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# TEST REPORT FOR BLUETOOTH TESTING

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Report No.:SRTC2018-9004(F)-18102401(D)

Product Name: HVAC Controller

Product Model: CPO-PC400-UW

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

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

Specification: FCC Part 15, Subpart C (2019)

FCC ID: 2ARTN-00001

The State Radio\_monitoring\_center Testing Center (SRTC)

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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

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
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### 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:	2018-10-24
Testing Start Date:	2018-10-24
Testing End Date:	2018-11-12

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	100100
Software Version	3.0.9.X
SN	Sample 8#
Antenna type	Refer to Note
Antenna connector	Refer to Note

#### **Note: Antenna requirement (FCC part 15.203)**

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

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

SN	Brand	Model	Antenna gain	Frequency band(GHz)	Antenna type	Connector Type
Ant1	adam	N/A	2.9	2.4GHz~2.4835GHz	Fixed External Antenna	N/A
Ant3	linx	N/A	2.8	2.4GHz~2.4835GHz	Fixed External Antenna	N/A

This report tested for all types of antenna which mentioned in page 4 of this report, just the worst data is showing in this report.

## 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, $\pi/4$ DQPSK, 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	39	GFSK, $\pi/4$ DQPSK, 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, $\pi/4$ 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, $\pi/4$ DQPSK, 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, $\pi/4$ 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

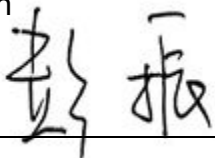

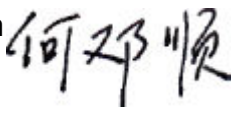
Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.



## 5 RESULT SUMMARY

No.	Test case	Reference	Verdict
1	20dB Bandwidth	15.247(a)(1)(iii)	Pass
2	Channel Separation	15.247(a)(1)	Pass
3	Peak Transmitter 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	15.205/15.209	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:  20200624

## **6 TEST RESULT**

### **6.1 20dB Bandwidth**

#### **6.1.1 Ambient condition**

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

#### **6.1.2 Test limit**

FCC Part15.247 (a.1.iii)

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

#### **6.1.3 Test Procedure Used**

ANSI C63.10-2013 – Section 6.9.2

#### **6.1.4 Test settings**

1.The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 20. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.

2.RBW = 1 – 5% OBW

3.VBW ≥ 3 x RBW

4.Reference level set to keep signal from exceeding maximum input mixer level for linear operation.

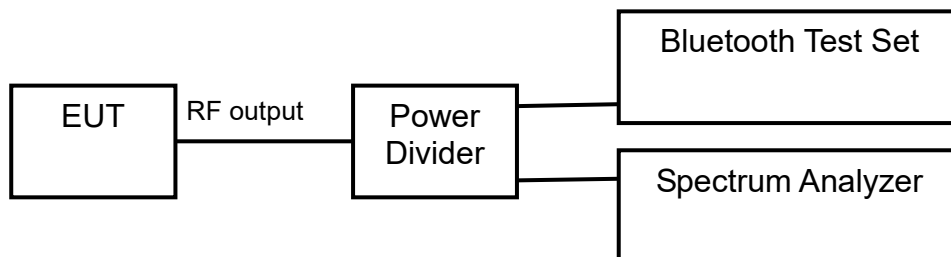
5.Detector = Peak

6.Trace mode = max hold

7.Sweep = auto couple

8.The trace was allowed to stabilize

#### **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 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.

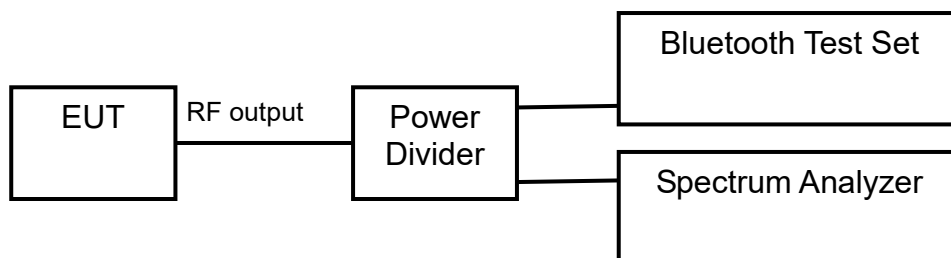
### 6.2.3 Test Procedure Used

ANSI C63.10-2013 – Section 7.8.2

### 6.2.4 Test Settings

1. Span = Wide enough to capture peaks of two adjacent channels
2. RBW = 30% of channel spacing. Adjust as necessary to best identify center of each individual channel
3. VBW  $\geq$  RBW
4. Sweep = Auto
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize.
8. Marker-delta function used to determine separation between peaks of the adjacent channels

### 6.2.5 Test Setup



### 6.2.6 Test result

The test results are shown in Appendix A.

### 6.3 Peak Transmitter Output Power

#### 6.3.1 Ambient condition

Temperature	Relative humidity	Pressure
25°C	30%	101.5kPa

#### 6.3.2 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

#### 6.3.3 Test Procedure Used

ANSI C63.10-2013 – Section 7.8.5

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

#### 6.3.4 Test Settings

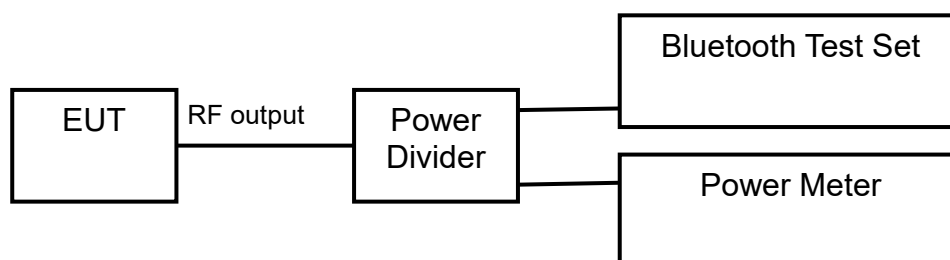
Peak Power Measurement

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.

#### 6.3.5 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 Part15.247(a)(1)(iii)

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

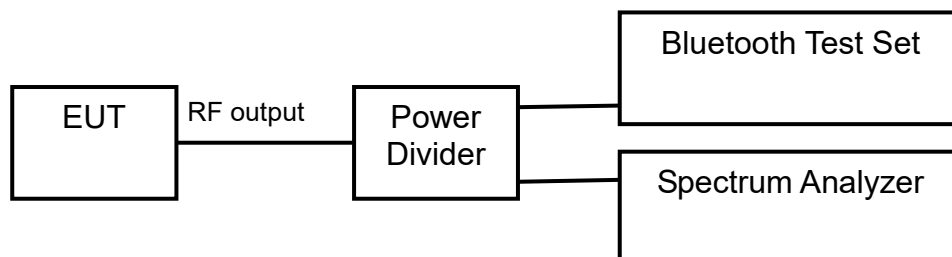
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 6.4.4 Test Settings

ANSI C63.10-2013 Section 7.8.4

1. Span = zero span, centered on a hopping channel
2. RBW ≤ channel spacing and >> 1/T, where T is expected dwell time per channel
3. Sweep = as necessary to capture entire dwell time. Second plot may be required to demonstrate two successive hops on a channel
4. Trigger is set with appropriate trigger delay to place pulse near the center of the plot
5. Detector = peak
6. Trace mode = max hold
7. Marker-delta function used to determine transmit time per hop

### 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)

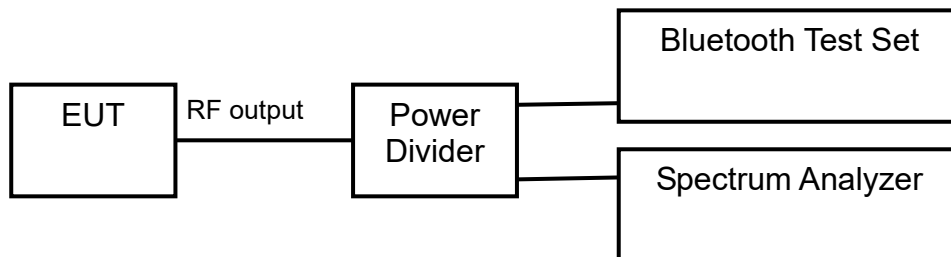
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### 6.5.4 Test Settings

ANSI C63.10-2013 Section 7.8.3

1. Span = frequency of band of operation (divided into two plots)
2. RBW < 30% of channel spacing or 20dB bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. Trace was allowed 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 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.

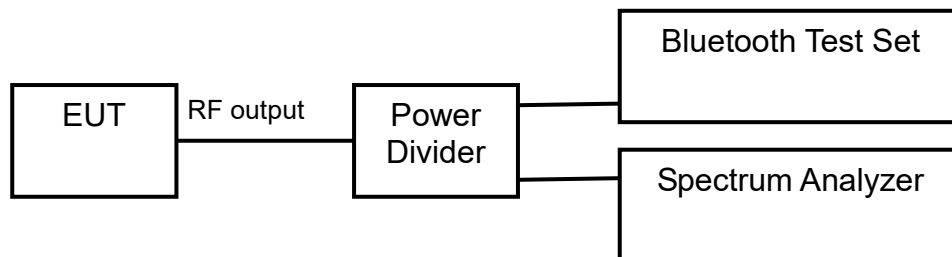
### 6.6.3 Test Procedure Used

ANSI C63.10-2013 – Section 7.8.8

### 6.6.4 Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 26GHz
2. RBW = 1MHz\* (See note below)
3. VBW = 3MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

### 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 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.

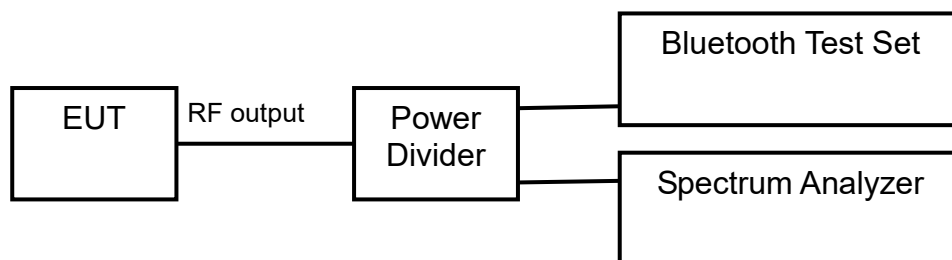
### 6.7.3 Test Procedure Used

ANSI C63.10-2013 – Section 6.10.4

### 6.7.4 Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 300kHz
5. Detector = Peak
6. Number of sweep points  $\geq 2 \times \text{Span}/\text{RBW}$
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### 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.

### 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. The spectrum shall be investigated from the lowest radio frequency signal generated in the device

Frequency [MHz]	Field strength [μV/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 (dBμV/m) = 20 log (Limit (μV/m)/1μV/m)**

Frequency [MHz]	Detector	Unit (dBμV/m)
30~88	Quasi-peak	40.0
88~216	Quasi-peak	43.5
216~960	Quasi-peak	46.0
960~1000	Quasi-peak	54.0
1000~5th 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

KDB 558074 D01 v05r02 – Section 12.2.7

### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and recorded the reading with Maximum Hold Mode.

#### NOTE:

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

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

### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground in chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and recorded the reading with Maximum Hold Mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detector and recorded the reading with Maximum Hold Mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**For the radiated emission test above 1GHz:**

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 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.

**6.8.5 Test Settings**

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

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

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

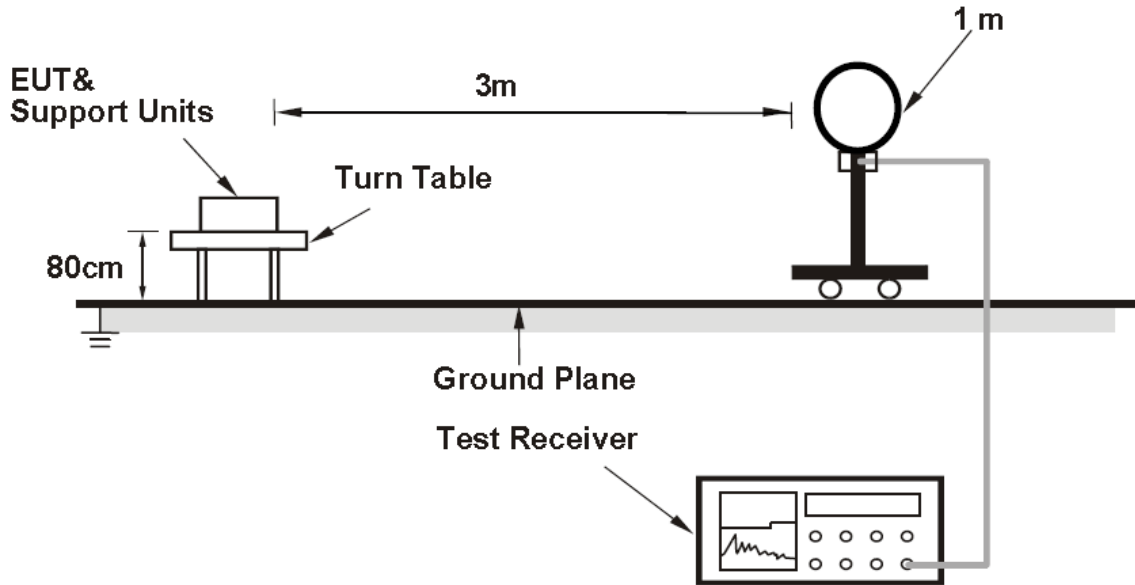
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in following table

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

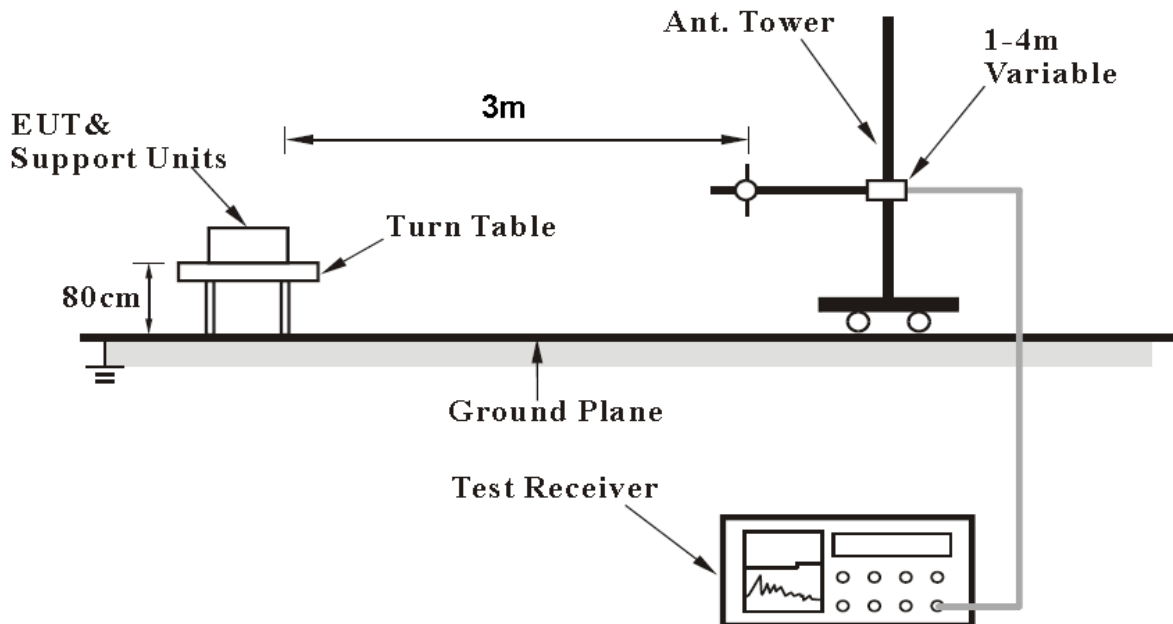
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

