REPORT No.: SZ20020089W01

TEST REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Video Baby Monitor 720P
MODEL NAME	:	T8321-C
BRAND NAME	:	eufy SECURITY
FCC ID	:	2AOKB-T8321C
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2020-02-27
TEST DATE	:	2020-04-02 to 2020-04-16
ISSUE DATE	:	2020-05-19

Edited by: Peng Mi

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DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2020-05-19	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19,Hollywood Plaza,610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19,Hollywood Plaza,610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Video Baby Monitor 720P	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	V01	
Software Version:	V3.2	
Modulation Type:	FHSS (GFSK)	
Operating Frequency Range:	2410MHz – 2477MHz	
Channel Number:	20	
Antenna Type:	PIFA Antenna	
Antenna Gain:	1.4dBi	
Accessory Information:	AC Adapter	
	Brand Name:	N/A
	Model No.:	TEKA006-0501000UK
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5.00V⎓1.0A
	Rated Input:	100-240V~0.3A, 50~60MHz

Note 1: The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1 (2410MHz), 10 (2441.5MHz) and 20 (2477MHz)..

Note2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. The Channel Number and Frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**2410**	11	2445
2	2413.5	12	2448.5
3	2417	13	2452
4	2420.5	14	2455.5
5	2424	15	2459
6	2427.5	13	2462.5
7	2431	17	2466
8	2434.5	18	2469.5
9	2438	19	2473
10	**2441.5**	**20**	**2477**

1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15(10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	N/A	N/A
2	15.247(a)	Number of Hopping Frequency	Apr 28, 2020	Tu Yanan	PASS	No deviation
3	15.247(b)	Peak Output Power	Apr 28, 2020	Tu Yanan	PASS	No deviation
4	15.247(a)	20dB Bandwidth	Apr 28, 2020	Tu Yanan	PASS	No deviation
5	15.247(a)	Carrier Frequency Separation	Apr 28, 2020	Tu Yanan	PASS	No deviation
6	15.247(a)	Time of Occupancy (Dwell time)	Apr 28, 2020	Tu Yanan	PASS	No deviation
7	15.247(d)	Conducted Spurious Emission	Apr 28, 2020	Tu Yanan	PASS	No deviation
8	15.207	Conducted Emission	Apr 02, 2020	Huang Zhiye	PASS	No deviation
9	15.247(d)	Restricted Frequency Bands	Apr 16, 2020	Gao Jianrou	PASS	No deviation
10	15.209, 15.247(d)	Radiated Emission	Apr 15, 2020	Gao Jianrou	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013.

Note 2: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments.The Ref offset 2.0dB means the cable loss is 2.0dB.

Note 3: Additions to, deviation, or exclusions from the method shall be judged in the"method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

1.5. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 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.

2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Hopping Mechanism

2.2.1. Requirement

According to FCC §15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to FCC §15.247(h), the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

2.2.2. Result: Compliant

1. The frequency of using is from 2410MHz to 2477MHz, and it is divided into 20 frequency point (frequency point 1 to frequency point 20). with an interval of 3.5M every two channels. in which Baby side, each channel ‘s working time is 6120us, keeps transmitting for 3240us, and at non-transmitting state for 2880us. in which Parent Unit each channel ‘s working time is 2080us, keeps transmitting for 360us, and at non-transmitting state for 1720us

2. There are 20 frequency points. when we power on the internal MCU, there will generate a random number by a timer, then through the random number to determine the 1st frequency hopping point, also generated in 2nd frequency point via a second random number (after deducting with frequency point, from the 15th channel to choose.), and the rest can be done at the same manners, there will generate a total sequence of 20 frequency point. When the total 20 frequency points finished the work (a cirle will be include 20 frequency points), MCU will determined the first frequency point in the next circle, then it will finish all the frequency points in this circle, and so on.

