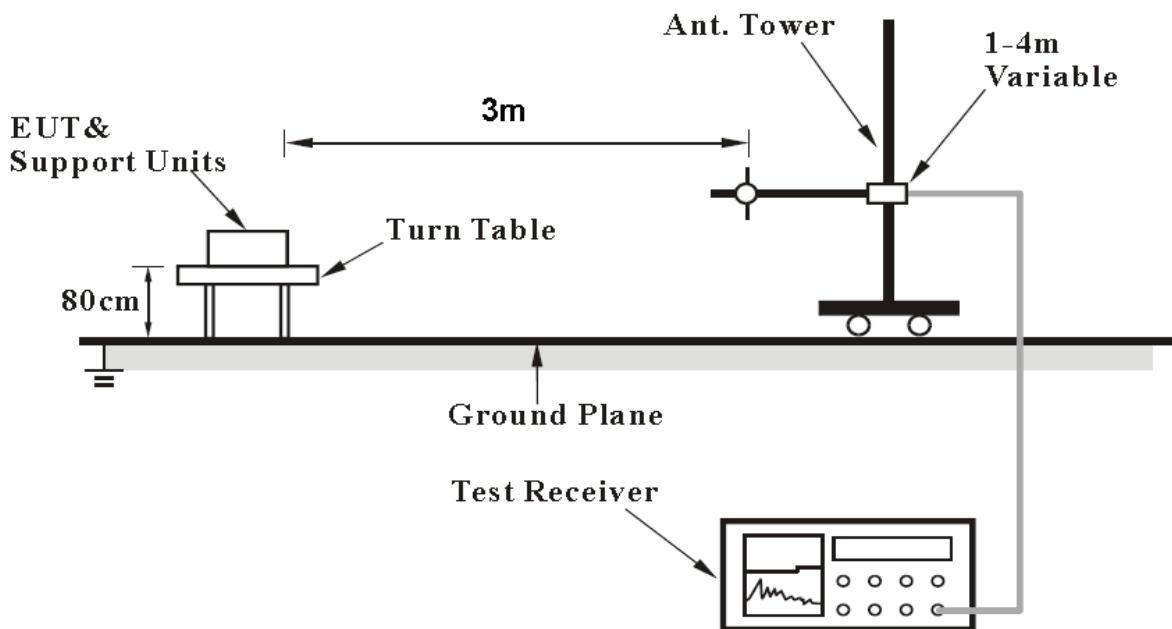
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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.

### 6.8.5 Test Setup

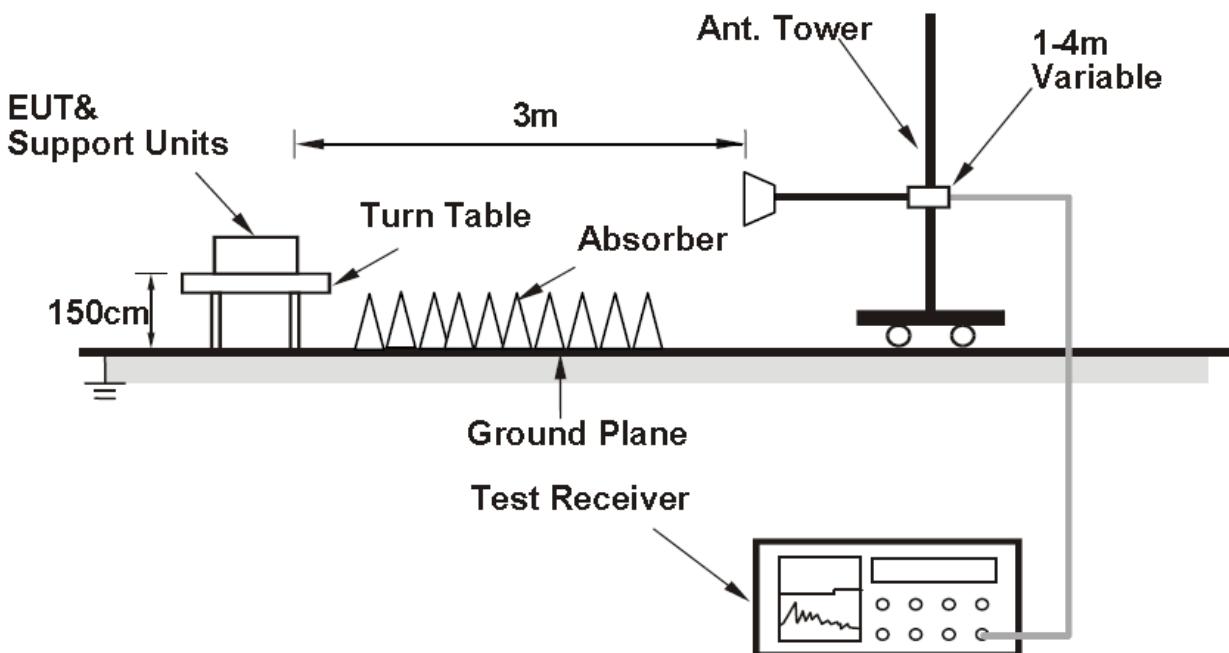
#### For Radiated emission below 30MHz



### For Radiated emission 30MHz to 1GHz



### For Radiated emission above 1GHz



#### 6.8.6 Test result

The test results are shown in Appendix B.

## 6.9 AC Power line Conducted Emission

### 6.9.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

### 6.9.2 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

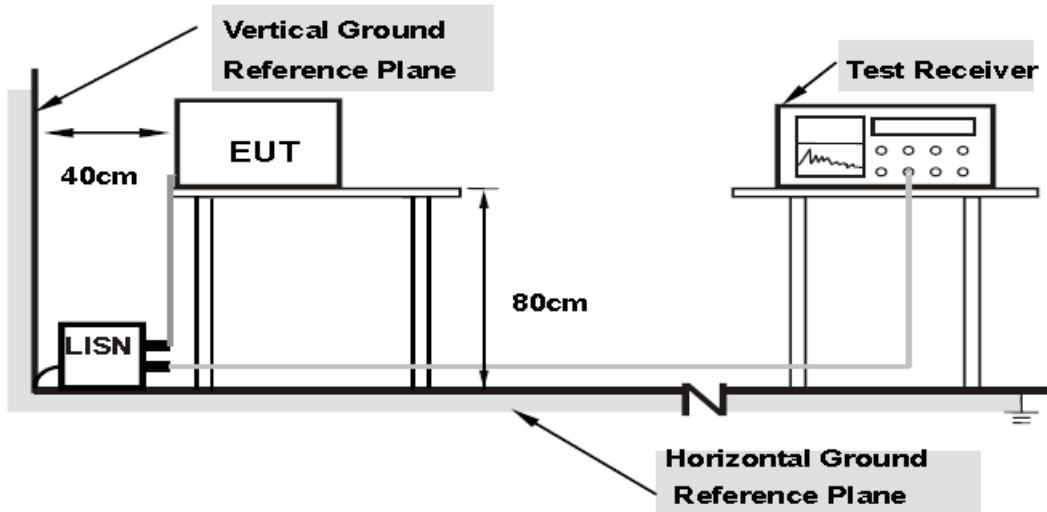
### 6.9.3 Test Procedures

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

#### 6.9.4 Test Setup



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

#### 6.9.5 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.	Spectrum Analyzer FSV	ROHDE&SCHWARZ	101065	2019.08.20	2020.08.19
2.	Bluetooth Test Set MT8852B	Anritsu	1142010	2019.03.01	2020.02.29
3.	Power Divider 6007	Weinschel	6007-GJ-1	2019.08.20	2020.08.19
4.	Power Meter E4416A	Agilent	MY52370013	2019.03.01	2020.02.29
5.	Power Sensor E9327A	Agilent	MY52420006	2019.03.01	2020.02.29
6.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	----	----
7.	Turn table Diameter:5m	FRANKONIA	----	----	----
8.	Antenna master SAC(MA4.0)	MATURO	----	----	----
9.	9.080m×5.255m×3.525m Shielding room	FRANKONIA	----	----	----
10.	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2019.08.20	2020.08.19
11.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2019.08.20	2020.08.19
12.	ESI 40 EMI test receiver	R&S	100015	2019.08.20	2020.08.19
13.	ESCS30 EMI test receiver	R&S	100029	2019.08.20	2020.08.19
14.	HL562 Receive antenna	R&S	100167	2019.08.20	2020.08.19
15.	ENV216 AMN	R&S	3560.6550.12	2019.08.20	2020.08.19

## APPENDIX A – TEST DATA OF CONDUCTED EMISSION

### 20dB Bandwidth

Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

Modulation type: GFSK

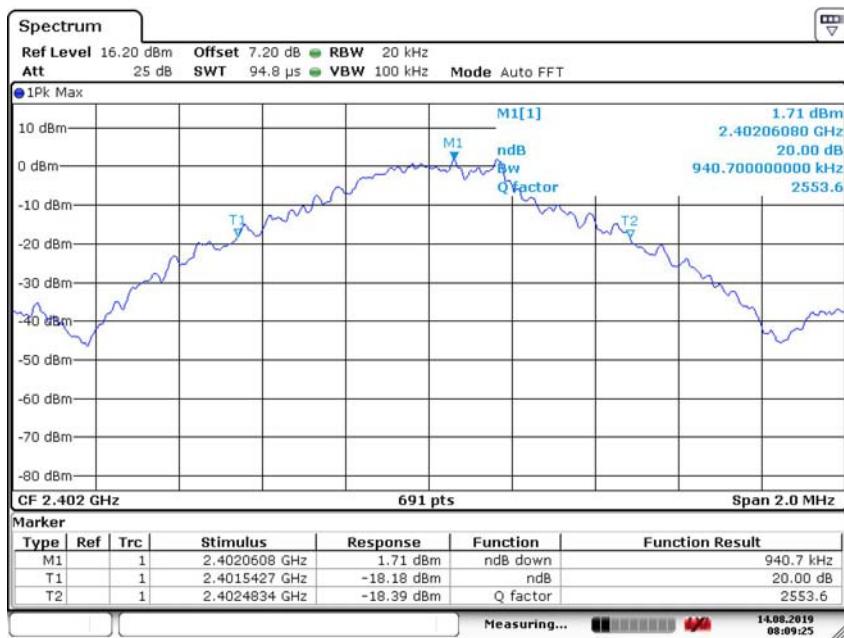
Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	940.7
2441	39	842.3
2480	78	842.3

Modulation type: π/4DQPSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	1230.1
2441	39	1233.0
2480	78	1230.1

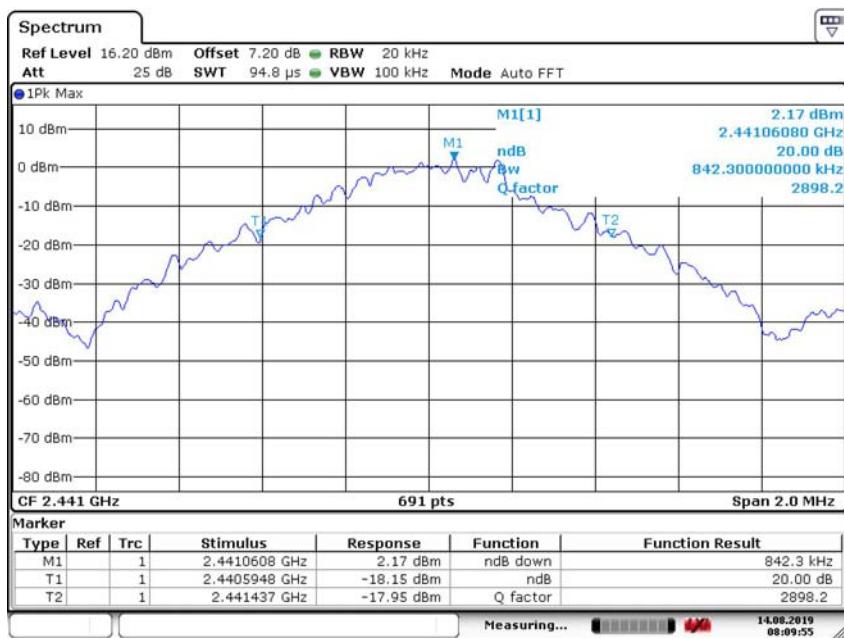
Modulation type: 8DPSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	1264.8
2441	39	1264.8
2480	78	1264.8



