FCC TEST REPORT

For

Vogo

WI VOKKERO GUARDIAN US CAN

Test Model: VO8161B

List Model No.: N/A

Prepared for	:	Vogo
Address	:	101, place Pierre Duhem, Immeuble Les Centuries II, 34000 Montpellier, France
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	Aug 05, 2019
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	Aug 05, 2019~ March 23, 2020
Date of Report	:	March 24, 2020

FCC TEST REPORT
FCC CFR 47 PART 15 C (15.247)

Report Reference No.	**:**	**LCS190730055AEA**
Date of Issue.....	:	March 24, 2020
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Vogo**
Address.....	:	101, place Pierre Duhem, Immeuble Les Centuries II, 34000 Montpellier, France
Test Specification		
Standard.....	:	FCC CFR 47 PART 15 C (15.247)
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

EUT Description.....	**:**	**WI VOKKERO GUARDIAN US CAN**
Trade Mark.....	:	VOKKERO
Test Model.....	:	VO8161B
Ratings.....	~	Input:100-240V~50/60Hz 400-200mA Output:24V ⎓ 750mA
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Jack Liu	Aking Jin	Gavin Liang
Jack Liu / File administrators	Aking Jin/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS190730055AEA**	March 24, 2020 Date of issue

Test Model.....	:	VO8161B
EUT.....	:	WI VOKKERO GUARDIAN US CAN
Applicant.....	**:**	**Vogo**
Address.....	:	101, place Pierre Duhem, Immeuble Les Centuries II, 34000 Montpellier, France
Telephone.....	:	
Fax.....	:	
Manufacturer.....	**:**	**Vogo**
Address.....	:	101, place Pierre Duhem, Immeuble Les Centuries II, 34000 Montpellier, France
Telephone.....	:	
Fax.....	:	
Factory.....	**:**	/
Address.....	:	/
Telephone.....	:	
Fax.....	:	

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	March 24, 2020	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	WI VOKKERO GUARDIAN US CAN
Model No.	:	VO8161B
Model Declaration	:	N/A
Test Model	:	VO8161B
Power Supply	:	Input:100-240V~50/60Hz 400-200mA Output:24V ⎓ 750mA
Hardware Version	:	V1
Software Version	:	V02.05.11
Bluetooth	:	
Frequency Range	:	902-928MHz
Spectrum	:	FHSS
Modulation:		
Spacing channel:	:	375kHz
Antenna Description	:	Dipole Antenna, 2.3dBi (Max.)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate

1.3. External I/O Cable

I/O Port Description	Quantity	Cable

1.4. Description of Test Facility

FCC Registration Number is 254912.

Industry Canada Registration Number is 9642A-1.

EMSD Registration Number is ARCB0108.

UL Registration Number is 100571-492.

TUV SUD Registration Number is SCN1081.

TUV RH Registration Number is UA 50296516-001.

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

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

1.7. Description of Test Modes

All tests are performed at Cmin and Cmax on the frequency range table .The Table H1, A1, H2, A2, H3 and A3 are tested only the Hopping channel separation, number of hopping frequencies and “Time of occupancy. The different tables use the same modulation.

	H1 (US1)	A1(US2)	H2 (US3)	A2 (US4)	H3	A3
	Min	Min	Min	Min	Min	Min
	Max	Max	Max	Max	Max	Max
	916,698	902,188	903,688	902,75	902,188	903,313
	927,688	916,063	927,313	926,375	917,938	917,563
1	916,698	910,813	903,688	915,875	917,938	917,563
2	917,448	910,063	911,188	904,625	917,188	916,813
3	920,448	908,938	925,063	920,75	910,438	903,313
4	923,073	902,938	917,938	923,375	917,563	904,813
5	917,823	910,438	922,063	902,75	906,688	905,563
6	927,198	911,188	926,938	922,25	908,188	913,438
7	921,198	907,813	904,438	913,25	915,313	905,188
8	921,948	911,563	905,563	917,75	916,813	903,688
9	917,073	905,188	909,313	923,75	910,063	914,563
10	926,448	915,688	907,813	915,5	902,938	909,688
11	922,323	913,813	927,313	926,375	908,938	915,313
12	927,688	908,188	909,688	922,625	911,563	912,313
13	921,573	912,313	906,688	913,625	904,813	908,563
14	925,323	914,938	912,688	910,625	910,813	912,688
15	924,573	905,938	910,063	923	907,063	916,438
16	922,698	903,688	904,813	907,25	905,938	913,813
17	923,823	906,313	912,313	914,375	914,938	911,188
18	926,823	908,563	916,813	911	911,188	906,688
19	925,698	914,188	926,563	921,5	915,688	913,063
20	920,823	915,313	924,313	907,625	909,313	907,438
21	926,073	909,313	915,313	916,625	902,563	908,188
22	924,948	907,063	906,313	908,375	916,063	914,188
23	923,448	904,438	914,938	926	907,813	909,313
24	918,198	912,688	905,188	920,375	913,063	906,313
25	924,198	902,188	925,438	917,375	902,188	910,813
26		905,563		908,75		914,938
27		916,063				

AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/50Hz modes, recorded worst case.

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be TX

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is directly placed on the ground. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turntable, which is directly placed on the ground. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

2.4. Test Sample

The application provides 2 samples to meet requirement;

Sample Number	Description
Sample 1	Engineer sample – continuous transmit
Sample 2	Normal sample – Intermittent transmit

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (MTool_REL_2_0_1_8) provided by application.

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	Lenovo	B470	/	/	/	SDOC
2	Power adapter	Lenovo	TEKA012-1201000UK	/	1.00m	unshielded	SDOC

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

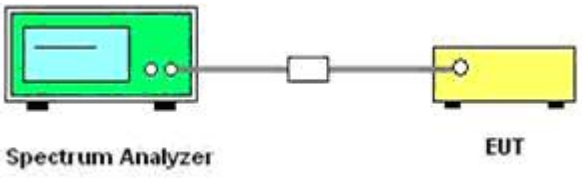
Applied Standard: FCC Part 15 Subpart C				
FCC Rules	Description of Test	Test Sample	Result	Remark
§15.247(b)(2)	Maximum Conducted Output Power	Sample 1	Compliant	Appendix A.1
§15.247(d)	Frequency Separation	Sample 1	Compliant	Appendix A.3
§15.247(d)	99% and 20 dB Bandwidth	Sample 1	Compliant	Appendix A.2
§15.247(a)(1)(i)	Number of Hopping Frequency	Sample 2	Compliant	Appendix A.4
§15.247(a)(1)(i)	Time Of Occupancy (Dwell Time)	Sample 2	Compliant	Appendix A.5
§15.209, §15.205	Conducted Spurious Emissions and Band Edges Test	Sample 1	Compliant	Appendix A.6 Appendix A.7
§15.209, §15.247(d)	Radiated Spurious Emissions	Sample 1	Compliant	Note 1
§15.205	Emissions at Restricted Band	Sample 1	Compliant	Appendix A.8
§15.207(a)	AC Conducted Emissions	Sample 1	Compliant	Note 1
§15.203	Antenna Requirements	Sample 1	Compliant	Note 1
§15.247(i)§2.1093	RF Exposure	Sample 1	Compliant	Note 2

Remark:
1. Note 1 – Test results inside test report;
2. Note 2 – Test results in other test report (RF Exposure Evaluation).

5. MEASUREMENT RESULTS

5.1. Peak Power

5.1.1 Block Diagram of Test Setup



5.1.2 Limit

According to §15.247(b)(2), For frequency hopping systems operating in the 902-928 MHz band employing at least 50 non-overlapping hopping channels, band: 1 watt. For all other frequency hopping systems in the 902-928 MHz band: 0.25 watts(24dBm).

5.1.3 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer. According to ANSI C63.10:2013 Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices; this is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW ≥ RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

5.1.4 Test Results

PASS

Please refer to Appendix A.1

Remark:

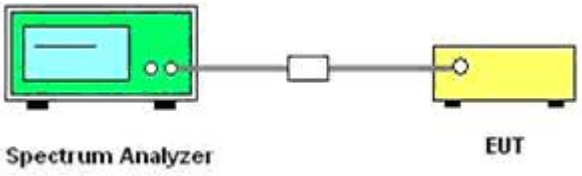
1) Test results including cable loss;

5.2. Frequency Separation and 20 dB Bandwidth

5.2.1 Limit

According to §15.247(d) , in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

5.2.2 Block Diagram of Test Setup



5.2.3 Test Procedure

Frequency separation test procedure:

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = middle of hopping channel.

4). Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 300 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.

5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB bandwidth test procedure:

1). Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.

2). RBW ≥1% of the 20 dB bandwidth, VBW ≥RBW.

3). Detector function = peak.

4). Trace = max hold.

5.2.4 Test Results

5.2.4.1 99% and 20dB Bandwidth

PASS

Please refer to Appendix A.2

Remark:

1. *Test results including cable loss;*
2. *Measured 99% and 20dB Bandwidth at difference Packet Type for each mode and recorded worst case for each mode.*

5.2.4.2 Frequency Separation

PASS

Please refer to Appendix A.3

Remark:

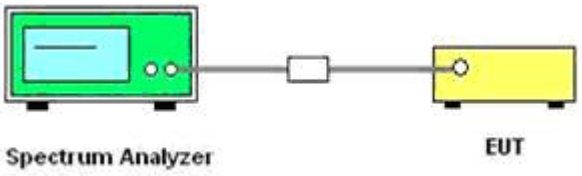
1. *Test results including cable loss;*

5.3. Number of Hopping Frequency

5.3.1 Limit

According to §15.247(a)(1)(i) , Frequency hopping systems operating in the band 902-928 MHz shall use at least 25 hopping channels, If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels.

5.3.2 Block Diagram of Test Setup



5.3.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set Spectrum Analyzer Start=900MHz, Stop = 930MHz, Sweep = auto.

4). Set the Spectrum Analyzer as RBW/VBW=100 KHz/300KHz.

5). Max hold, view and count how many channel in the band.

5.3.4 Test Results

PASS

Please refer to Appendix A.4

Remark:

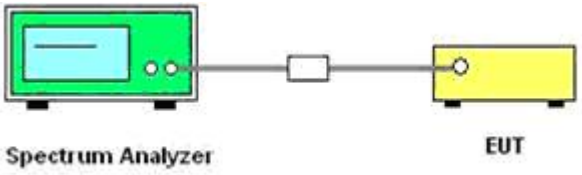
1). Test results including cable loss;

5.4. Time of Occupancy (Dwell Time)

5.4.1 Limit

According to §15.247(a)(1)(i) , Frequency hopping systems operating in the 902 MHz -928 MHz bands. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10 second period.

5.4.2 Block Diagram of Test Setup



5.4.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = operating frequency.

4). Set the Spectrum Analyzer as RBW/VBW=1MHz/3MHz, Span = 0Hz, Sweep = auto.

5). Repeat above procedures until all frequency measured was complete.

5.4.4 Test Results

PASS

Please refer to Appendix A.5

Remark:

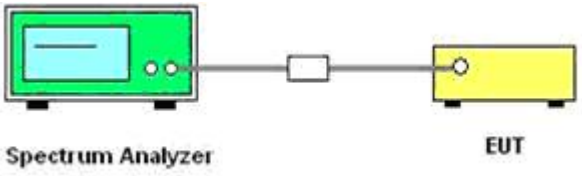
1. *Test results including cable loss;*

5.5. Conducted Spurious Emissions and Band Edges Test

5.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

5.5.2 Block Diagram of Test Setup



5.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 9 KHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels

5.5.4 Test Results of Conducted Spurious Emissions

PASS

Please refer to Appendix A.6 for conducted spurious emission.

Please refer to Appendix A.7 for conducted band edge.

Remark:
1). Test results including cable loss;
2). Measured at difference Packet Type for each mode and recorded worst case for each mode.
3). "---"means that the fundamental frequency not for 15.209 limits requirement.
4). Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.

5.6. Restricted Band Emission Limit

5.6.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement 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

5.6.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

5.6.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

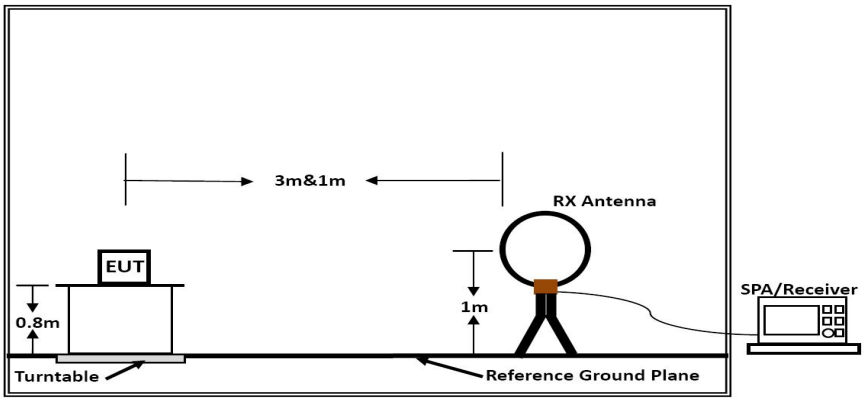
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

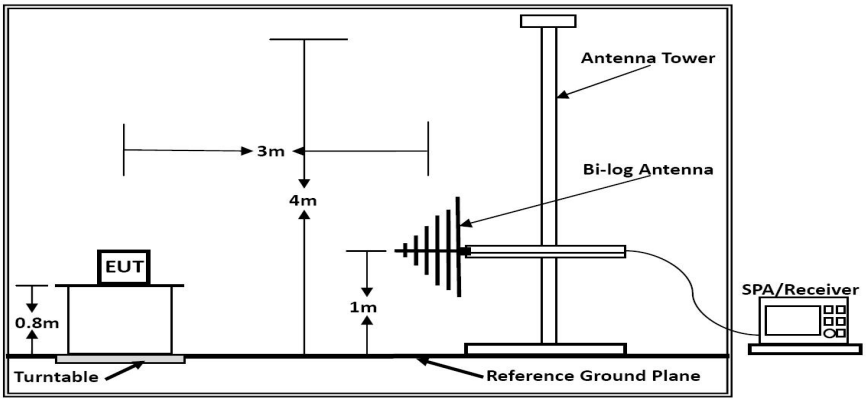
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