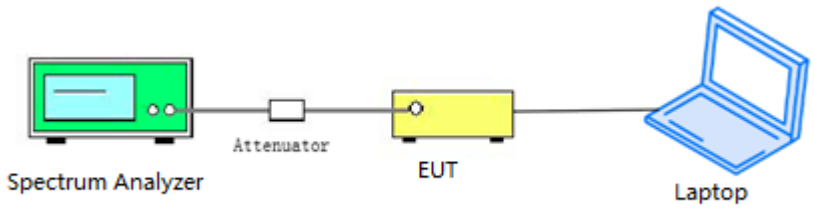
2.3. Duty Cycle of Test Signal

2.3.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration(T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e.,no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this subclause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.3.2. Test Description

Test Setup:



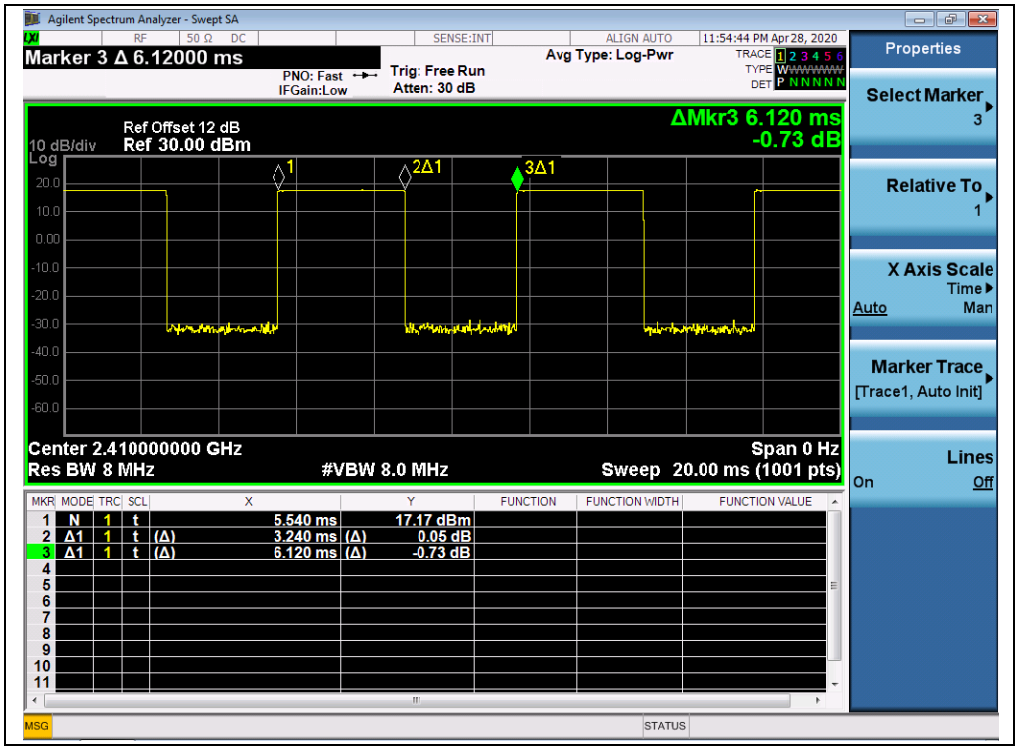
ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.3.3. Test Result

A. Test Verdict:

Test Mode	Duty Cycle(%) (D)	Duty Factor (10*lg[1/D])
GFSK	52.94	2.76

B. Test Plots



(GFSK)

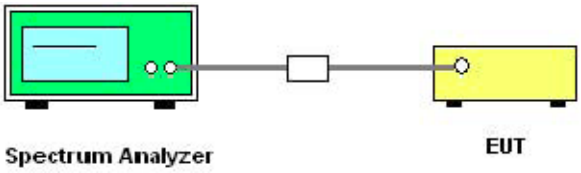
2.4. Number of Hopping Frequency

2.4.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.4.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.4.3. Test Procedure