### 6.8.6 Test Setup

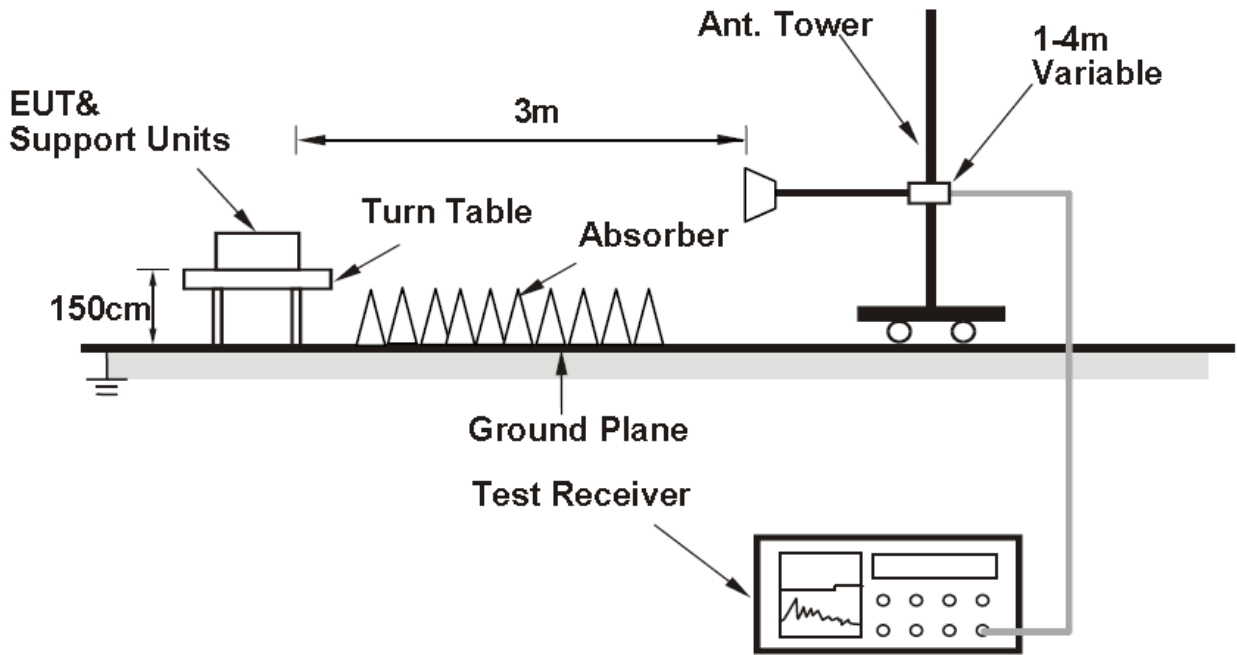
#### For Radiated emission below 30MHz



#### For Radiated emission 30MHz to 1GHz



### For Radiated emission above 1GHz



### 6.8.7 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)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

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

### 6.9.3 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.

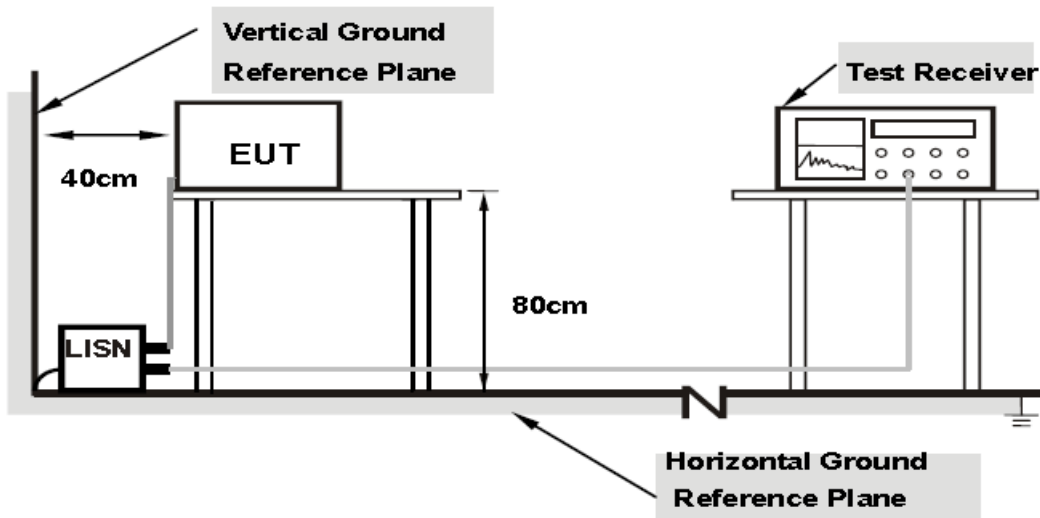
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

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.

### 6.9.4 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 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

Modulation type: GFSK

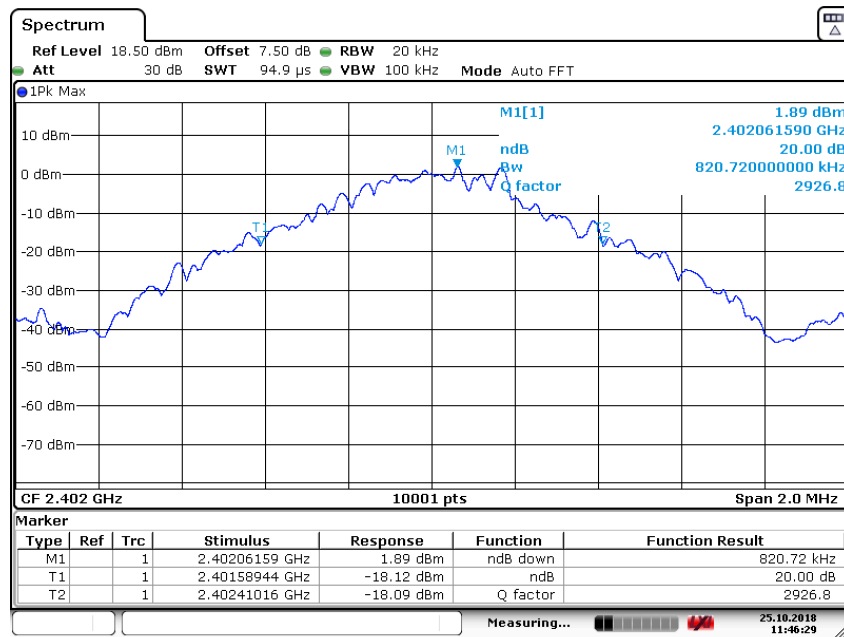
Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	820.72
2441	39	820.72
2480	78	821.32

Modulation type:  $\pi/4$ DQPSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	1295.07
2441	39	1294.07
2480	78	1295.67

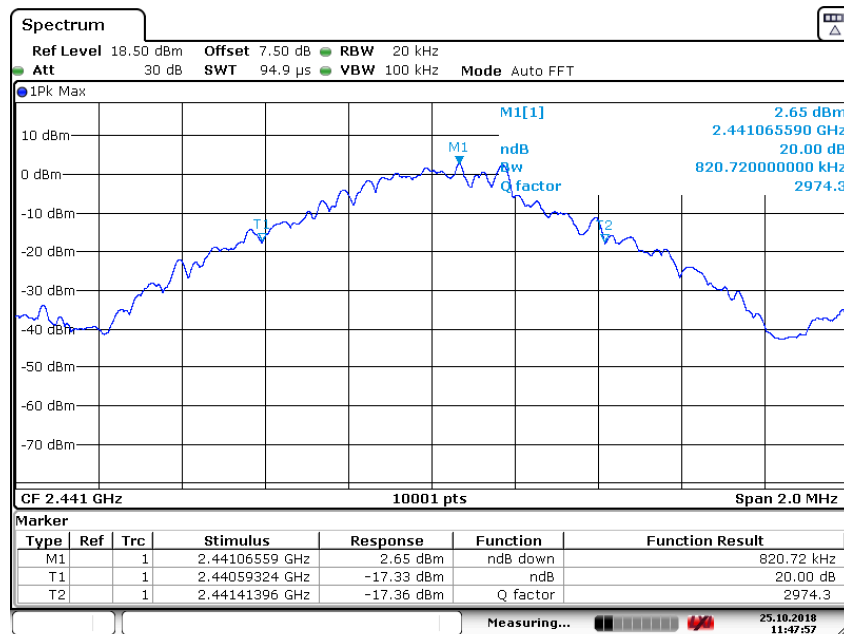
Modulation type: 8DPSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	1314.87
2441	39	1343.87
2480	78	1314.67



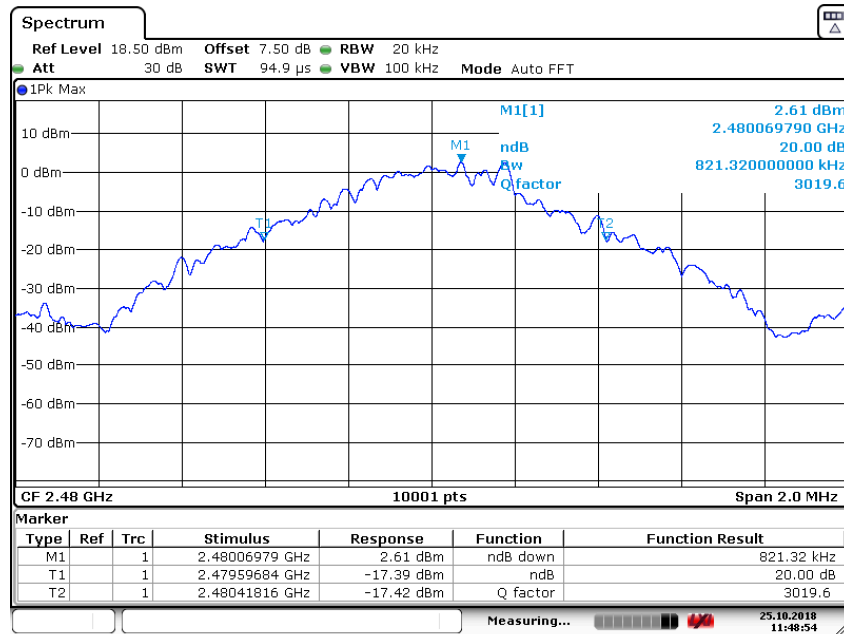
Date: 25.OCT.2018 11:46:29

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



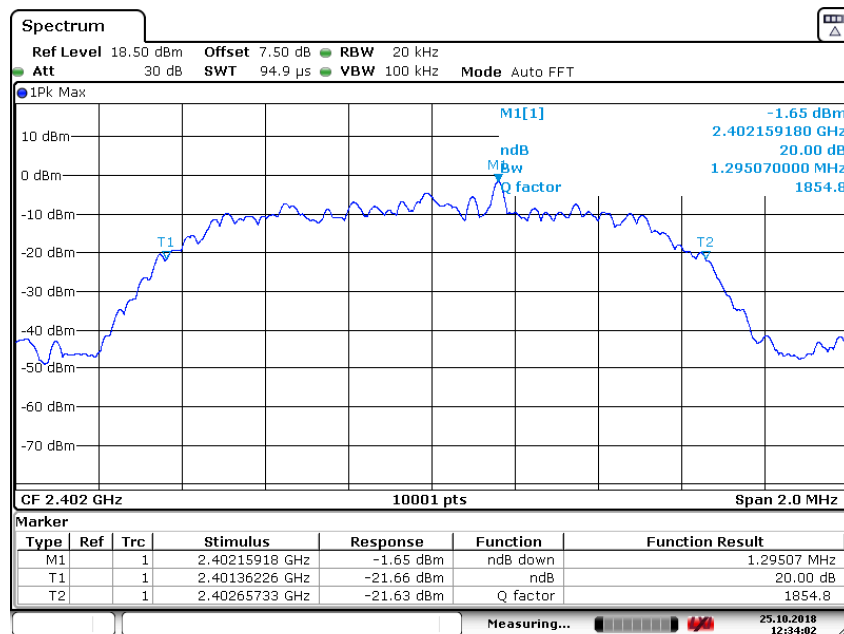
Date: 25.OCT.2018 11:47:57

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



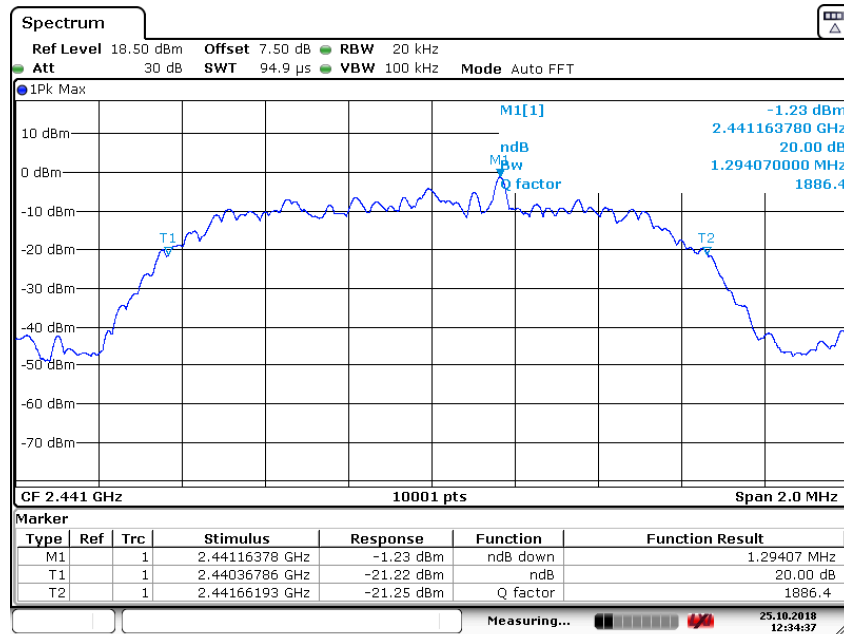
Date: 25.OCT.2018 11:48:54

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



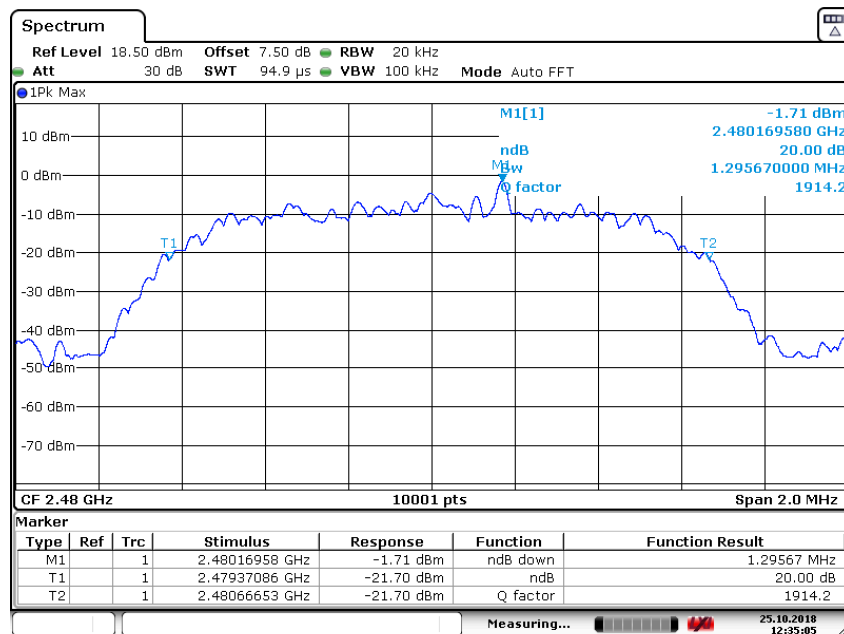
Date: 25.OCT.2018 12:34:02

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



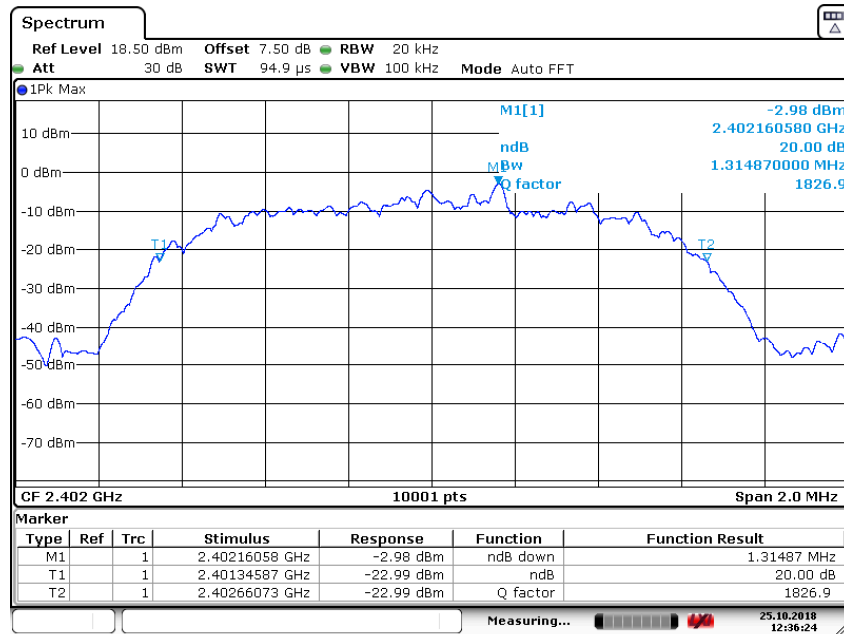
Date: 25.OCT.2018 12:34:37

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



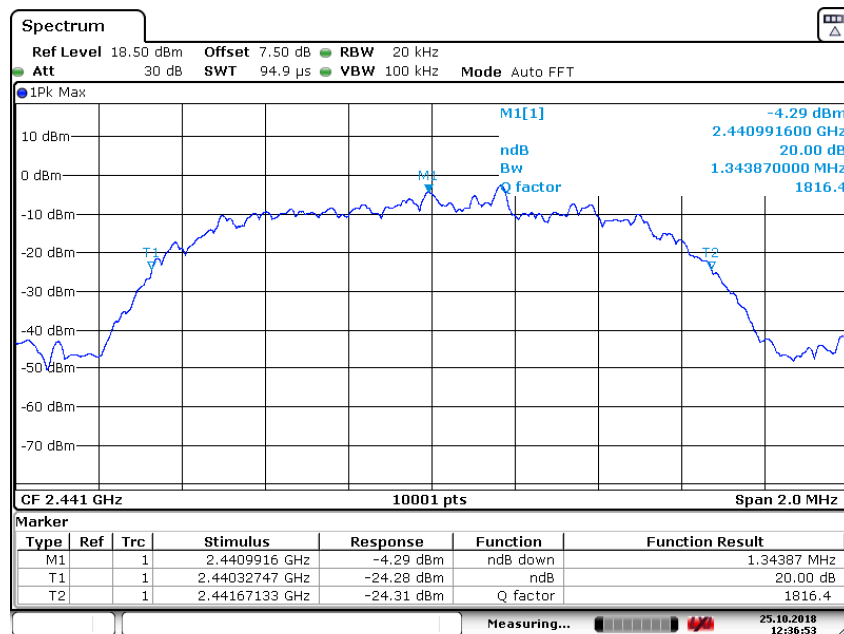
Date: 25.OCT.2018 12:35:05

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



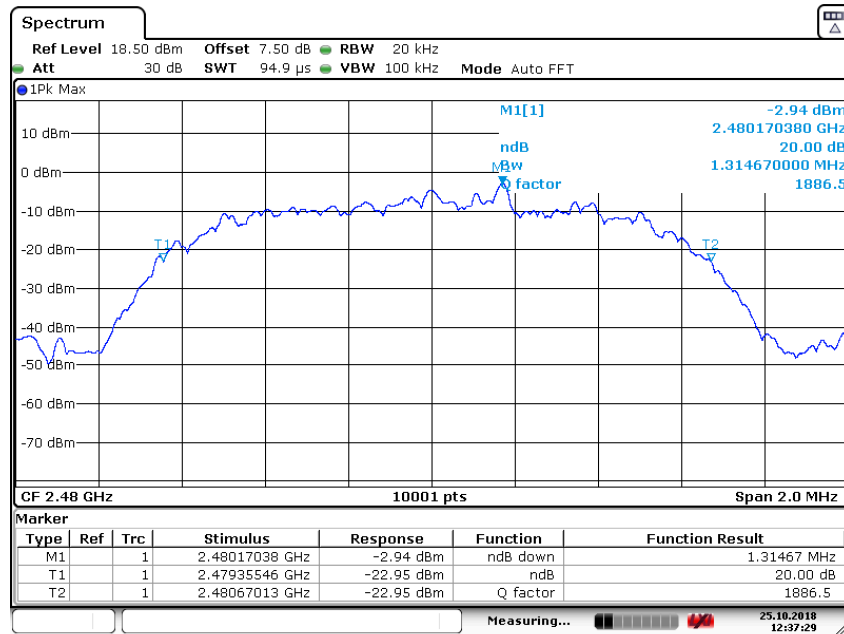
Date: 25.OCT.2018 12:36:23

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



Date: 25.OCT.2018 12:36:53

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



Date: 25.OCT.2018 12:37:29

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

### 99% Bandwidth

Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

Modulation type: GFSK

Carrier frequency (MHz)	Channel No.	99% bandwidth(kHz)
2402	0	895.91
2441	39	893.51
2480	78	895.31