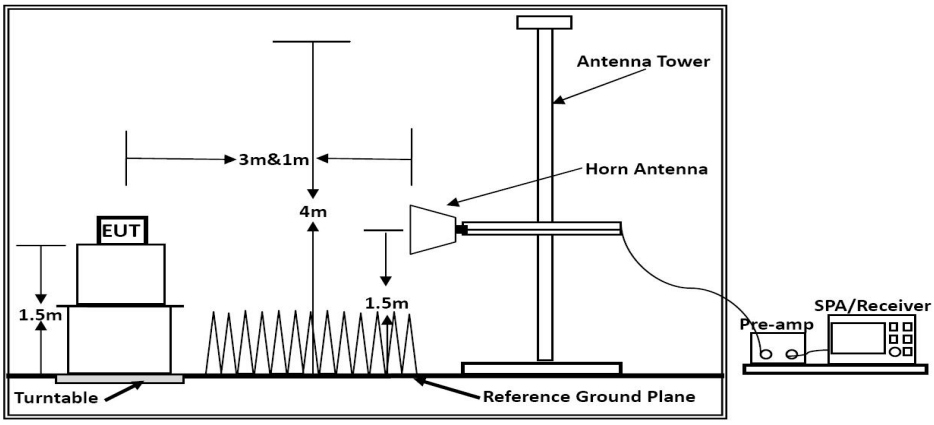
5.6.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.6.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	23.1℃	Humidity	53.9%
Test Engineer	David Luo	Configurations	GFSK

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.6.7. Results of Radiated Emissions (30 MHz – 1000 MHz)

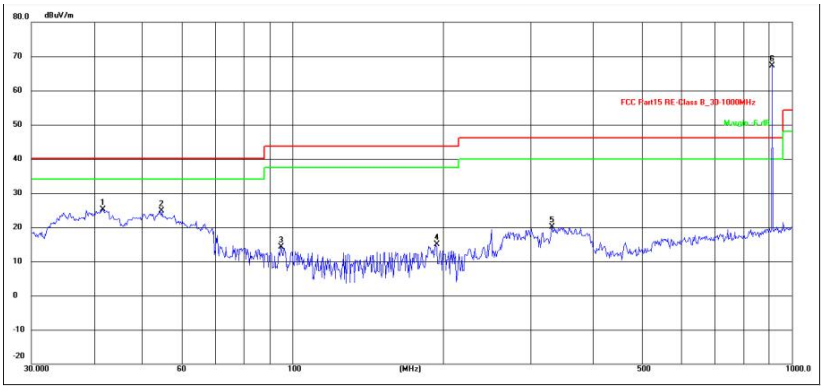
PASS.

Only record the worst test result in this report.

The test data please refer to following page.

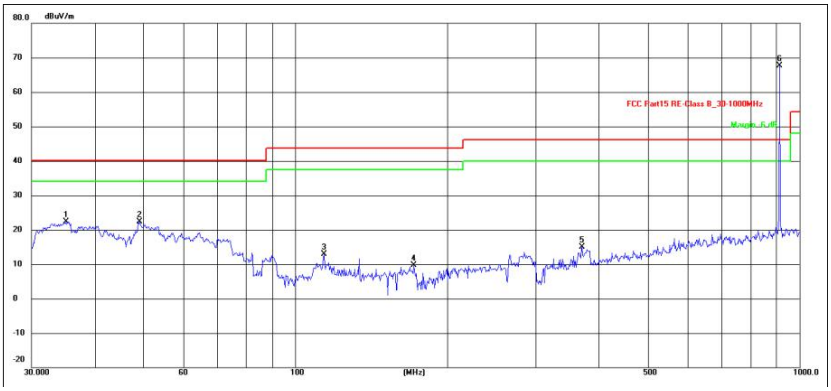
Below 1GHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	41.7129	42.19	-17.08	25.11	40.00	-14.89	QP			
2	54.4516	41.92	-17.10	24.82	40.00	-15.18	QP			
3	94.7601	33.47	-19.20	14.27	43.50	-29.23	QP			
4	193.7728	33.74	-18.76	14.98	43.50	-28.52	QP			
5	331.3546	34.96	-14.83	20.13	46.00	-25.87	QP			
6 *	912.8620	72.90	-5.59	67.31	46.00	21.31	peak			

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	35.1277	41.31	-18.97	22.34	40.00	-17.66	QP			
2	49.1865	38.83	-16.40	22.43	40.00	-17.57	QP			
3	114.1137	32.05	-19.10	12.95	43.50	-30.55	QP			
4	171.9946	30.29	-20.60	9.69	43.50	-33.81	QP			
5	370.7023	29.02	-13.99	15.03	46.00	-30.97	QP			
6 *	912.8620	73.30	-5.59	67.71	46.00	21.71	peak			

Note:

1). Pre-scan all modes and recorded the worst case results in this report (Low Channel).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4).needs BRC filters prevents instrument overload.

5.6.8. Results of Radiated Emissions (1 GHz – 26 GHz)

Note: All the modes have been tested and recorded worst mode in the report.

The worst test result for GFSK, Channel 902.188 MHz

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1804.37	58.21	32.14	34.12	3.53	59.76	74.00	-14.24	Peak	Horizontal
1804.37	41.35	32.14	34.12	3.53	42.90	54.00	-11.10	Average	Horizontal
1804.37	55.12	32.17	34.15	3.55	56.69	74.00	-17.31	Peak	Vertical
1804.37	39.26	32.17	34.15	3.55	40.83	54.00	-13.17	Average	Vertical

The worst test result for GFSK, Channel 912.313 MHz

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1824.62	61.57	33.06	35.04	3.94	63.53	74.00	-10.47	Peak	Horizontal
1824.62	39.66	33.06	35.04	3.94	41.62	54.00	-12.38	Average	Horizontal
1824.62	53.92	33.16	35.15	3.96	55.89	74.00	-18.11	Peak	Vertical
1824.62	41.45	33.16	35.15	3.96	43.42	54.00	-10.58	Average	Vertical

The worst test result for GFSK, Channel 927.688 MHz

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1855.37	53.03	33.26	35.14	3.98	55.13	74.00	-18.87	Peak	Horizontal
1855.37	44.05	33.26	35.14	3.98	46.15	54.00	-7.85	Average	Horizontal
1855.37	53.64	33.36	35.16	4.00	55.84	74.00	-18.16	Peak	Vertical
1855.37	39.03	33.36	35.16	4.00	41.23	54.00	-12.77	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3). 18~25GHz at least have 20dB margin. No recording in the test report.

5.7. AC Power Line Conducted Emissions

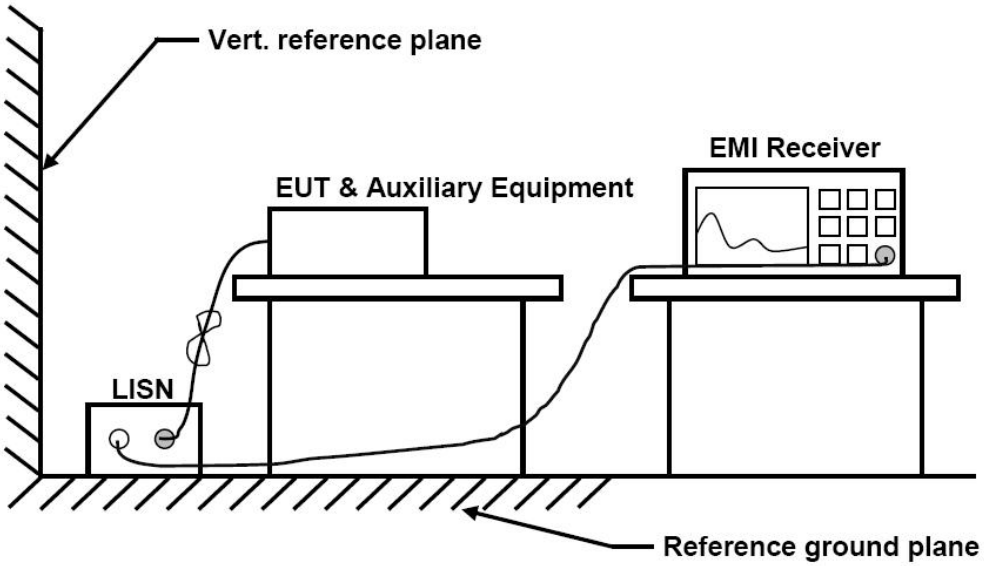
5.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.7.2 Block Diagram of Test Setup



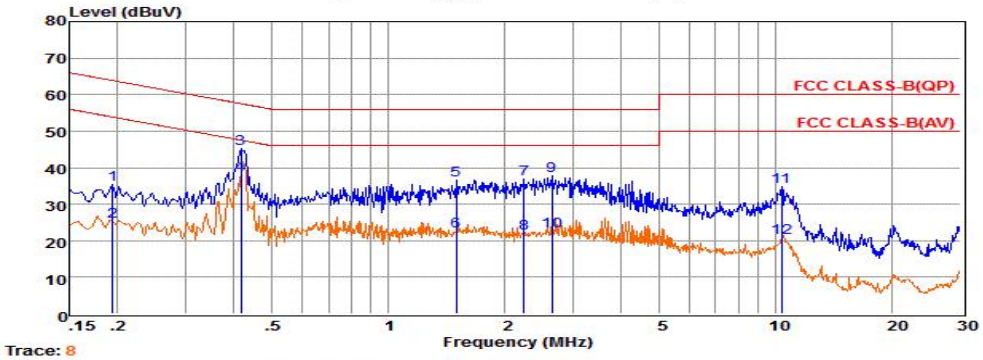
5.7.3 Test Results

PASS.

The test data please refer to following page.

AC Conducted Emission of charge from Adapter mode @ AC 120V/60Hz (worst case)

Line

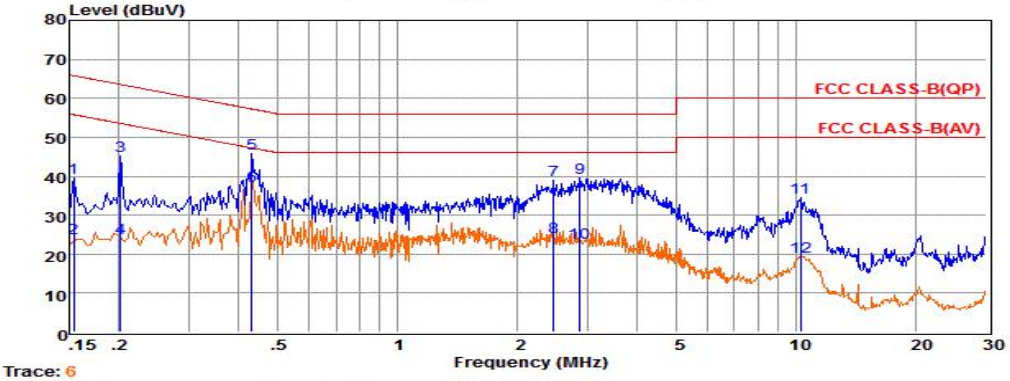


Trace: 8
Env. Ins: 24.8*/54.8%
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.19	15.86	9.62	0.02	10.00	35.50	63.84	-28.34	QP
2	0.19	5.76	9.62	0.02	10.00	25.40	53.84	-28.44	Average
3	0.42	25.57	9.62	0.04	10.00	45.23	57.51	-12.28	QP
4	0.42	18.50	9.62	0.04	10.00	38.16	47.50	-9.34	Average
5	1.50	16.94	9.64	0.05	10.00	36.63	56.00	-19.37	QP
6	1.50	3.03	9.64	0.05	10.00	22.72	46.00	-23.28	Average
7	2.24	17.31	9.64	0.05	10.00	37.00	56.00	-19.00	QP
8	2.24	2.41	9.64	0.05	10.00	22.10	46.00	-23.90	Average
9	2.65	18.11	9.64	0.05	10.00	37.80	56.00	-18.20	QP
10	2.65	2.95	9.64	0.05	10.00	22.64	46.00	-23.36	Average
11	10.34	14.92	9.69	0.08	10.00	34.69	60.00	-25.31	QP
12	10.34	1.02	9.69	0.08	10.00	20.79	50.00	-29.21	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

Neutral



Trace: 6
Env. Ins: 24.8*/54.8%
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.15	19.84	9.69	0.02	10.00	39.55	65.78	-26.23	QP
2	0.15	4.28	9.69	0.02	10.00	23.99	55.77	-31.78	Average
3	0.20	25.73	9.59	0.02	10.00	45.34	63.54	-18.20	QP
4	0.20	4.56	9.59	0.02	10.00	24.17	53.53	-29.36	Average
5	0.43	26.28	9.62	0.04	10.00	45.94	57.24	-11.30	QP
6	0.43	17.83	9.62	0.04	10.00	37.49	47.24	-9.75	Average
7	2.46	19.27	9.64	0.05	10.00	38.96	56.00	-17.04	QP
8	2.46	4.71	9.64	0.05	10.00	24.40	46.00	-21.60	Average
9	2.87	19.87	9.64	0.06	10.00	39.57	56.00	-16.43	QP
10	2.87	3.25	9.64	0.06	10.00	22.95	46.00	-23.05	Average
11	10.23	14.63	9.72	0.08	10.00	34.43	60.00	-25.57	QP
12	10.23	-0.50	9.72	0.08	10.00	19.30	50.00	-30.70	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

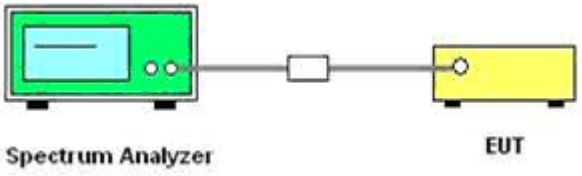
****Note: Pre-scan all modes and recorded the worst case results in this report (GFSK).*

5.8. Restrict-band Band-edge Measurements

5.8.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.8.2. Test Setup Layout



5.8.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.8.4. Test Procedures

According to KDB 412172 section 1.1 Field Strength Approach (linear terms):
eirp = p_t x g_t = $(E \times d)^2/30$
Where:
p_t = transmitter output power in watts,
g_t = numeric gain of the transmitting antenna (unit less),
E = electric field strength in V/m,
d = measurement distance in meters (m).
erp = eirp/1.64 = $(E \times d)^2/(30 \times 1.64)$
Where all terms are as previously defined.

1). Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2). Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3). Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for Peak detector.
4). Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5). Repeat above procedures until all measured frequencies were complete.
6). Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7). Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8). Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9). For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10). Compare the resultant electric field strength level to the applicable regulatory limit.
11). Perform radiated spurious emission test duress until all measured frequencies were complete.