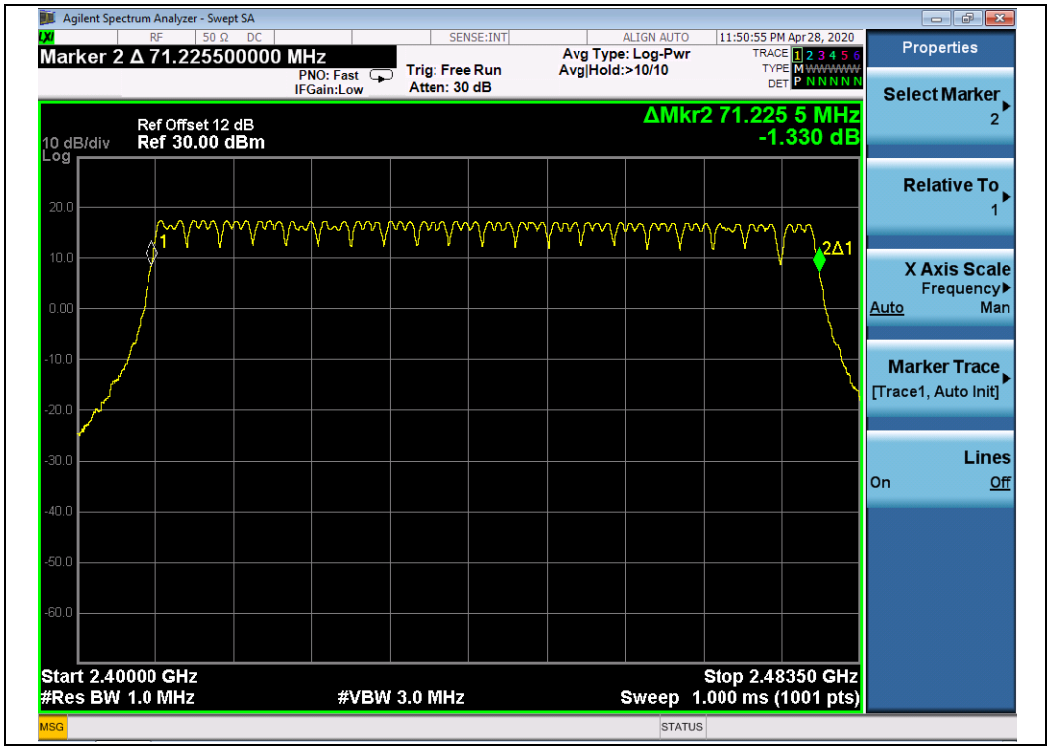
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

2.4.4. Test Result

C. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	20	15	PASS

D. Test Plots:



(GFSK)

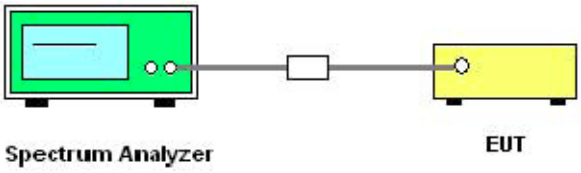
2.5. Maximum Peak and Average Conducted Output Power

2.5.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.5.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.5.3. Test Result

GFSK Mode

Maximum Peak Conducted Output Power

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2410	**17.55**	**0.0569**	20.97	0.125	PASS
10	2441.5	17.11	0.0514			PASS
20	2477	16.83	0.0482			PASS

Maximum Average Conducted Output Power

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	2410	14.77	2.76	**17.53**	**0.0566**	20.97	0.125	PASS
10	2441.5	14.32		17.08	0.0511			PASS
20	2477	14.03		16.79	0.0478			PASS

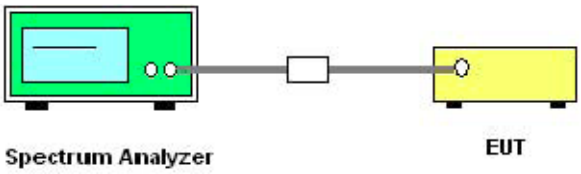
2.6. 20dB Bandwidth

2.6.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.6.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.6.3. Test Procedure

Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

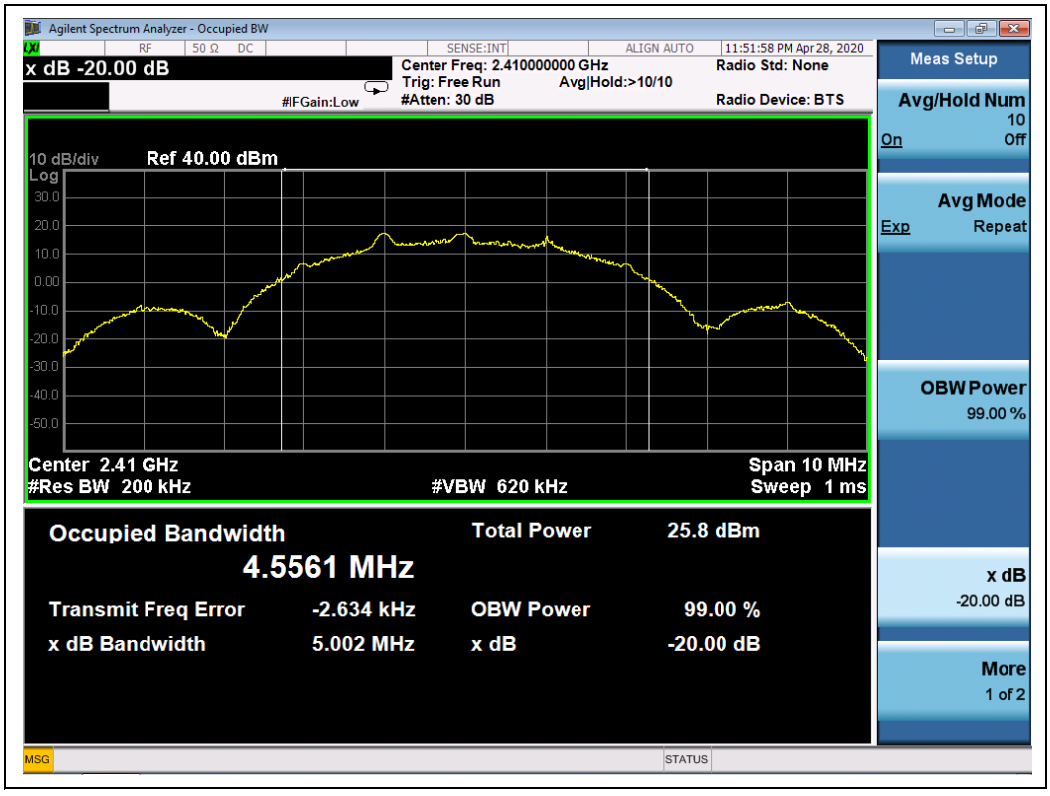
2.6.4. Test Result

GFSK Mode

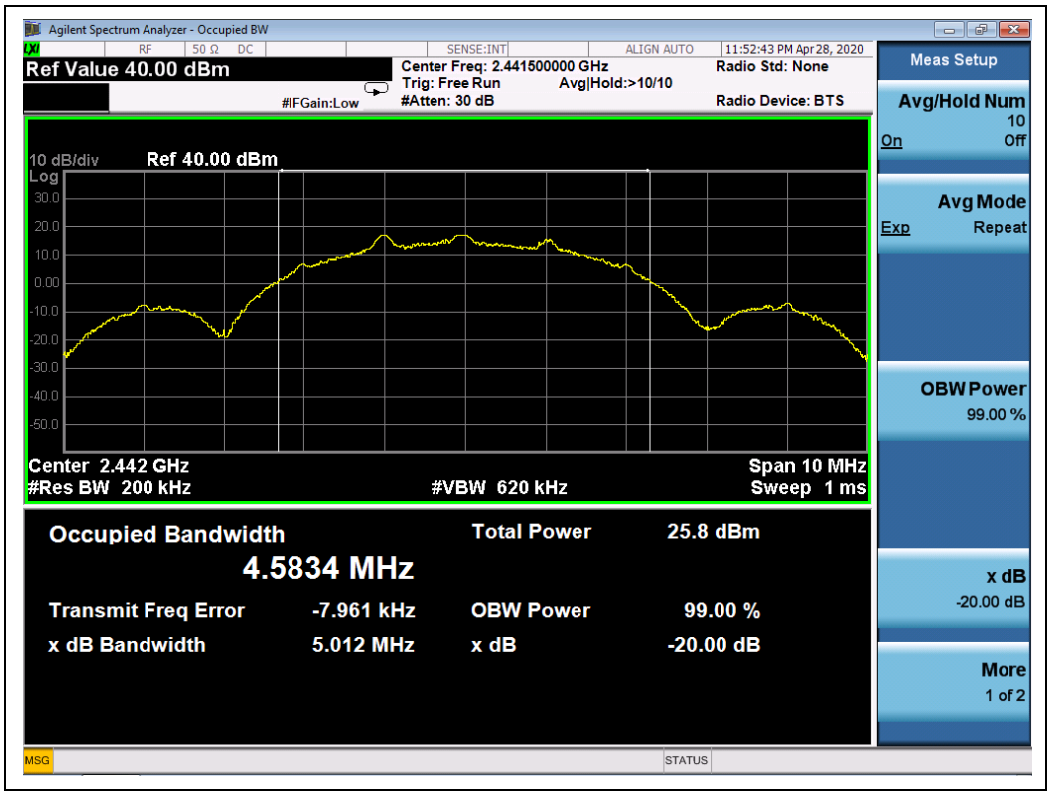
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
1	2410	5.002	PASS
10	2441.5	5.012	PASS
20	2477	5.019	PASS