Date: 14.AUG.2019 08:09:24

Carrier frequency (MHz): 2402  
Channel No.:0  
Modulation type: GFSK



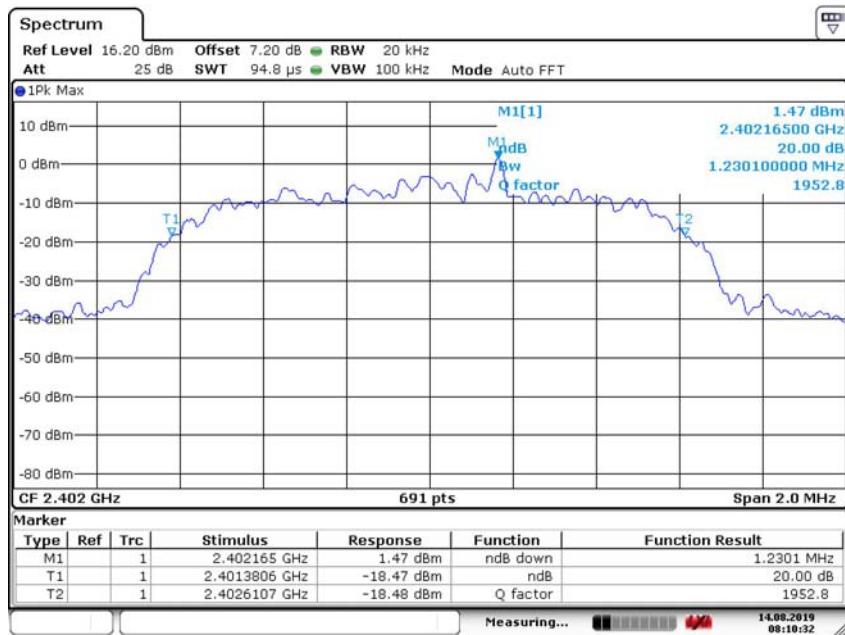
Date: 14.AUG.2019 08:09:55

Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: GFSK



Date: 14.AUG.2019 08:10:08

Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: GFSK



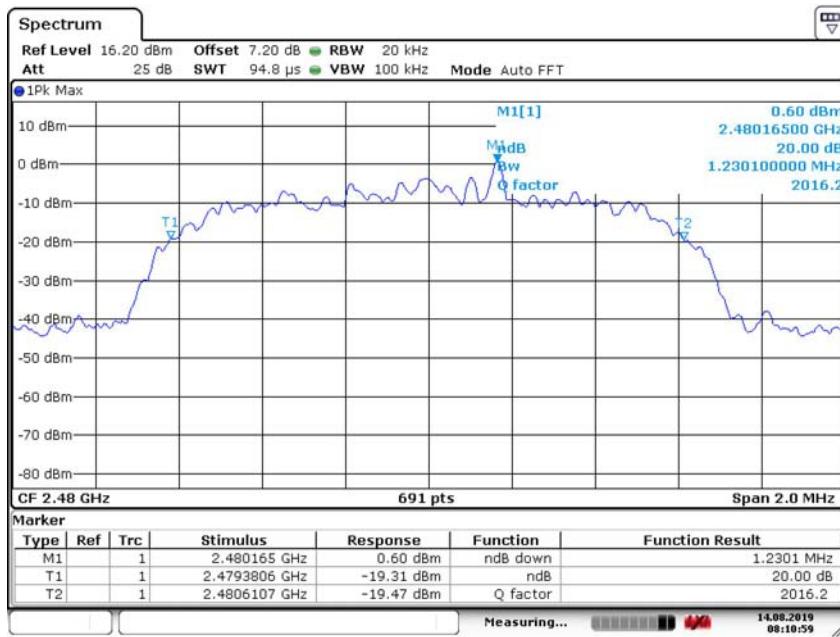
Date: 14.AUG.2019 08:10:32

Carrier frequency (MHz): 2402  
Channel No.:0  
Modulation type: π/4DQPSK



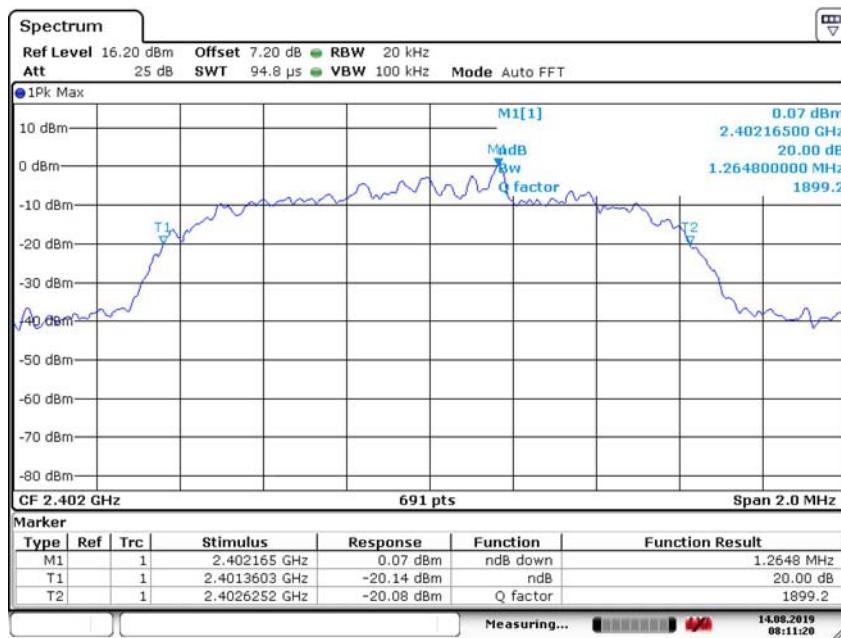
Date: 14.AUG.2019 08:10:44

Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: π/4DQPSK



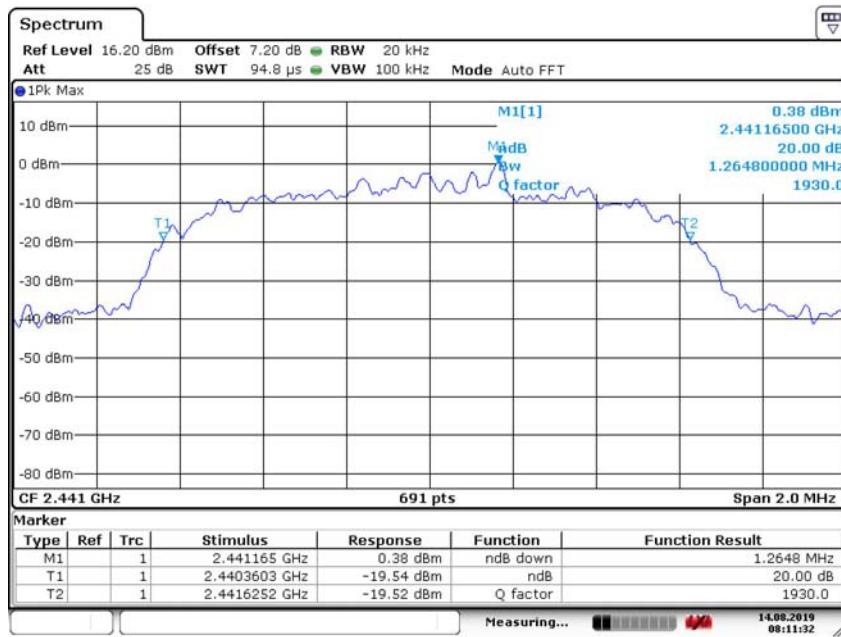
Date: 14.AUG.2019 08:10:59

Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: π/4DQPSK



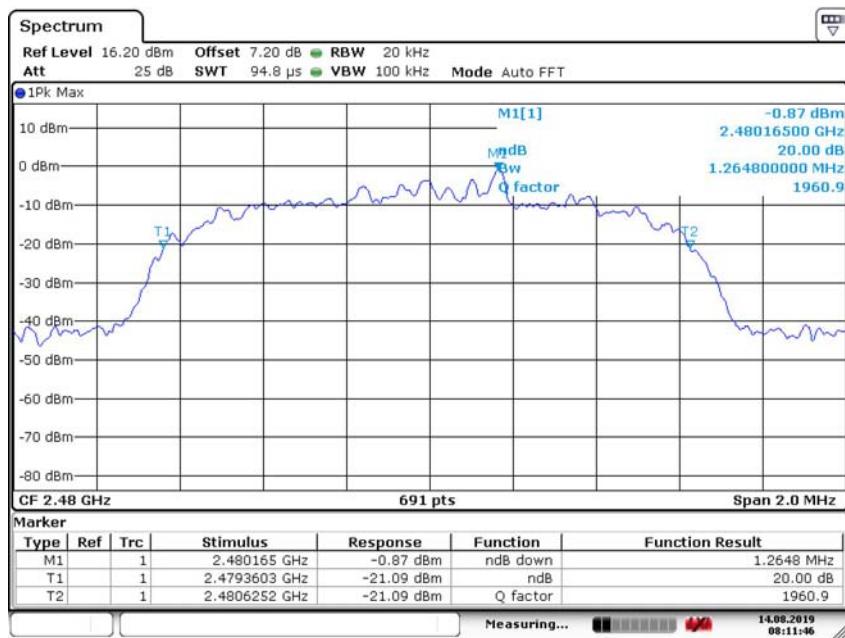
Date: 14.AUG.2019 08:11:20

Carrier frequency (MHz): 2402  
Channel No.:0  
Modulation type: 8DPSK



Date: 14.AUG.2019 08:11:32

Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: 8DPSK

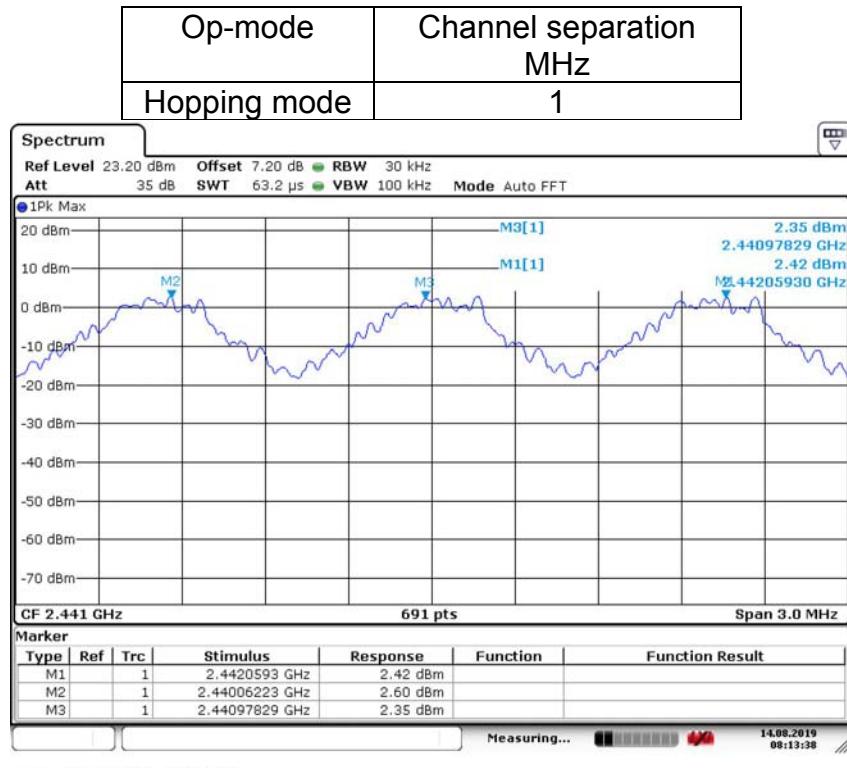


Date: 14.AUG.2019 08:11:46

Carrier frequency (MHz): 2480  
 Channel No.:78  
 Modulation type: 8DPSK

## Channel Separation

Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB



Op-mode: Hopping mode

## Peak Power Output

Modulation type	Average Power Output (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	1.19	2.38	2.23
$\pi/4$ DQPSK	-1.46	-0.19	-0.76
8DPSK	-1.79	-0.25	-0.74

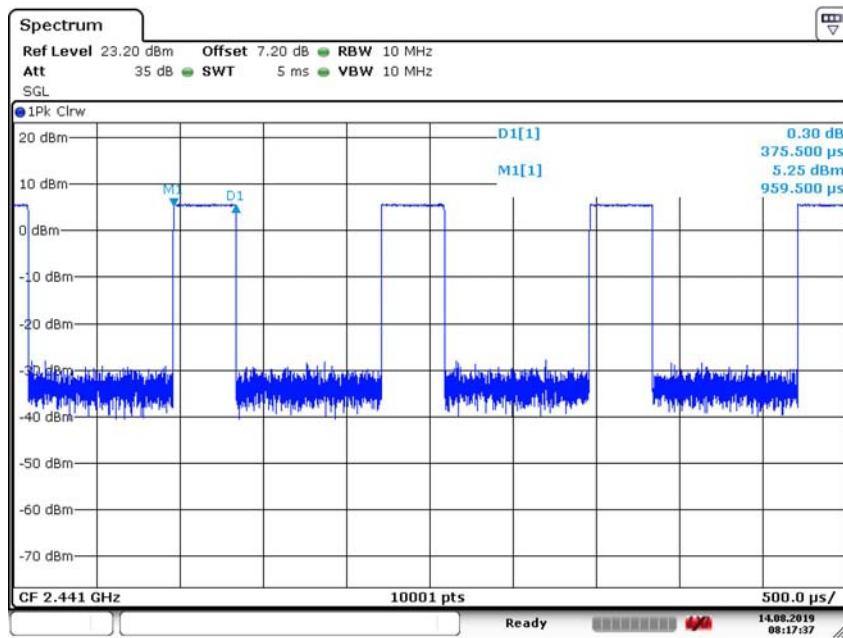
Modulation type	Peak Power Output (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	4.84	6.06	5.82
$\pi/4$ DQPSK	4.09	5.40	4.95
8DPSK	4.26	5.59	5.17

## Dwell Time

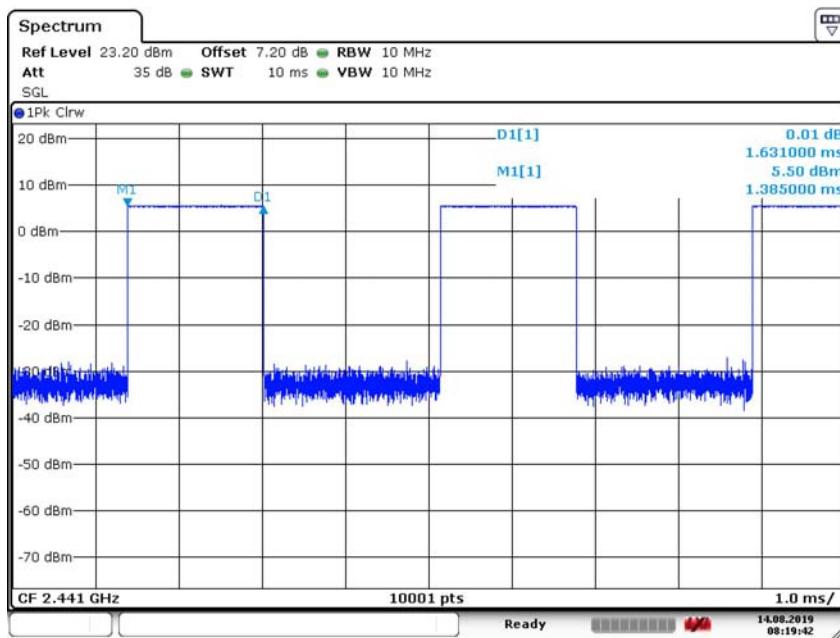
Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

Modulation type: GFSK

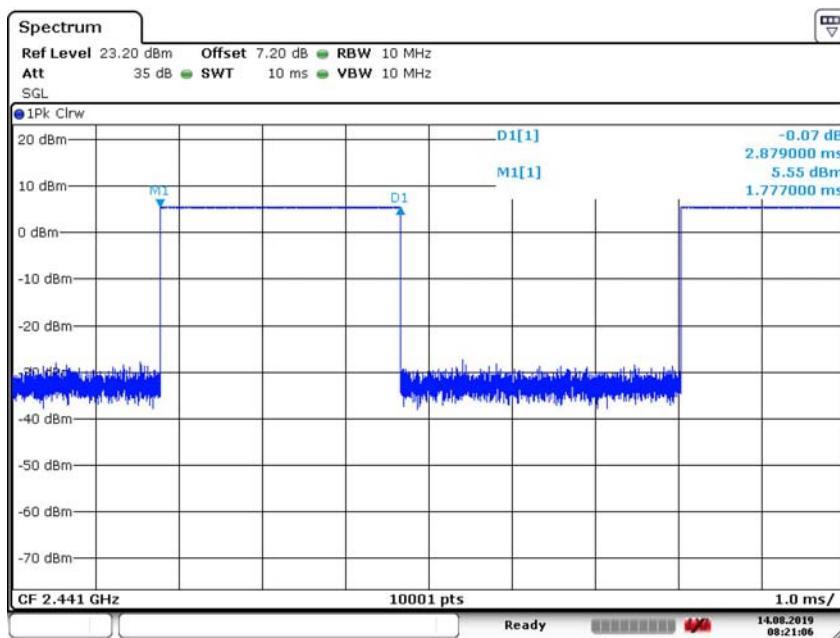
Packet type	Time slot length μs	Dwell time	Dwell time ms
DH1	376	time slot length *31.6 *1600/2 /79	120
DH3	1631	time slot length * 31.6 *1600/4 /79	261
DH5	2879	time slot length * 31.6 *1600/6 /79	307



Carrier frequency (MHz): 2441  
 Packet type: DH1  
 Modulation type: GFSK



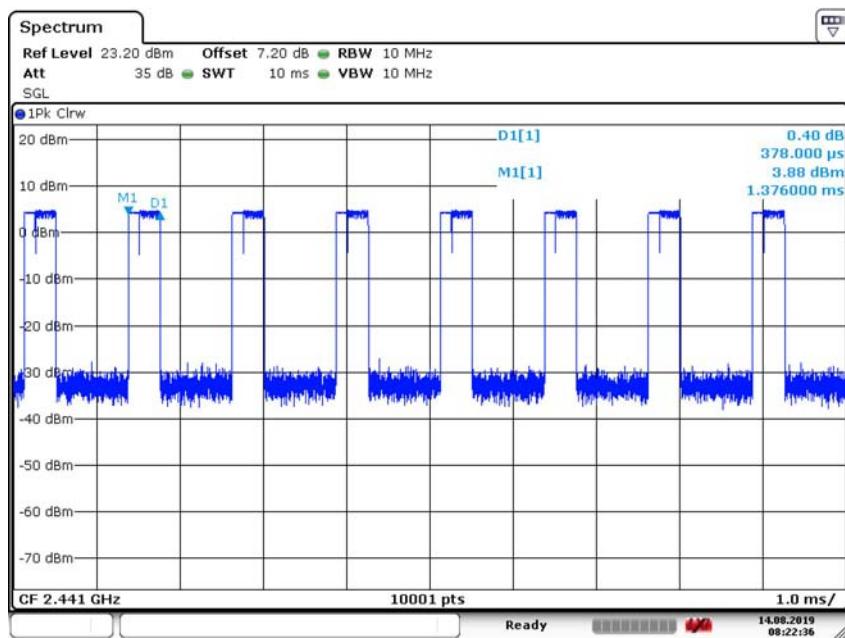
Carrier frequency (MHz): 2441  
Packet type: DH3  
Modulation type: GFSK



Carrier frequency (MHz): 2441  
Packet type: DH5  
Modulation type: GFSK

Modulation type: π/4DQPSK

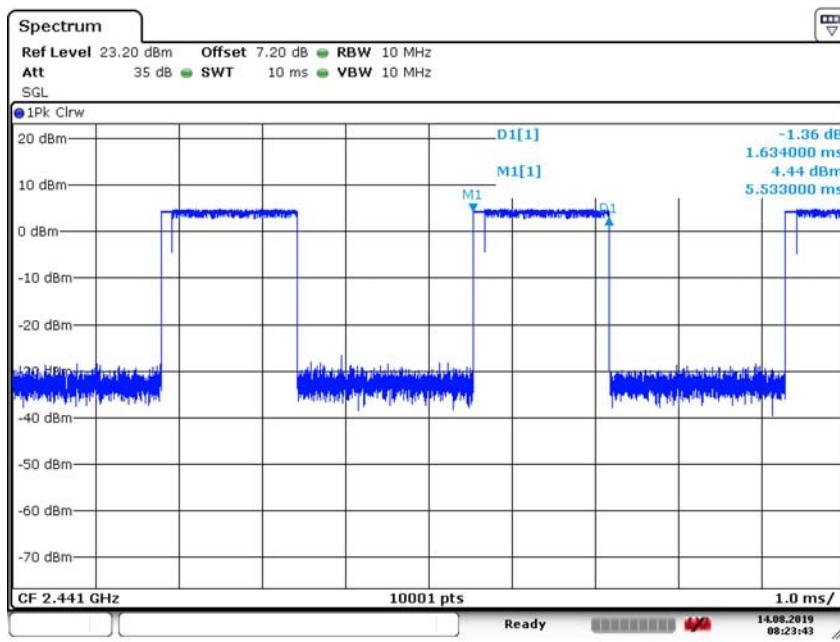
Packet type	Time slot length μs	Dwell time	Dwell time ms
DH1	378	time slot length *31.6 *1600/2 /79	121
DH3	1634	time slot length * 31.6 *1600/4 /79	261
DH5	2877	time slot length * 31.6 *1600/6 /79	307



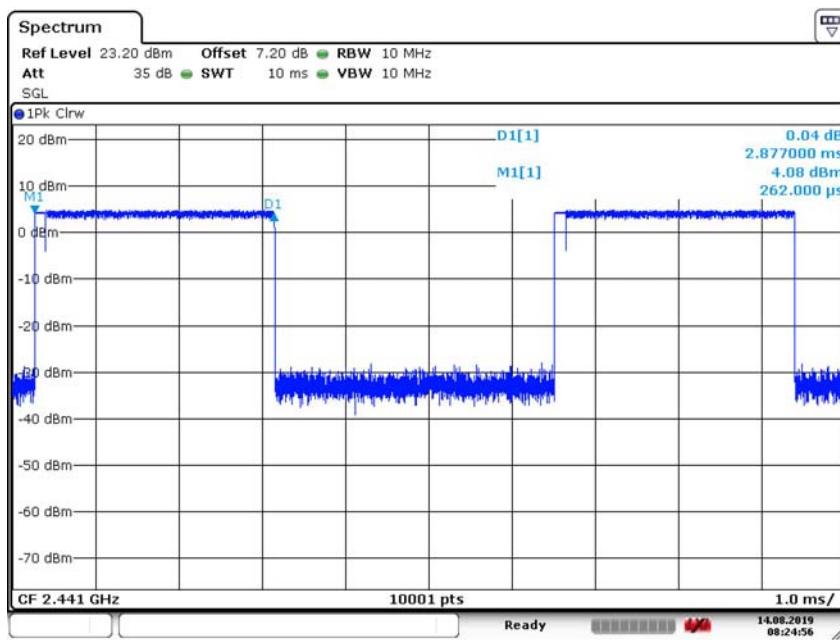
Carrier frequency (MHz): 2441

Packet type: DH1

Modulation type: π/4DQPSK



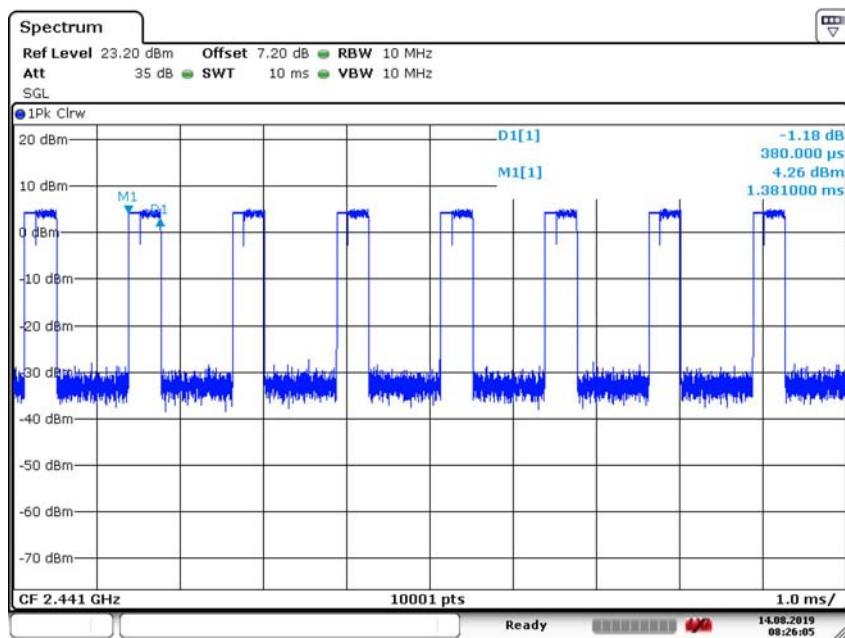
Carrier frequency (MHz): 2441  
Packet type: DH3  
Modulation type:  $\pi/4$ DQPSK



Carrier frequency (MHz): 2441  
Packet type: DH5  
Modulation type:  $\pi/4$ DQPSK

Modulation type: 8DPSK

Packet type	Time slot length μs	Dwell time	Dwell time ms
DH1	380	time slot length *31.6 *1600/2 /79	122
DH3	1630	time slot length * 31.6 *1600/4 /79	261
DH5	2883	time slot length * 31.6 *1600/6 /79	308