5.8.5. Test Results

PASS

Please refer to Appendix A.8

Remark:

1. *Worst case data at GFSK modulation type;*
2. *Measured at Hopping and Non-Hopping mode, recorded worst at Non-Hopping mode.*
3. *The other emission levels were very low against the limit.*
4. *The average measurement was not performed when the peak measured data under the limit of average detection.*
5. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330KHz/Sweep time=Auto/Detector=Peak;*
6. *Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.*

5.9. Pseudorandom Frequency Hopping Sequence

5.9.1 Standard Applicable

For 47 CFR Part 15C sections 15.247 (a) (1) (i) requirement:

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

5.9.2 EUT Pseudorandom Frequency Hopping Sequence Requirement

The device meet Pseudorandom Frequency Hopping Sequence requirement, please refer to Operation Description for Pseudorandom Frequency Hopping Sequence.

5.10. Antenna Requirement

5.10.1 Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

5.10.2 Antenna Connected Construction

5.10.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

5.10.2.2. Antenna Connector Construction

The gains of antenna used for transmitting is 2.30dBi, and the antenna is a Dipole antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details, meet RSS-Gen antenna requirement.

5.10.2.3. Results: Compliance.

6. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Meter	R&S	NRVS	100444	2019-06-11	2020-06-10
2	Power Sensor	R&S	NRV-Z81	100458	2019-06-11	2020-06-10
3	Power Sensor	R&S	NRV-Z32	10057	2019-06-11	2020-06-10
4	Test Software	Tonscend	JS1120-2	/	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-2	N/A	2019-06-11	2020-06-10
6	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2019-06-11	2020-06-10
7	DC Power Supply	Agilent	E3642A	N/A	2019-11-14	2020-11-13
8	EMI Test Software	AUDIX	E3	/	N/A	N/A
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2019-06-12	2020-06-11
10	Positioning Controller	MF	MF-7082	N/A	2019-06-12	2020-06-11
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2019-07-27	2020-07-26
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2019-07-27	2020-07-26
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2019-07-03	2020-07-02
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2019-09-19	2020-09-18
15	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-025	2019-09-19	2020-09-18
16	EMI Test Receiver	R&S	ESR 7	101181	2019-06-12	2020-06-11
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2019-11-14	2020-11-13
18	Broadband Preamplifier	/	BP-01M18G	P190501	2019-07-01	2020-06-30
19	RF Cable-R03m	Jye Bao	RG142	CB021	2019-06-12	2020-06-11
20	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2019-06-12	2020-06-11
21	6dB Attenuator	/	100W/6dB	1172040	2019-06-11	2020-06-10
22	3dB Attenuator	/	2N-3dB	/	2019-06-11	2020-06-10
23	EMI Test Receiver	R&S	ESPI	101840	2019-06-11	2020-06-10
24	Artificial Mains	R&S	ENV216	101288	2019-06-12	2020-06-11
25	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2019-06-11	2020-06-10
Note: All equipment is calibrated through CHINA CEPREI LABORATORY and GUANGZHOU LISAI CALIBRATION AND TEST CO., LTD.						

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

Appendix A

RF Test Data forGFSK (Conducted Measurement)

Product Name: WI VOKKERO GUARDIAN US CAN

Trade Mark: VOKKERO

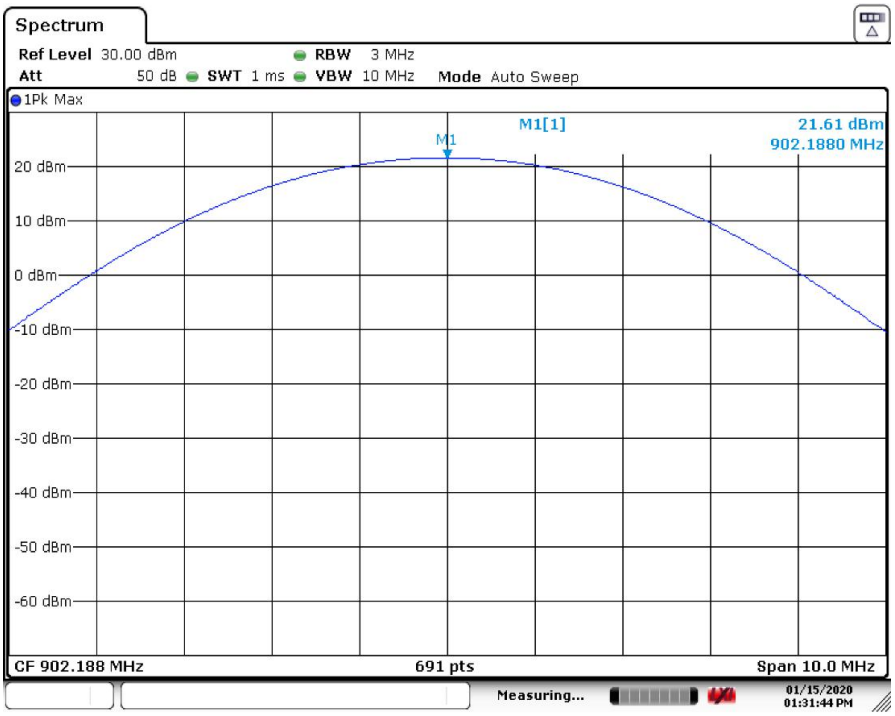
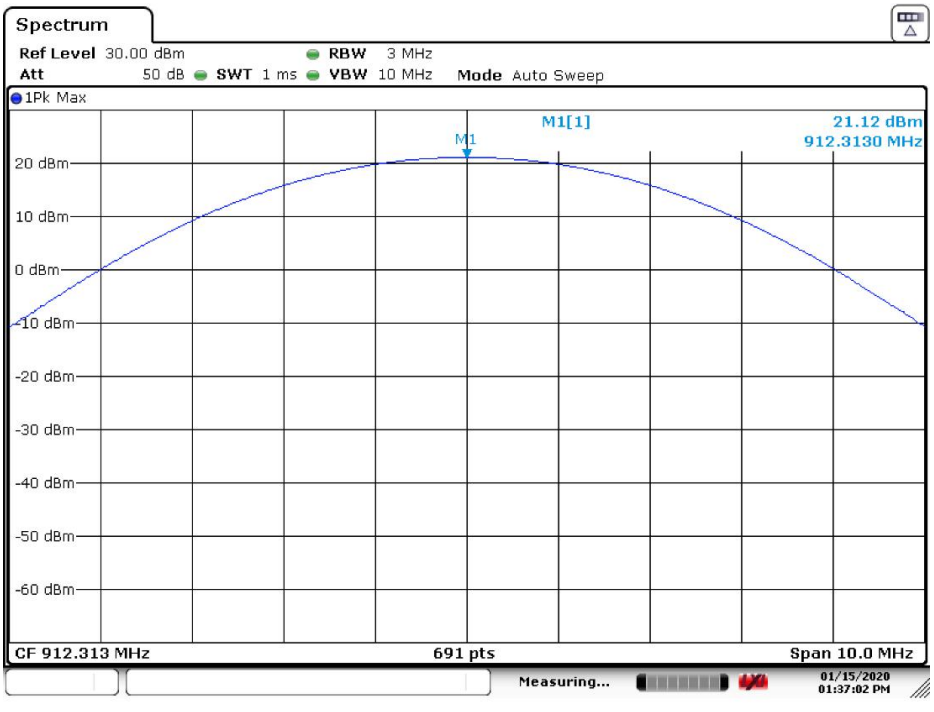
Test Model: VO8161B

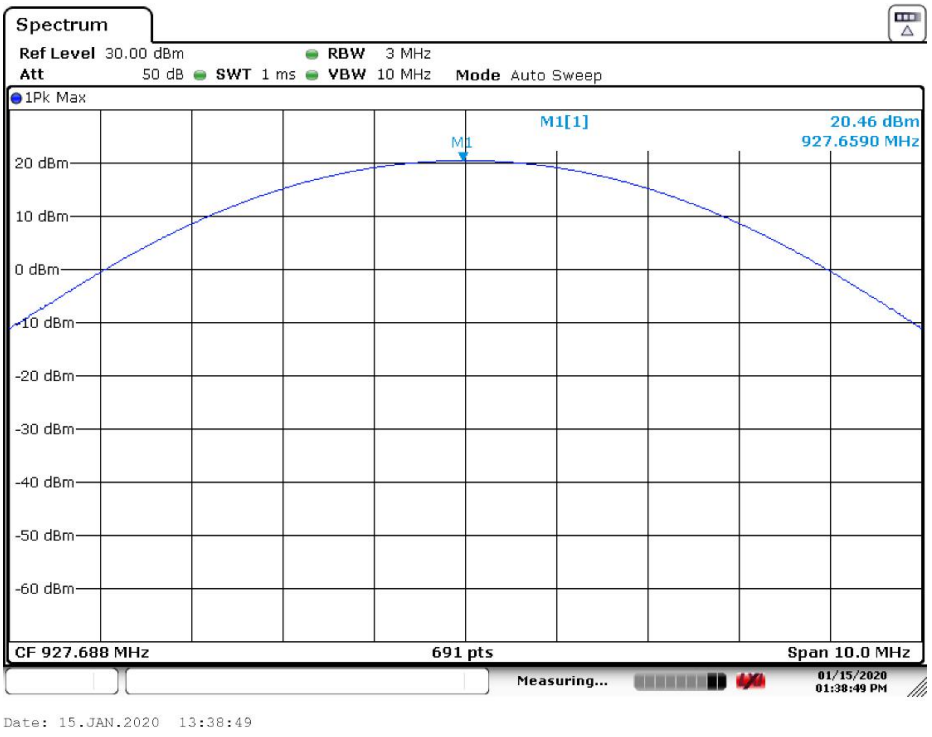
Environmental Conditions

Temperature:	23.6 ° C
Relative Humidity:	53.6%
ATM Pressure:	100.0 kPa
Test Engineer:	David Luo
Supervised by:	Jayden.Zhuo

A.1 Maximum Conducted Peak Output Power

Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	902.188	21,61	24	PASS
	912.313	21,12	24	PASS
	927.688	20,46	24	PASS

Test Graphs	
GFSK/LCH	 Date: 15.JAN.2020 13:31:44
GFSK/MCH	 Date: 15.JAN.2020 13:37:02

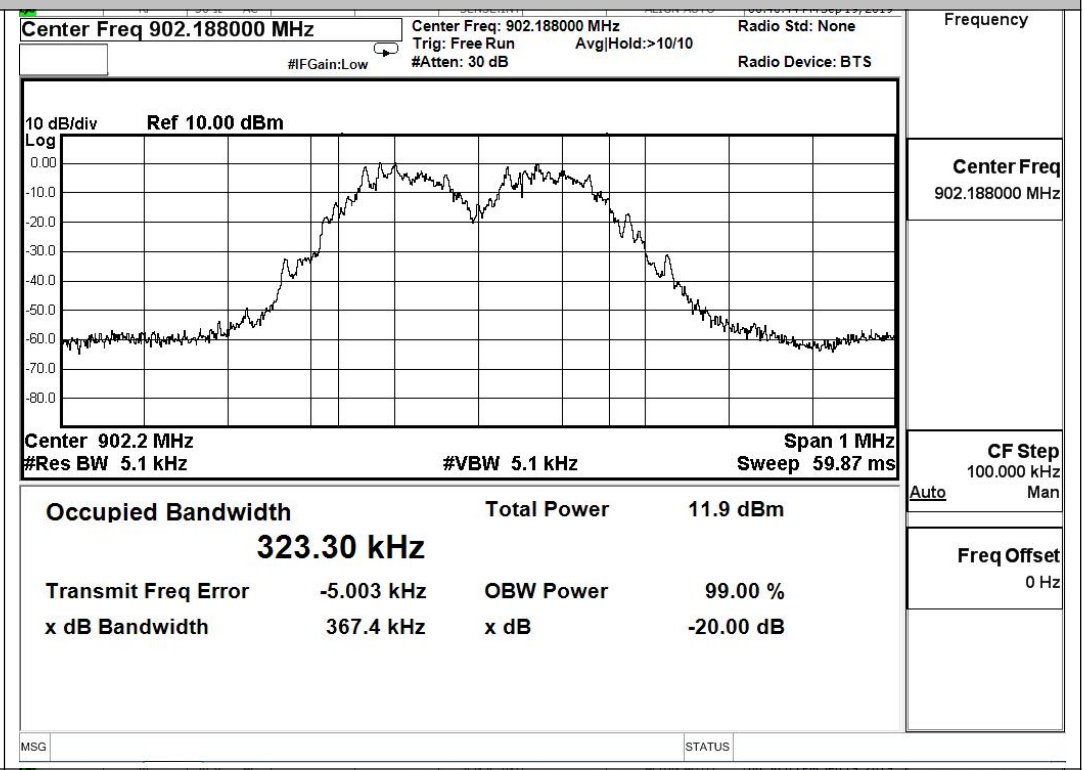
GFSK/HCH	 Spectrum Ref Level 30.00 dBm RBW 3 MHz Att 50 dB SWT 1 ms VBW 10 MHz Mode Auto Sweep 1Pk Max M1[1] 20.46 dBm 927.6590 MHz M1 20 dBm 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm CF 927.688 MHz 691 pts Span 10.0 MHz Measuring... 01/15/2020 01:38:49 PM Date: 15.JAN.2020 13:38:49