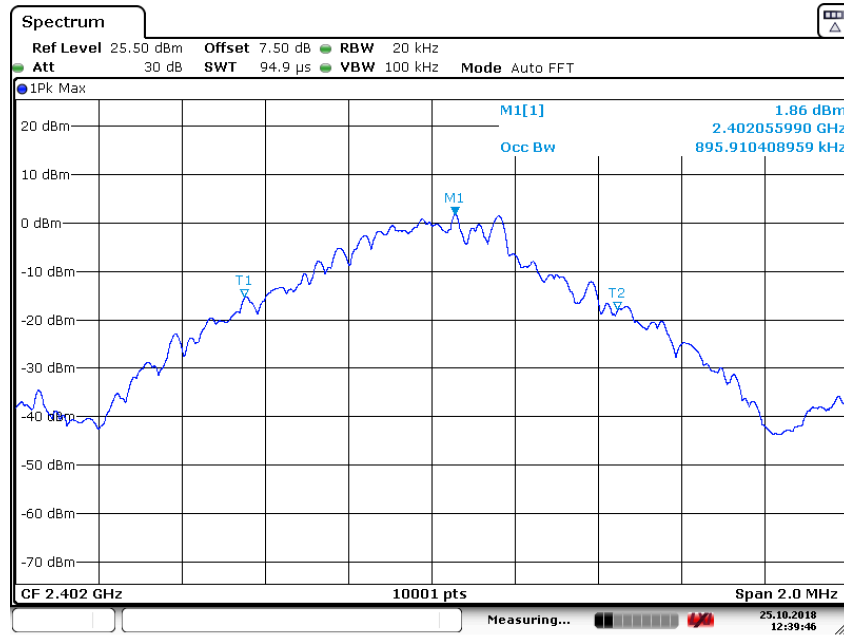
Modulation type:  $\pi/4$ DQPSK

Carrier frequency (MHz)	Channel No.	99% bandwidth(kHz)
2402	0	1207.08
2441	39	1207.08
2480	78	1207.28

Modulation type: 8DPSK

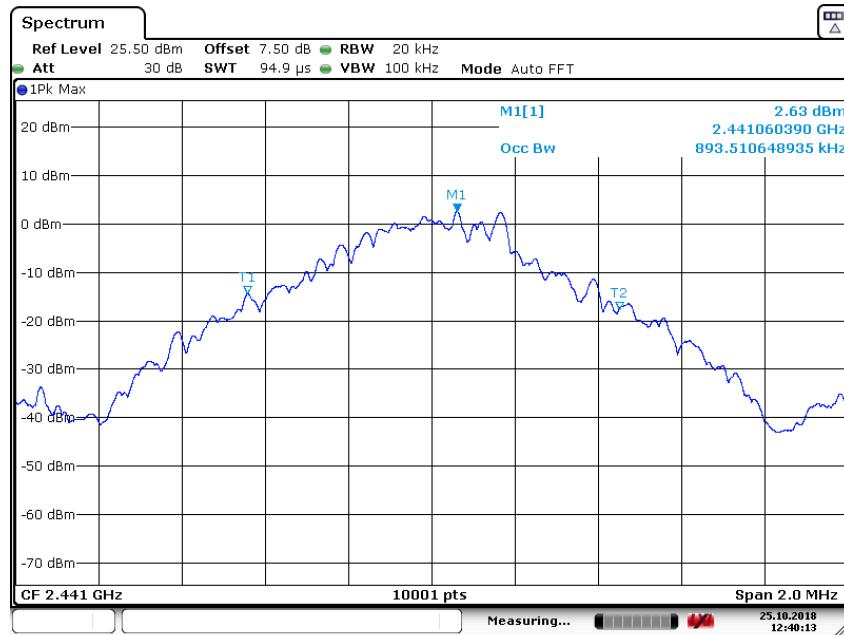
Carrier frequency (MHz)	Channel No.	99% bandwidth(kHz)
2402	0	1213.08
2441	39	1214.08
2480	78	1213.28





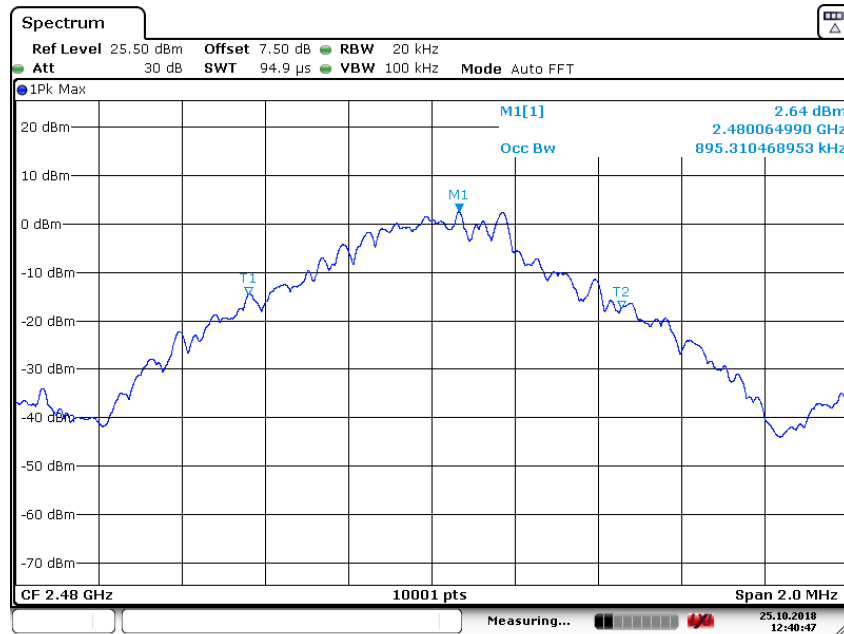
Date: 25.OCT.2018 12:39:46

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



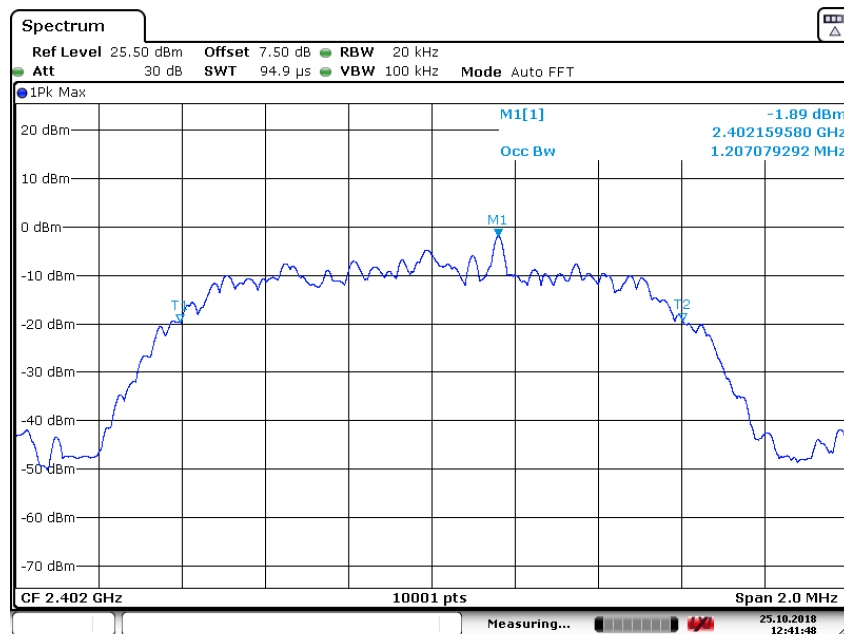
Date: 25.OCT.2018 12:40:13

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



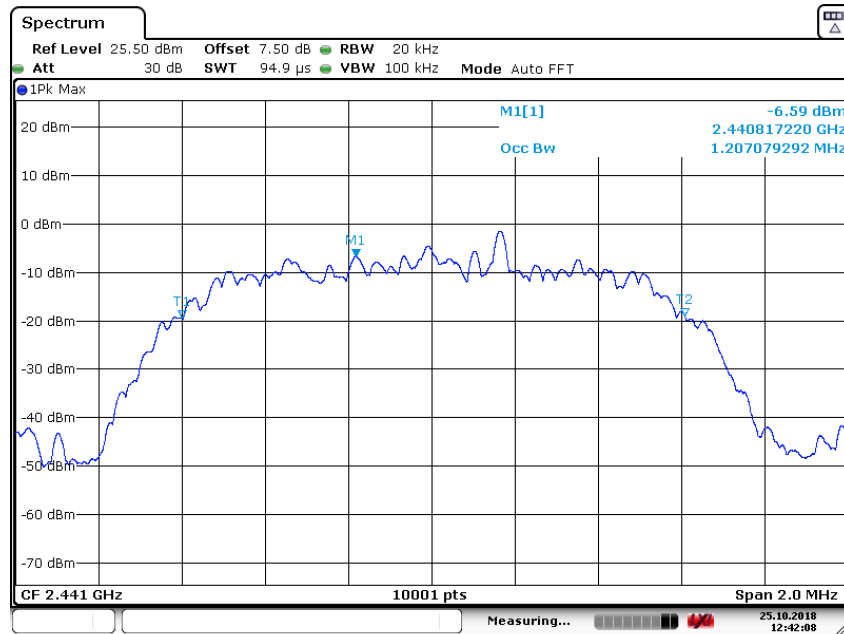
Date: 25.OCT.2018 12:40:47

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



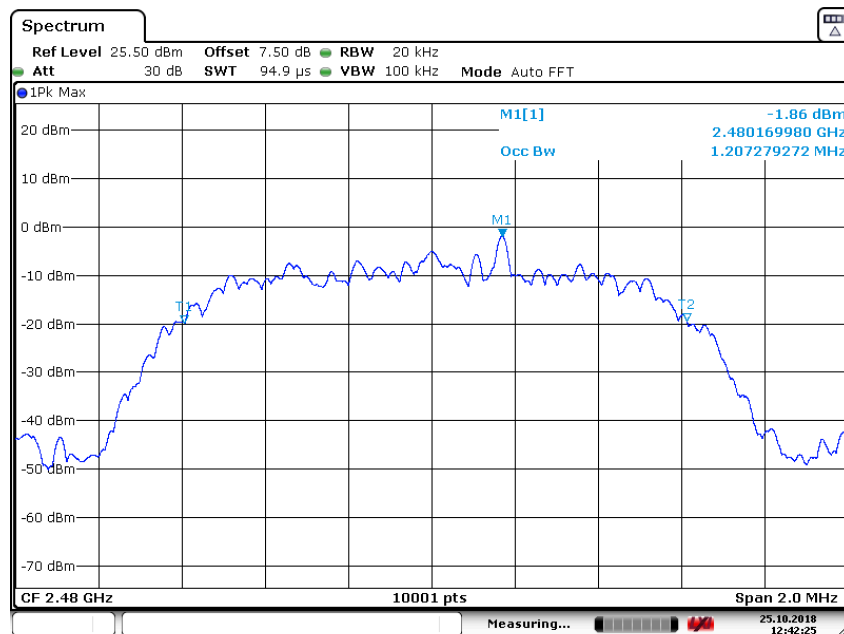
Date: 25.OCT.2018 12:41:47

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



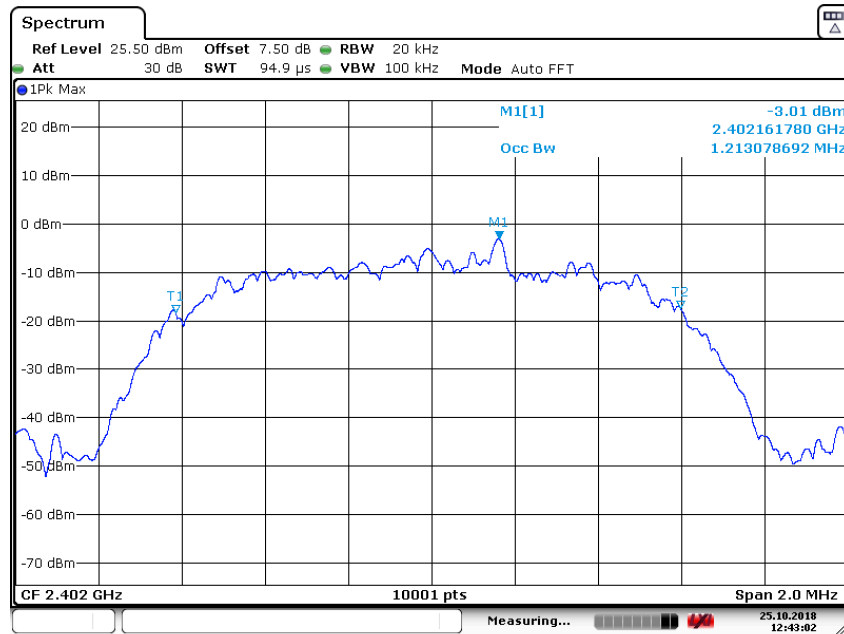
Date: 25.OCT.2018 12:42:08

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

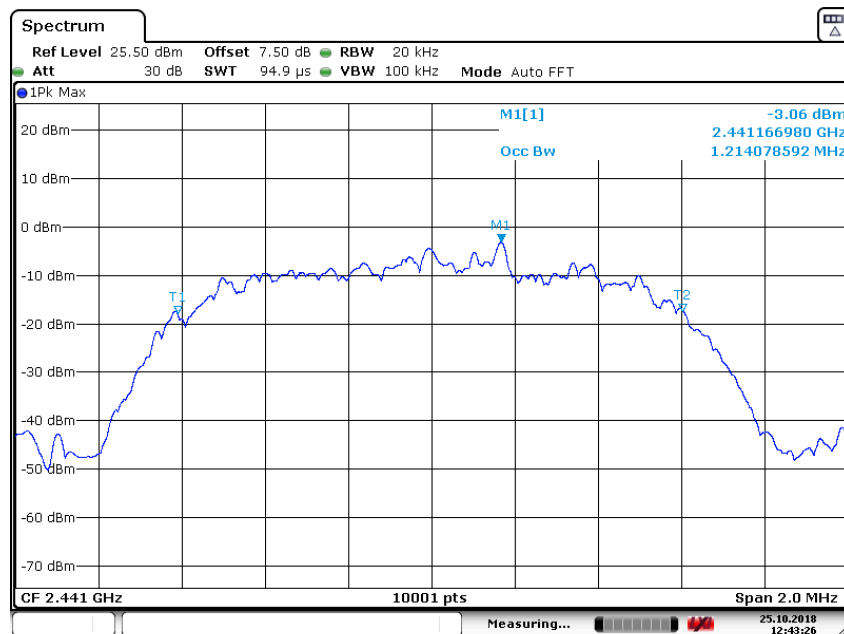


Date: 25.OCT.2018 12:42:25

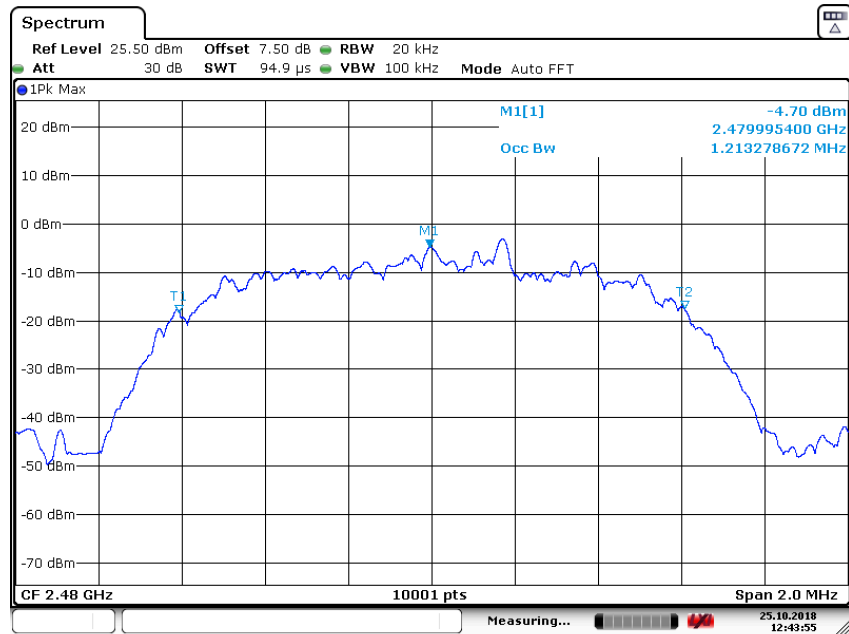
Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type:  $\pi/4$ DQPSK