B. Test Plots:



(GFSK, Channel 1, 2410MHz)



(GFSK, Channel 10, 2441.5MHz)

(GFSK, Channel 20, 2477MHz)

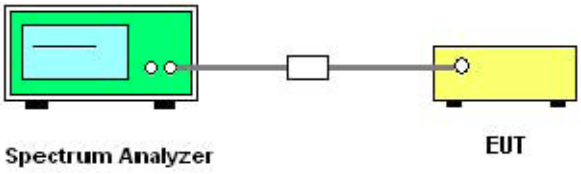
2.7. Carried Frequency Separation

2.7.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.7.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

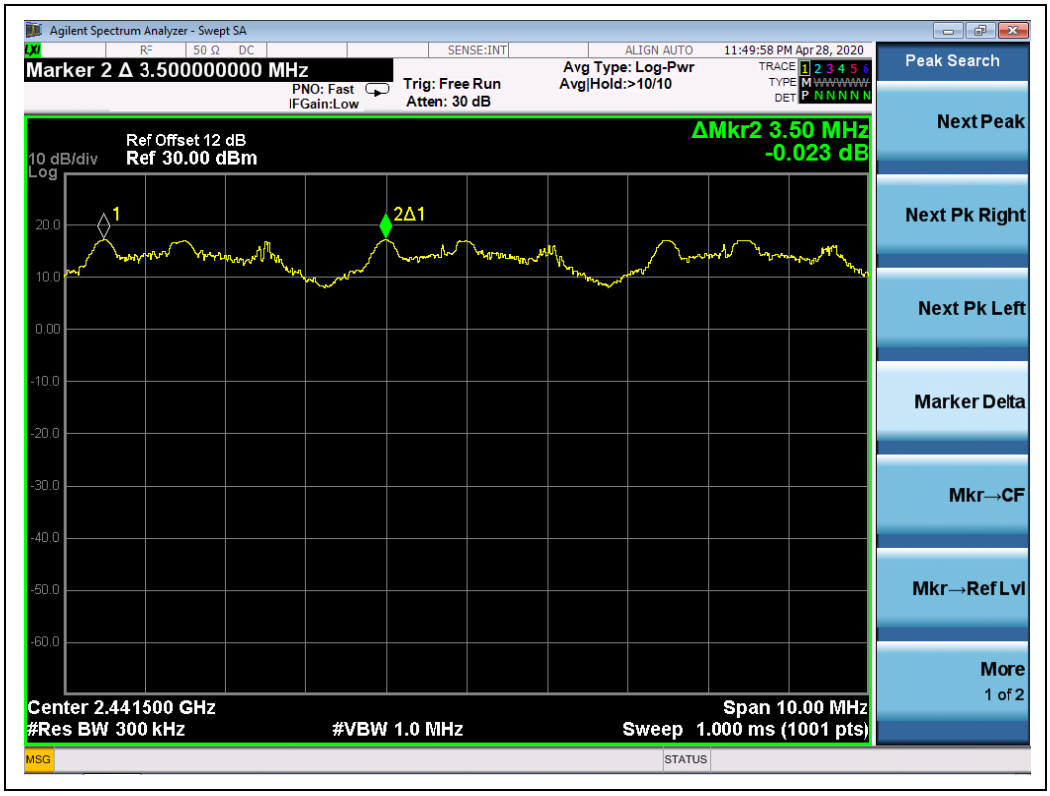
2.7.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

2.7.4. Test Result

The EUT operates at hopping-on test mode.For any adjacent channels (e.g. the channel 9 and 10 as showed below), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 2.4.4), whichever is greater. So, the verdict is PASSING.