A.2 99% and 20dB Bandwidth

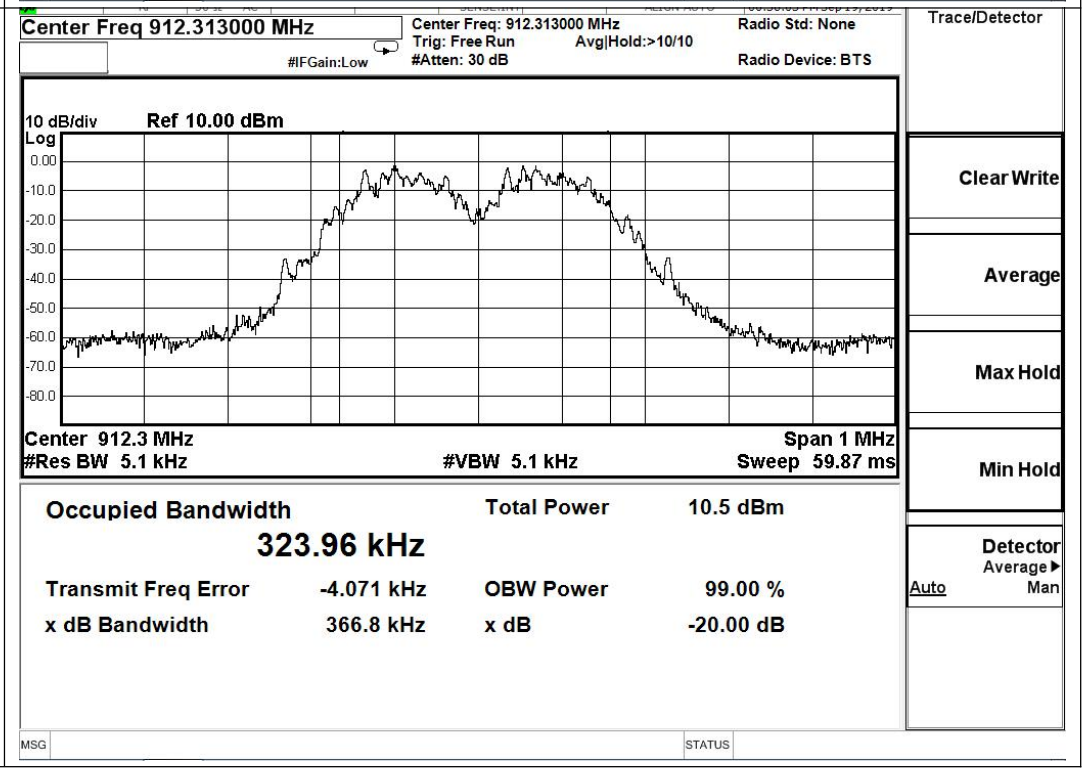
Mode	Channel.	99% Bandwidth [MHz]	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	902.188	0.32330	0.3674	500kHz	PASS
	912.313	0.32396	0.3668	500kHz	PASS
	927.688	0.32455	0.3675	500kHz	PASS

Test Graphs

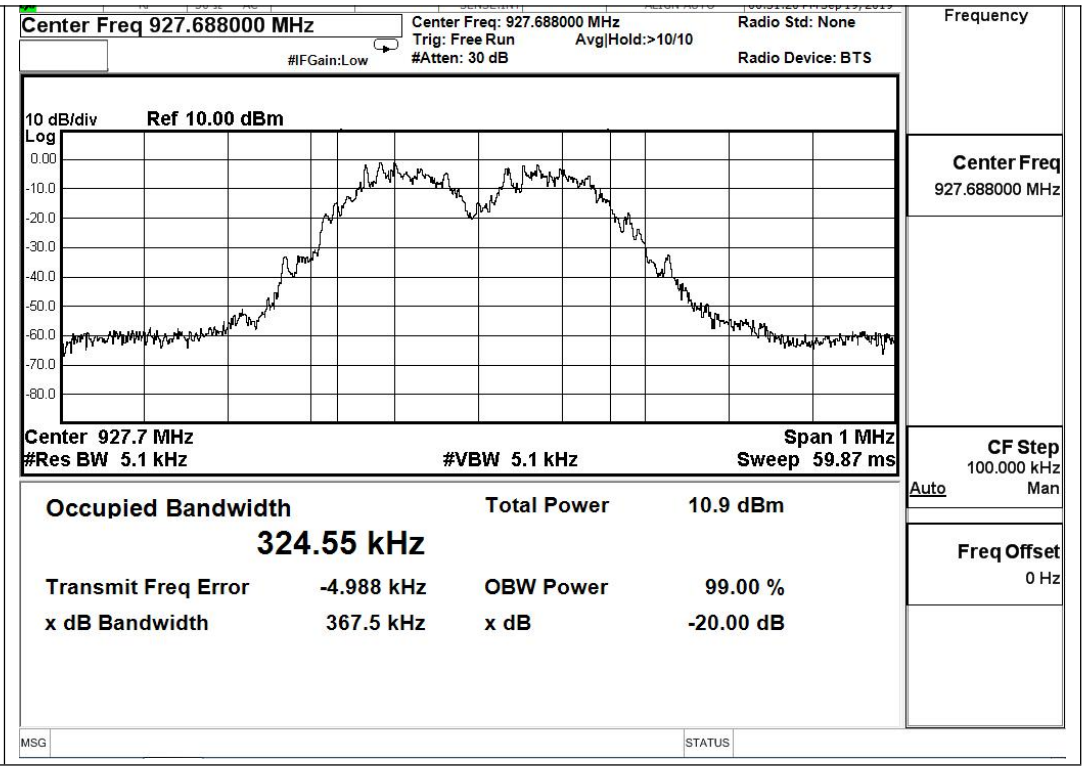
GFSK/LCH



GFSK/MCH

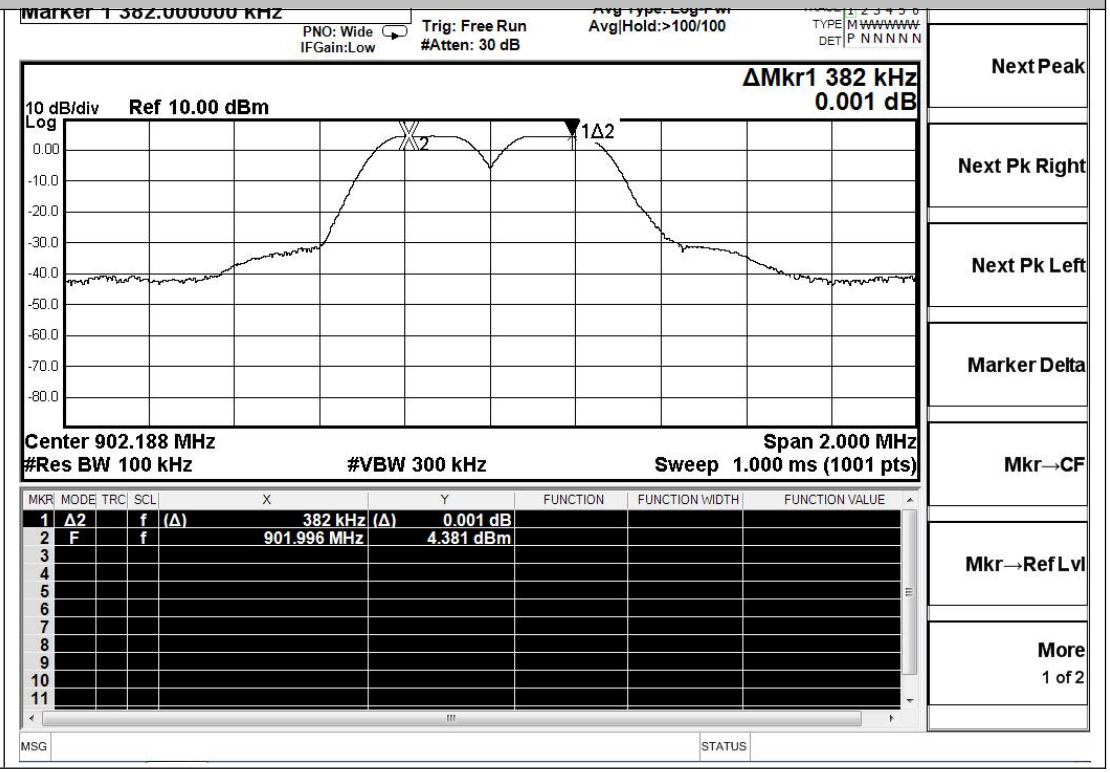


GFSK/HCH

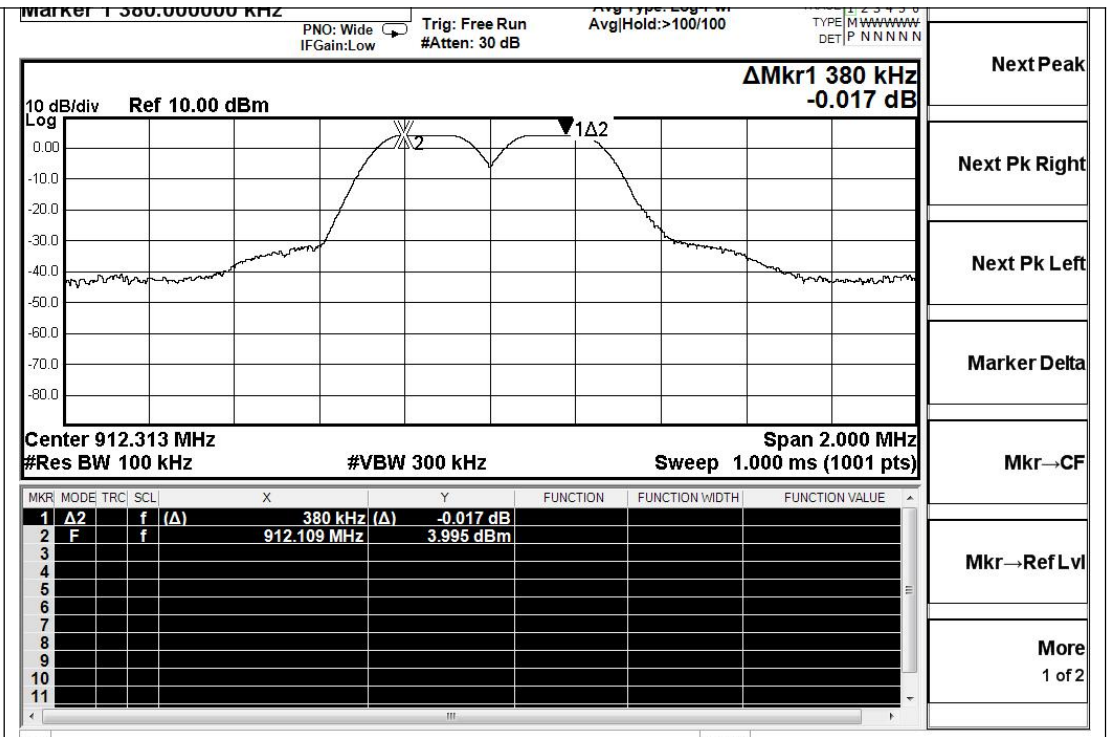

Center Freq 927.688000 MHz
Center Freq: 927.688000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center Freq
927.688000 MHz
Center 927.7 MHz
#Res BW 5.1 kHz
#VBW 5.1 kHz
Span 1 MHz
Sweep 59.87 ms
CF Step
100.000 kHz
Auto
Man
Occupied Bandwidth
324.55 kHz
Total Power 10.9 dBm
Transmit Freq Error -4.988 kHz
OBW Power 99.00 %
x dB Bandwidth 367.5 kHz
x dB -20.00 dB
Freq Offset
0 Hz
MSG
STATUS

A.3 Carrier Frequency Separation

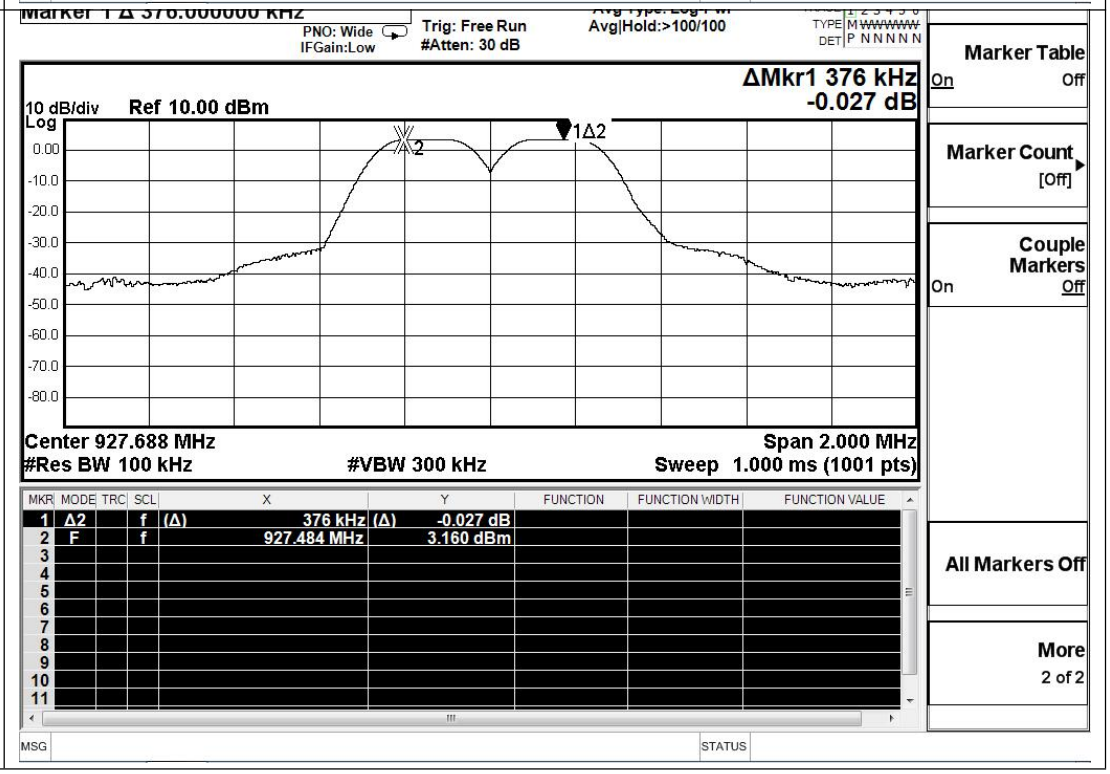
Mode	Channel.	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	902.188	0.382	0.367	PASS
	912.313	0.380	0.367	PASS
	927.688	0.376	0.367	PASS