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



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



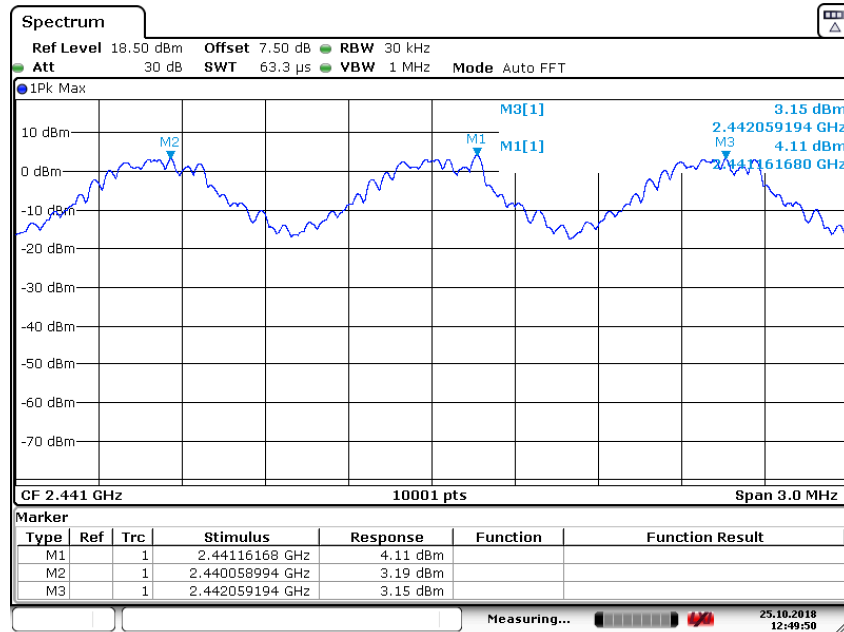
Date: 25.OCT.2018 12:43:54

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

### Channel Separation

Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

Op-mode	Channel separation MHz
Hopping mode	1



Date: 25.OCT.2018 12:49:50

Op-mode: Hopping mode

### Peak Power Output

Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB  
Antenna gain=2.9dBi

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

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

### EIRP

Modulation type	Average EIRP (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	5.28	6.07	6.10
$\pi/4$ DQPSK	0.94	1.29	0.98
8DPSK	0.92	1.30	0.98

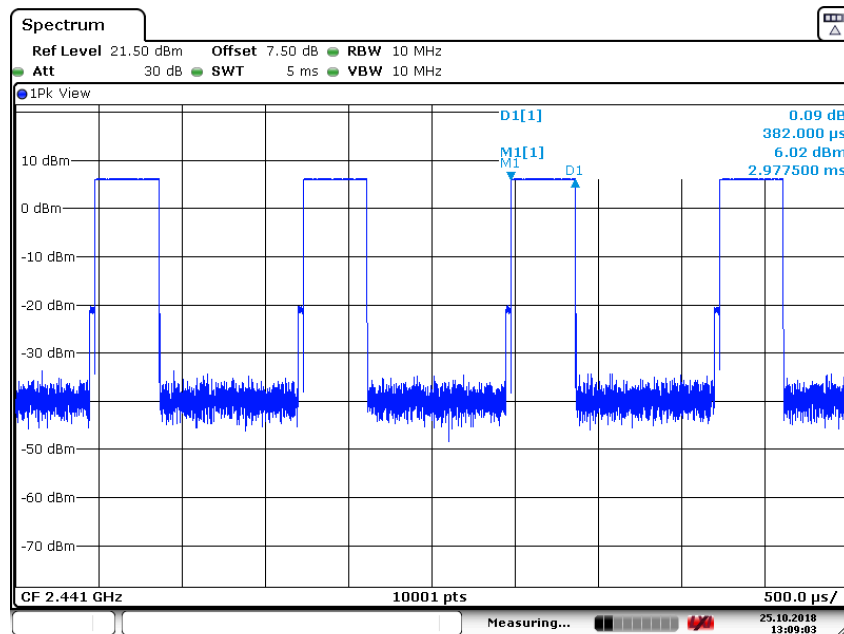
Modulation type	Peak EIRP (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	8.67	9.47	9.51
$\pi/4$ DQPSK	6.73	7.02	6.78
8DPSK	6.77	7.12	6.83

**Dwell Time**

Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

Modulation type: GFSK

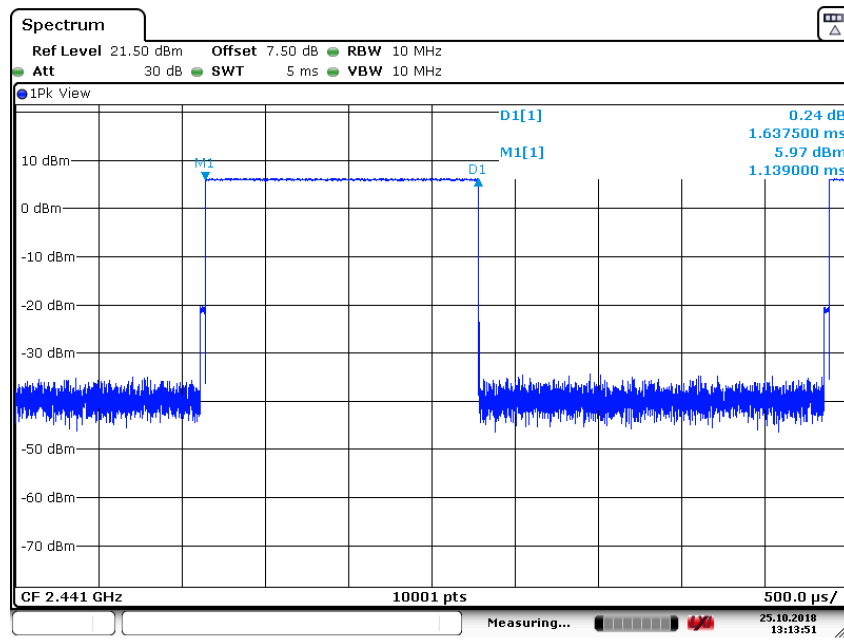
Packet type	Time slot length $\mu$ s	Dwell time	Dwell time ms
DH1	382	time slot length * 31.6 *1600/2 /79	122
DH3	1638	time slot length * 31.6 *1600/4 /79	262
DH5	2882	time slot length * 31.6 *1600/6 /79	307



Date: 25.OCT.2018 13:09:03

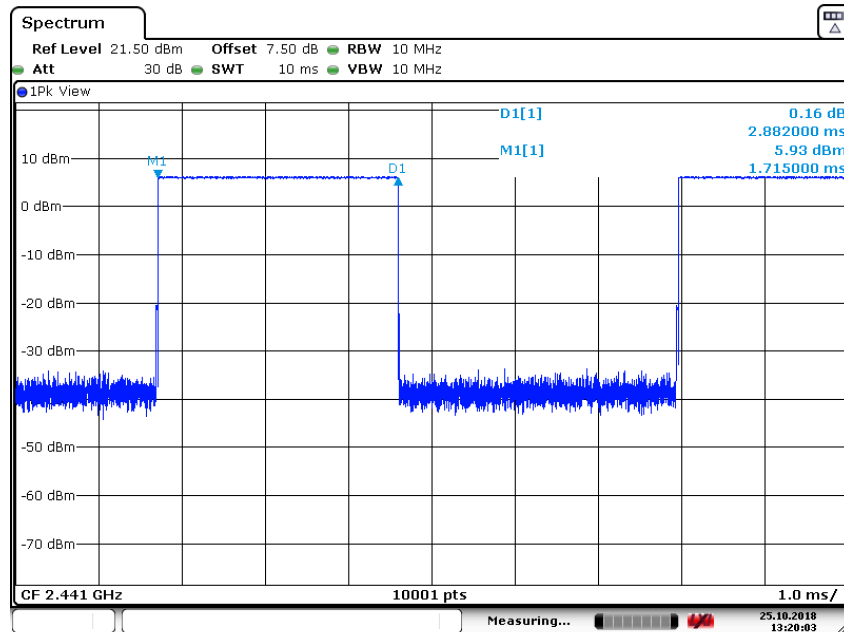
Carrier frequency (MHz): 2441  
Packet type: DH1  
Modulation type: GFSK





Date: 25.OCT.2018 13:13:50

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

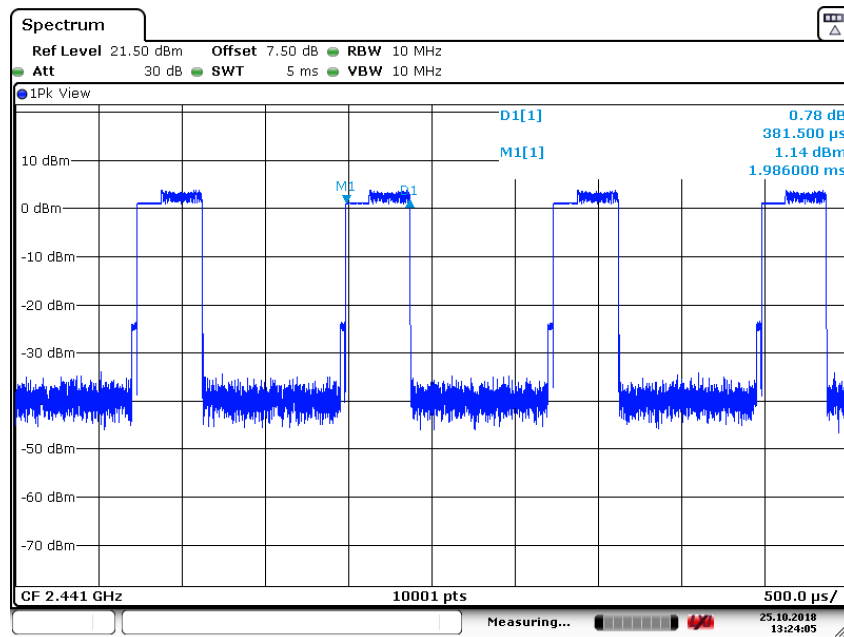


Date: 25.OCT.2018 13:20:03

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

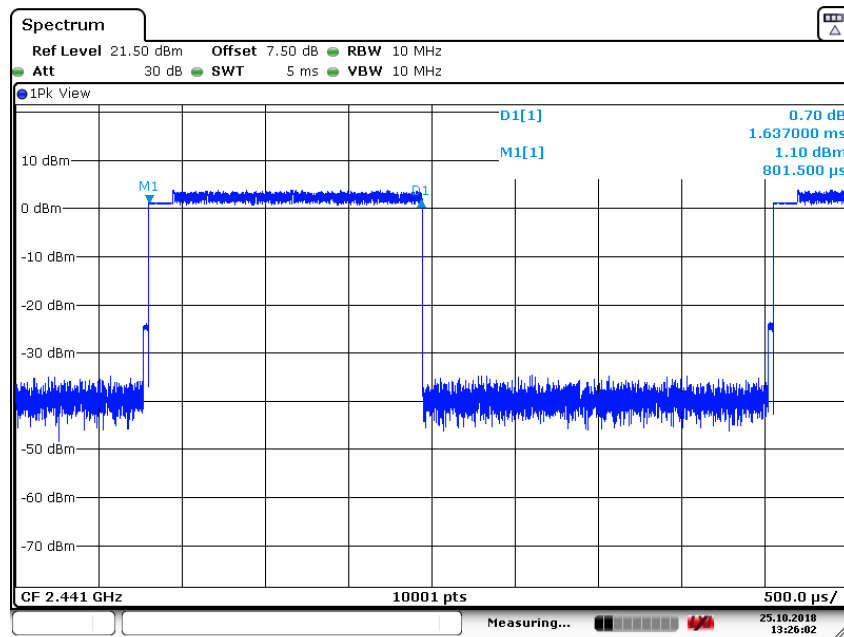
Modulation type:  $\pi/4$ DQPSK

Packet type	Time slot length $\mu$ s	Dwell time	Dwell time ms
DH1	382	time slot length * 31.6 *1600/2 /79	122
DH3	1637	time slot length * 31.6 *1600/4 /79	262
DH5	2880	time slot length * 31.6 *1600/6 /79	307



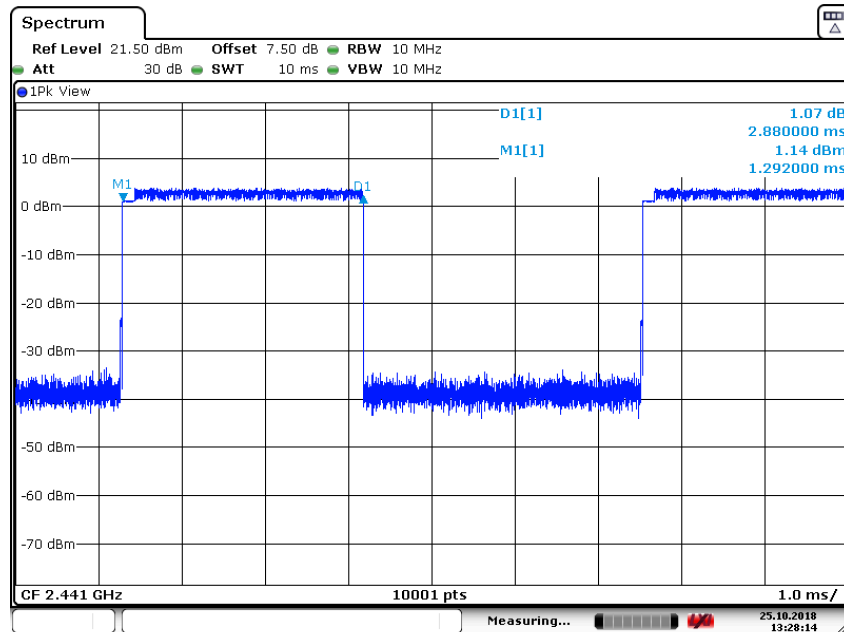
Date: 25.OCT.2018 13:24:04

Carrier frequency (MHz): 2441  
Packet type: DH1  
Modulation type:  $\pi/4$ DQPSK