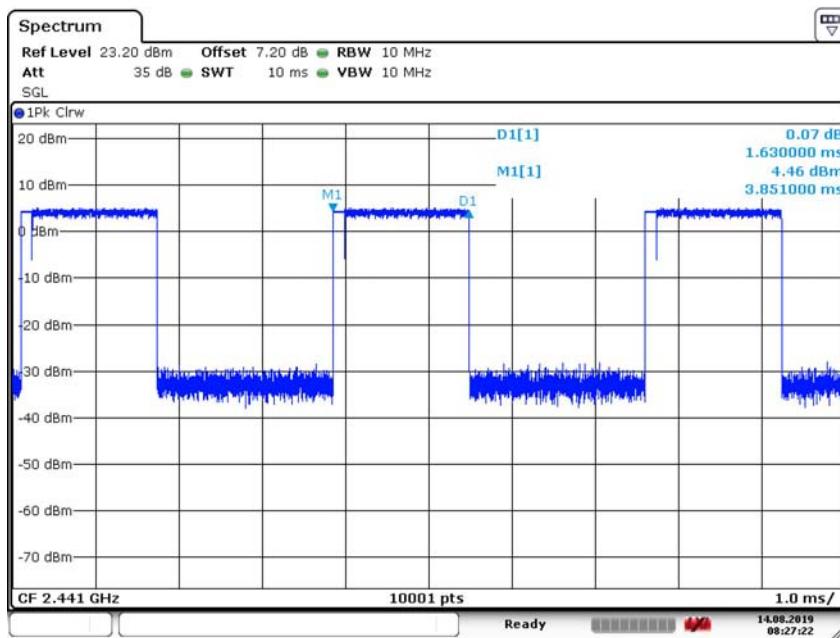


Date: 14.AUG.2019 08:26:05

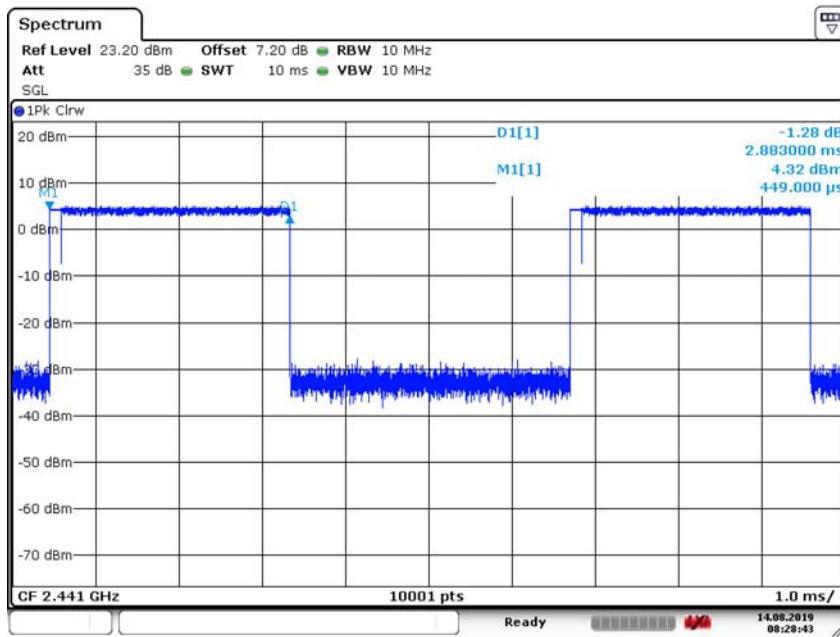
Carrier frequency (MHz): 2441

Packet type: DH1

Modulation type: 8DPSK



Carrier frequency (MHz): 2441  
Packet type: DH3  
Modulation type: 8DPSK

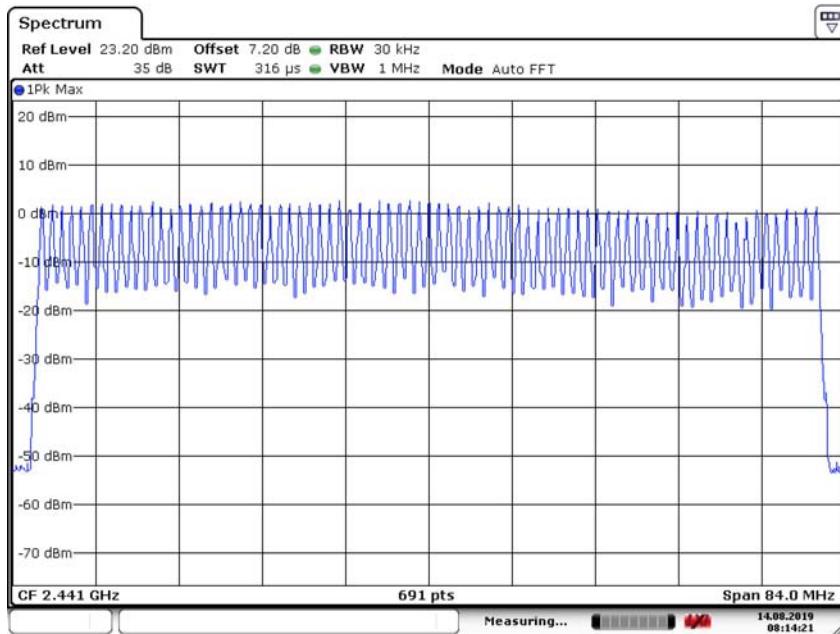


Carrier frequency (MHz): 2441  
Packet type: DH5  
Modulation type: 8DPSK

## Number of Hopping Frequencies

Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

Op-mode	Result
Hopping mode	79



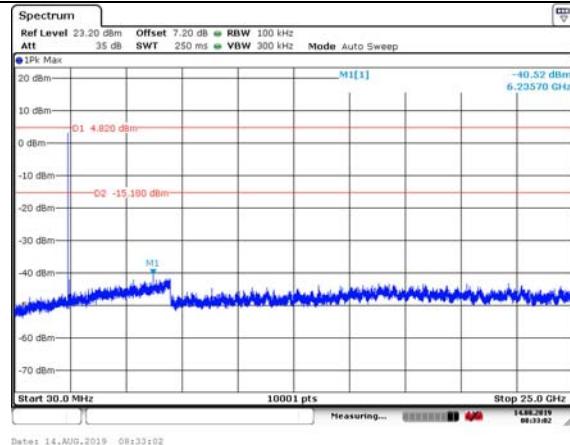
Op-mode: Hopping mode

## Conducted out of band emission measurement

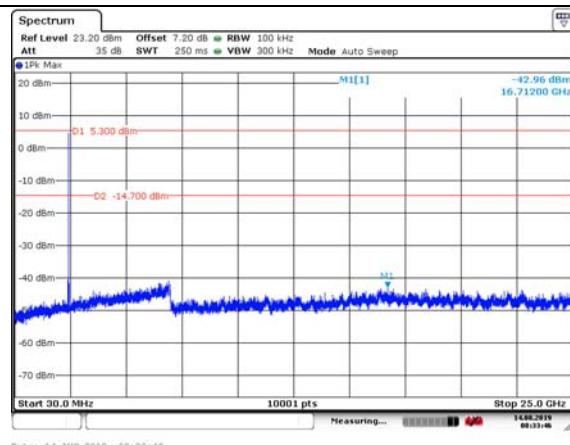
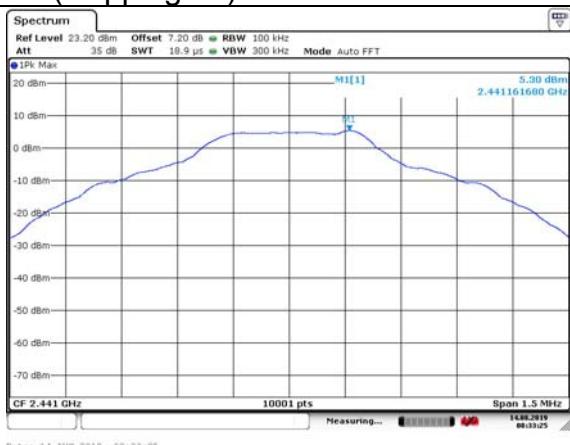
Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

**GFSK**

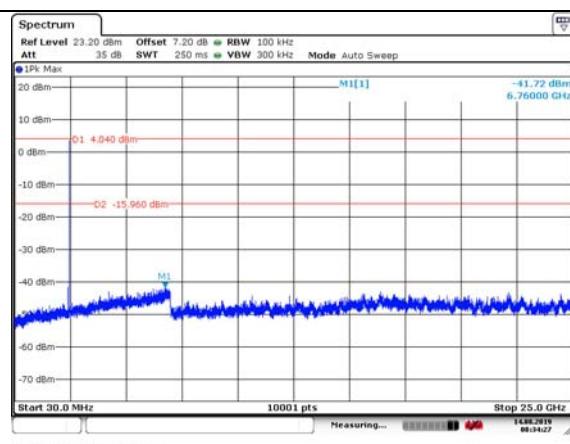
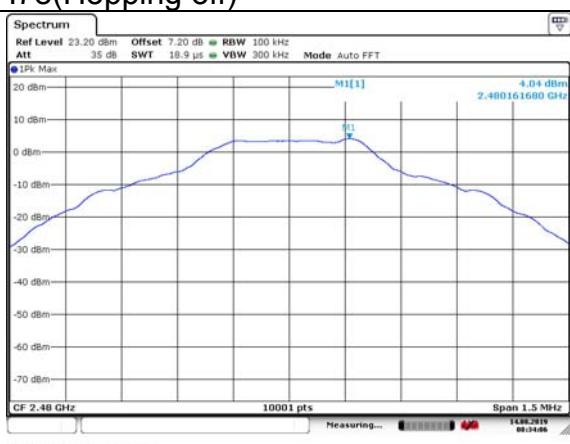
**CH0 (Hopping off)**



**CH39(Hopping off)**

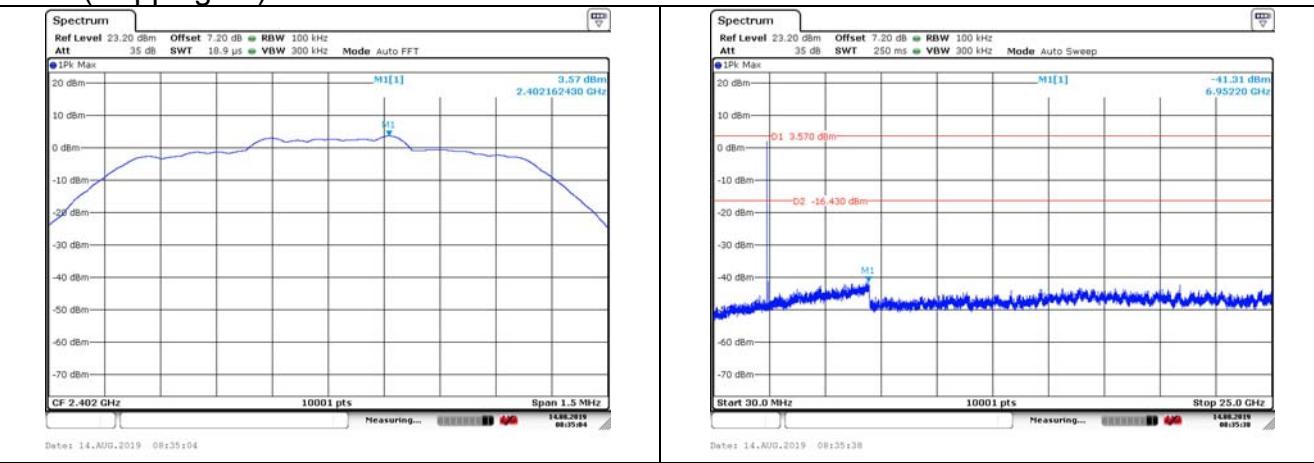


**CH78(Hopping off)**

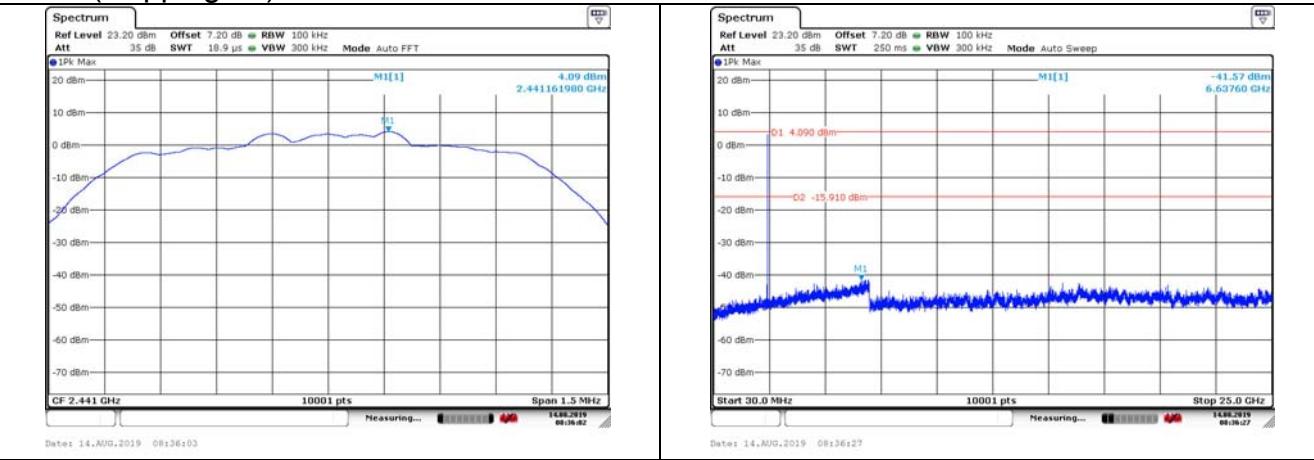


## $\pi/4$ DQPSK

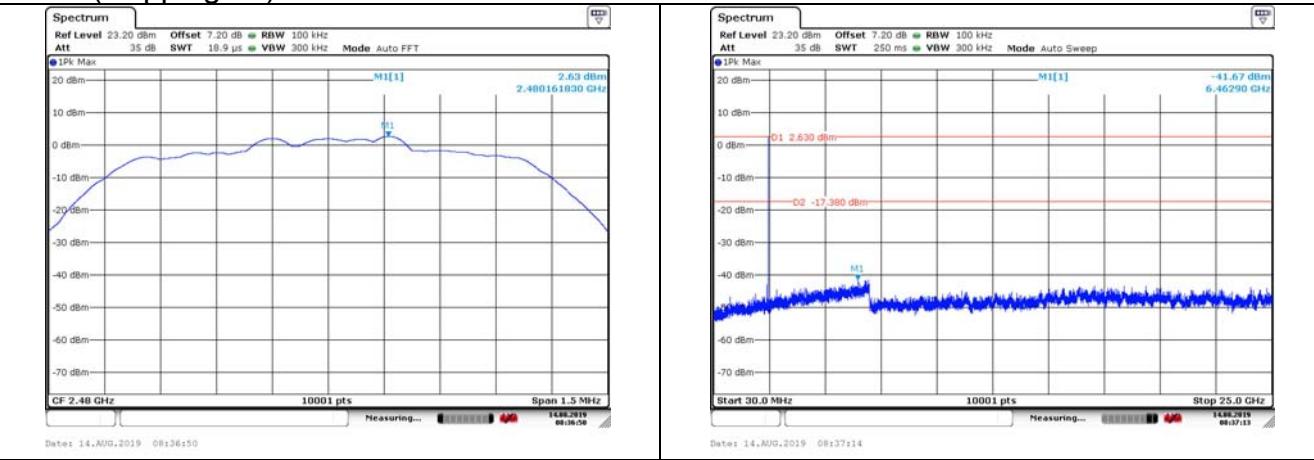
### CH0 (Hopping off)



### CH39(Hopping off)

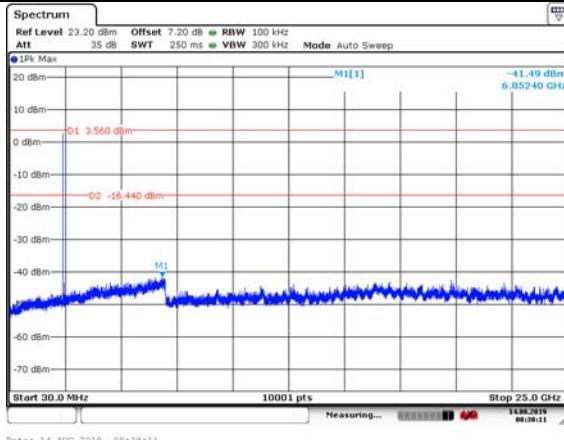
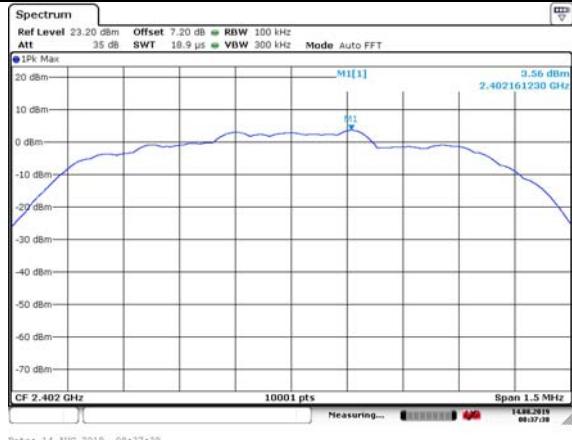


### CH78(Hopping off)

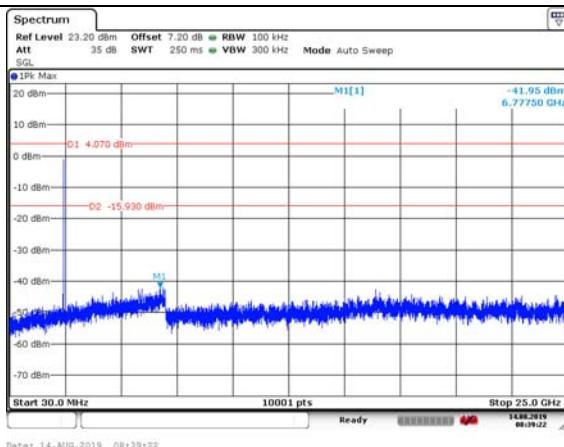
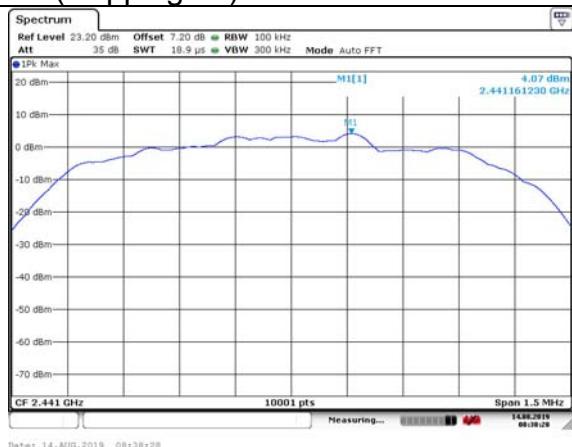


## 8DPSK

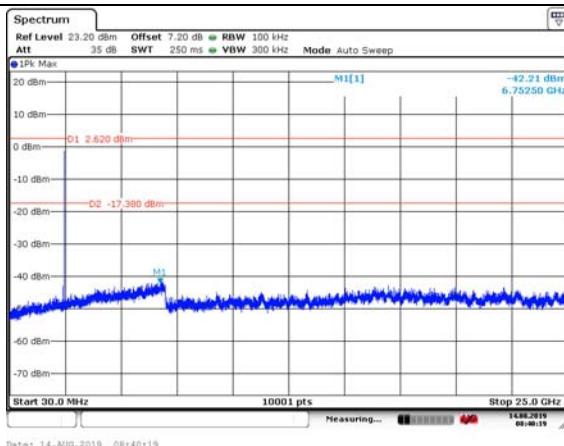
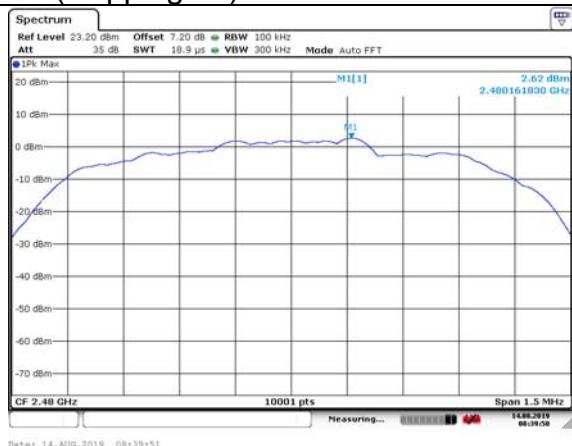
### CH0 (Hopping off)