Test Graphs	
GFSK/LCH	

GFSK/MCH

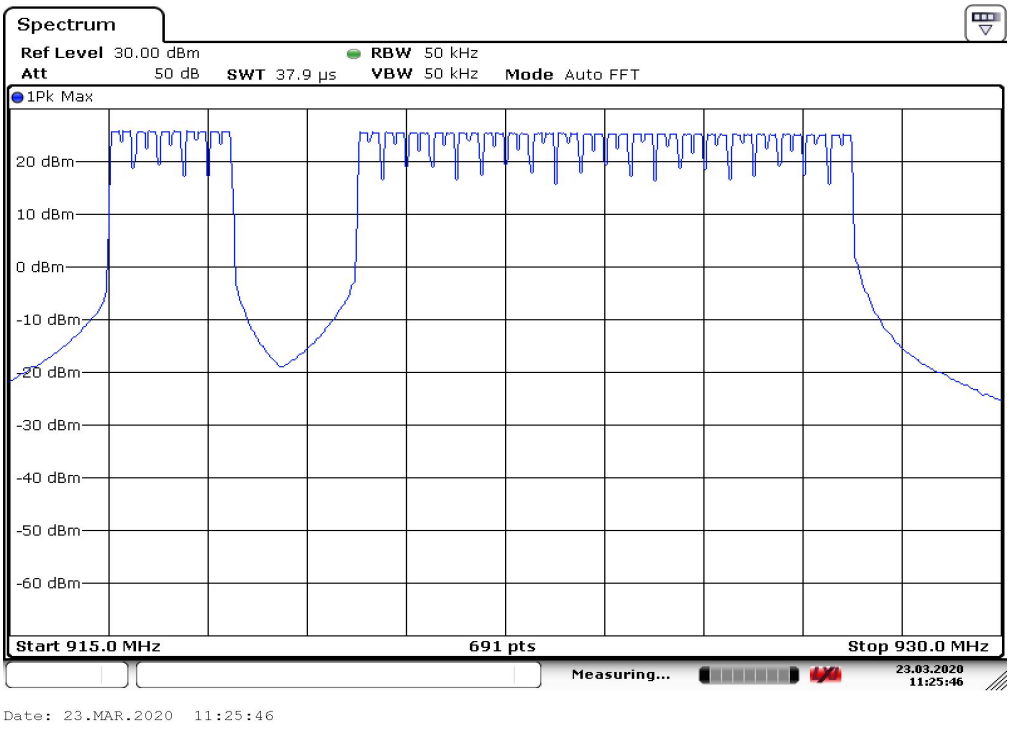


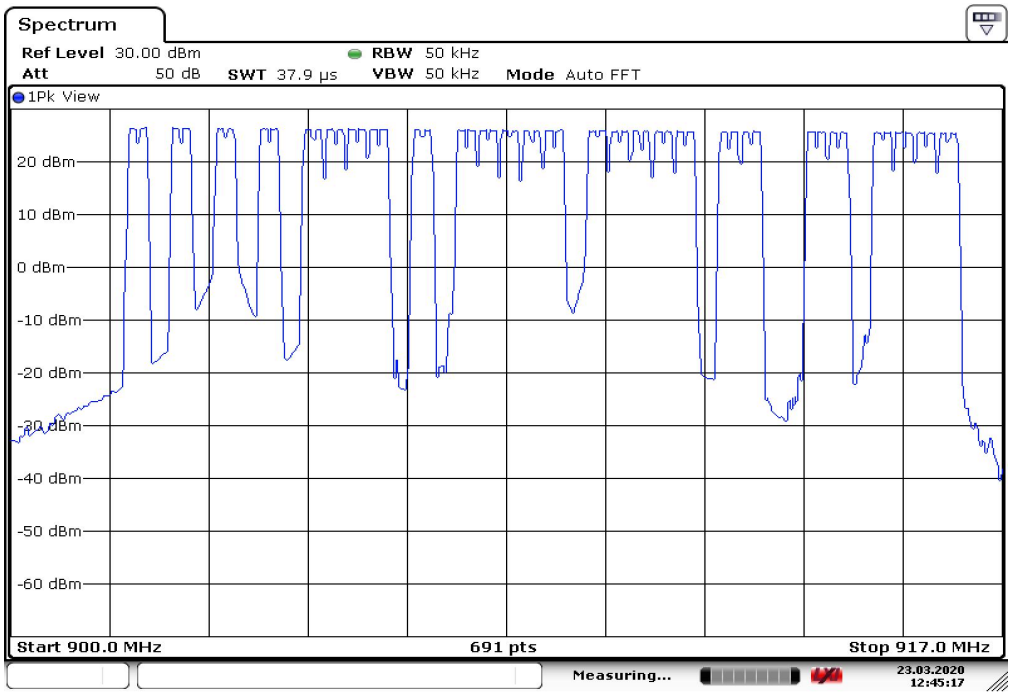
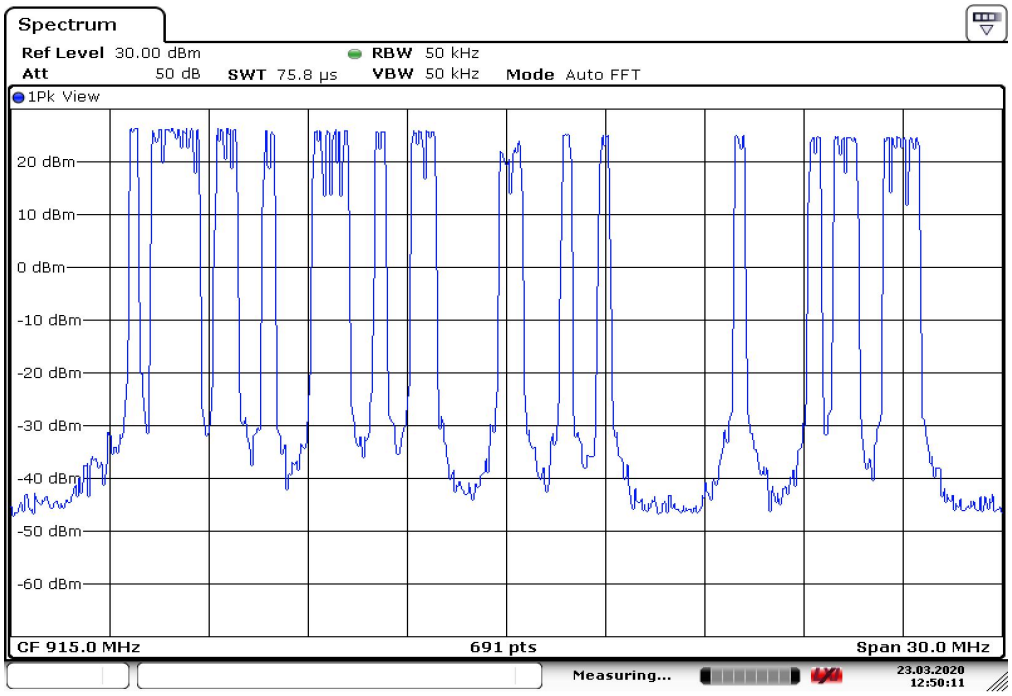
GFSK/HCH

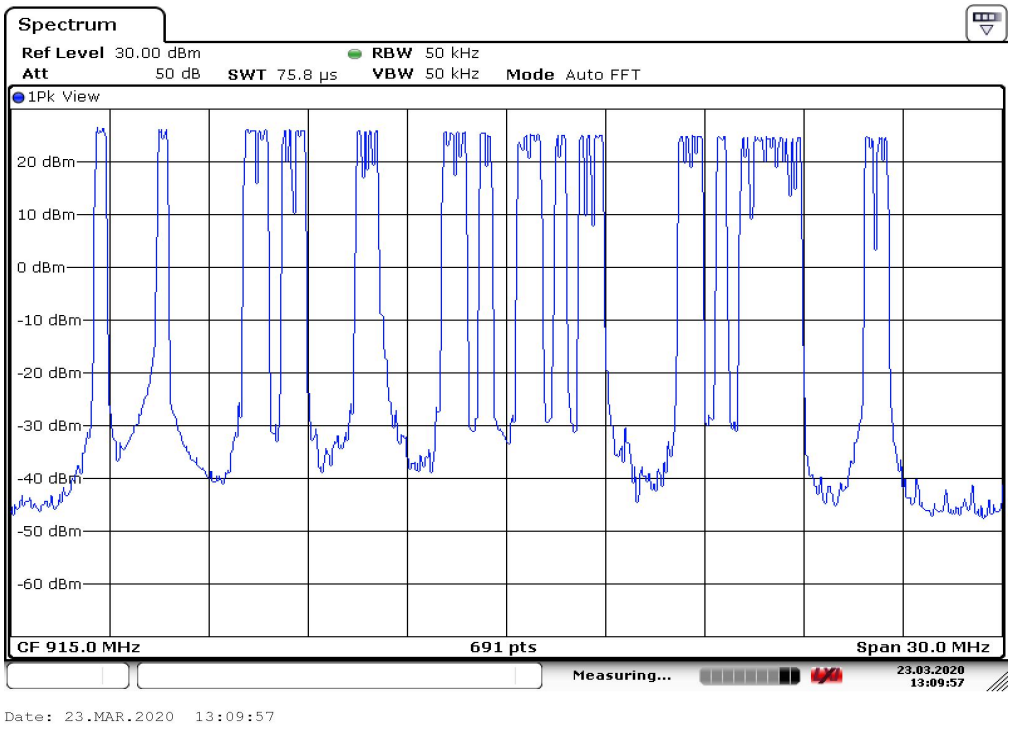


A.4 Hopping Channel Number

Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	H1(US1)	25	>=25	PASS
GFSK	A1(US2)	27	>=25	PASS
GFSK	H2(US3)	25	>=25	PASS
GFSK	H2(US4)	26	>=25	PASS

Test Graphs	
GFSK/H1(US1)	

GFSK/A1(US2)	 Date: 23.MAR.2020 12:45:17
GFSK/H2(US3)	 Date: 23.MAR.2020 12:50:10

GFSK/A2(US4)	

Spectrum
Ref Level 30.00 dBm
RBW 50 kHz
Att 50 dB
SWT 75.8 µs
VBW 50 kHz
Mode Auto FFT
1Pk View
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 915.0 MHz
691 pts
Span 30.0 MHz
Measuring...
23.03.2020
13:09:57
Date: 23.MAR.2020 13:09:57

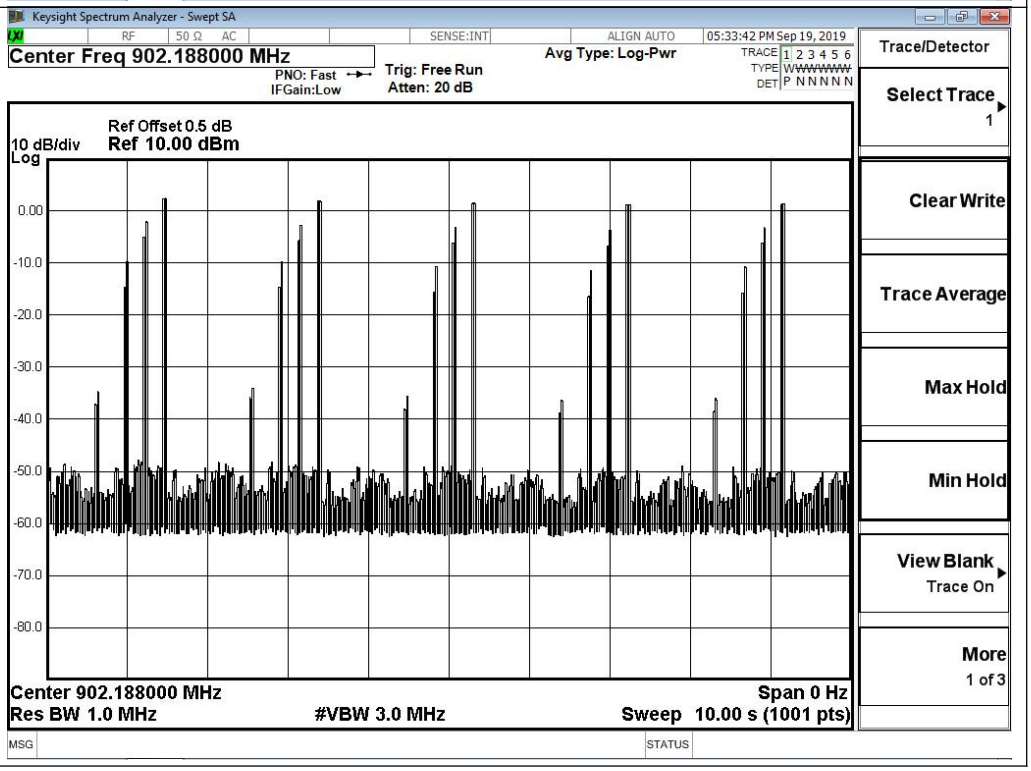
A.5 Dwell Time

Mode	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit [s]	Verdict
GFSK	902.188	2.280	5	0.0114	0.4	PASS
	912.313	2.280	5	0.0114	0.4	PASS
	927.688	2.280	5	0.0114	0.4	PASS