Date: 25.OCT.2018 13:26:02

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

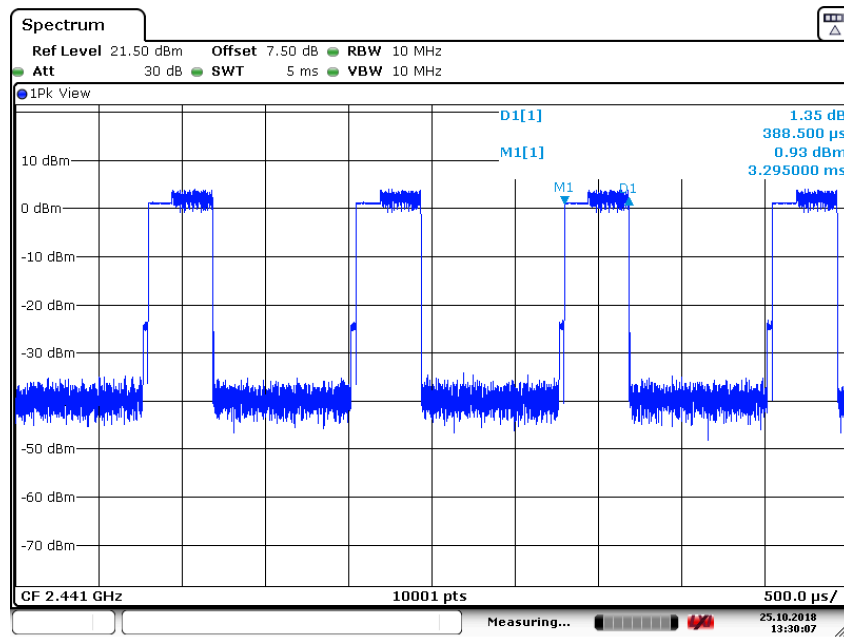


Date: 25.OCT.2018 13:28:13

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

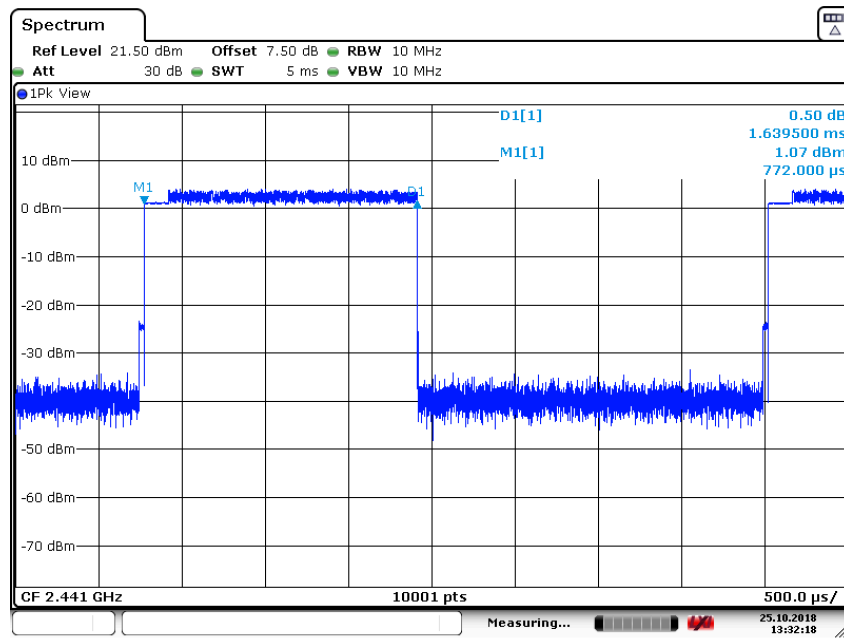
Modulation type: 8DPSK

Packet type	Time slot length μs	Dwell time	Dwell time ms
DH1	389	time slot length * 31.6 *1600/2 /79	124
DH3	1640	time slot length * 31.6 *1600/4 /79	262
DH5	2889	time slot length * 31.6 *1600/6 /79	308



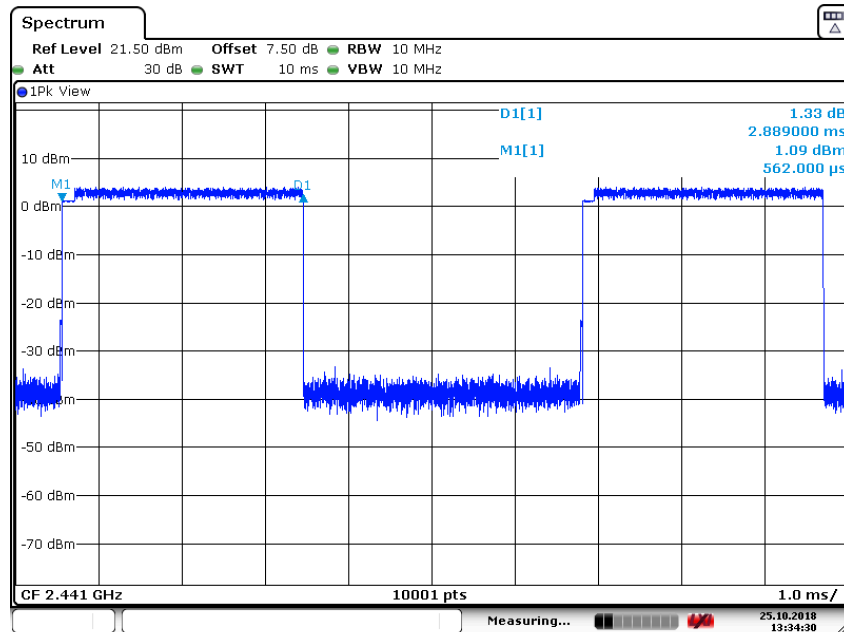
Date: 25.OCT.2018 13:30:07

Carrier frequency (MHz): 2441  
Packet type:DH1  
Modulation type: 8DPSK



Date: 25.OCT.2018 13:32:18

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



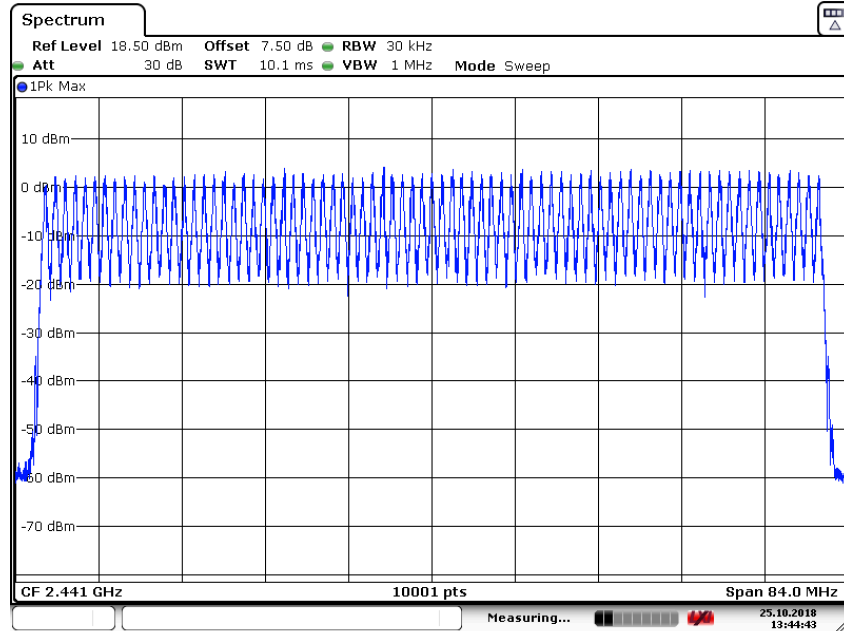
Date: 25.OCT.2018 13:34:30

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

### Number of Hopping Frequencies

Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

Op-mode	Result
Hopping mode	79



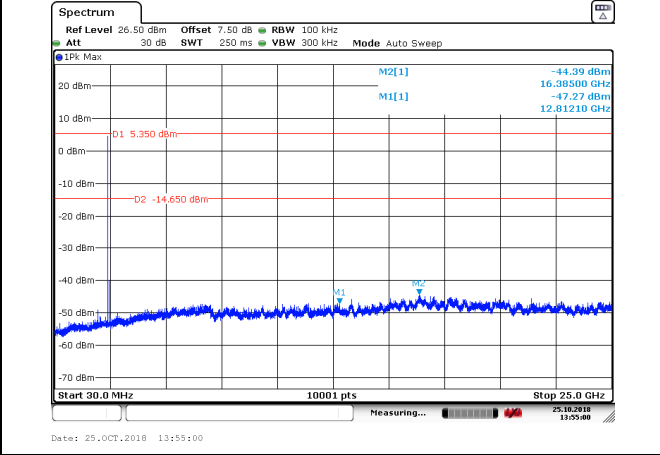
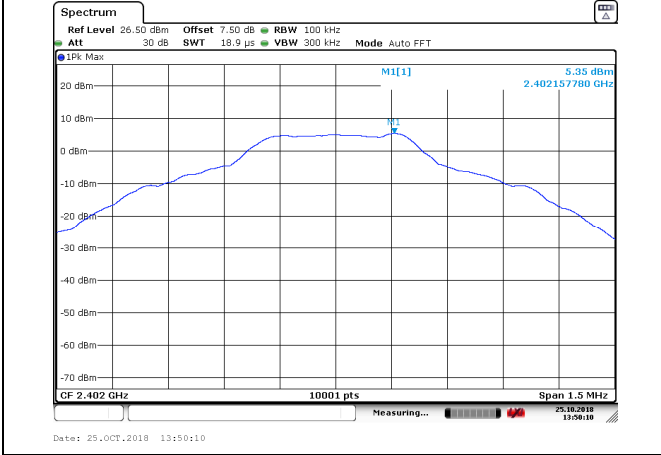
Date: 25.OCT.2018 13:44:43

Op-mode: Hopping mode

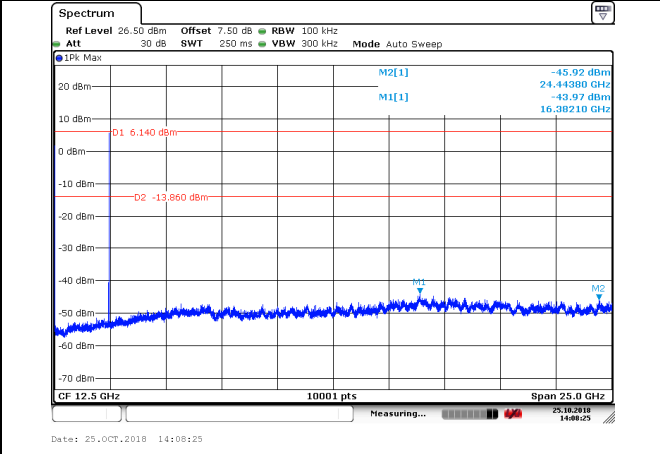
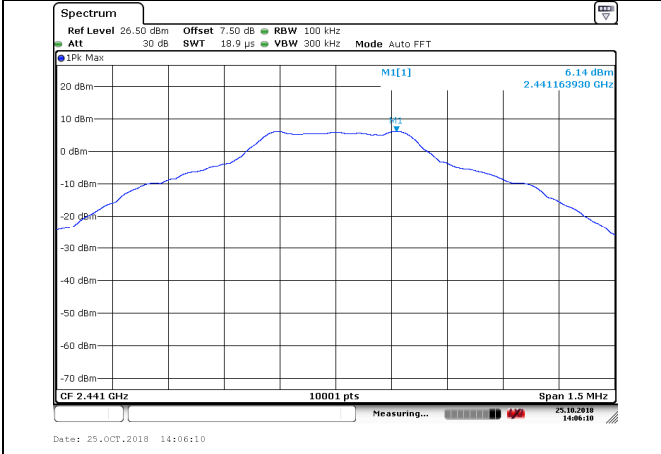
**Conducted out of band emission measurement**

Offset 7.5dB = Attenuator 7dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB  
**GFSK**

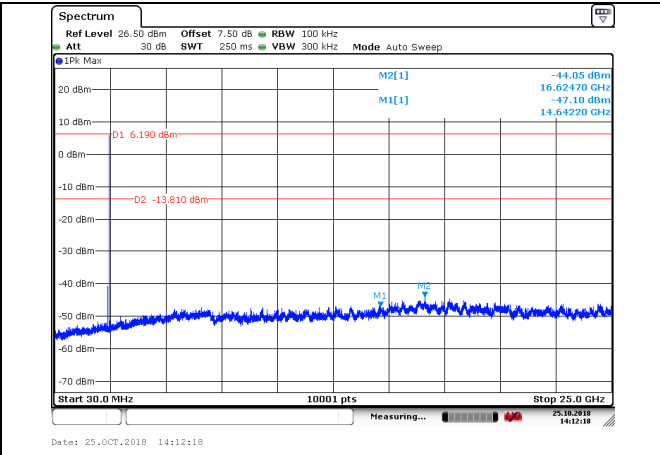
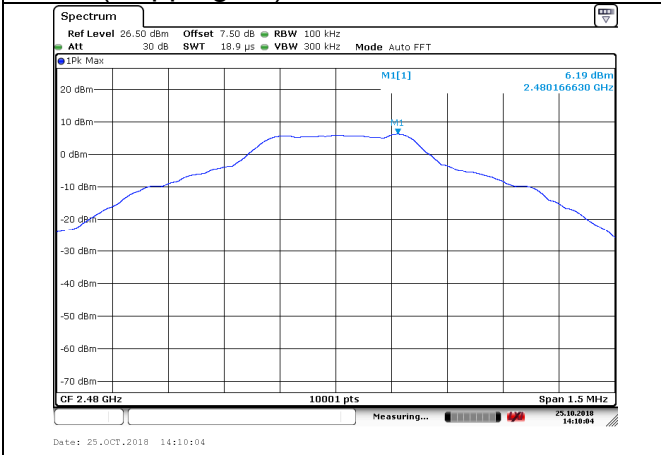
**CH0 (Hopping off)**



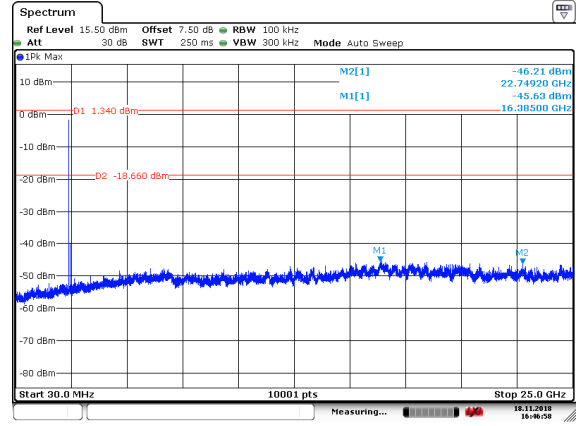
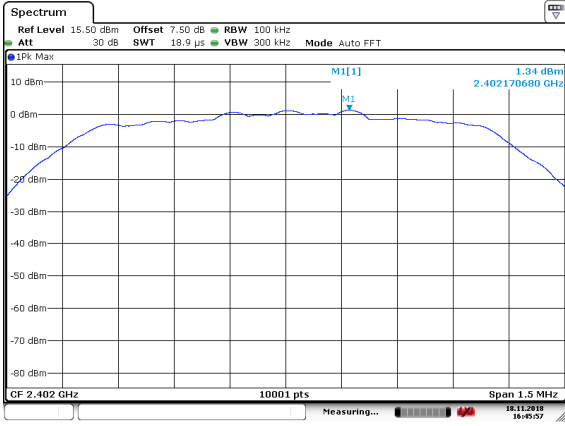
**CH39(Hopping off)**



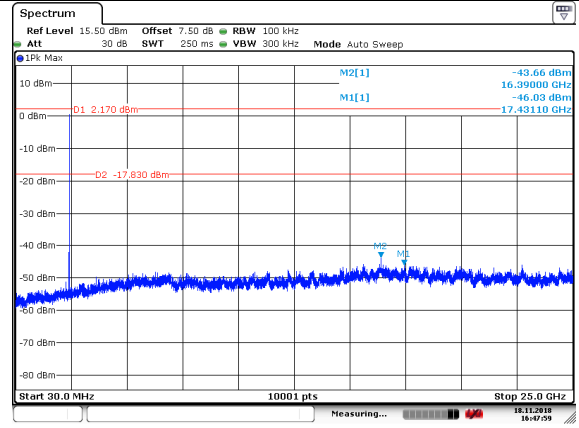
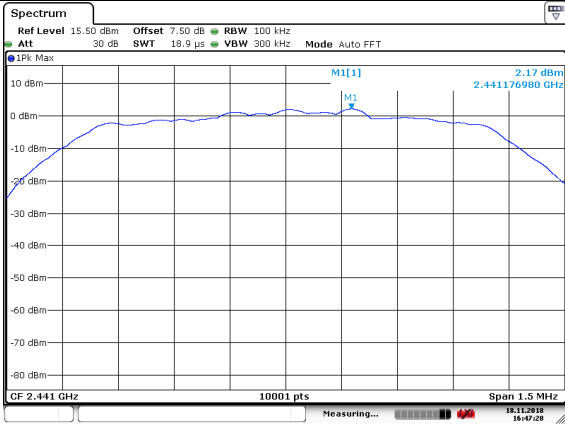
**CH78(Hopping off)**



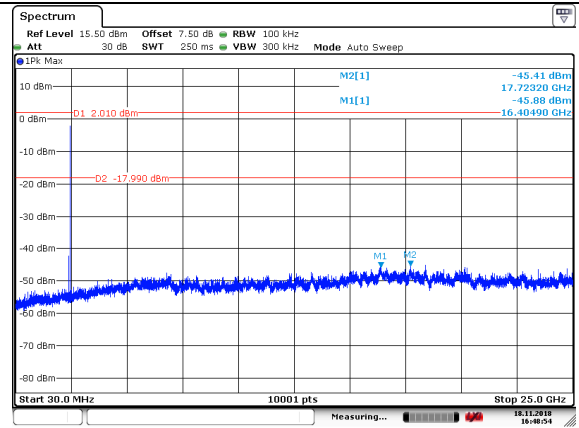
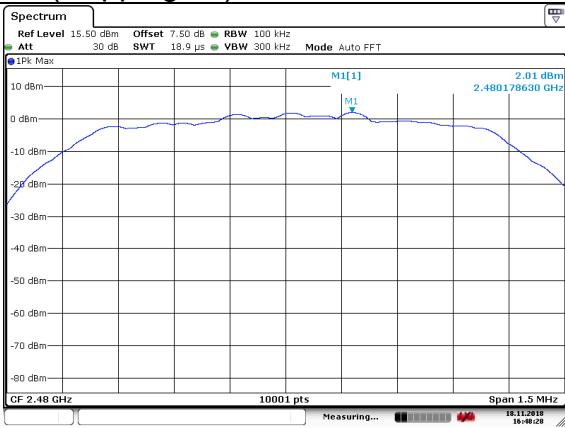
**$\pi/4$ DQPSK**  
**CH0 (Hopping off)**