### CH39(Hopping off)



### CH78(Hopping off)

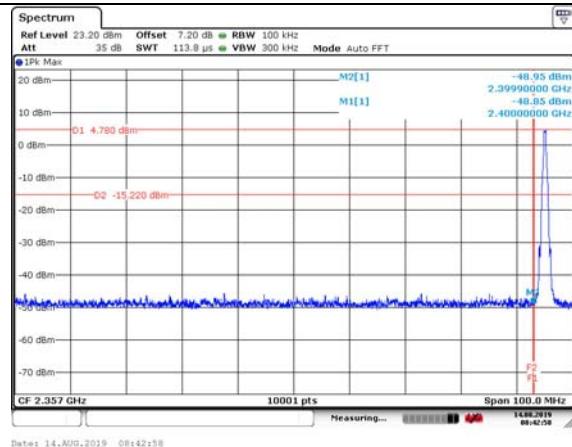


## Band Edge measurement

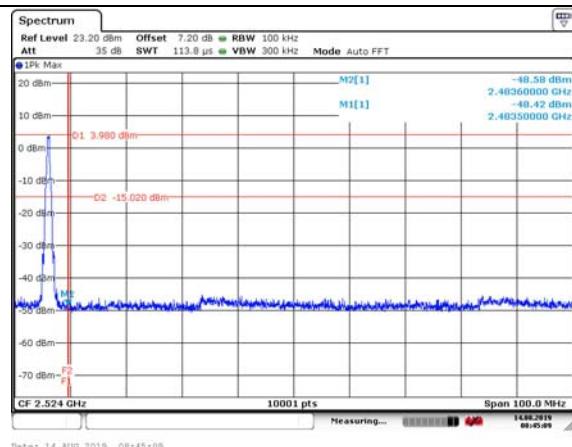
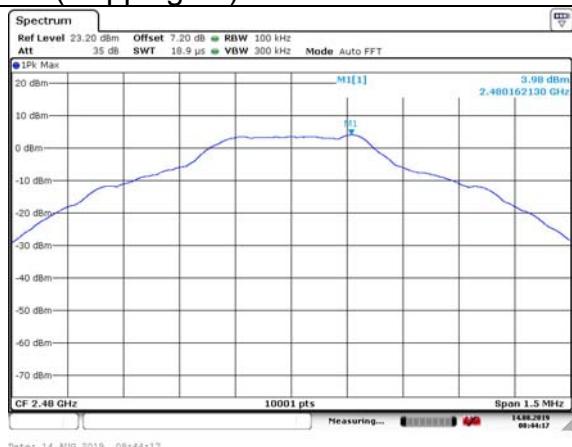
Offset 7.2dB = Power Divider 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

### GFSK

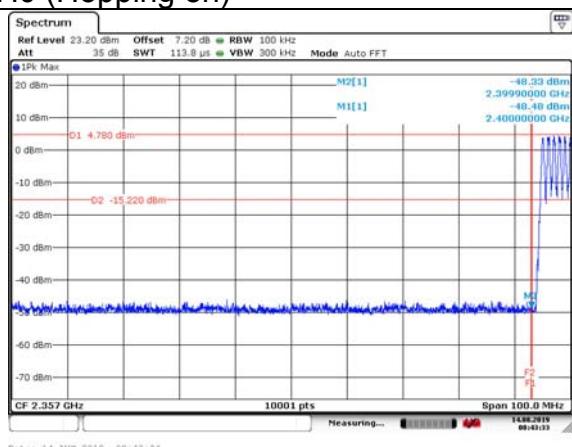
#### CH0 (Hopping off)



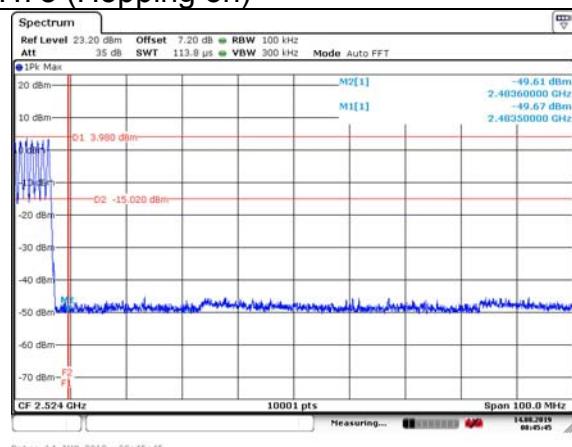
#### CH78(Hopping off)



#### CH0 (Hopping on)

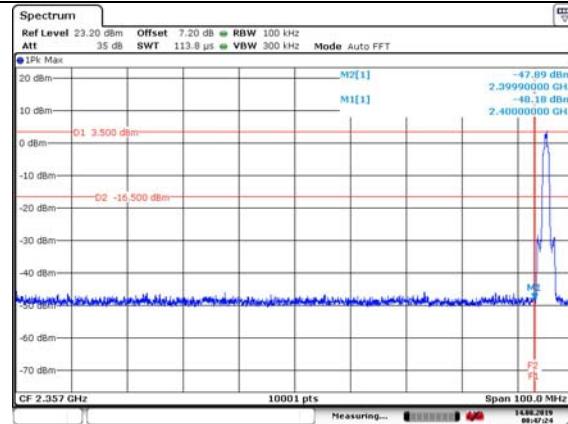
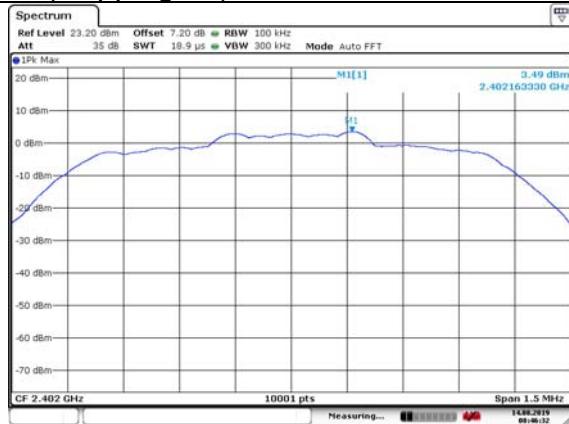


#### CH78 (Hopping on)

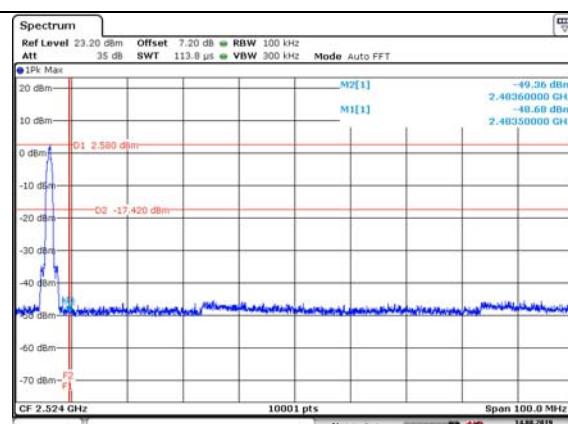
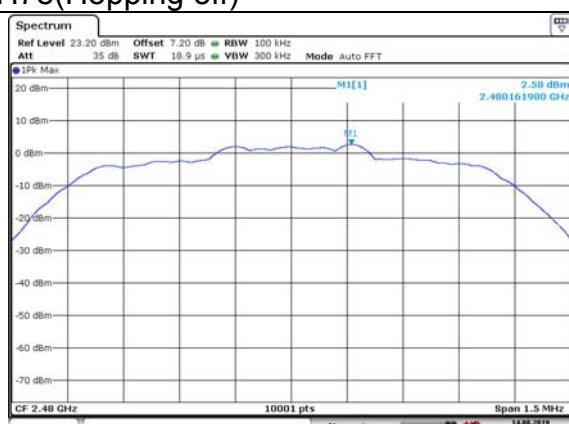


## $\pi/4$ DQPSK

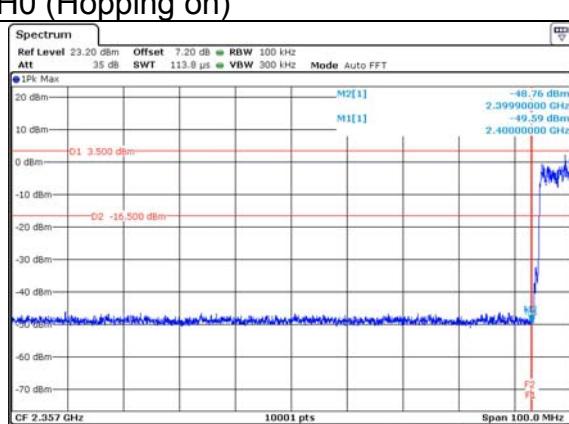
### CH0 (Hopping off)



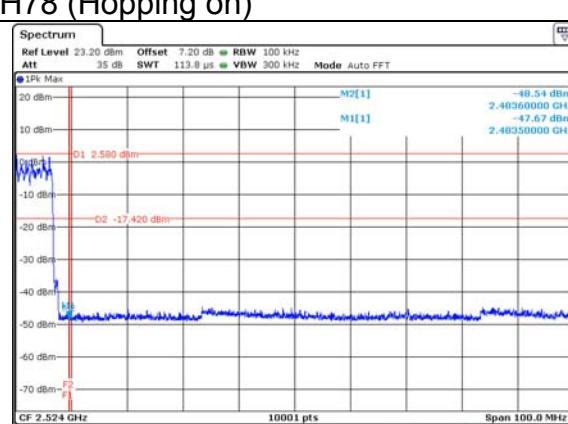
### CH78(Hopping off)



### CH0 (Hopping on)

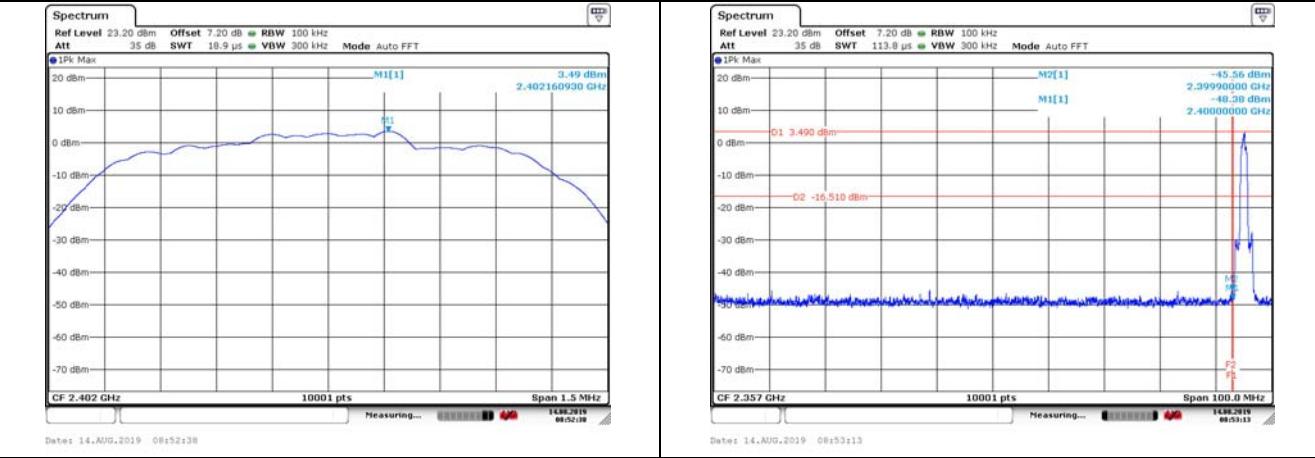


### CH78 (Hopping on)

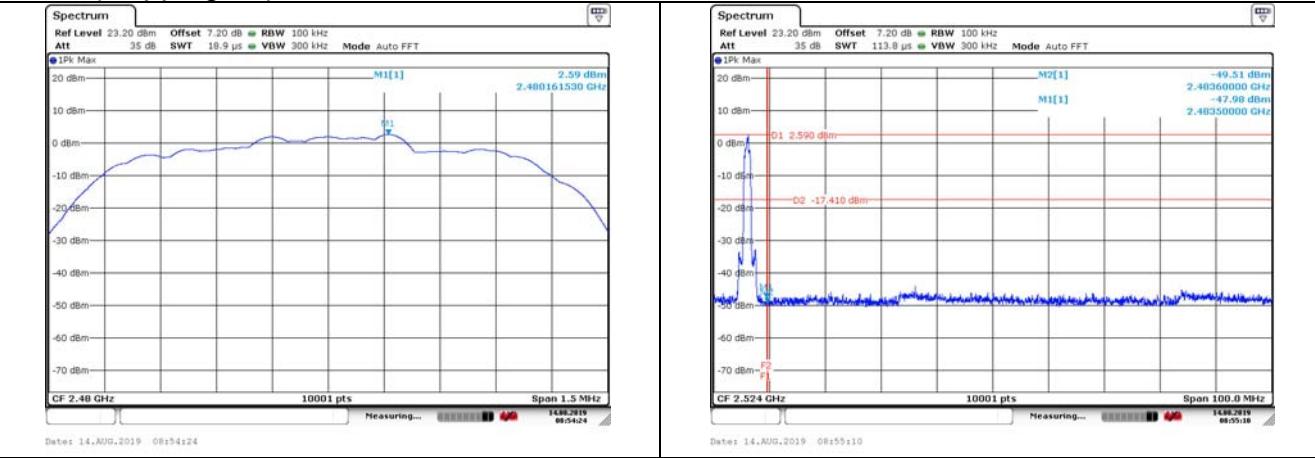


## 8DPSK

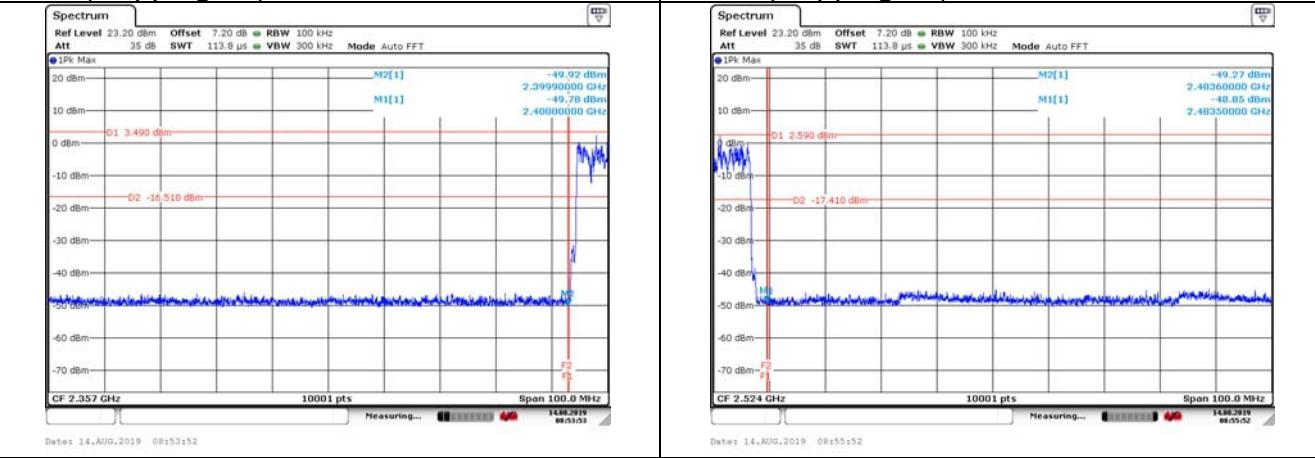
### CH0 (Hopping off)



### CH78(Hopping off)



### CH0 (Hopping on)



## **APPENDIX B – TEST DATA OF RADIATED EMISSION**

### **Radiated Emission Band Edge**

The worst case attitude: The mobile lay down.

The measurement results are obtained as described below:

Measure Level = Reading Level + cable loss + antenna factor

Sample calculation: (97.75 dB<sub>UV</sub>/m) = (63.75 dB<sub>μV</sub>) + (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 (dB <sub>UV</sub> /m)	Reading Level (dB <sub>UV</sub> )	Over Limit (dB)	Limit (dB <sub>UV</sub> /m)	cable loss (dB)	antenna factor (dB)
1	2402	97.75	63.75	N/A	N/A	8.90	25.10
2	2390	44.14	10.14	-29.86	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 (dB <sub>UV</sub> /m)	Reading Level (dB <sub>UV</sub> )	Over Limit (dB)	Limit (dB <sub>UV</sub> /m)	cable loss (dB)	antenna factor (dB)
1	2402	91.94	57.94	N/A	N/A	8.90	25.10
2	2390	40.73	6.73	-33.27	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 (dB <sub>UV</sub> /m)	Reading Level (dB <sub>UV</sub> )	Over Limit (dB)	Limit (dB <sub>UV</sub> /m)	cable loss (dB)	antenna factor (dB)
1	2402	83.19	49.19	N/A	N/A	8.90	25.10
2	2390	33.38	-0.62	-20.62	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 (dB <sub>UV</sub> /m)	Reading Level (dB <sub>UV</sub> )	Over Limit (dB)	Limit (dB <sub>UV</sub> /m)	cable loss (dB)	antenna factor (dB)
1	2402	80.36	46.36	N/A	N/A	8.90	25.10
2	2390	30.58	-3.42	-23.42	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	99.91	65.91	N/A	N/A	8.90	25.10
2	2483.5	47.12	13.12	-26.88	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	93.72	59.72	N/A	N/A	8.90	25.10
2	2483.5	42.22	8.22	-31.78	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	86.40	52.40	N/A	N/A	8.90	25.10
2	2483.5	34.33	0.33	-19.67	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	81.40	47.40	N/A	N/A	8.90	25.10
2	2483.5	33.40	-0.60	-20.60	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: π/4DQPSK

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	98.21	64.21	N/A	N/A	8.90	25.10
2	2390	43.87	9.87	-30.13	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: π/4DQPSK

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	91.38	57.38	N/A	N/A	8.90	25.10
2	2390	42.93	8.93	-31.07	74.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: π/4DQPSK

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	82.96	48.96	N/A	N/A	8.90	25.10
2	2390	32.33	-1.67	-21.67	54.00	8.90	25.10

Carrier frequency (MHz): 2402

Channel No.:0

Test Mode: π/4DQPSK

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	80.52	46.52	N/A	N/A	8.90	25.10
2	2390	31.69	-2.31	-22.31	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: π/4DQPSK

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	98.83	64.83	N/A	N/A	8.90	25.10
2	2483.5	45.78	11.78	-28.22	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: π/4DQPSK

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	92.23	58.23	N/A	N/A	8.90	25.10
2	2483.5	41.68	7.68	-32.32	74.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: π/4DQPSK

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	82.90	48.90	N/A	N/A	8.90	25.10
2	2483.5	31.84	-2.16	-22.16	54.00	8.90	25.10

Carrier frequency (MHz): 2480

Channel No.:78

Test Mode: π/4DQPSK

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	83.19	49.19	N/A	N/A	8.90	25.10
2	2483.5	32.39	-1.61	-21.61	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	96.16	62.16	N/A	N/A	8.90	25.10
2	2390	46.10	12.10	-27.90	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	91.95	57.95	N/A	N/A	8.90	25.10
2	2390	42.50	8.50	-31.50	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	83.05	49.05	N/A	N/A	8.90	25.10
2	2390	33.30	-0.70	-20.70	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	81.49	47.49	N/A	N/A	8.90	25.10
2	2390	31.18	-2.82	-22.82	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	99.13	65.13	N/A	N/A	8.90	25.10
2	2483.5	45.34	11.34	-28.66	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	92.97	58.97	N/A	N/A	8.90	25.10
2	2483.5	40.80	6.80	-33.20	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	84.12	50.12	N/A	N/A	8.90	25.10
2	2483.5	33.14	-0.86	-20.86	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	81.17	47.17	N/A	N/A	8.90	25.10
2	2483.5	32.88	-1.12	-21.12	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:  $(29.54 \text{ dB}\mu\text{V/m}) = (56.54 \text{ dB}\mu\text{V}) + (-27.0 \text{ dB/m})$ , the corresponding frequency is 31.164000MHz.