Test Graphs

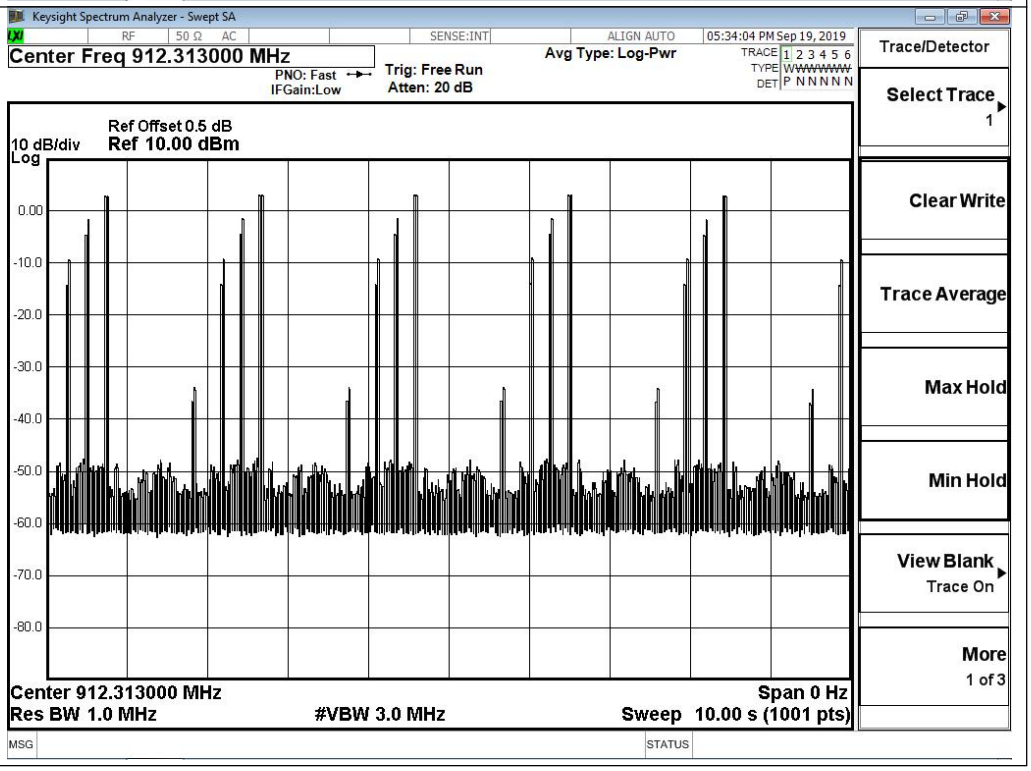
GFSK/LCH

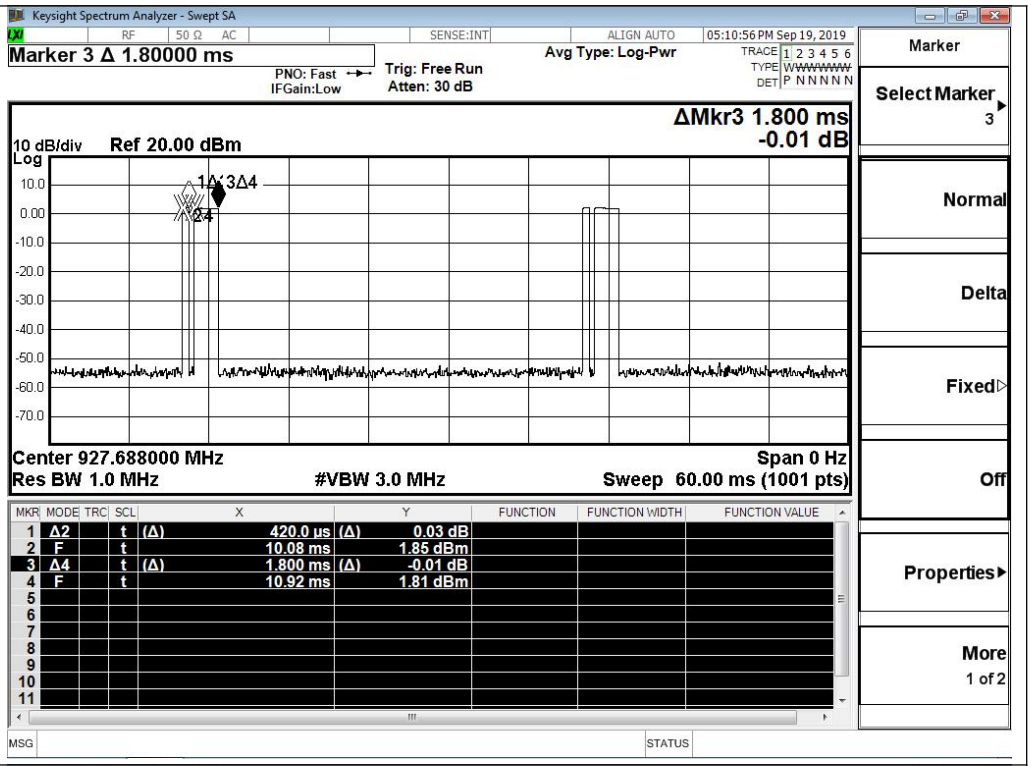
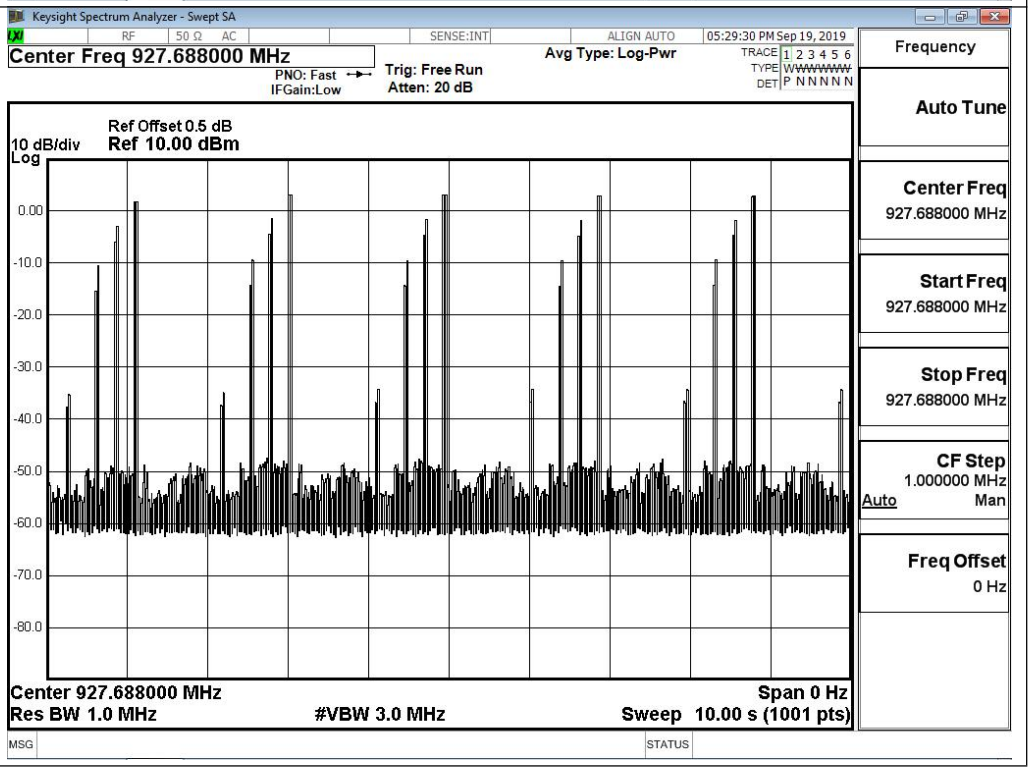
GFSK/LCH



GFSK /MCH

GFSK /MCH



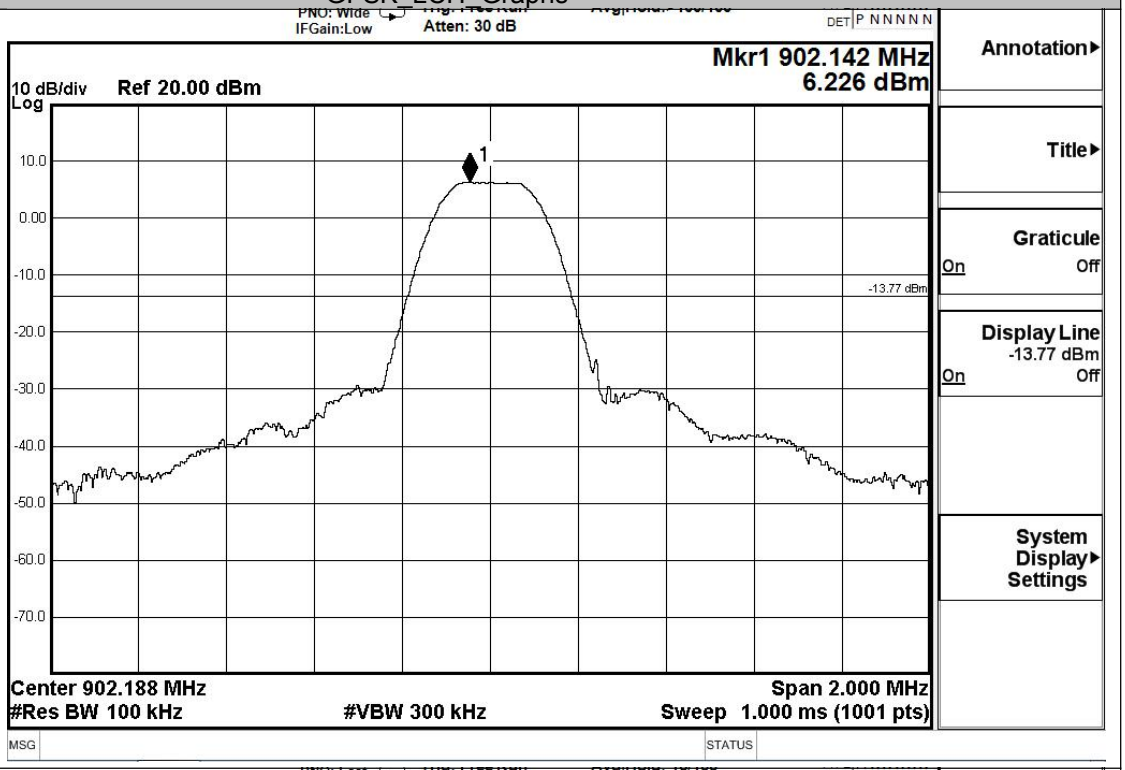
GFSK /HCH	
GFSK /HCH	

A.6 RF Conducted Spurious Emissions

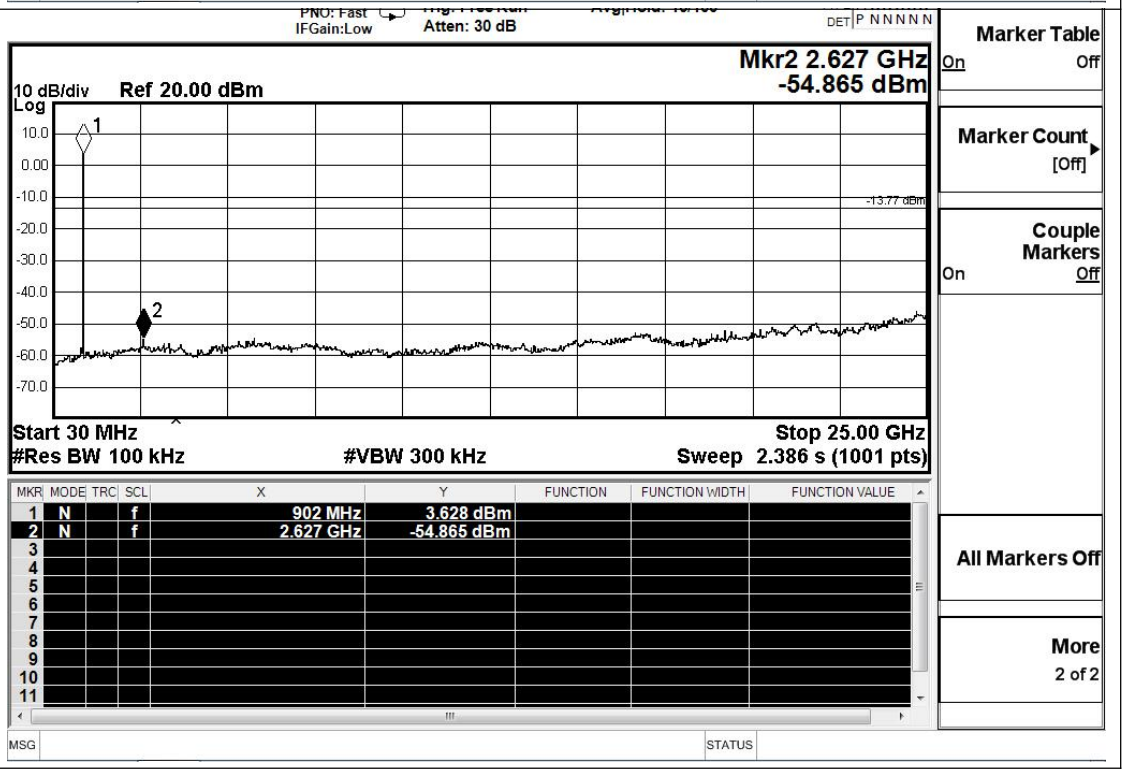
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	6.226	-54.865	-13.774	PASS
	MCH	6.261	-36.813	-13.739	PASS
	HCH	4.861	-45.104	-15.139	PASS