**CH39(Hopping off)**



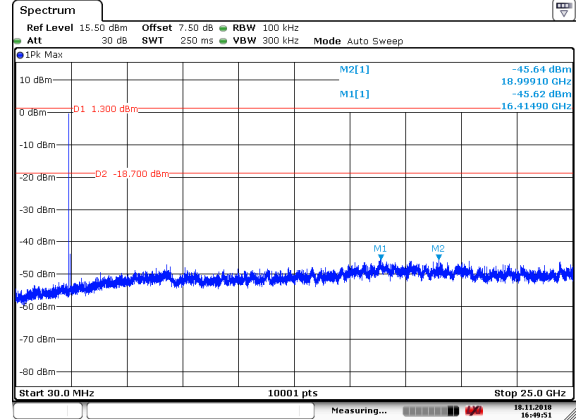
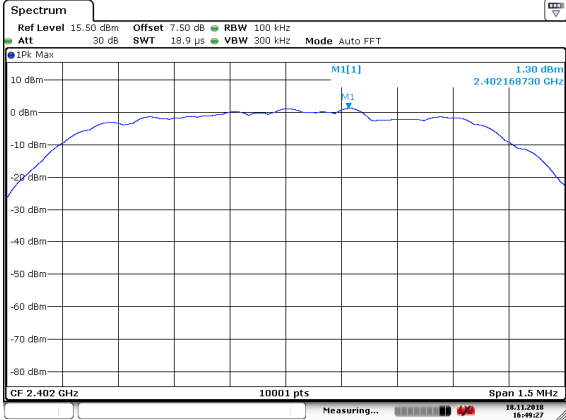
**CH78(Hopping off)**



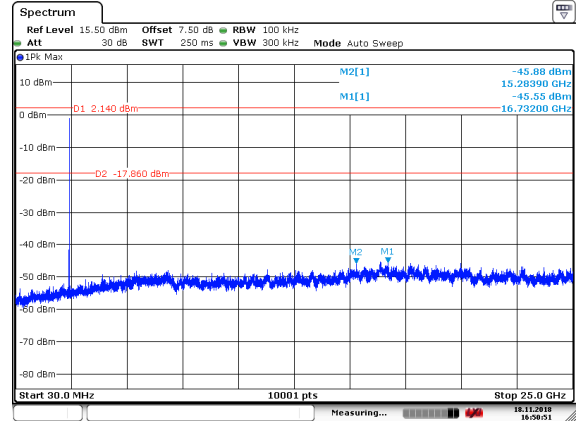
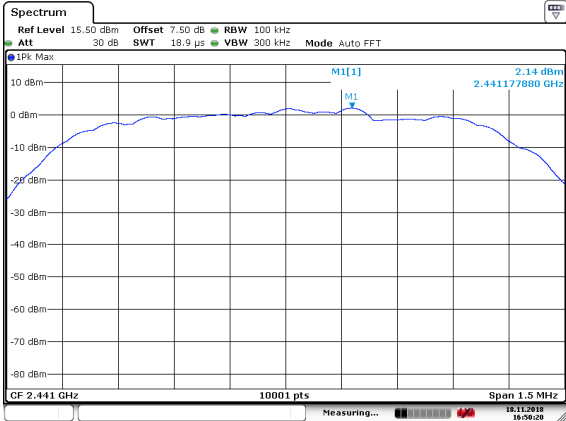


**8DPSK**

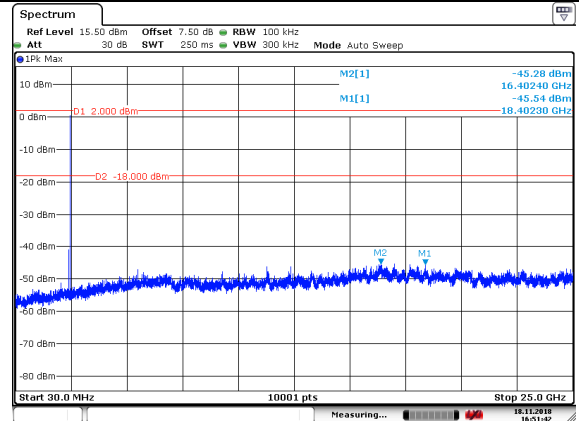
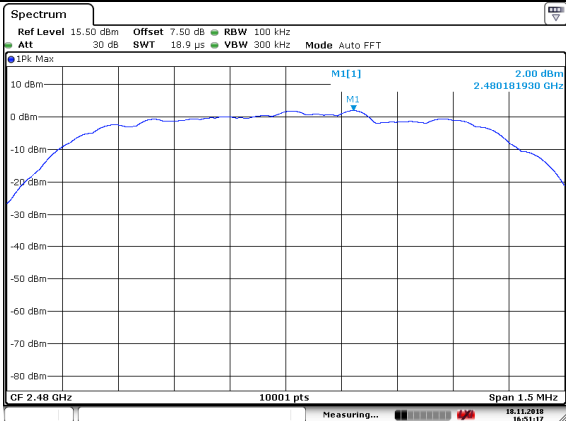
**CH0 (Hopping off)**



**CH39(Hopping off)**



**CH78(Hopping off)**

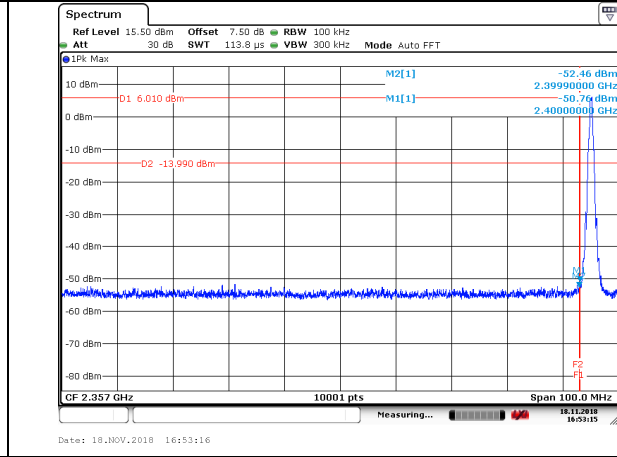
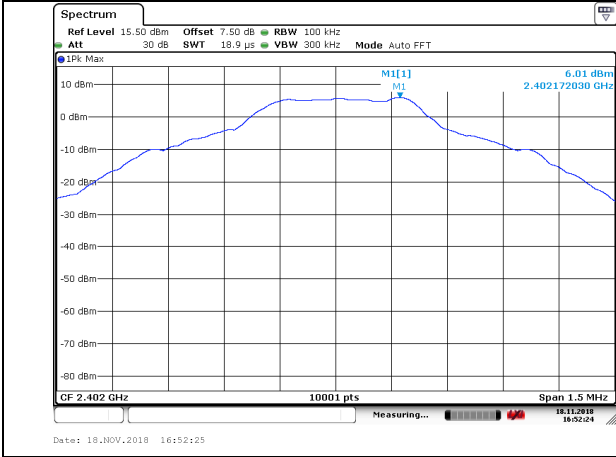


### Band Edge measurement

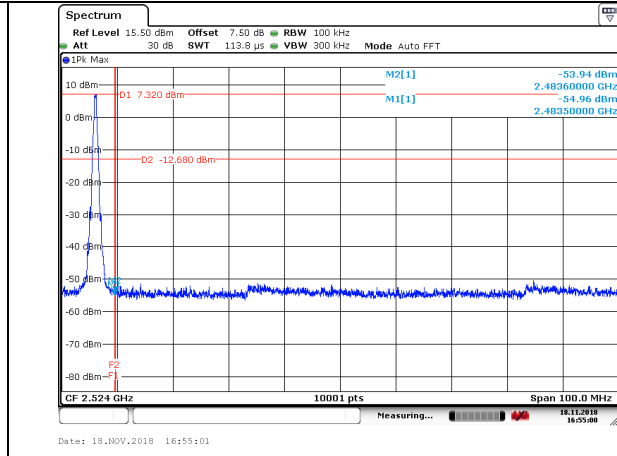
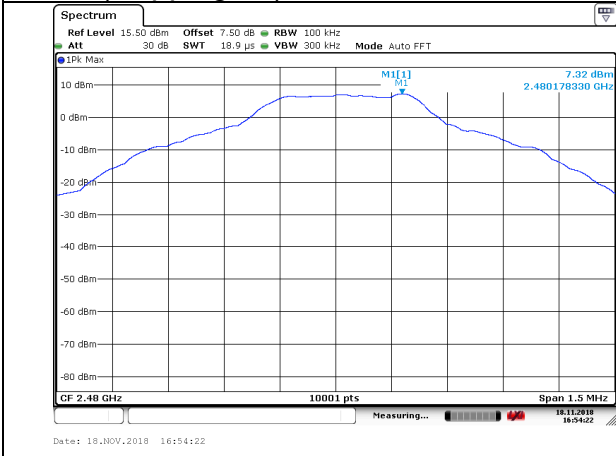
Offset 7.5dB = Attenuator 6dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.3dB

### GFSK

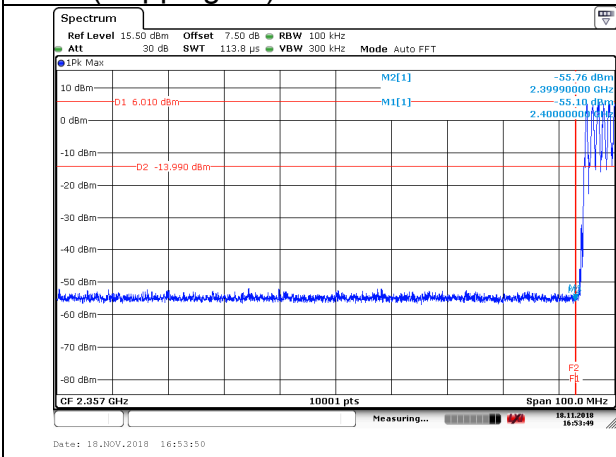
#### CH0 (Hopping off)



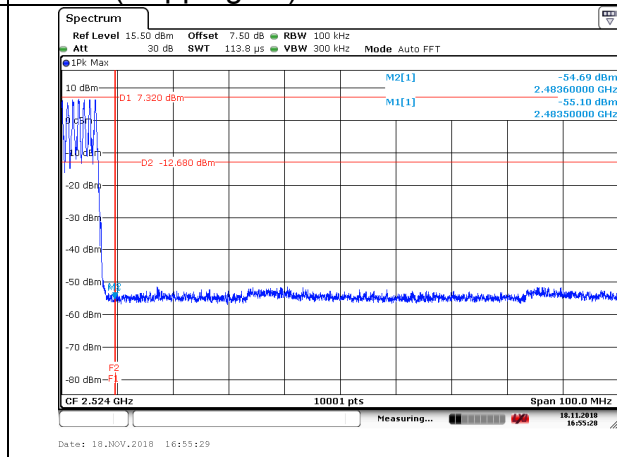
#### CH78 (Hopping off)



#### CH0 (Hopping on)

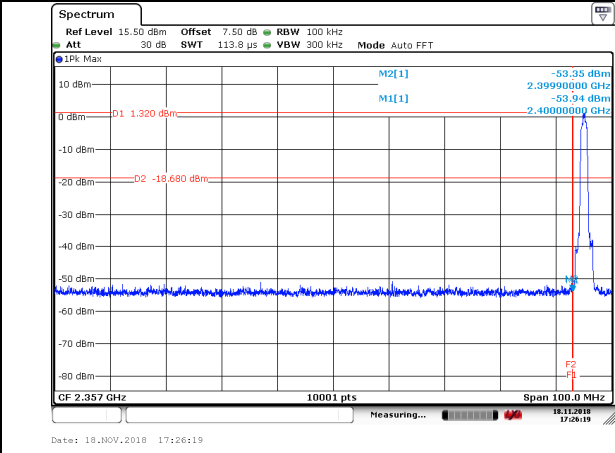
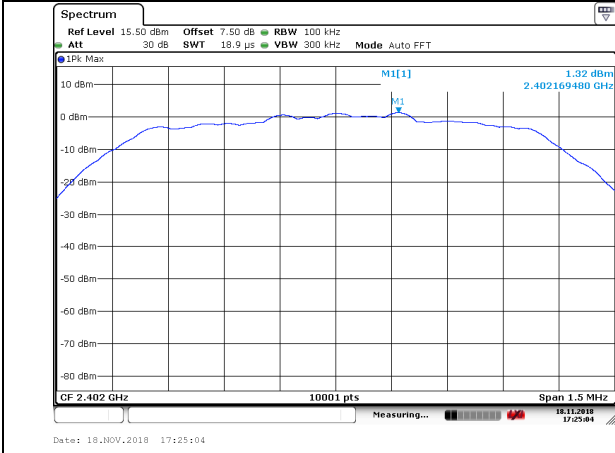


#### CH78 (Hopping on)

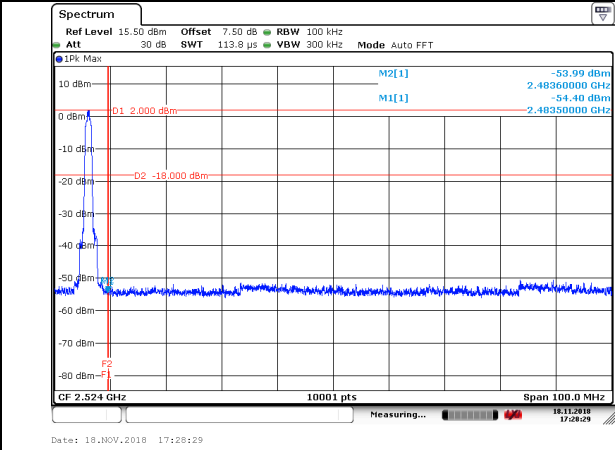
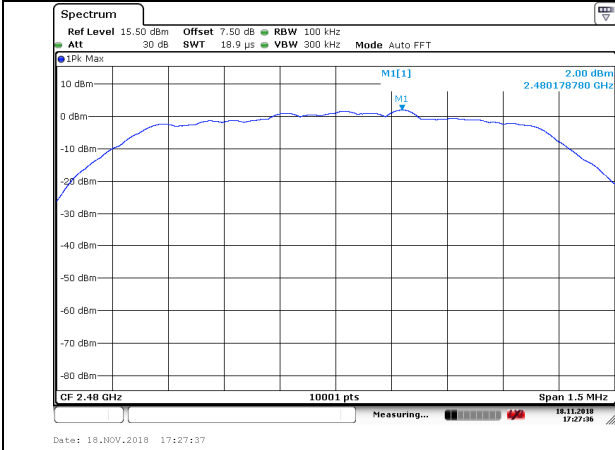


$\pi/4$ DQPSK

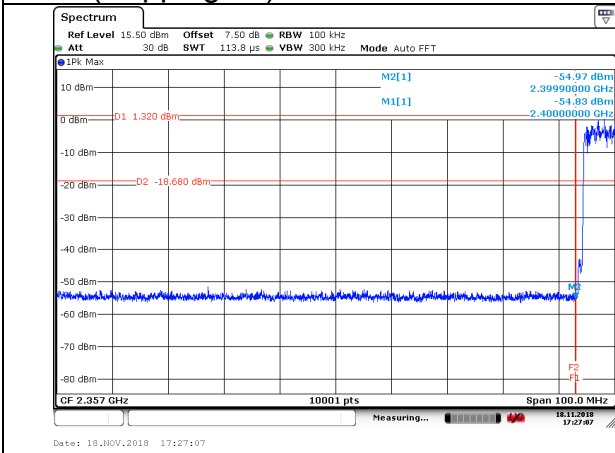
CH0 (Hopping off)



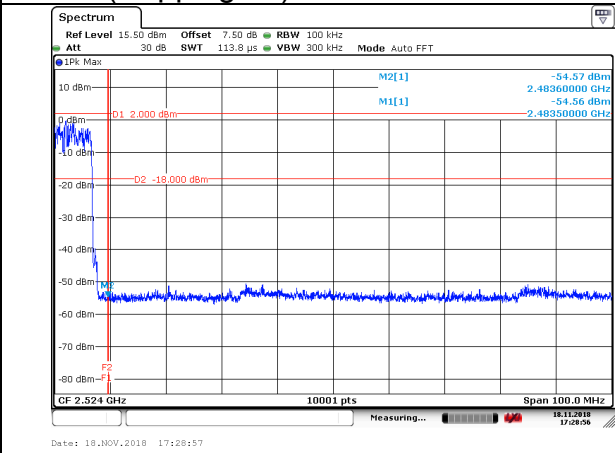
CH78 (Hopping off)



CH0 (Hopping on)

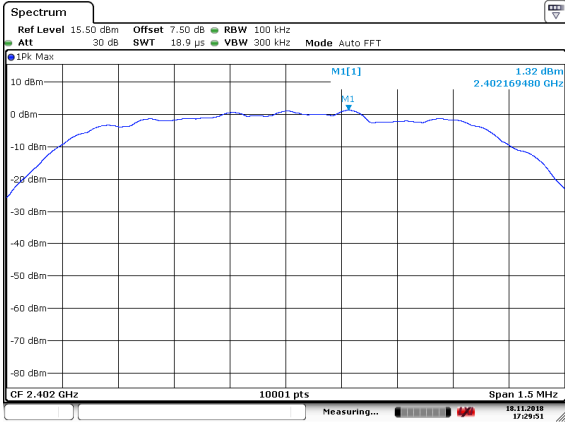


CH78 (Hopping on)