The worst case attitude: The mobile lay down.

For GFSK

Channel No.:0

Frequency (MHz)	Result (dBuV/m)	$A_{Rpl}$ (dB)	$P_{\text{mea}}$ (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.54	-27.0	56.54	Vertical	40.00
40.864000	35.73	-23.9	59.63	Vertical	40.00
42.610000	30.56	-23.5	54.06	Vertical	40.00
60.409500	30.16	-24.3	54.46	Vertical	40.00
82.719500	27.89	-29.1	56.99	Vertical	40.00
86.017500	29.58	-28.1	57.68	Vertical	40.00

For π/4DQPSK

Channel No.:0

Frequency (MHz)	Result (dBuV/m)	$A_{Rpl}$ (dB)	$P_{\text{mea}}$ (dBuV/m)	Polarity	Limit (dBuV/m)
31.115500	26.03	-27.0	53.03	Vertical	40.00
40.864000	35.59	-23.9	59.49	Vertical	40.00
59.827500	28.23	-24.2	52.43	Vertical	40.00
60.118500	30.03	-24.2	54.23	Vertical	40.00
85.678000	29.39	-28.2	57.59	Vertical	40.00
85.920500	29.23	-28.1	57.33	Vertical	40.00

For 8DPSK

Channel No.:0

Frequency (MHz)	Result (dBuV/m)	$A_{Rpl}$ (dB)	$P_{\text{mea}}$ (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.54	-27.0	56.54	Vertical	40.00
41.106500	35.68	-23.8	59.48	Vertical	40.00
59.827500	28.14	-24.2	52.34	Vertical	40.00
60.118500	30.01	-24.2	54.21	Vertical	40.00
60.409500	30.17	-24.3	54.47	Vertical	40.00
85.338500	29.12	-28.3	57.42	Vertical	40.00

For GFSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.52	-27.0	56.52	Vertical	40.00
40.912500	35.58	-23.9	59.48	Vertical	40.00
60.118500	30.03	-24.2	54.23	Vertical	40.00
60.652000	27.63	-24.4	52.03	Vertical	40.00
85.775000	29.26	-28.1	57.36	Vertical	40.00
86.793500	29.45	-27.8	57.25	Vertical	40.00

For π/4DQPSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
40.767000	35.45	-23.9	59.35	Vertical	40.00
60.118500	30.01	-24.2	54.21	Vertical	40.00
60.409500	30.19	-24.3	54.49	Vertical	40.00
60.700500	28.55	-24.4	52.95	Vertical	40.00
83.592500	28.53	-28.9	57.43	Vertical	40.00
87.472500	29.12	-27.5	56.62	Vertical	40.00

For 8DPSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.55	-27.0	56.55	Vertical	40.00
41.009500	35.66	-23.8	59.46	Vertical	40.00
60.118500	29.96	-24.2	54.16	Vertical	40.00
60.409500	30.14	-24.3	54.44	Vertical	40.00
85.387000	28.90	-28.3	57.2	Vertical	40.00
86.114500	29.43	-28.0	57.43	Vertical	40.00

For GFSK

Channel No.:78

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.115500	26.01	-27.0	53.01	Vertical	40.00
40.864000	35.41	-23.9	59.31	Vertical	40.00
42.610000	29.93	-23.5	53.43	Vertical	40.00
60.070000	26.73	-24.2	50.93	Vertical	40.00
84.902000	29.07	-28.5	57.57	Vertical	40.00
86.842000	29.24	-27.7	56.94	Vertical	40.00

For π/4DQPSK  
Channel No.:78

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.53	-27.0	56.53	Vertical	40.00
41.203500	35.41	-23.8	59.21	Vertical	40.00
60.118500	29.92	-24.2	54.12	Vertical	40.00
60.409500	30.13	-24.3	54.43	Vertical	40.00
60.700500	28.54	-24.4	52.94	Vertical	40.00
87.666500	28.97	-27.4	56.37	Vertical	40.00

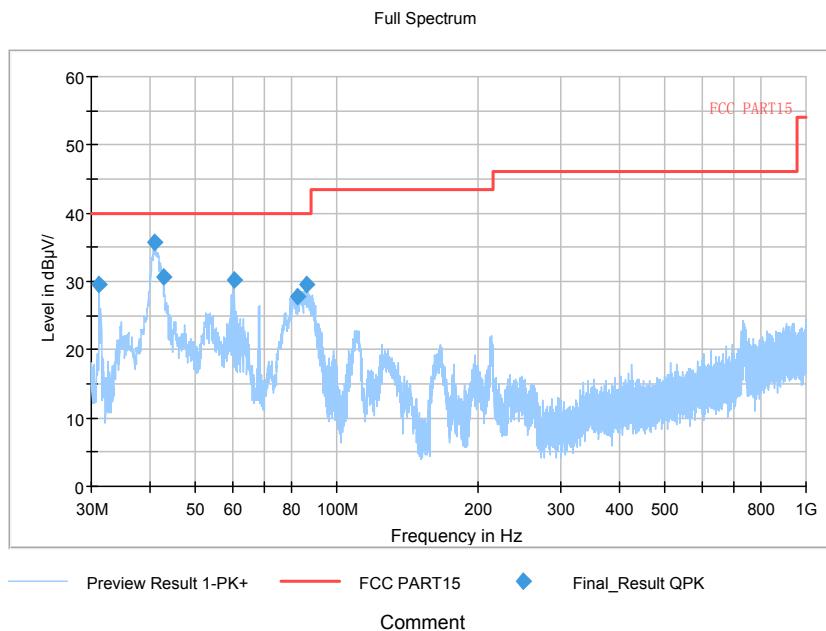
For 8DPSK  
Channel No.:78

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.115500	25.96	-27.0	52.96	Vertical	40.00
41.155000	35.48	-23.8	59.28	Vertical	40.00
60.361000	27.78	-24.3	52.08	Vertical	40.00
60.652000	27.38	-24.4	51.78	Vertical	40.00
85.678000	29.06	-28.2	57.26	Vertical	40.00
86.114500	29.12	-28.0	57.12	Vertical	40.00

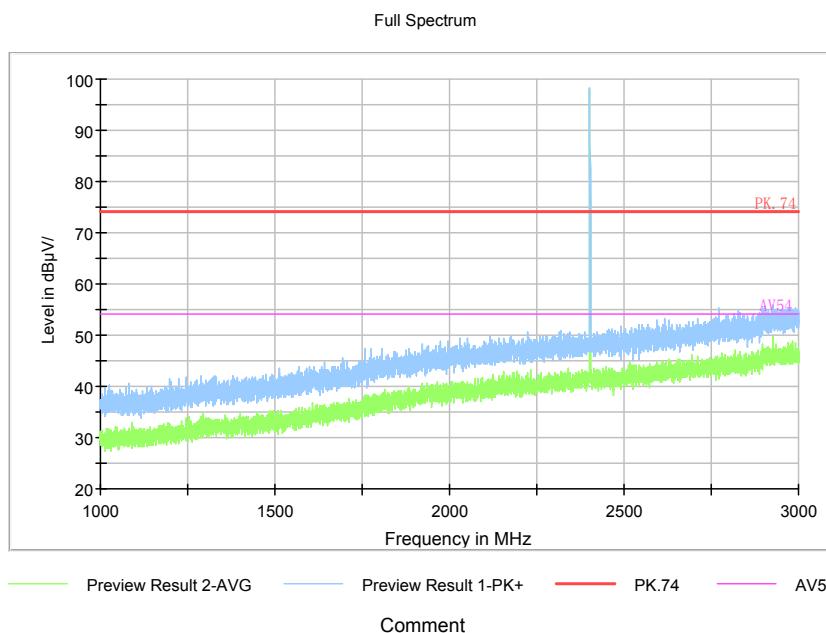
GFSK MODE Channel 39 is selected as the worst point for RSE.  
Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.164000	29.54	-27.0	56.54	Horizontal	40.00
40.912500	35.49	-23.9	59.39	Vertical	40.00
60.118500	29.89	-24.2	54.09	Vertical	40.00
60.409500	30.11	-24.3	54.41	Vertical	40.00
84.320000	28.83	-28.6	57.43	Vertical	40.00
87.472500	28.99	-27.5	56.49	Vertical	40.00

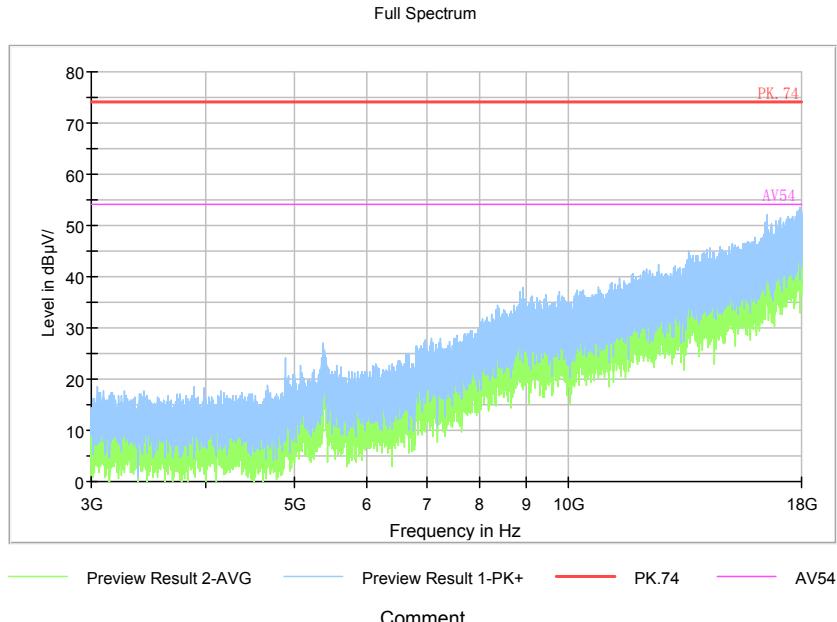
Carrier frequency (MHz): 2402  
 Channel No.:0



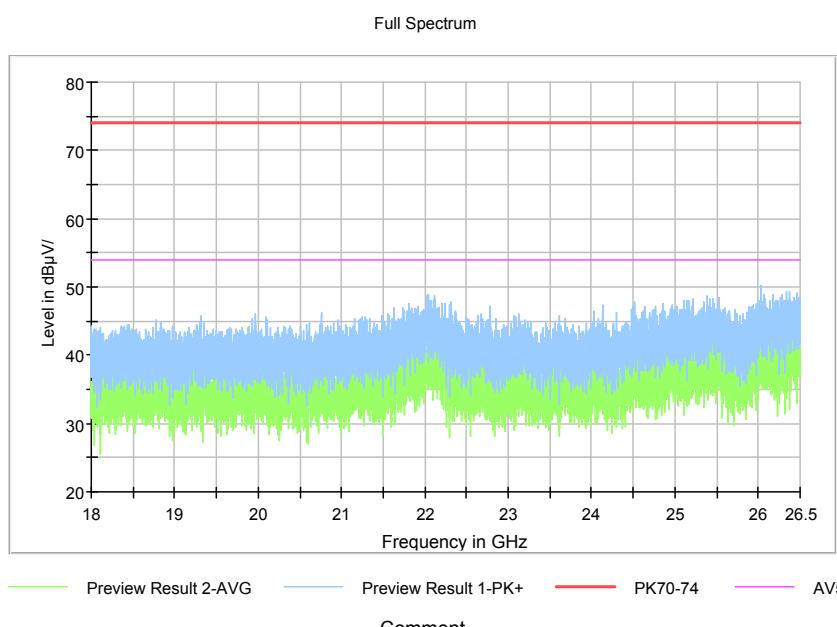
Frequency Range: 30MHz-1000MHz  
 Detector: QP mode  
 Modulation type: GFSK



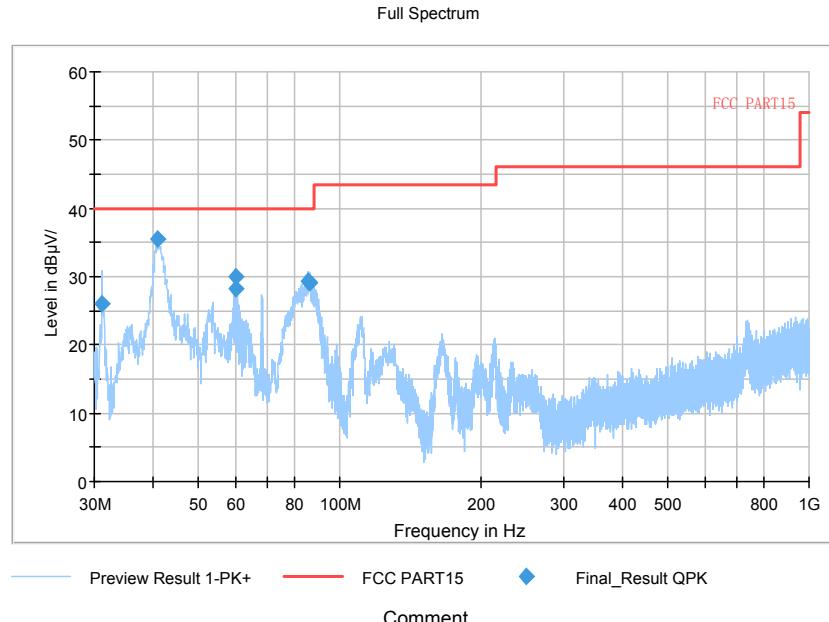
Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



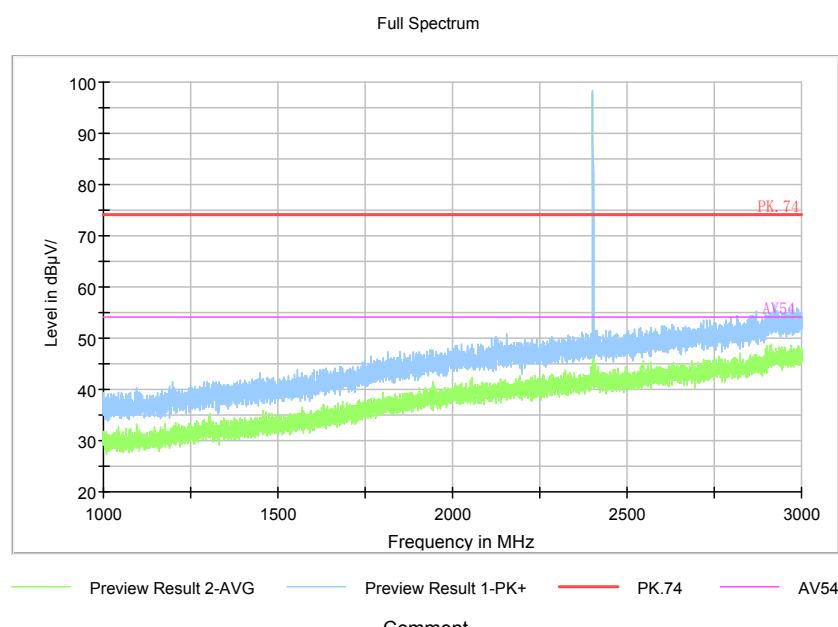
Frequency Range: 3GHz- 18GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



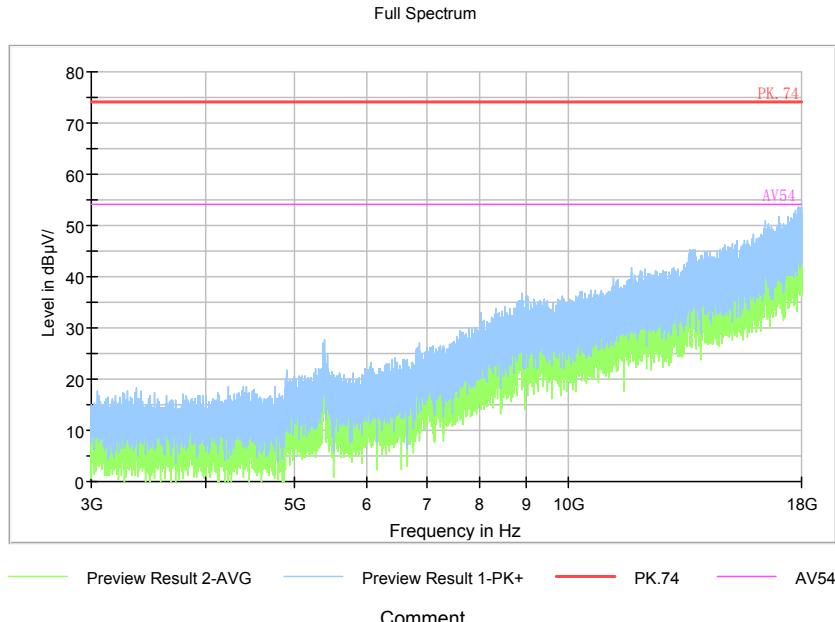
Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



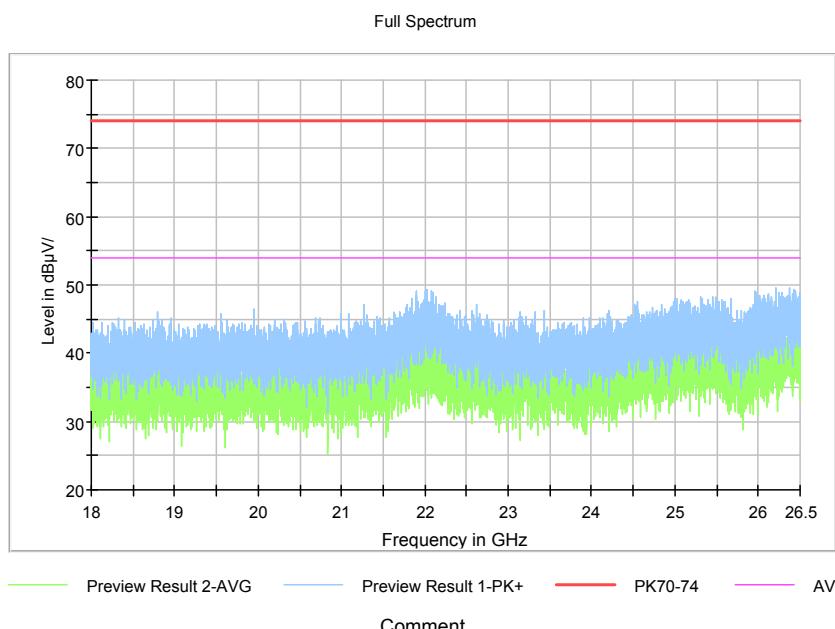
Frequency Range: 30MHz-1000 MHz  
Detector: QP mode  
Modulation type:  $\pi/4$ DQPSK