Test Mode	Measured Channel Numbers	Carried Frequency Separation(MHz)	20dBband width (MHz)	Min. Limit	Verdict
GFSK	9 and 10	3.50	5.019	two-thirdsof the 20dBbandwidth	PASS



(GFSK)

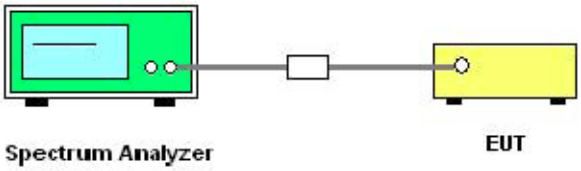
2.8. Time of Occupancy (Dwell time)

2.8.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.8.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.8.3. Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 8 second scan, to enable resolution of each occurrence.
The average time of occupancy in the specified 8 second period (20 channel * 0.4 s) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

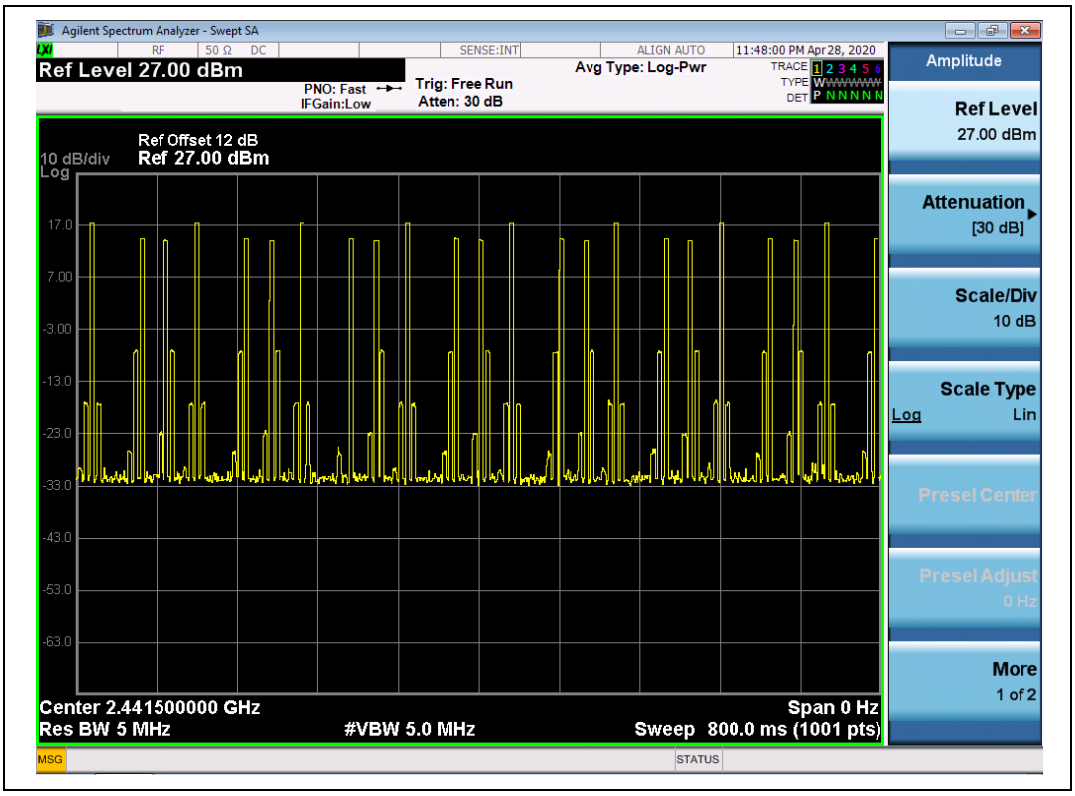
2.8.4. Test Result

2.6.4.1 GFSK Mode

A. Test Verdict:

Pulse Width (seconds)	Number of pulse in 0.8 seconds	Number of pulse in 8 seconds	Dwell Timein 8 seconds (sec)	Limit (sec)	Verdict
0.00327	8	80	0.2616	0.4	PASS

B. Test Plots:


Agilent Spectrum Analyzer - Swept SA
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
11:48:00 PM Apr 28, 2020
Ref Level 27.00 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
Ref Offset 12 dB
10 dB/div
Log
Ref 27.00 dBm
17.0
7.00
-3.00
-13.0
-23.0
-33.0
-43.0
-53.0
-63.0
Center 2.441500000 GHz
Res BW 5 MHz
#VBW 5.0 MHz
Span 0 Hz
Sweep 800.0 ms (1001 pts)
Amplitude
Ref Level
27.00 dBm
Attenuation
[30 dB]
Scale/Div
10 dB
Scale Type
Log
Lin
Presel Center
Presel Adjust
0 Hz
More
1 of 2
MSG
STATUS

(GFSK)