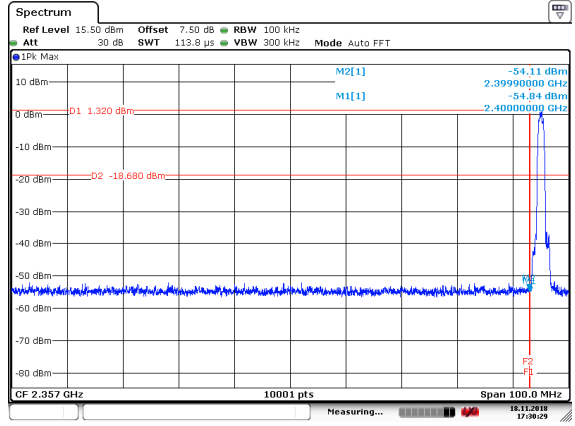


**8DPSK**

**CH0 (Hopping off)**

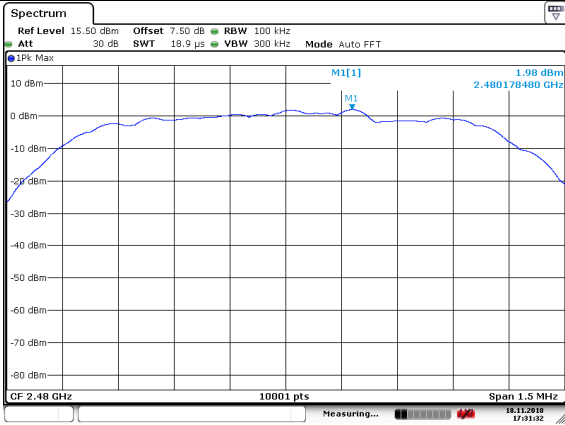


Date: 18\_NOV.2018 17:29:52

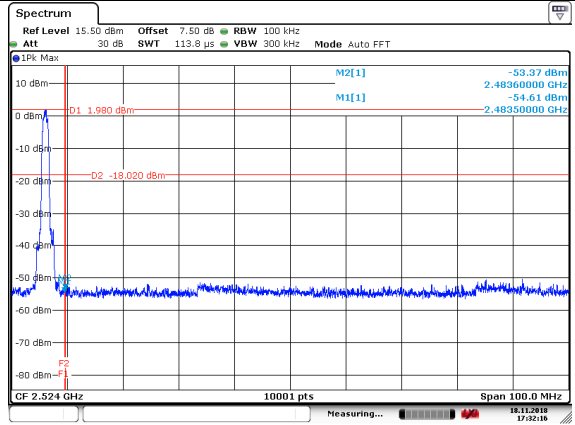


Date: 18\_NOV.2018 17:30:29

**CH78(Hopping off)**

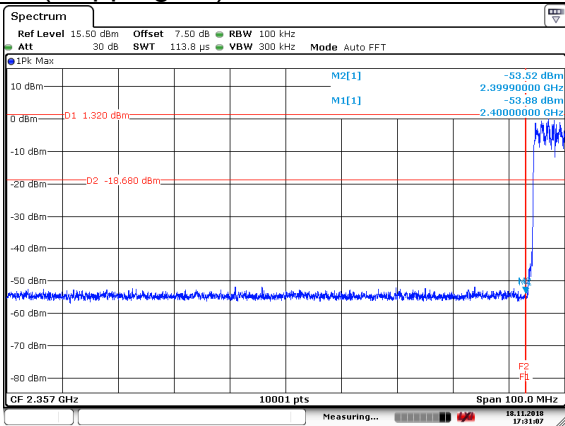


Date: 18\_NOV.2018 17:31:32



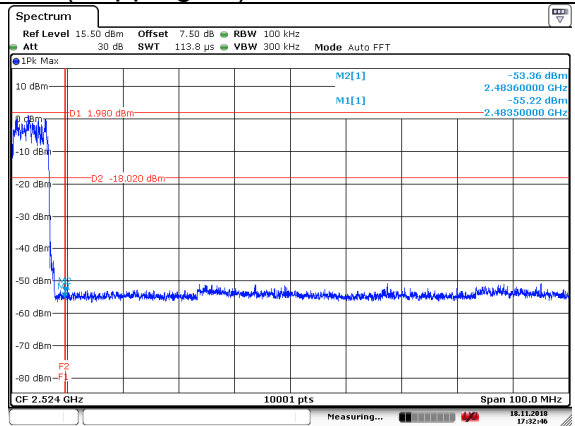
Date: 18\_NOV.2018 17:32:16

**CH0 (Hopping on)**



Date: 18\_NOV.2018 17:31:07

**CH78 (Hopping on)**



Date: 18\_NOV.2018 17:32:46

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

### **Spurious Radiated Emissions**

The worst case attitude: The EUT lay down.

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	98.85	64.85	N/A	N/A	8.90	25.10
2	2390	46.16	12.16	-27.84	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	94.76	60.76	N/A	N/A	8.90	25.10
2	2390	45.18	11.18	-28.82	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	85.33	51.33	N/A	N/A	8.90	25.10
2	2390	36.07	2.07	-17.93	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	83.59	49.59	N/A	N/A	8.90	25.10
2	2390	34.90	0.90	-19.10	54.00	8.90	25.10

Carrier frequency (MHz): 2480  
Channel No.:39  
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	99.63	65.63	N/A	N/A	8.90	25.10
2	2483.5	48.28	14.28	-25.72	74.00	8.90	25.10

Carrier frequency (MHz): 2480  
Channel No.:39  
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	93.77	59.77	N/A	N/A	8.90	25.10
2	2483.5	43.87	9.87	-30.13	74.00	8.90	25.10

Carrier frequency (MHz): 2480  
Channel No.:39  
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	87.35	53.35	N/A	N/A	8.90	25.10
2	2483.5	35.05	1.05	-18.95	54.00	8.90	25.10

Carrier frequency (MHz): 2480  
Channel No.:39  
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	85.13	51.13	N/A	N/A	8.90	25.10
2	2483.5	33.79	-0.21	-20.21	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	99.60	65.60	N/A	N/A	8.90	25.10
2	2390	47.53	13.53	-26.47	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	94.44	60.44	N/A	N/A	8.90	25.10
2	2390	41.55	7.55	-32.45	74	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	86.90	52.90	N/A	N/A	8.90	25.10
2	2390	36.12	2.12	-17.88	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	83.55	49.55	N/A	N/A	8.90	25.10
2	2390	34.92	0.92	-19.08	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	98.50	64.50	N/A	N/A	8.90	25.10
2	2483.5	45.47	11.47	-28.53	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	95.25	61.25	N/A	N/A	8.90	25.10
2	2483.5	44.30	10.30	-29.70	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	86.64	52.64	N/A	N/A	8.90	25.10
2	2483.5	35.69	1.69	-18.31	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	84.39	50.39	N/A	N/A	8.90	25.10
2	2483.5	33.82	-0.18	-20.18	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	99.54	65.54	N/A	N/A	8.90	25.10
2	2390	45.90	11.90	-28.10	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	94.54	60.54	N/A	N/A	8.90	25.10
2	2390	41.13	7.13	-32.87	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	87.59	53.59	N/A	N/A	8.90	25.10
2	2390	34.48	0.48	-19.52	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	84.23	50.23	N/A	N/A	8.90	25.10
2	2390	33.68	-0.32	-20.32	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	100.48	66.48	N/A	N/A	8.90	25.10
2	2483.5	48.54	14.54	-25.46	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	93.83	59.83	N/A	N/A	8.90	25.10
2	2483.5	44.48	10.48	-29.52	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	85.03	51.03	N/A	N/A	8.90	25.10
2	2483.5	33.74	-0.26	-20.26	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	82.27	48.27	N/A	N/A	8.90	25.10
2	2483.5	34.60	0.60	-19.40	54.00	8.90	25.10

### Sample Calculations

Determining Spurious Emissions Levels

A “reference path loss” is established and the  $AR_{pl}$  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:

$$\text{Result} = P_{\text{mea}} + AR_{pl}$$

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)
31.41659	25.8	12.1	13.7	Vertical	40.00
35.36705	26.4	13.4	13.0	Vertical	40.00
60.5435	25.4	13.8	11.6	Vertical	40.00
493.676	31.7	15.2	16.5	Horizontal	46.00
498.0636	32.0	16.7	15.3	Vertical	46.00
502.2425	32.2	16.8	15.4	Vertical	46.00

For  $\pi/4$ DQPSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
31.41659	25.8	12.1	13.7	Vertical	40.00
35.36705	26.4	13.4	13.0	Vertical	40.00
60.5435	25.4	13.8	11.6	Horizontal	40.00
493.676	31.7	15.2	16.5	Horizontal	46.00
498.0636	32.0	16.7	15.3	Vertical	46.00
502.2425	32.2	16.8	15.4	Horizontal	46.00

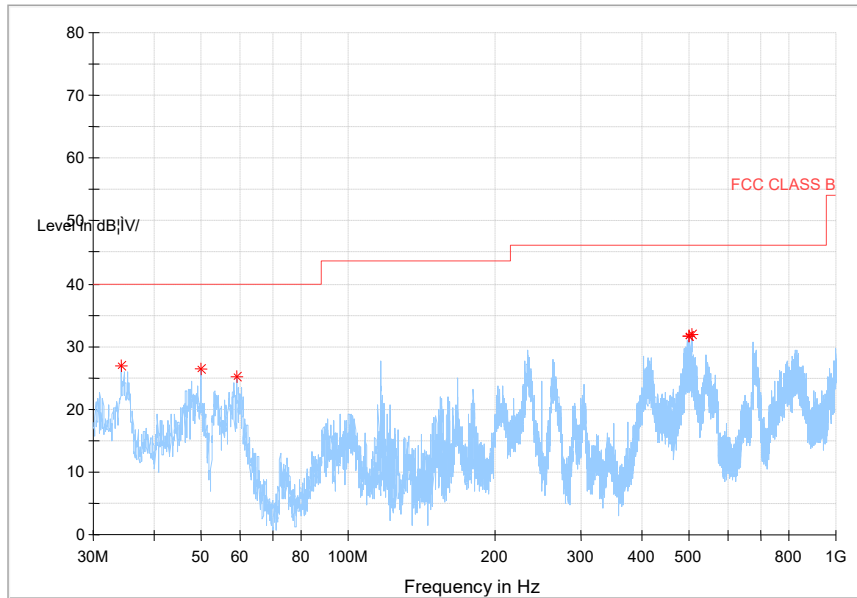
For 8DPSK

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
34.77293	27.3	12.1	15.2	Vertical	40.00
54.07236	25.4	13.4	12.0	Vertical	40.00
498.1567	32.0	13.8	18.2	Horizontal	46.00
499.5517	32.1	15.2	16.9	Horizontal	46.00
501.3435	31.6	16.7	14.9	Vertical	46.00
505.7178	31.4	16.8	14.6	Horizontal	46.00

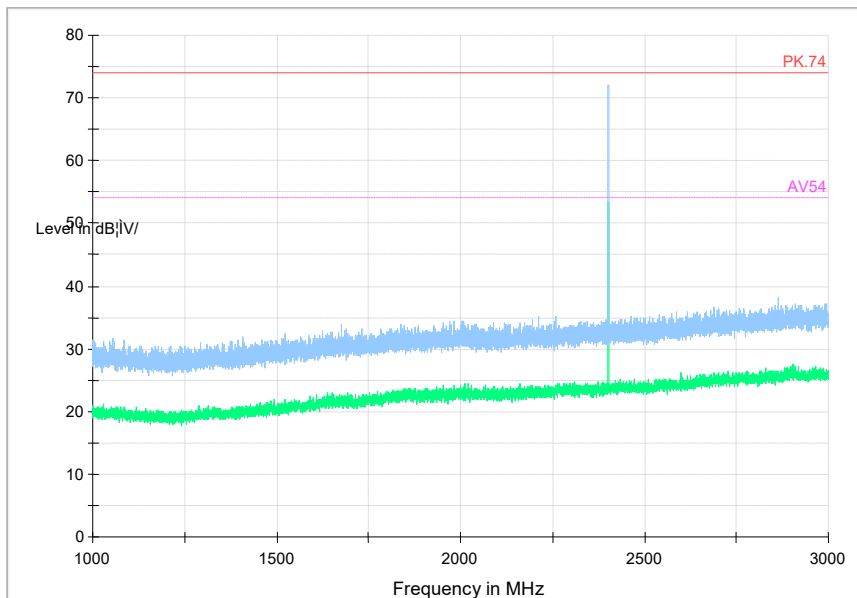
Carrier frequency (MHz): 2441  
Channel No.:39

Full Spectrum



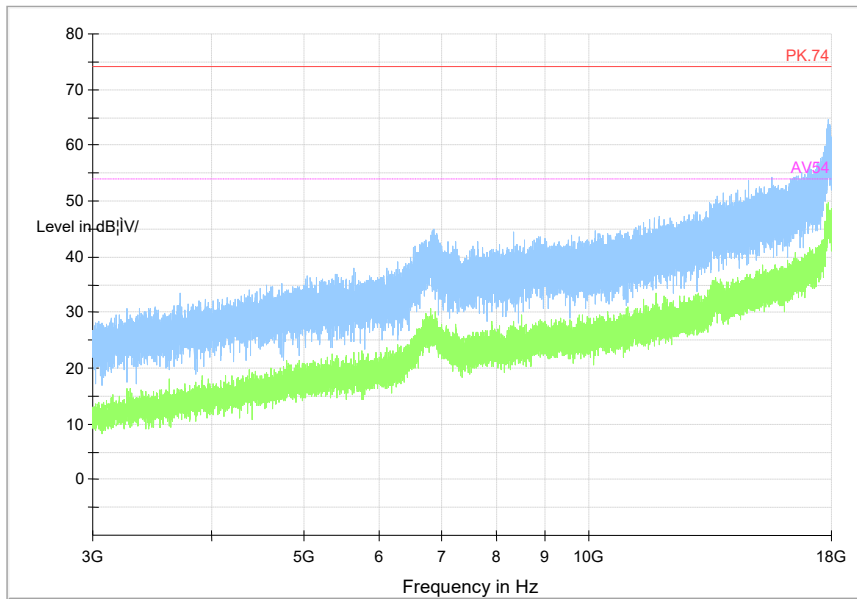
Frequency Range: 30MHz-1000MHz  
Detector: QP mode  
Modulation type: GFSK

Full Spectrum



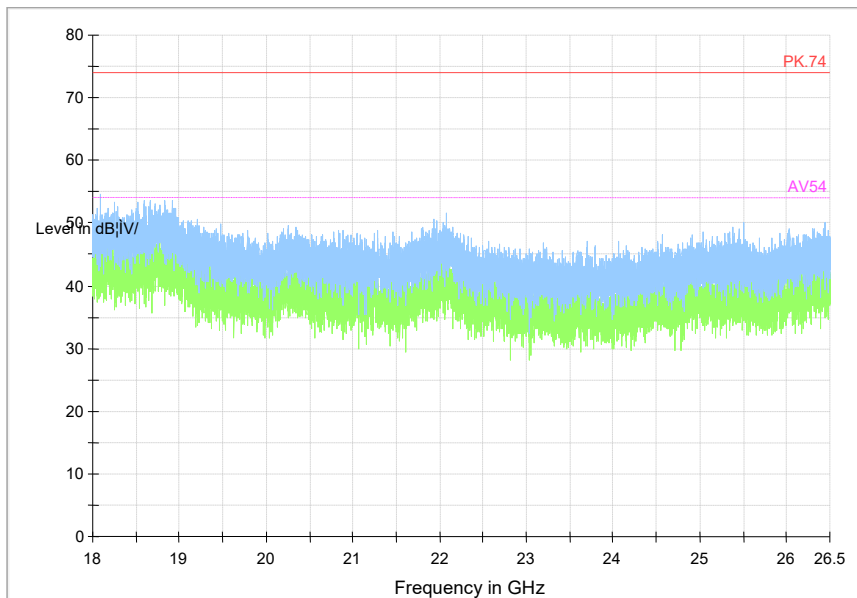
Frequency Range: 1GHz-3GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK

Full Spectrum



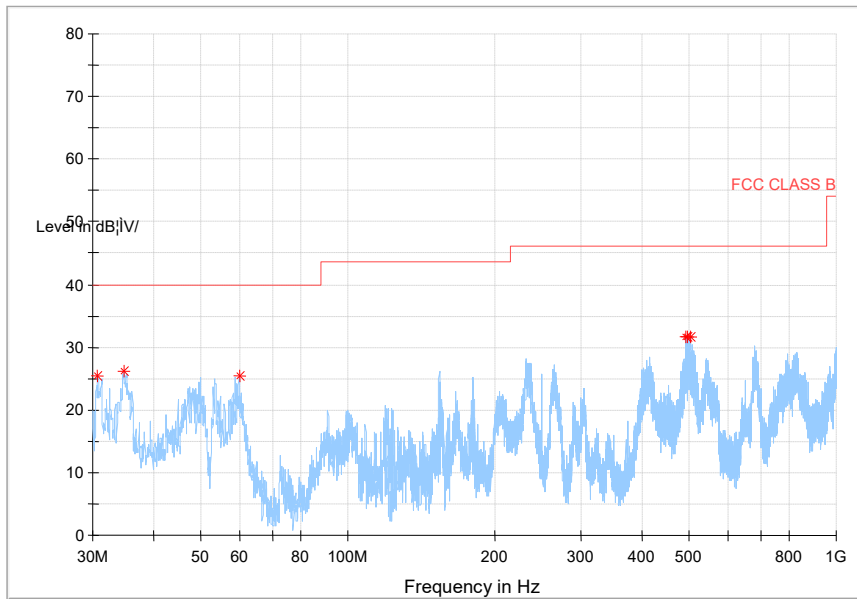
Frequency Range: 3GHz-18GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK