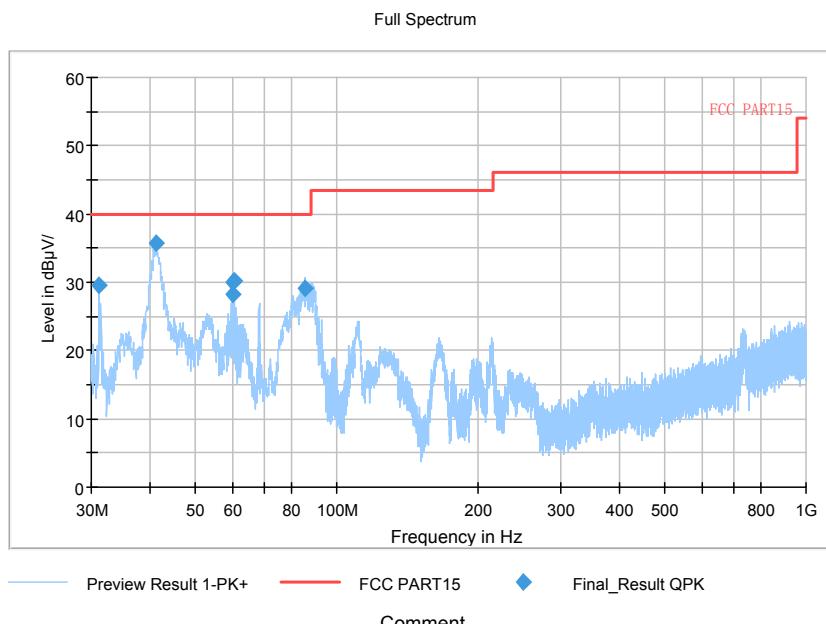
Frequency Range: 1GHz-3GHz  
Detector: Av mode and PK mode  
Modulation type:  $\pi/4$ DQPSK



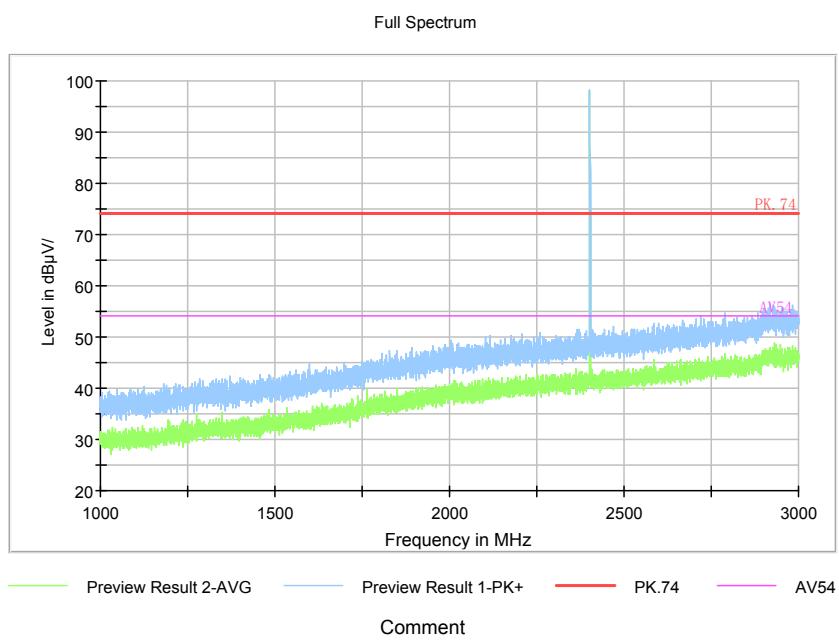
Frequency Range: 3GHz-18GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK



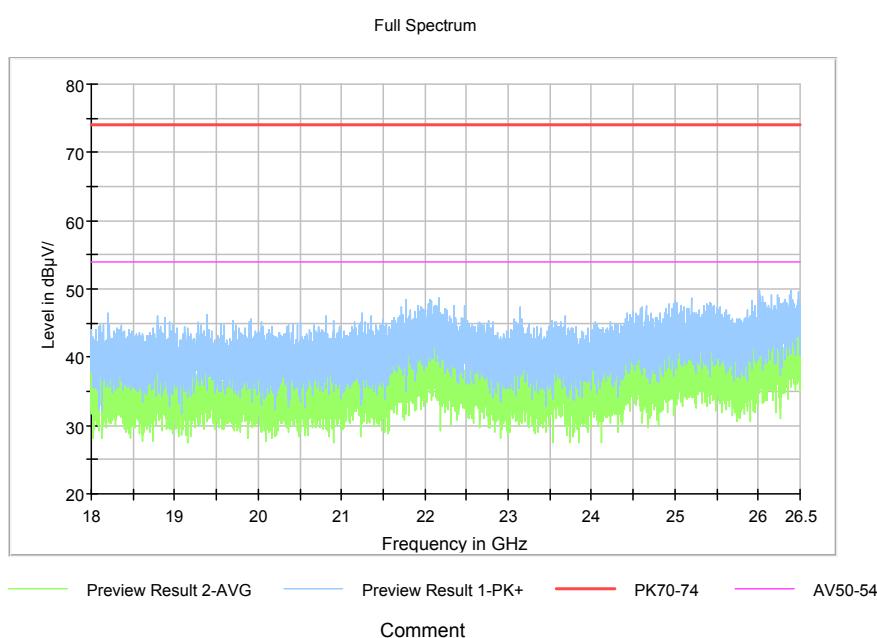
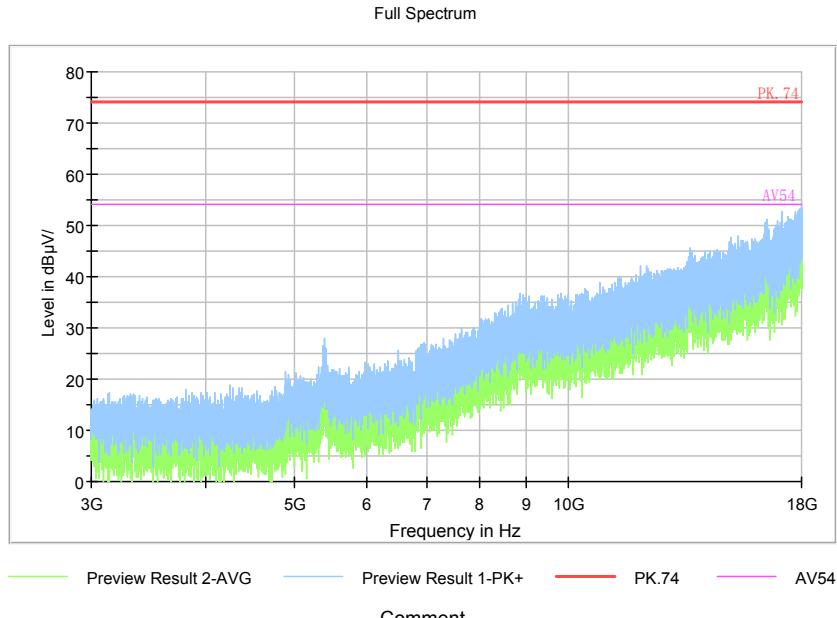
Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK



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



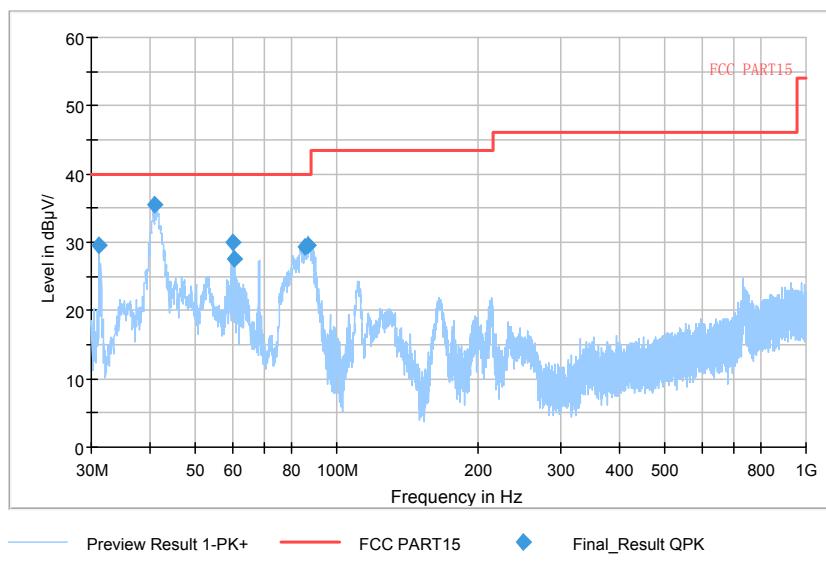
Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK



Carrier frequency (MHz): 2441

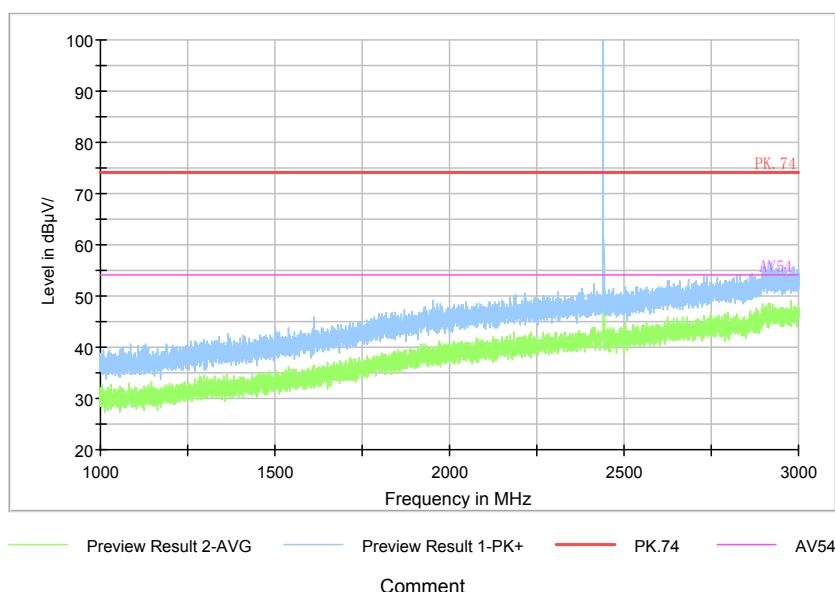
Channel No.:39

Full Spectrum

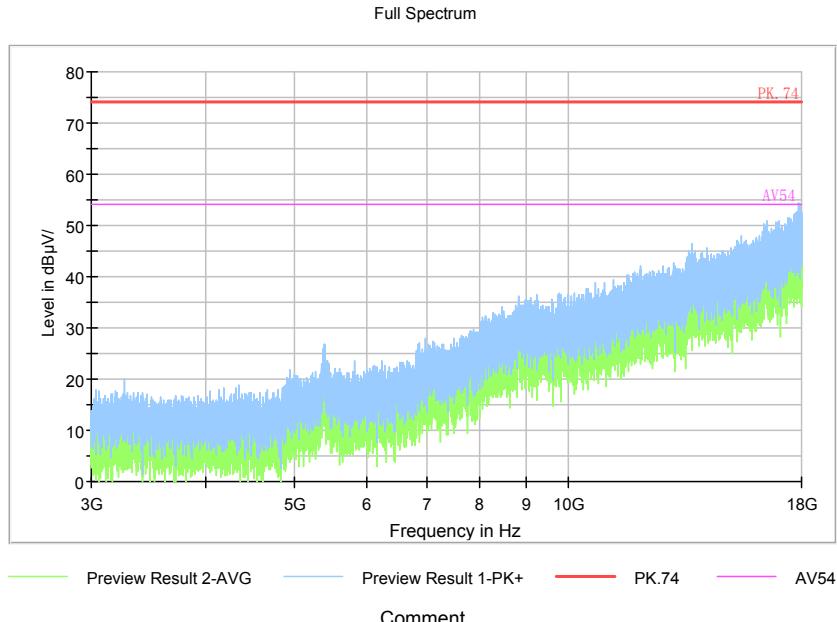


Frequency Range: 30MHz-1000MHz  
 Detector: QP mode  
 Modulation type: GFSK

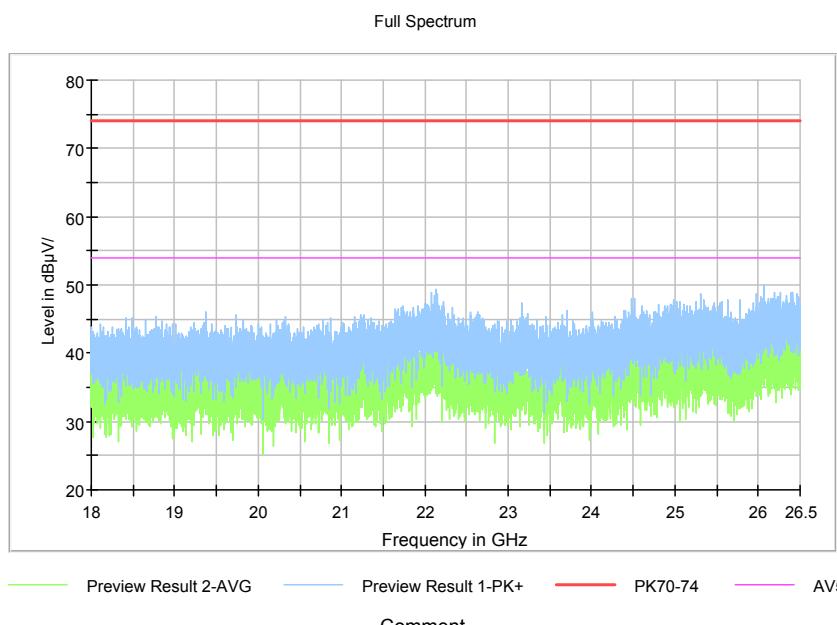
Full Spectrum



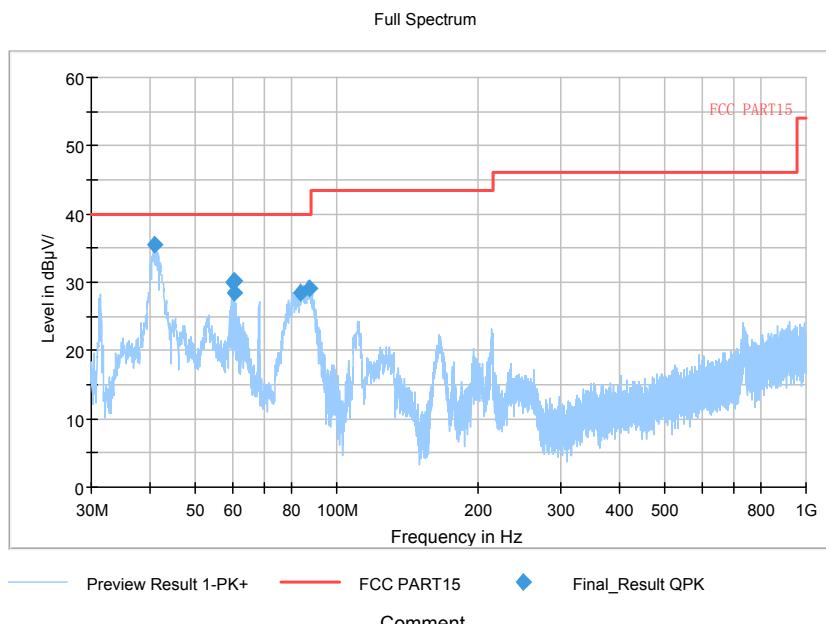
Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



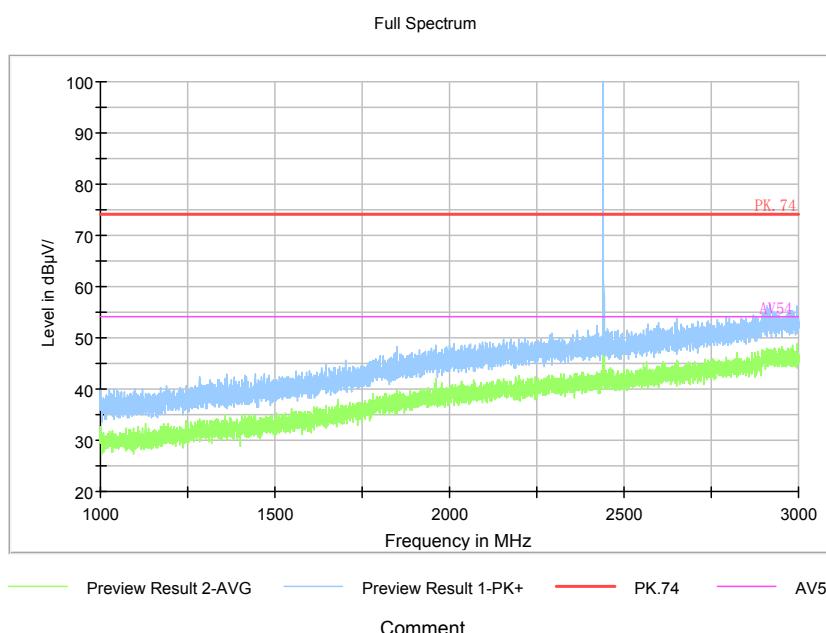
Frequency Range: 3GHz- 18GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



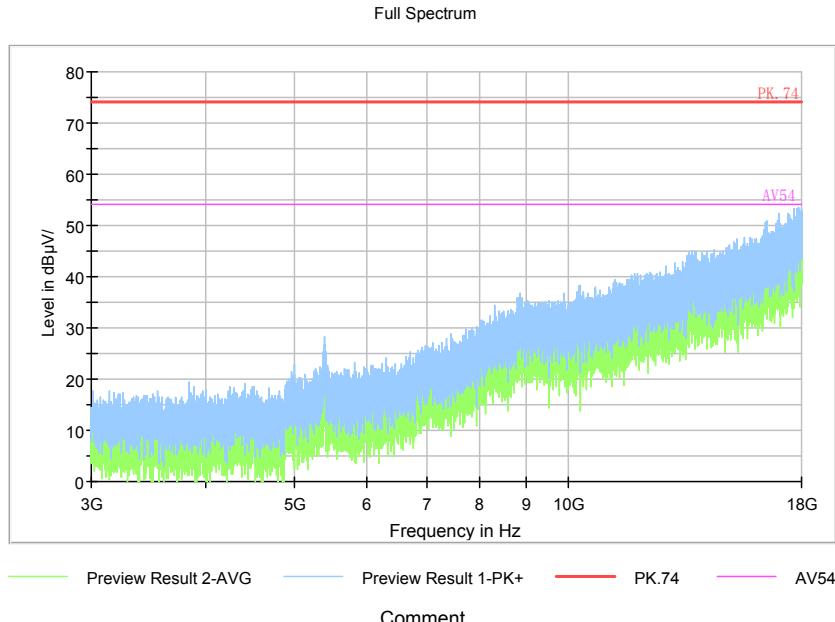
Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



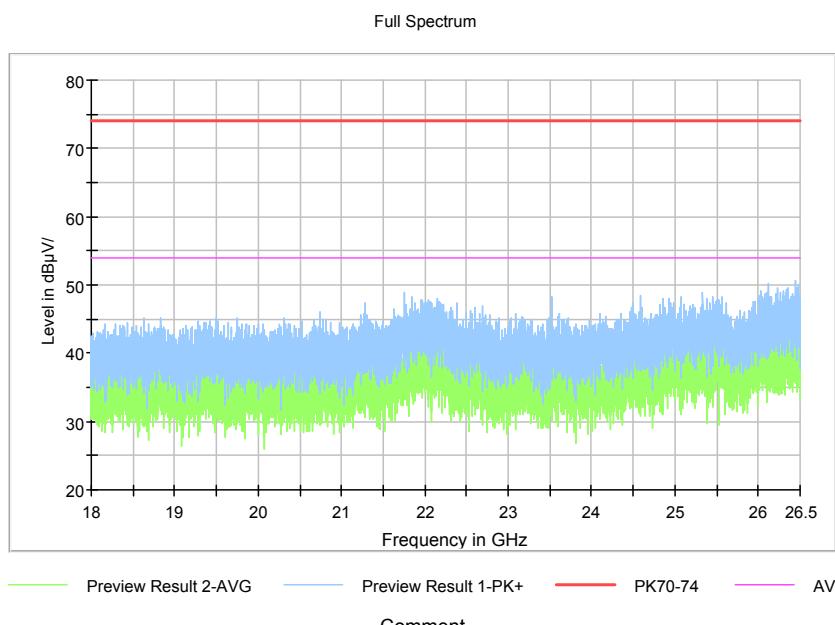
Frequency Range: 30MHz-1000 MHz  
 Detector: QP mode  
 Modulation type:  $\pi/4$ DQPSK