GFSK_LCH_Graphs

Pref

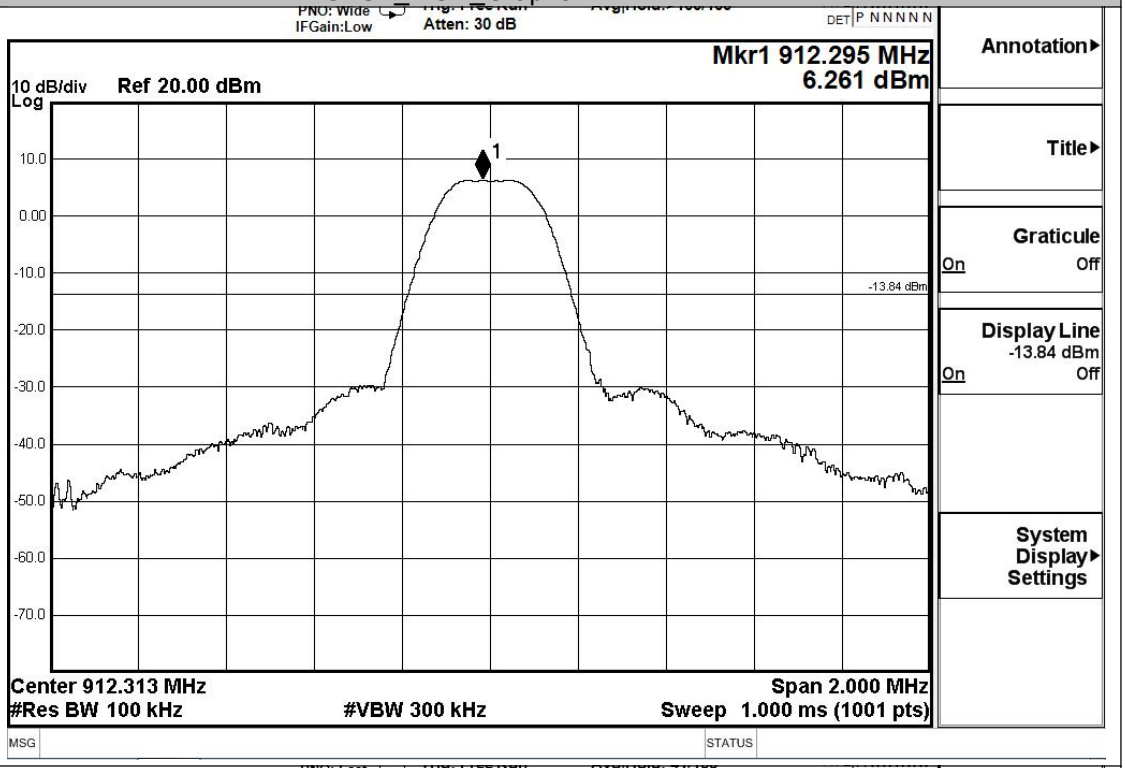


Puw

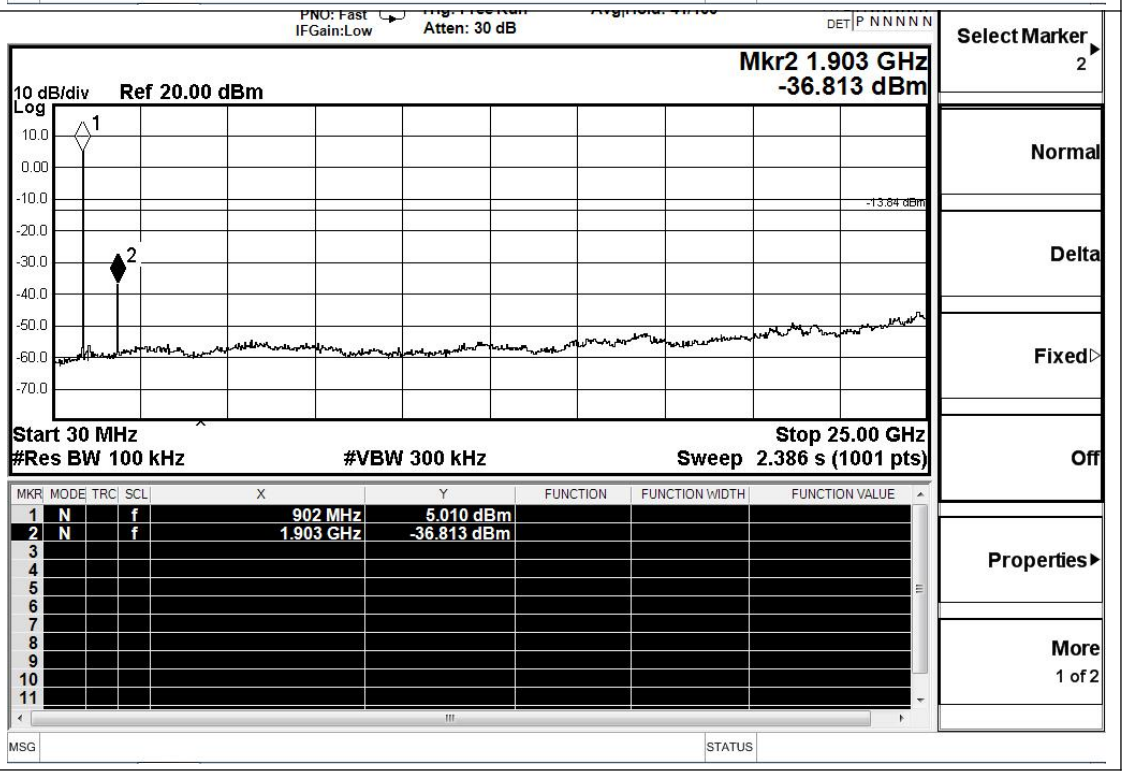


GFSK_MCH_Graphs

Pref

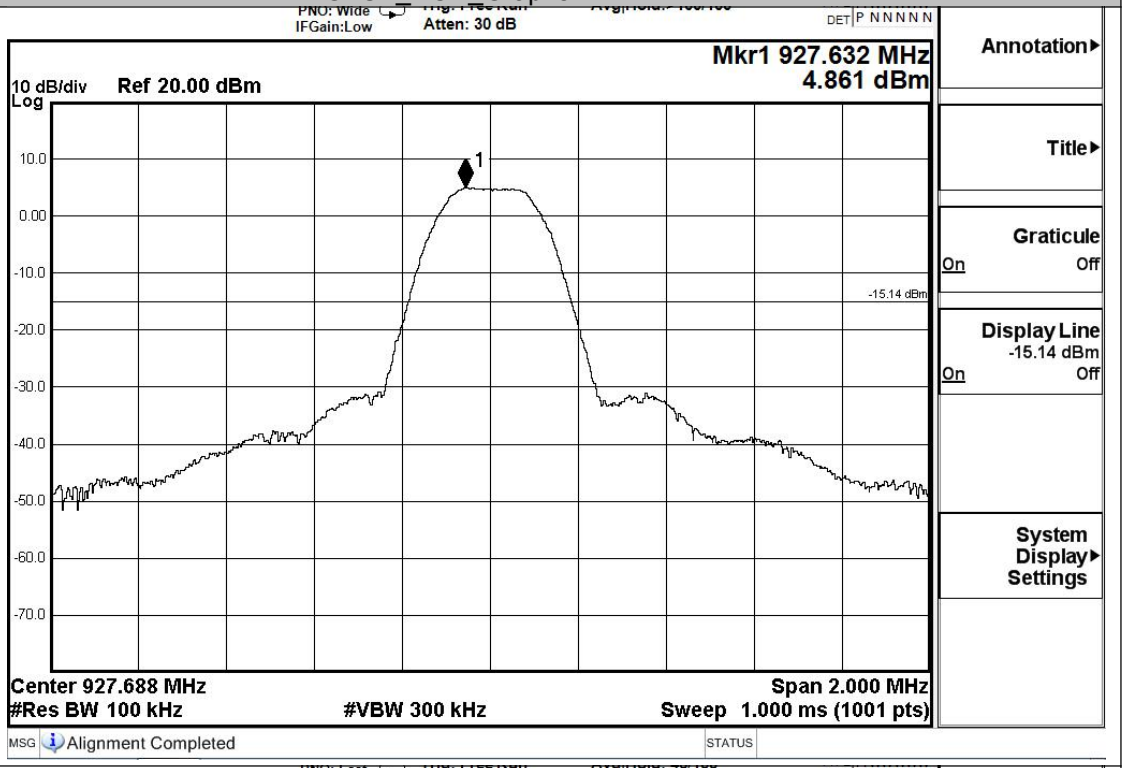


Puw

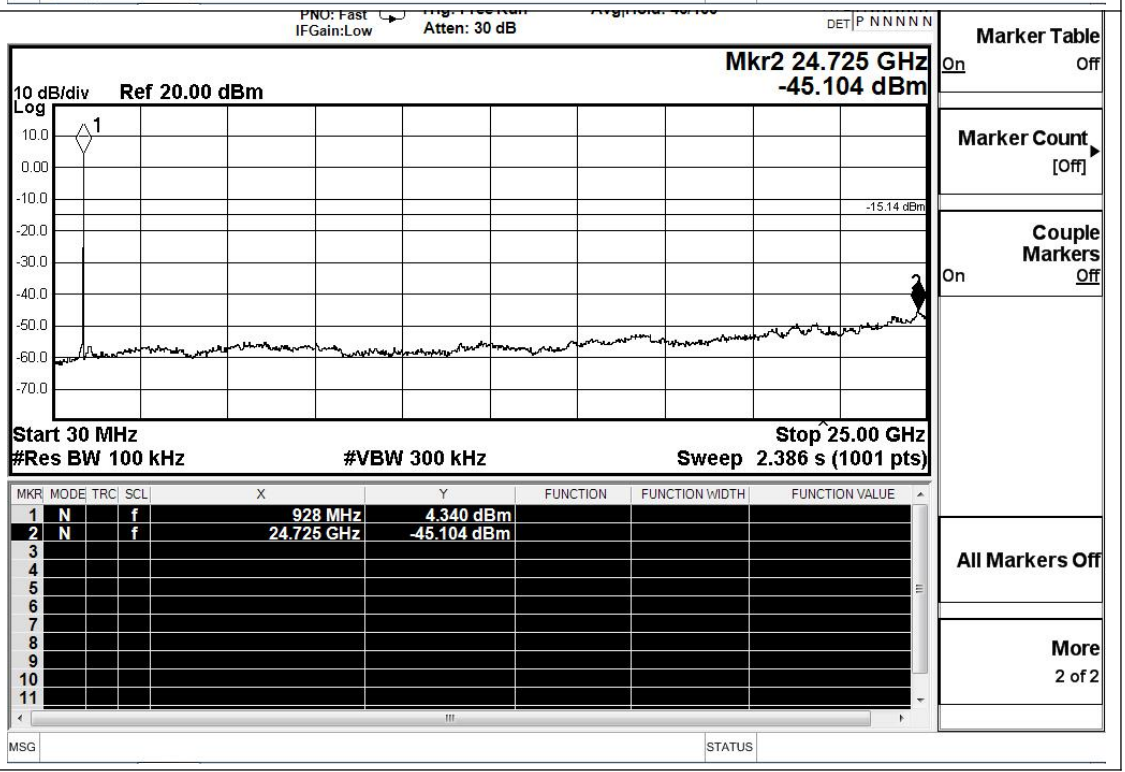


GFSK_HCH_Graphs

Pref



Puw

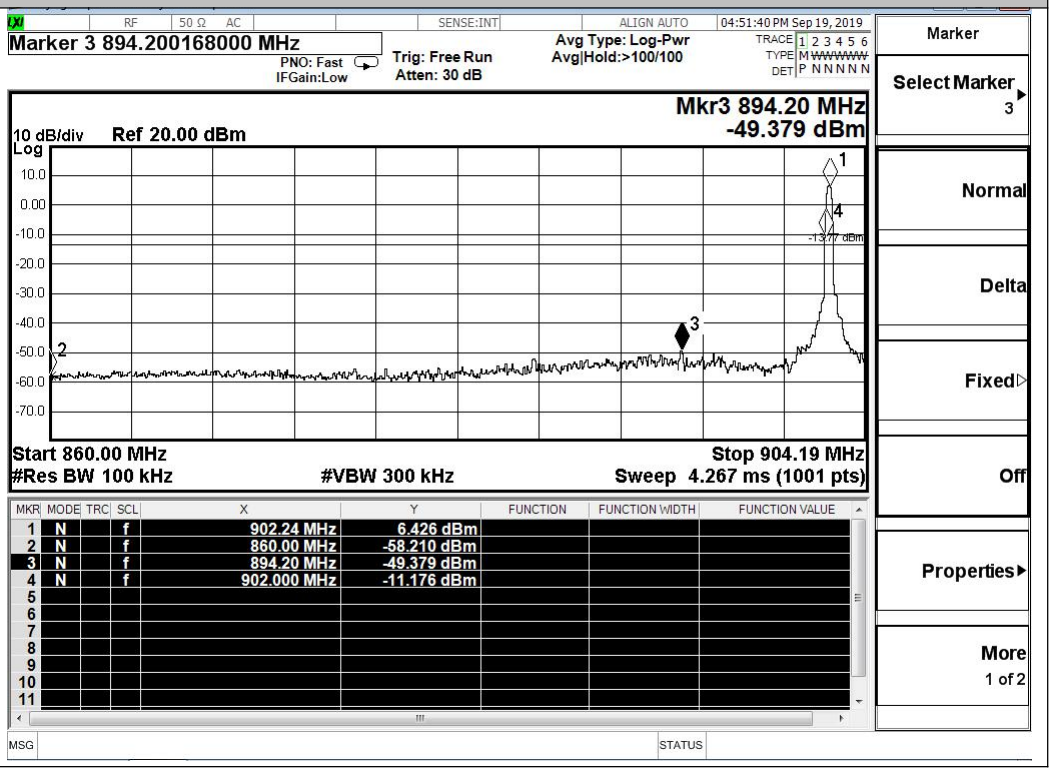


A.7 Band-edge for RF Conducted Emissions

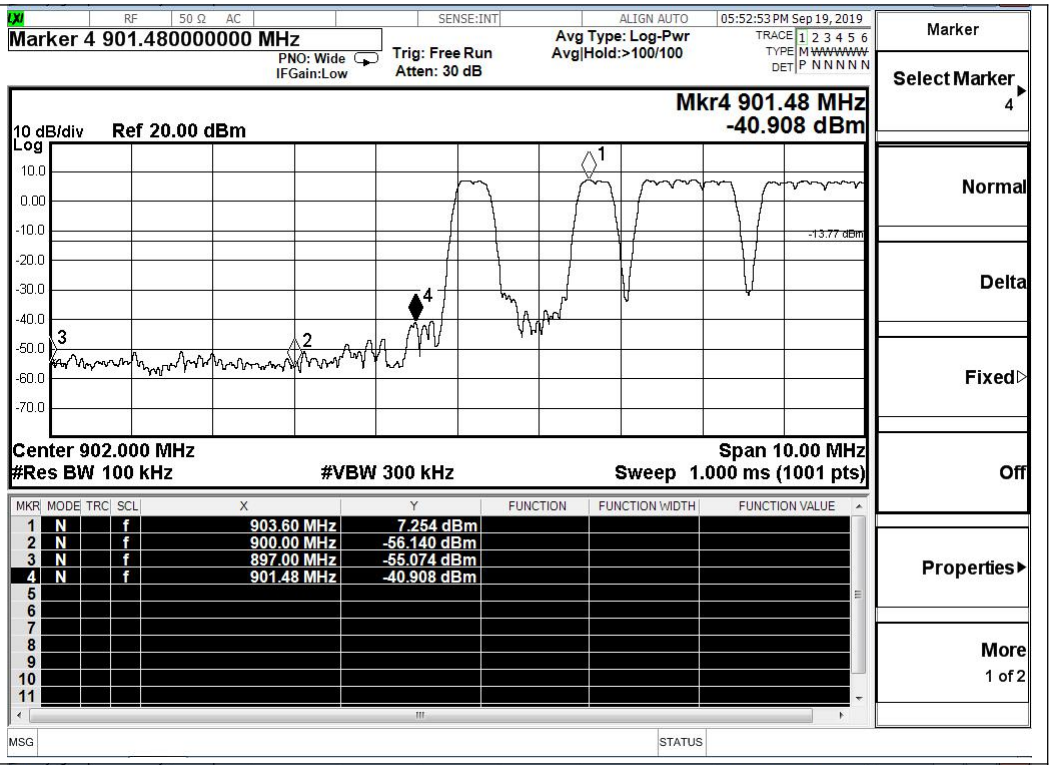
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	902.166	6.426	Off	-49.379	-13.57	PASS
			7.254	On	-55.074	-12.75	PASS
	HCH	927.688	5.311	Off	-50.471	-14.69	PASS
			3.741	On	-57.281	-16.259	PASS