Full Spectrum



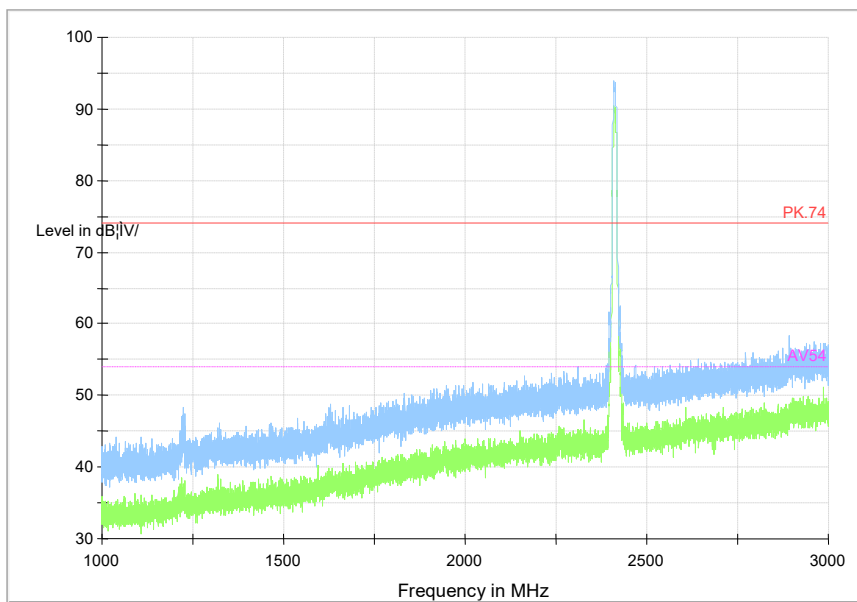
Frequency Range: 18GHz-26.5GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK

Full Spectrum



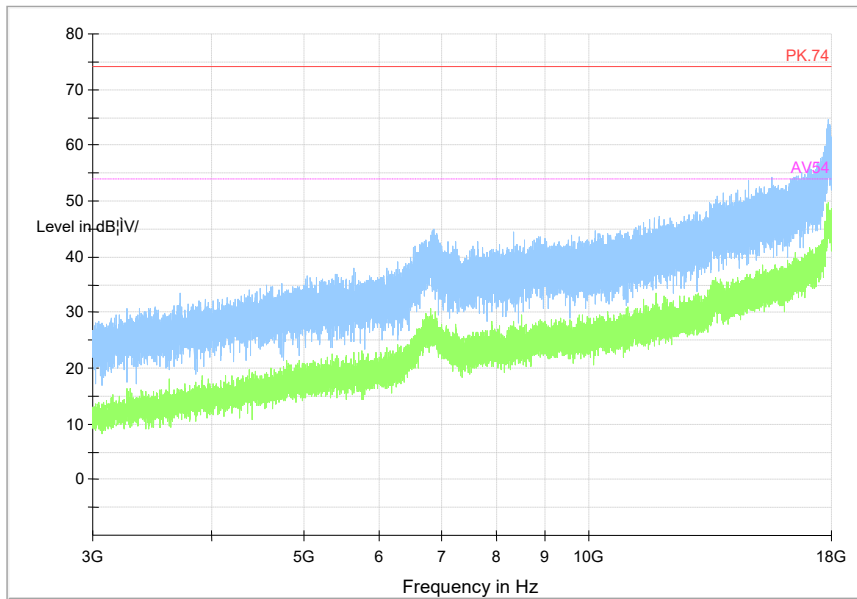
Frequency Range: 30MHz-1000 MHz  
Detector: QP mode  
Modulation type:  $\pi/4$ DQPSK

Full Spectrum



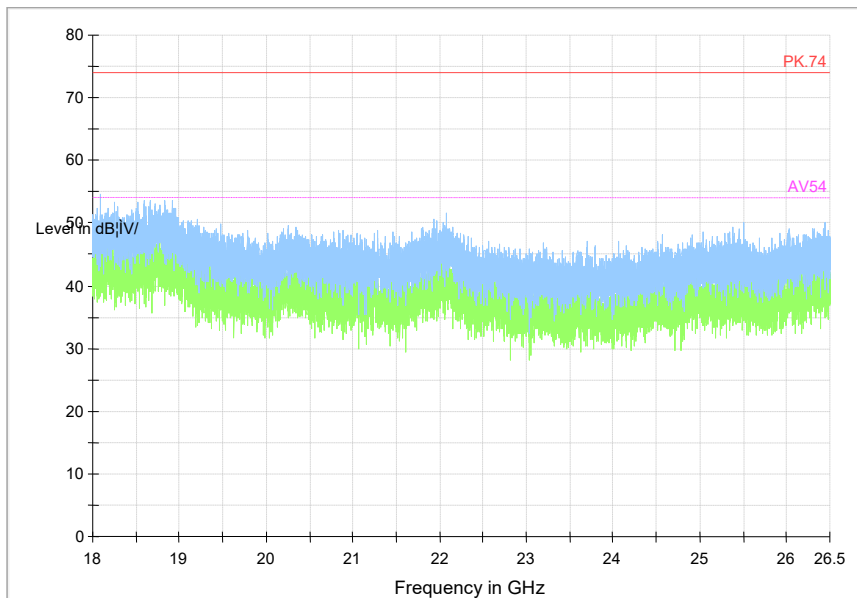
Frequency Range: 1GHz-3GHz  
Detector: Av mode and PK mode  
Modulation type:  $\pi/4$ DQPSK

Full Spectrum



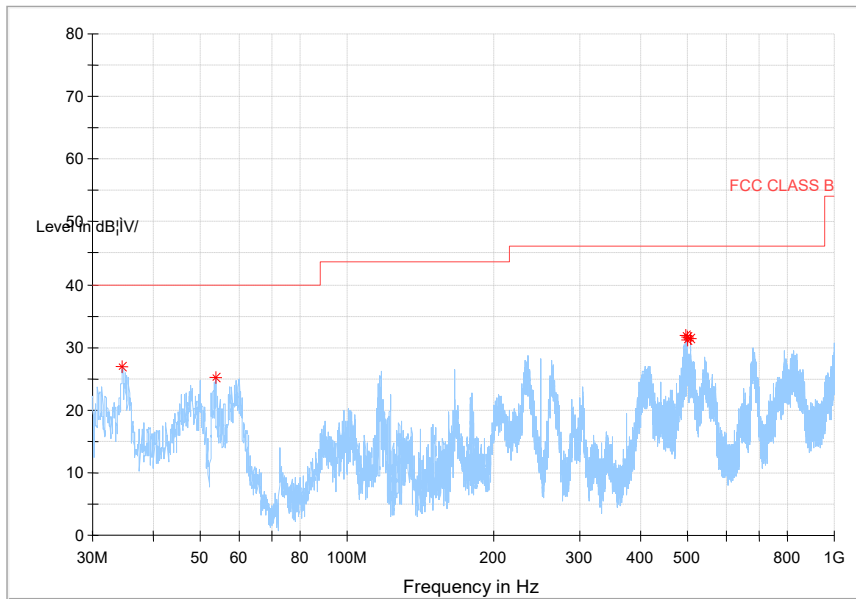
Frequency Range: 3GHz-18GHz  
Detector: Av mode and PK mode  
Modulation type:  $\pi/4$ DQPSK

Full Spectrum



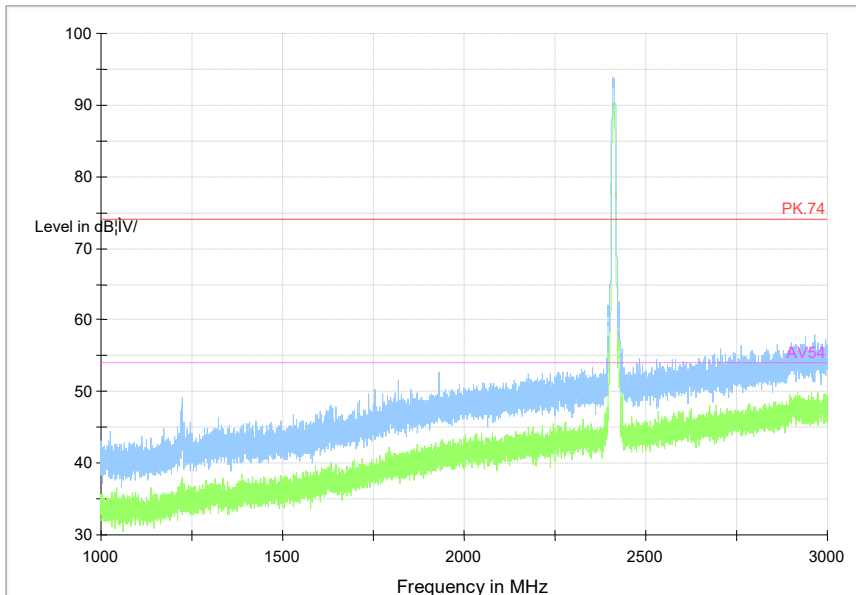
Frequency Range: 18GHz-26.5GHz  
Detector: Av mode and PK mode  
Modulation type:  $\pi/4$ DQPSK

Full Spectrum



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

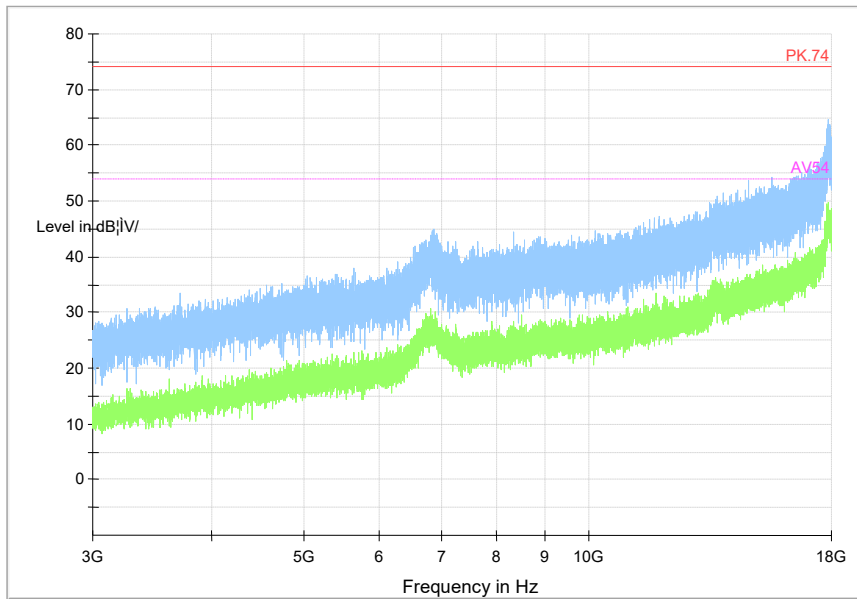
Full Spectrum



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

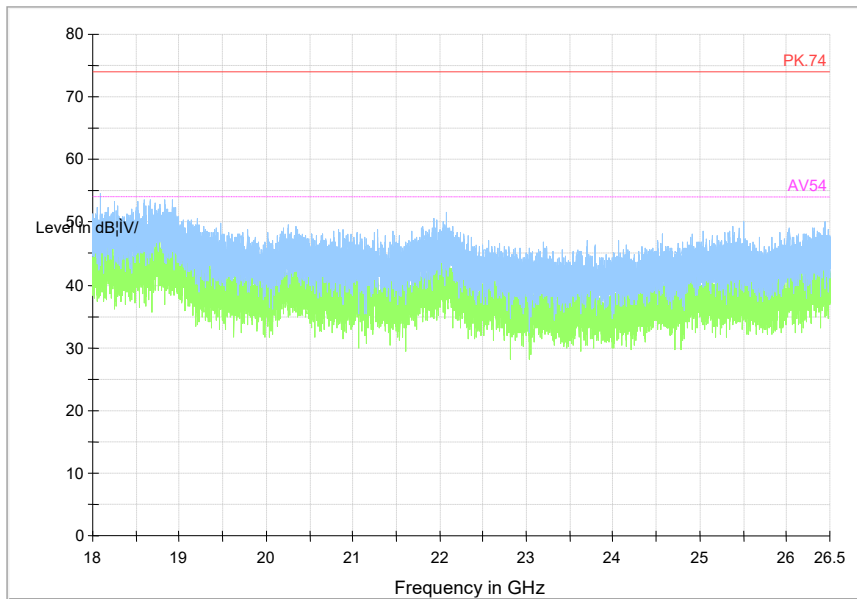


Full Spectrum



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

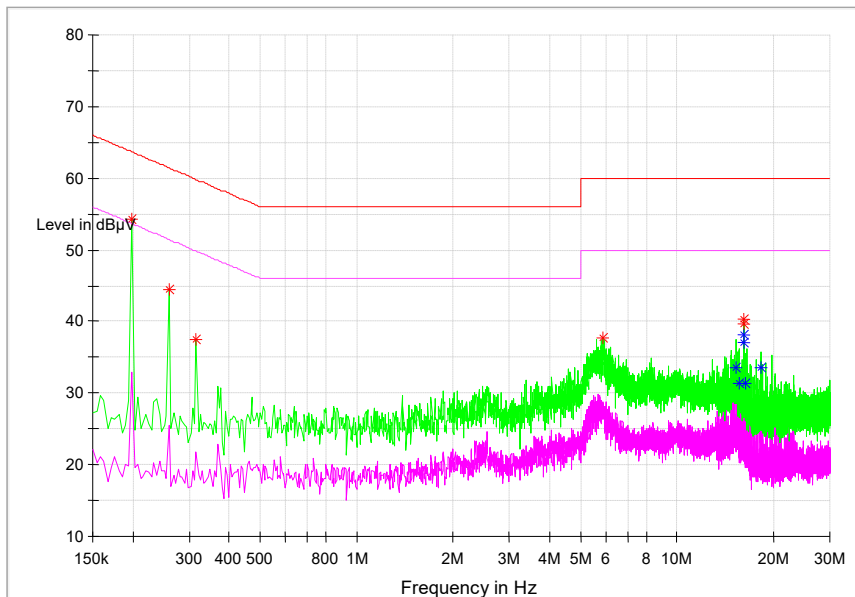
Full Spectrum



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

## AC Power line Conducted Emission

Full Spectrum



L+N Line

### MEASUREMENT RESULT:

Frequency (MHz)	MaxPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr. (dB)
5.839059	37.67	---	60.00	22.33	L1	29.8
0.198287	54.36	---	63.68	9.32	N	30.1
0.259743	44.50	---	61.44	16.94	N	30.1
0.316809	37.46	---	59.79	22.33	N	30.1
15.250588	---	33.65	50.00	16.35	N	30.0
15.614934	---	31.37	50.00	18.63	L1	30.0
16.168037	39.74	---	60.00	20.26	N	30.0
16.168037	---	36.98	50.00	13.02	L1	30.0
16.229493	40.39	---	60.00	19.61	N	30.0
16.229493	---	38.20	50.00	11.80	L1	30.0
16.352404	---	31.40	50.00	18.60	L1	30.0
18.244368	---	33.48	50.00	16.52	N	30.0

**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)
31.41659	25.8	12.1	13.7	Vertical	40.00
35.36705	26.4	13.4	13.0	Vertical	40.00
60.5435	25.4	13.8	11.6	Vertical	40.00
493.676	31.7	15.2	16.5	Horizontal	46.00
498.0636	32.0	16.7	15.3	Vertical	46.00
502.2425	32.2	16.8	15.4	Vertical	46.00

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
30.565833	33.28	12.1	21.18	Vertical	40.00
31.374167	32.95	12.1	20.85	Vertical	40.00
32.586667	32.77	12.1	20.67	Vertical	40.00
34.567083	31.09	10.8	20.29	Horizontal	40.00
35.335000	33.39	10.8	22.59	Vertical	40.00
501.298750	33.72	17.30	16.42	Vertical	46.00

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
35.011667	25.98	12.1	13.88	Vertical	40.00
35.415833	26.53	13.6	12.93	Horizontal	40.00
35.739167	25.54	13.2	12.34	Horizontal	40.00
46.045417	31.39	14.2	17.19	Vertical	40.00
47.904583	20.7	12.7	8.00	Horizontal	40.00
206.337917	22.9	17.3	5.60	Vertical	43.50

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)
30.444583	25.80	12.1	13.70	Horizontal	40.00
35.658333	26.38	12.1	14.28	Horizontal	40.00
49.965833	25.70	10.6	15.10	Vertical	40.00
60.757083	25.68	11.2	14.48	Vertical	40.00
493.296250	32.22	16.2	16.02	Vertical	46.00
499.237500	32.54	15.6	16.94	Vertical	46.00

---End of Test Report---