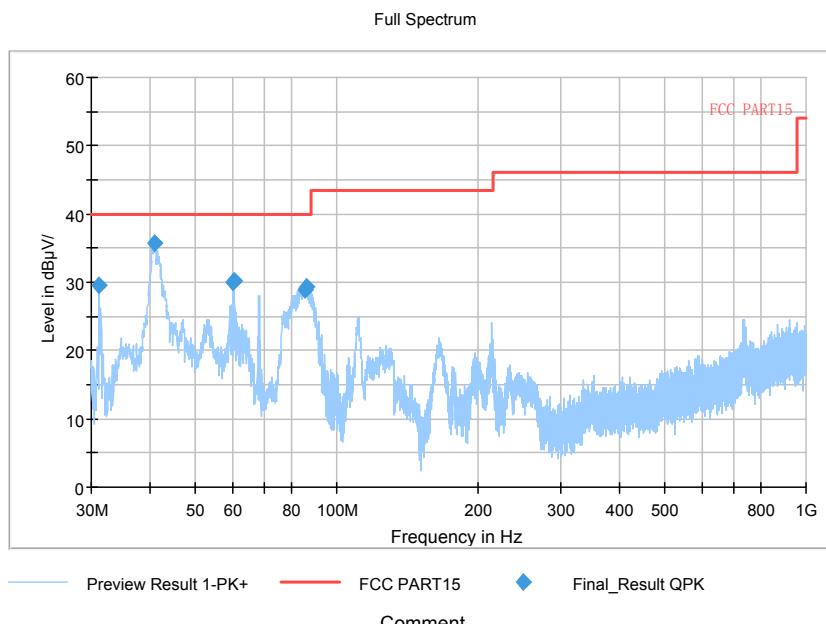
Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK



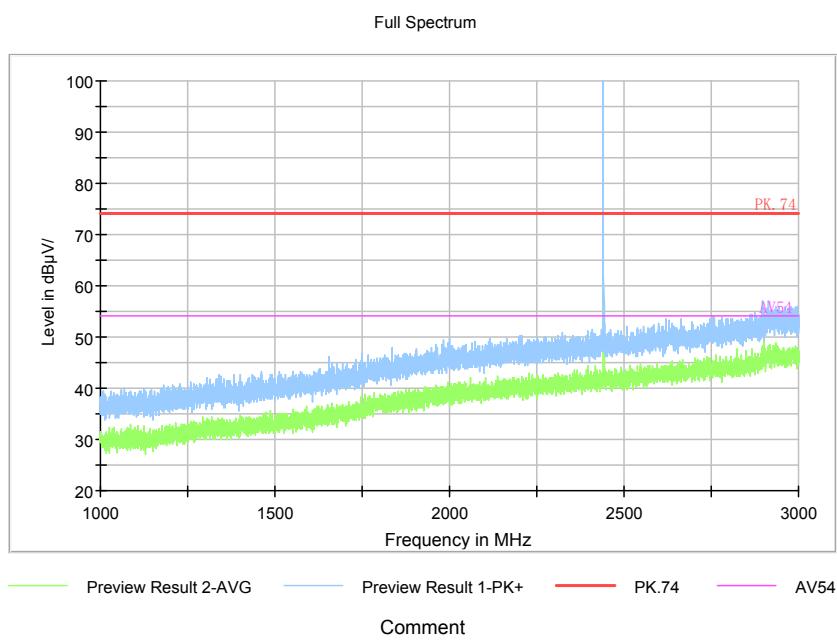
Frequency Range: 3GHz-18GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK



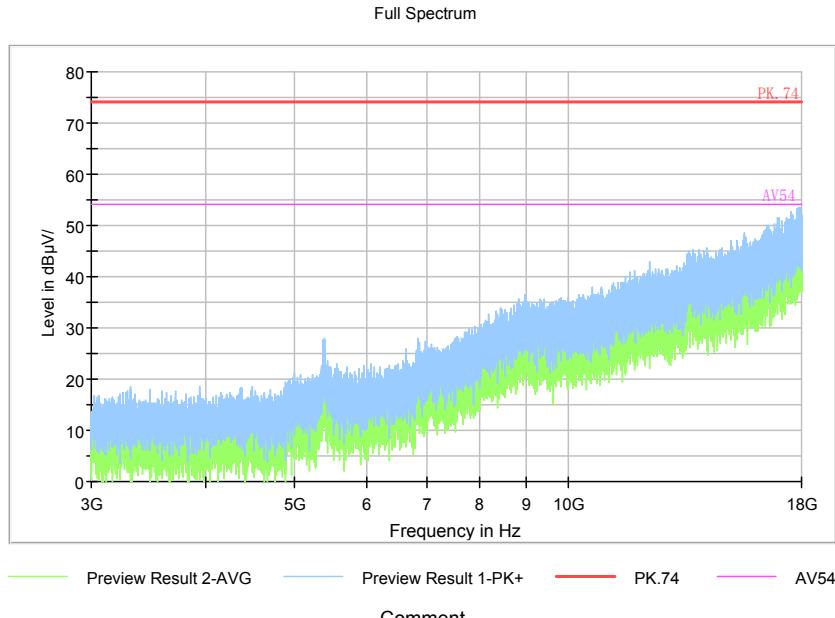
Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK



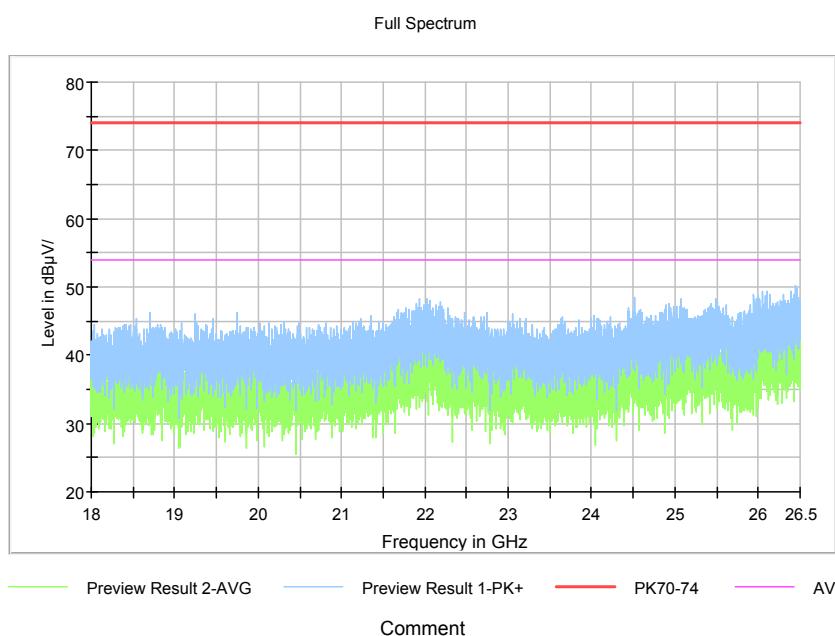
Frequency Range: 30MHz-1000 MHz  
 Detector: QP mode  
 Modulation type: 8DPSK



Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

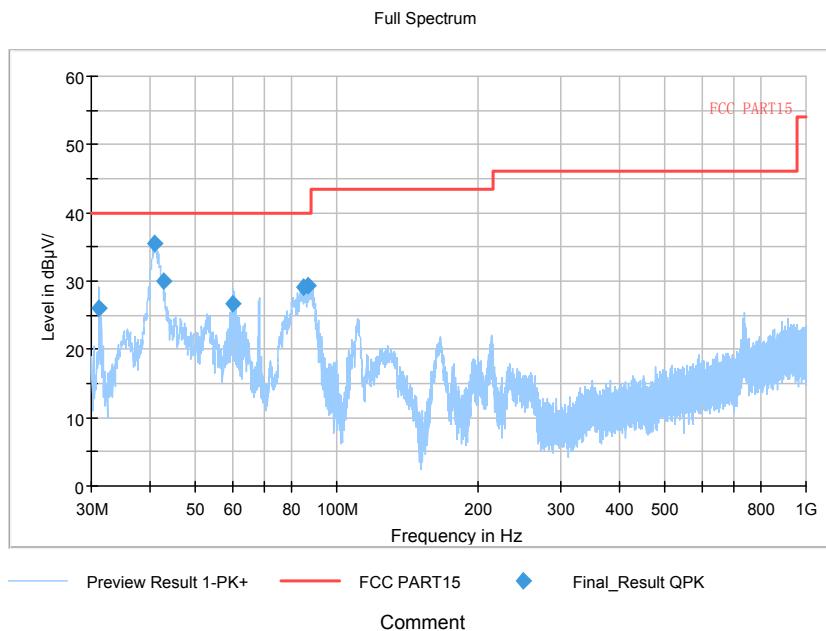


Frequency Range: 3GHz-18GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

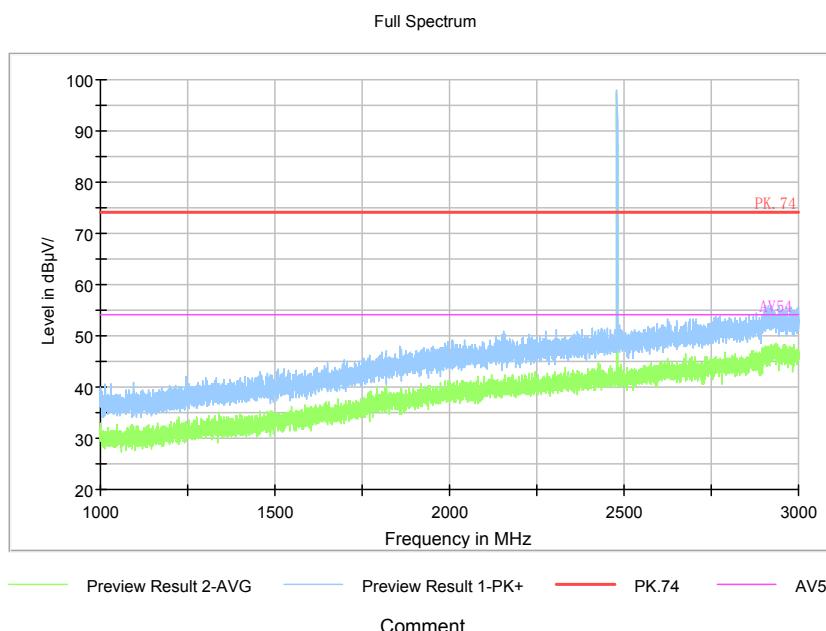


Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

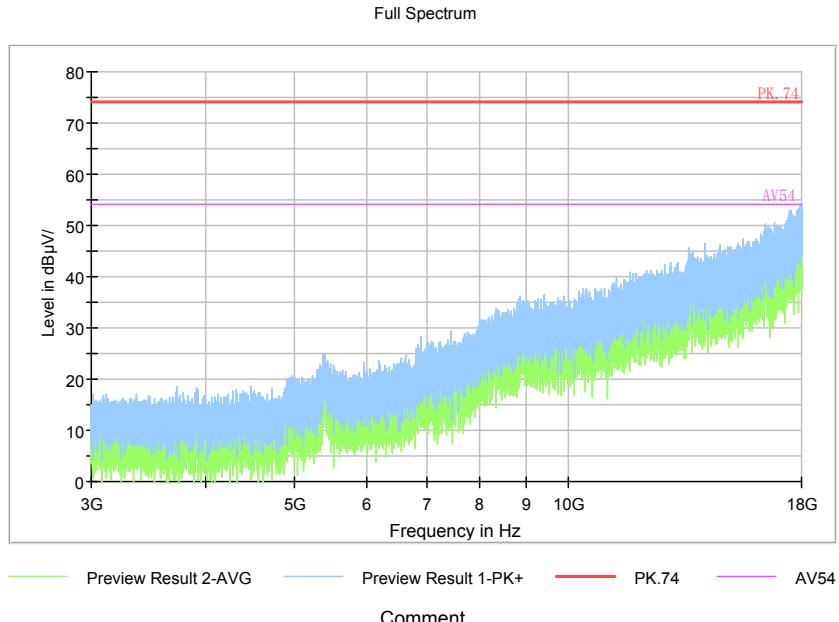
Carrier frequency (MHz): 2480  
Channel No.: 78



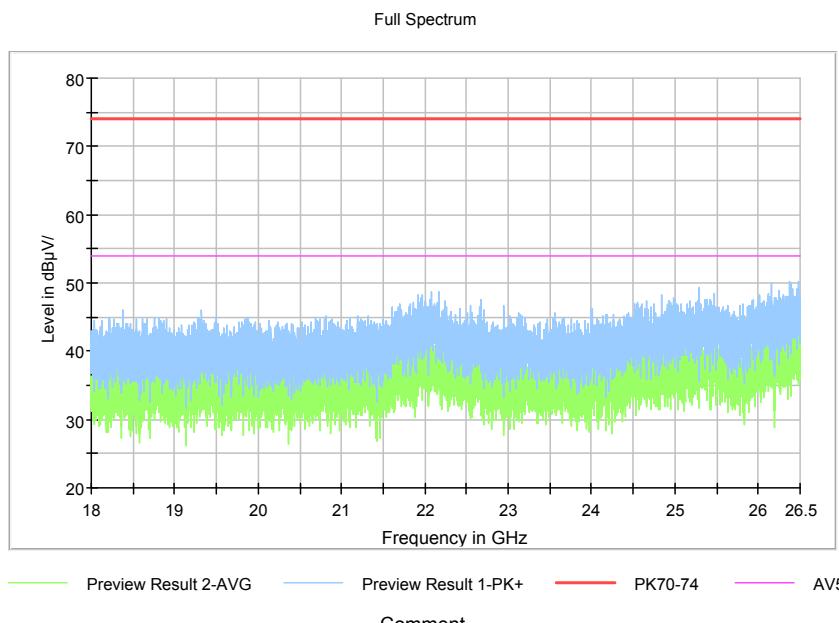
Frequency Range: 30MHz-1000MHz  
Detector: QP mode  
Modulation type: GFSK



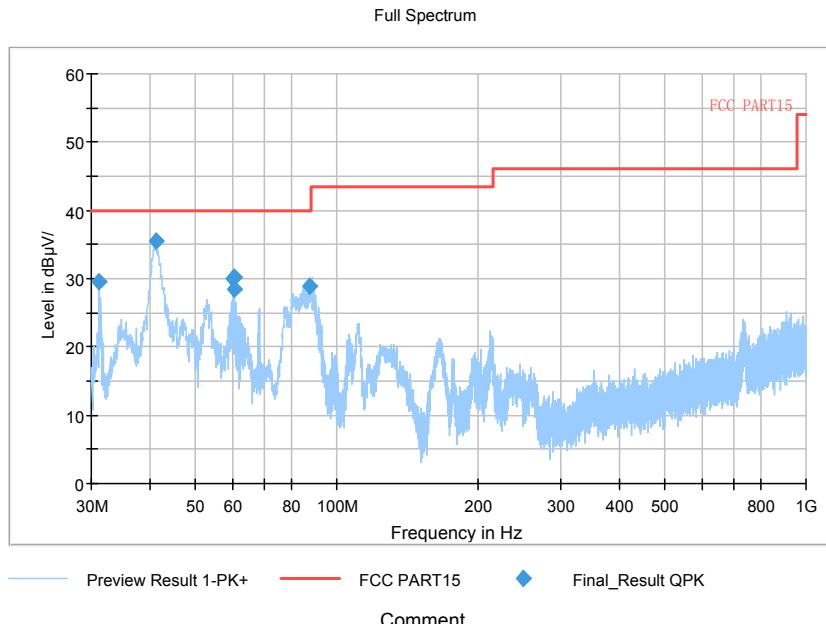
Frequency Range: 1GHz-3GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK



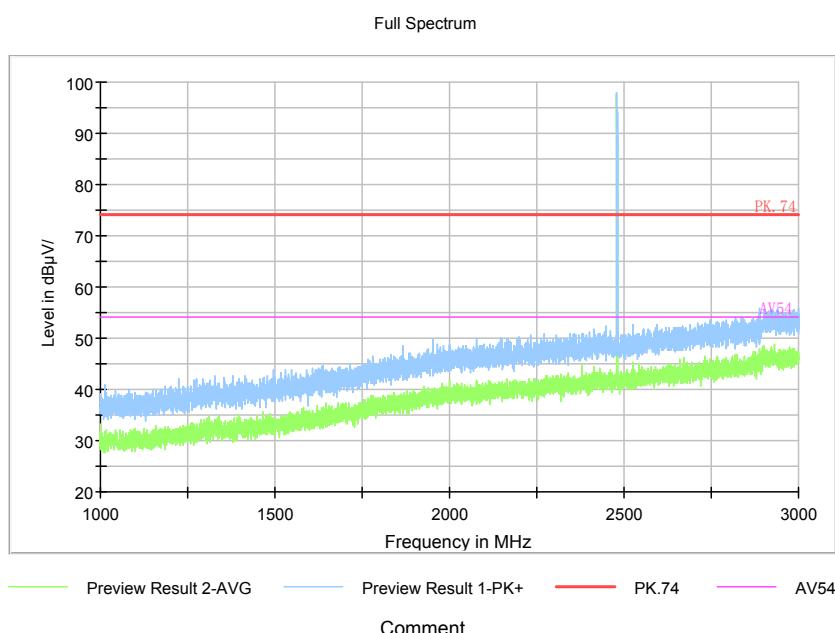
Frequency Range: 3GHz- 18GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK



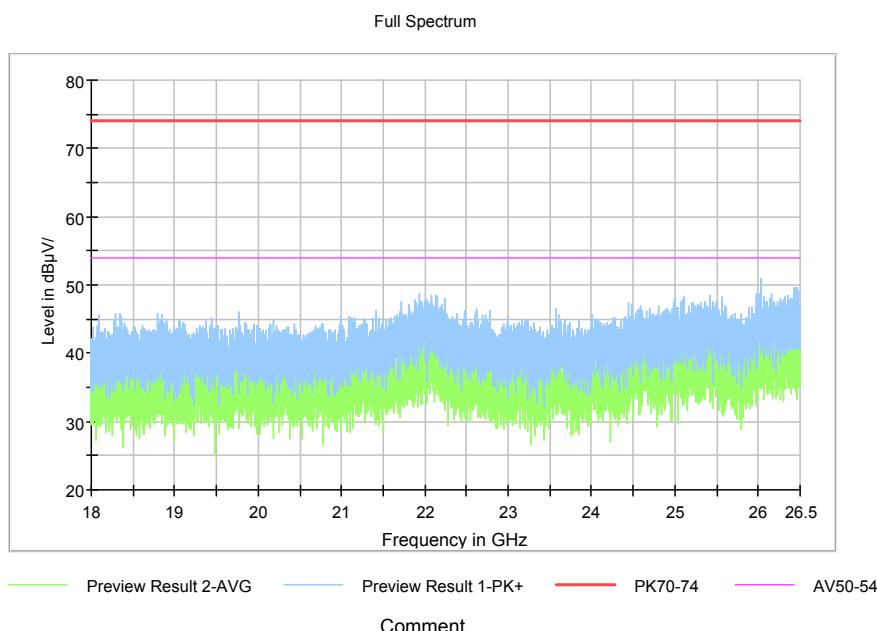
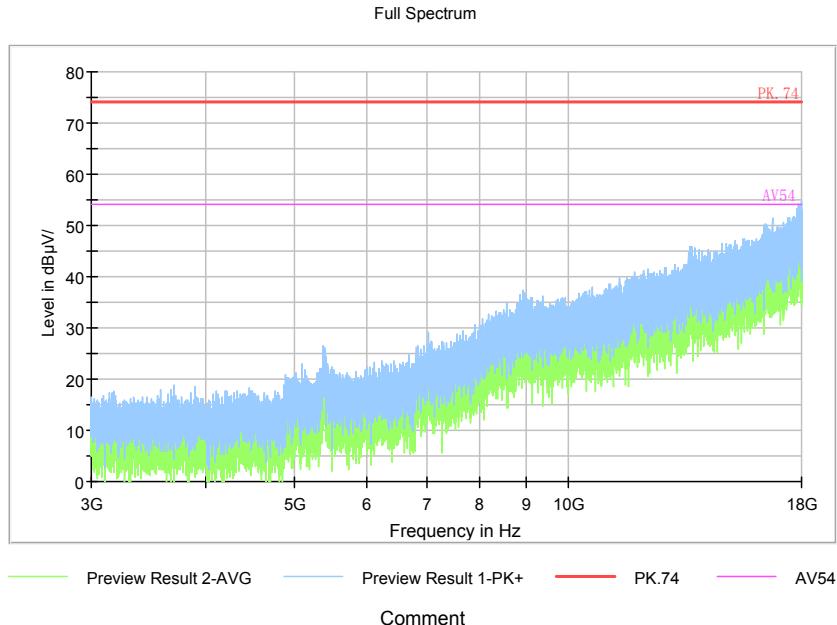
Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type: GFSK

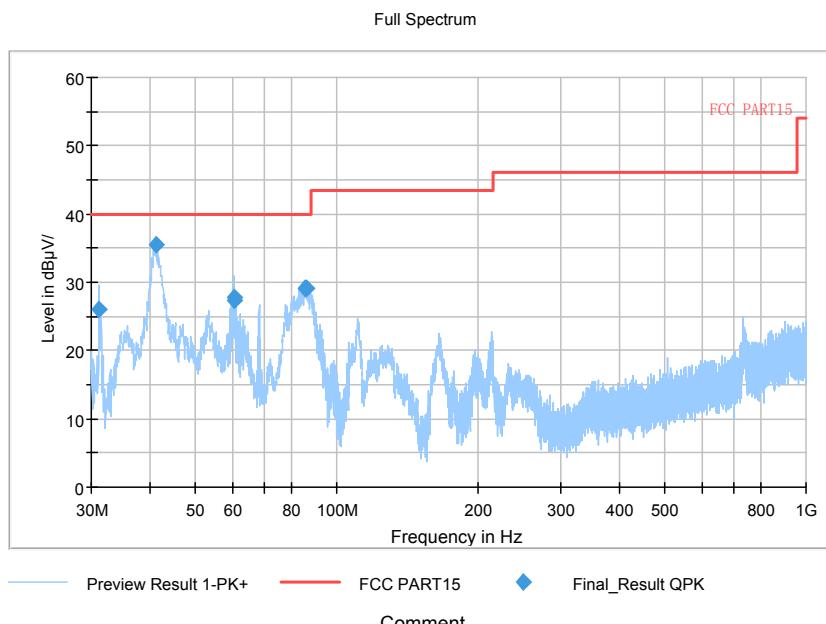


Frequency Range: 30MHz-1000 MHz  
 Detector: QP mode  
 Modulation type:  $\pi/4$ DQPSK

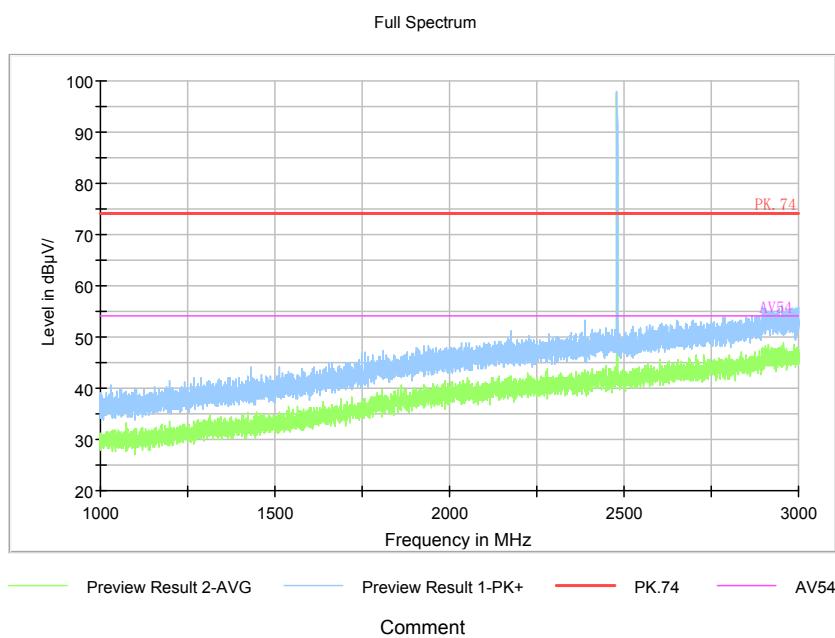


Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type:  $\pi/4$ DQPSK

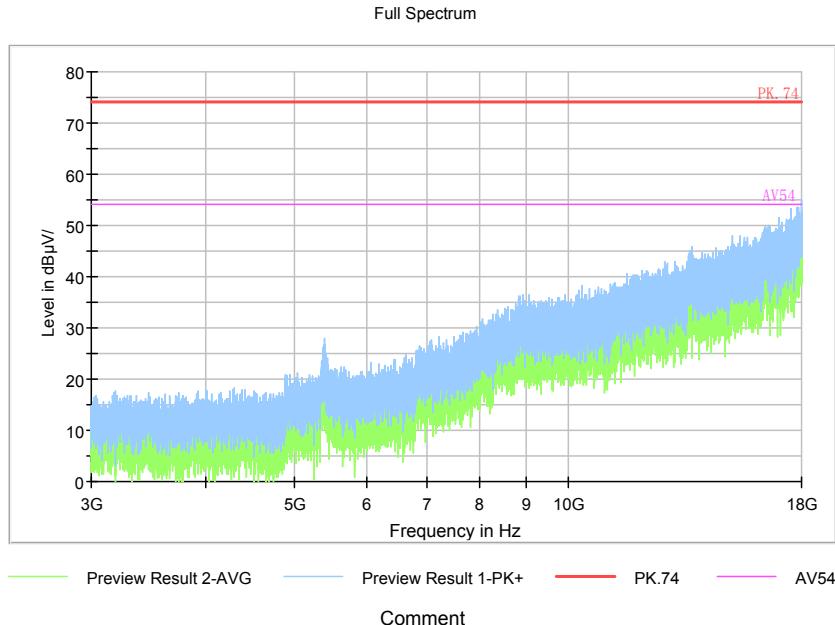




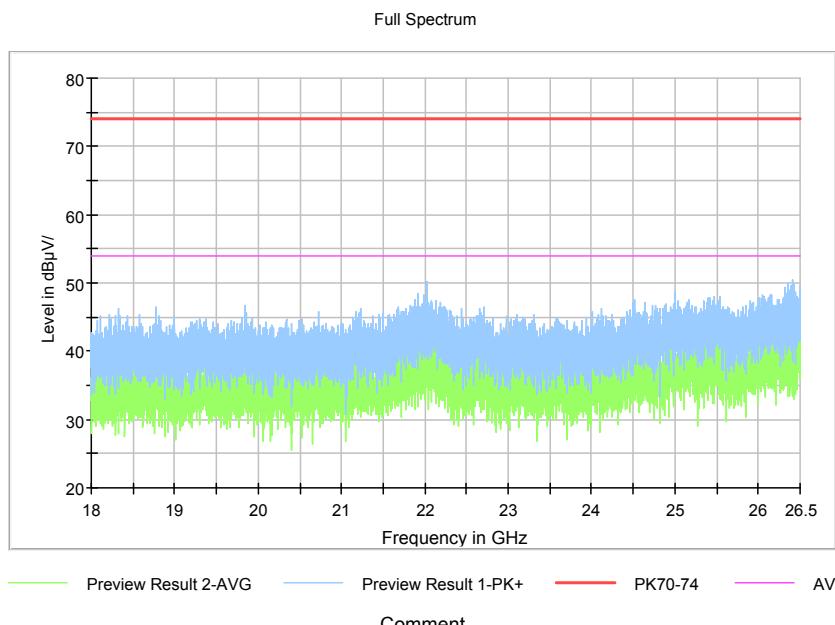
Frequency Range: 30MHz-1000 MHz  
 Detector: QP mode  
 Modulation type: 8DPSK



Frequency Range: 1GHz-3GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

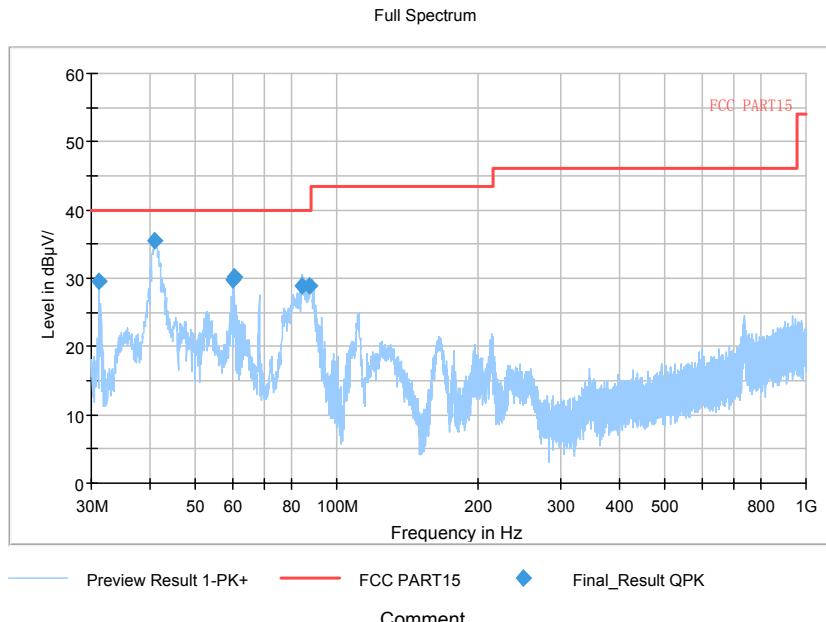


Frequency Range: 3GHz-18GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

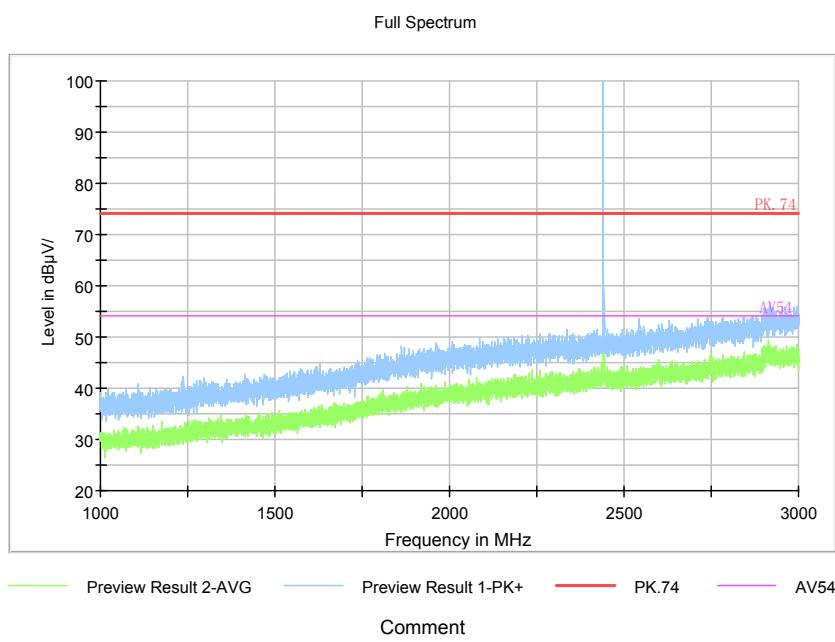


Frequency Range: 18GHz-25GHz  
 Detector: Av mode and PK mode  
 Modulation type: 8DPSK

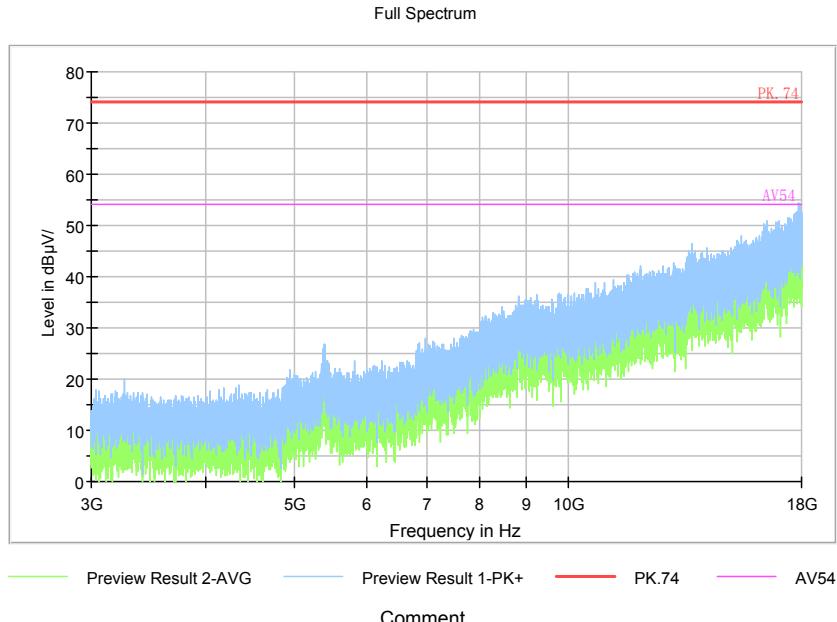
Carrier frequency (MHz): 2441 for secondary supply  
 Channel No.:39



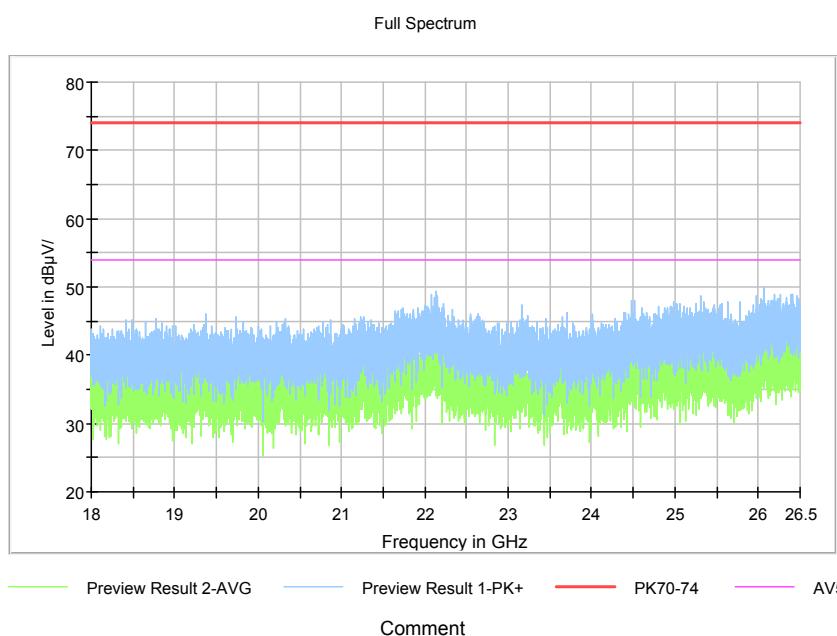
Frequency Range: 30MHz-1000MHz  
 Detector: QP mode  
 Modulation type: GFSK



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



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



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

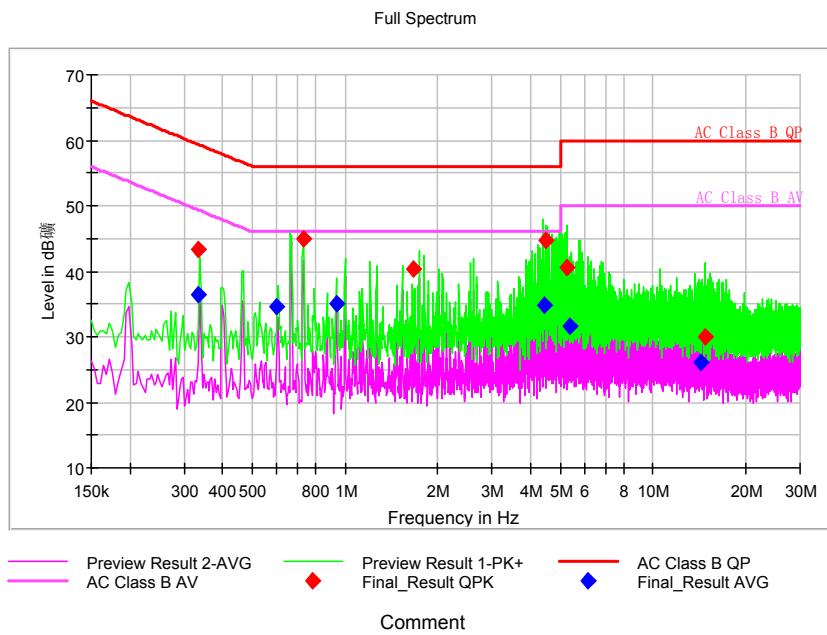
## AC Power line Conducted Emission (GFSK + Charge)

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:

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

Sample calculation:  $(43.30 \text{ dB}\mu\text{V}) = (13.6 \text{ dB}\mu\text{V}) + (29.7 \text{ dB})$ , the corresponding frequency is 0.333562MHz.



## L+N Line

### MEASUREMENT RESULT:

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Line	Corr. (dB)	Pmea QuasiPeak (dB $\mu$ V)	Pmea Average (dB $\mu$ V)
0.333562	43.30	---	59.36	16.06	L1	29.7	13.6	---
0.333562	---	36.44	49.36	12.92	L1	29.7	---	6.74
0.601644	---	34.68	46.00	11.32	L1	29.7	---	4.98
0.736806	44.96	---	56.00	11.04	L1	29.7	15.26	---
0.937725	---	35.05	46.00	10.95	L1	29.7	---	5.35
1.672512	40.28	---	56.00	15.72	L1	29.8	10.48	---
4.424894	---	34.84	46.00	11.16	L1	29.8	---	5.04
4.468894	44.61	---	56.00	11.39	L1	29.8	14.81	---
5.226544	40.54	---	60.00	19.46	L1	29.8	10.74	---
5.354544	---	31.67	50.00	18.33	L1	29.8	---	1.87
14.315931	---	25.99	50.00	24.01	L1	29.9	---	-3.91
14.689231	29.89	---	60.00	30.11	L1	29.9	-0.01	---

---End of Test Report---