Test Graphs

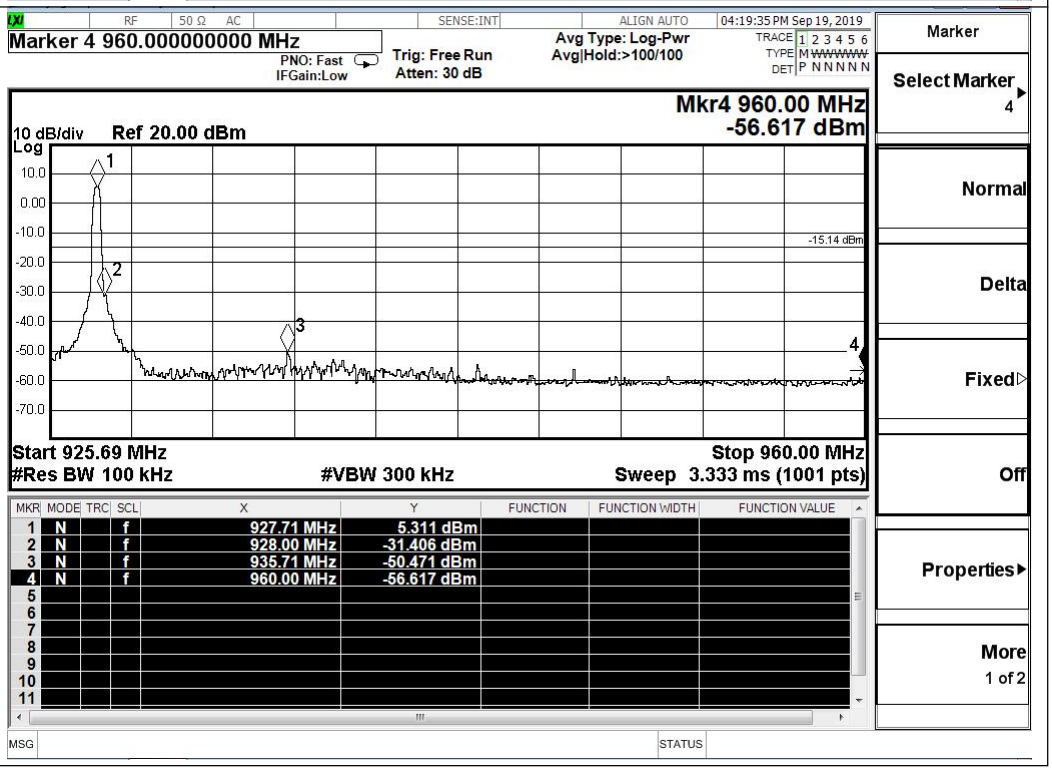
GFSK/LCH/No Hop



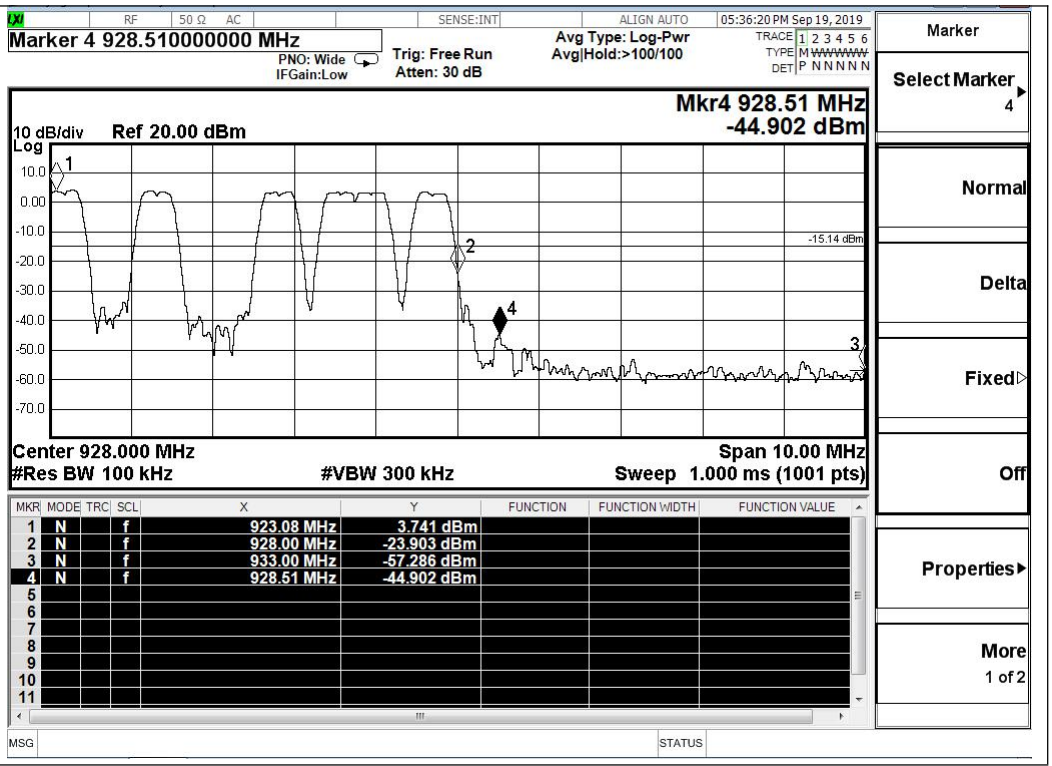
GFSK/LCH/Hop



GFSK/HCH/No Hop



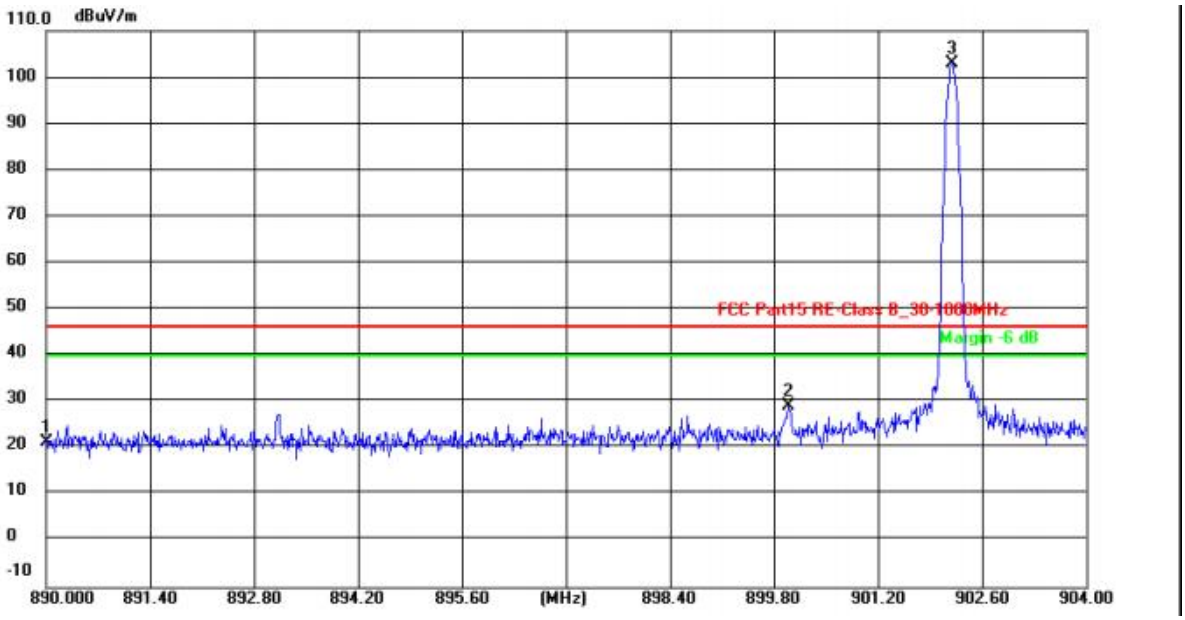
GFSK/HCH/Hop


RF 50 Ω AC
SENSE:INT
ALIGN AUTO
05:36:20 PM Sep 19, 2019
Marker 4 928.510000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr4 928.51 MHz
-44.902 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-15.14 dBm
Center 928.000 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10.00 MHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N f 923.08 MHz 3.741 dBm
2 N f 928.00 MHz -23.903 dBm
3 N f 933.00 MHz -57.286 dBm
4 N f 928.51 MHz -44.902 dBm
5
6
7
8
9
10
11
MSG
STATUS
Marker
Select Marker 4
Normal
Delta
Fixed
Off
Properties
More 1 of 2

A.8 Restrict-band band-edge measurements

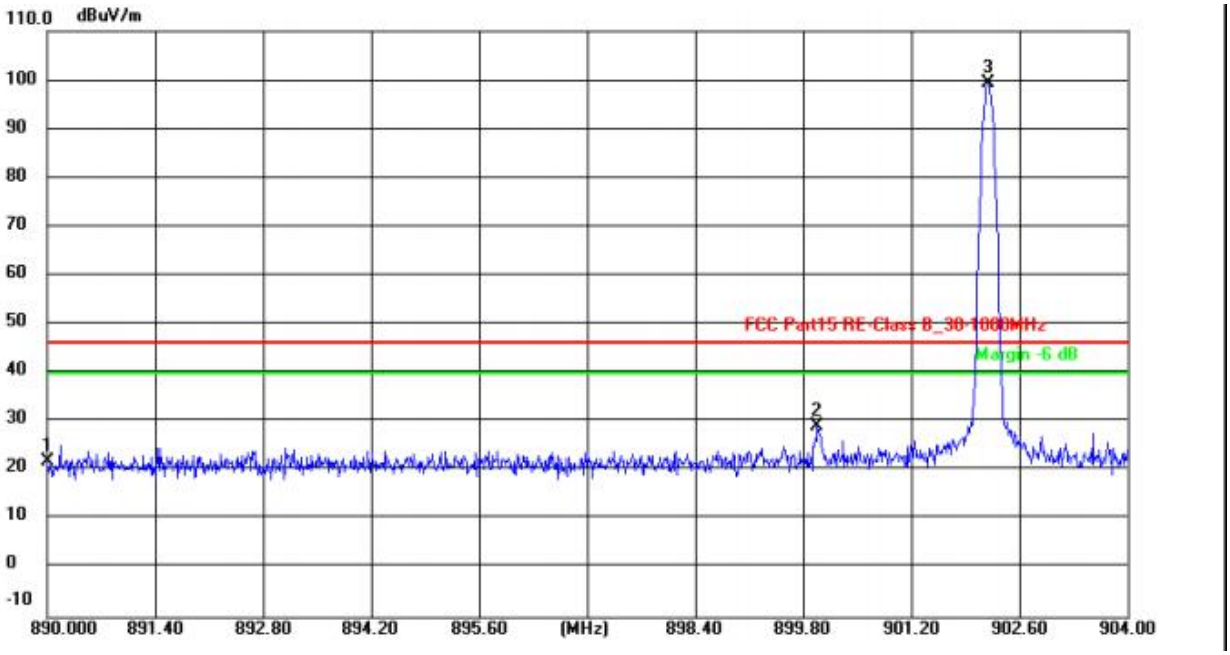
Test result for (Low Channel,902.188MHz,for fundamental frequency ,needs BRC filters prevents instrument overload.)

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	890.0000	27.02	-5.80	21.22	46.00	-24.78	QP				
2	899.9960	34.63	-5.62	29.01	46.00	-16.99	QP				
3	902.1940	108.43	-5.62	102.81	46.00	56.81	QP				

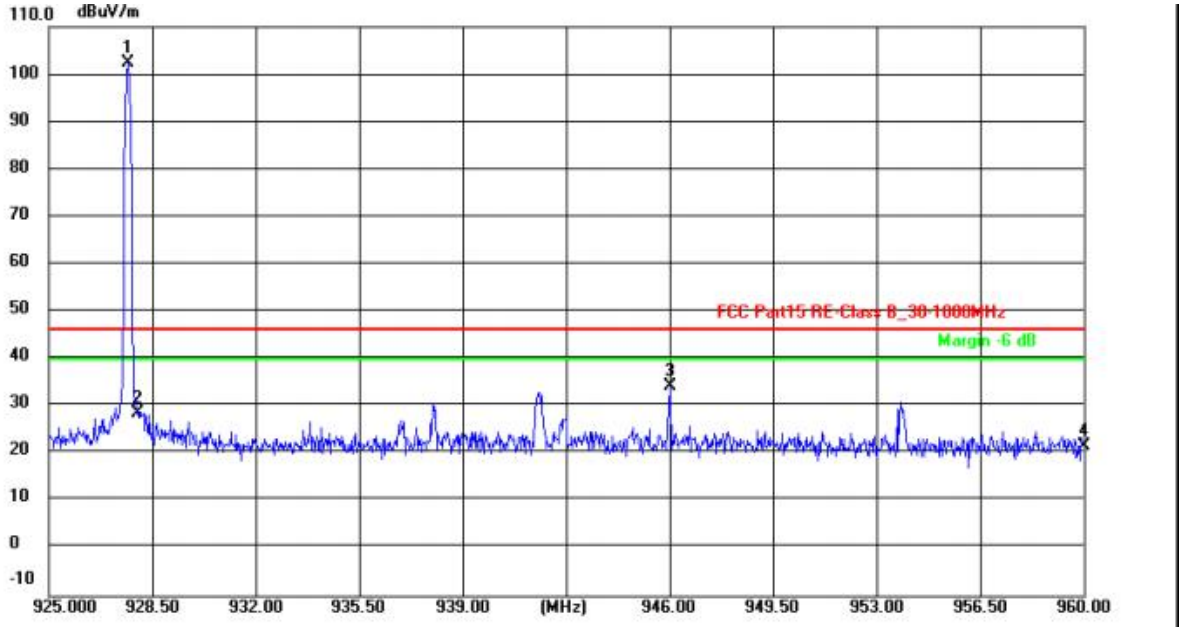
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	890.0000	27.82	-5.80	22.02	46.00	-23.98	QP				
2	899.9820	34.91	-5.62	29.29	46.00	-16.71	QP				
3	902.1940	104.90	-5.62	99.28	46.00	53.28	QP				

Test result for (High Channel,907.688MHz,for fundamental frequency ,needs BRC filters prevents instrument overload.)

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	927.6600	107.77	-5.52	102.25	46.00	56.25	QP				
2	928.0100	34.17	-5.52	28.65	46.00	-17.35	QP				
3	946.0000	39.59	-5.40	34.19	46.00	-11.81	QP				
4	960.0000	27.11	-5.33	21.78	46.00	-24.22	QP				

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	927.6600	104.92	-5.52	99.40	46.00	53.40	QP				
2	928.0100	33.16	-5.52	27.64	46.00	-18.36	QP				
3	953.8400	41.15	-5.36	35.79	46.00	-10.21	QP				
4	960.0000	28.60	-5.33	23.27	46.00	-22.73	QP				

----------THE END OF REPORT----------