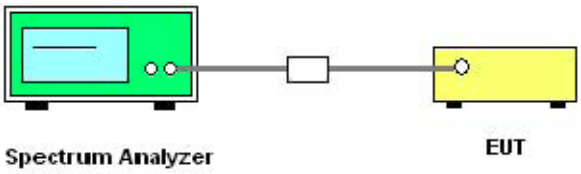
2.9. Conducted Spurious Emissions

2.9.1. Requirement

According to FCC §15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.9.2. Test Description

Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.9.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.9.4. Test Result

The EUT operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

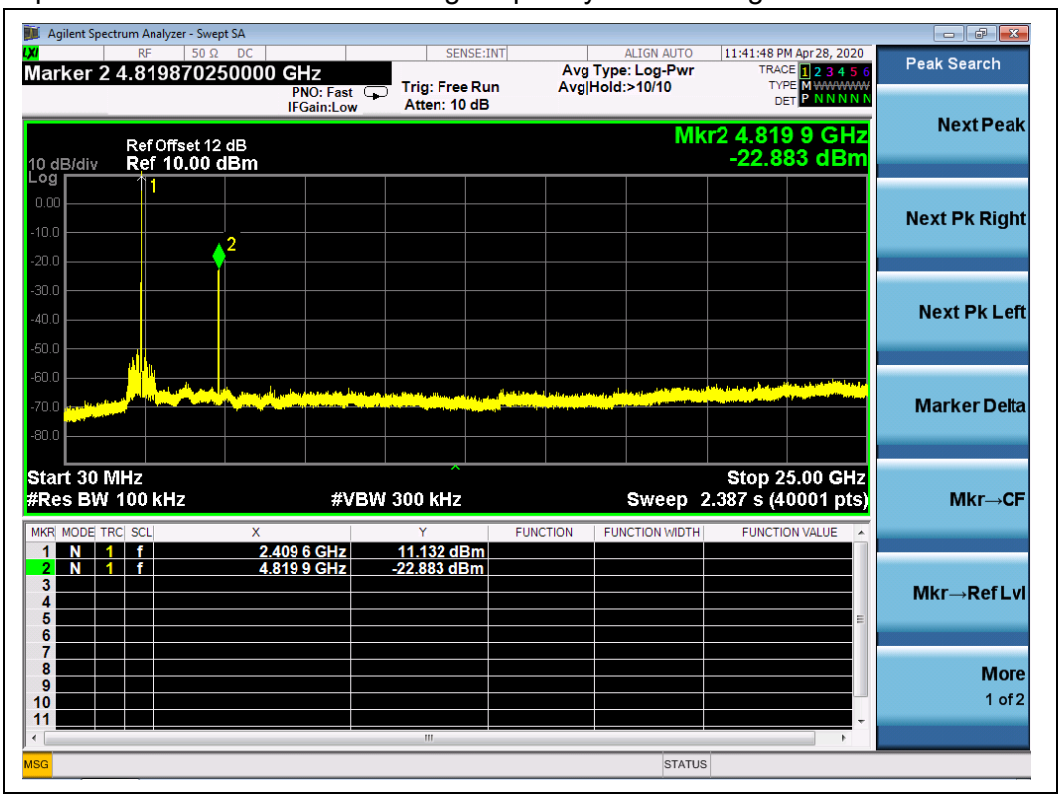
GFSK Mode

A. Test Verdict:

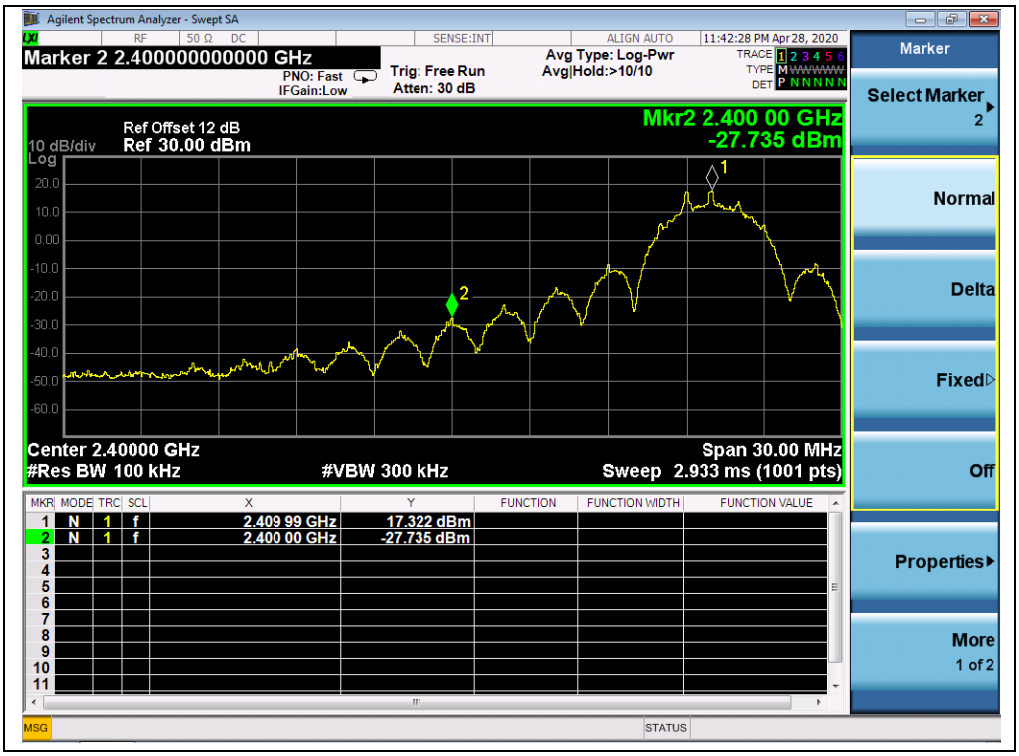
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2410	-22.88	11.13	-8.87	PASS
10	2441.5	-25.43	10.29	-9.71	PASS
20	2477	-31.72	14.01	-5.99	PASS

B. Test Plots:

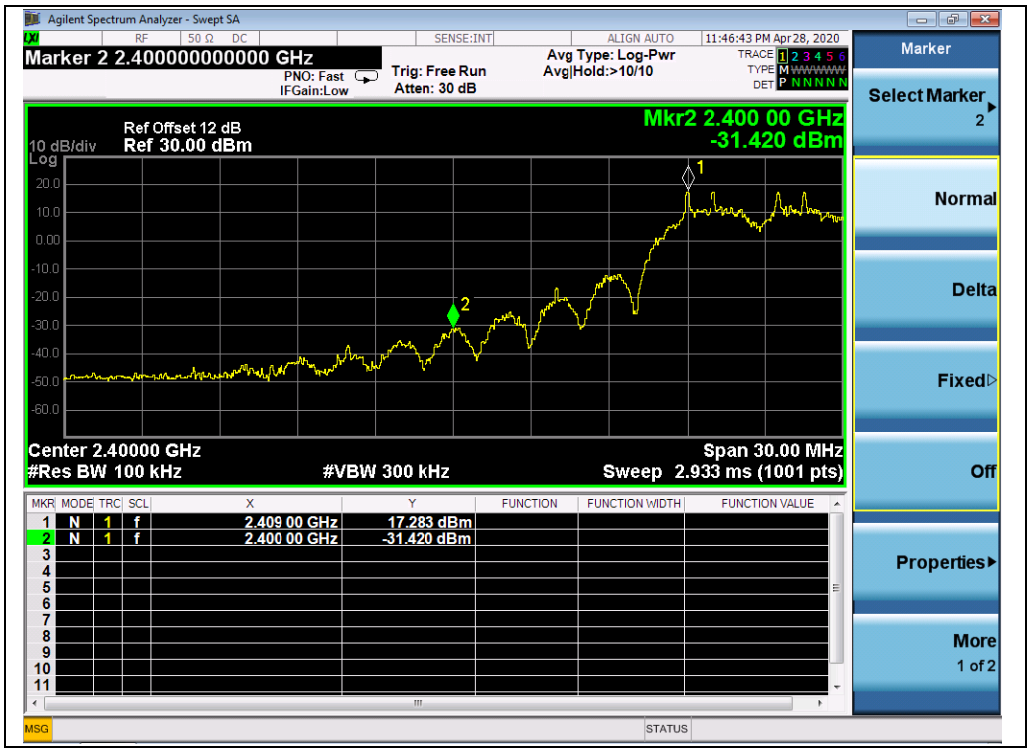
Note: The power of the Module transmitting frequency should be ignored.



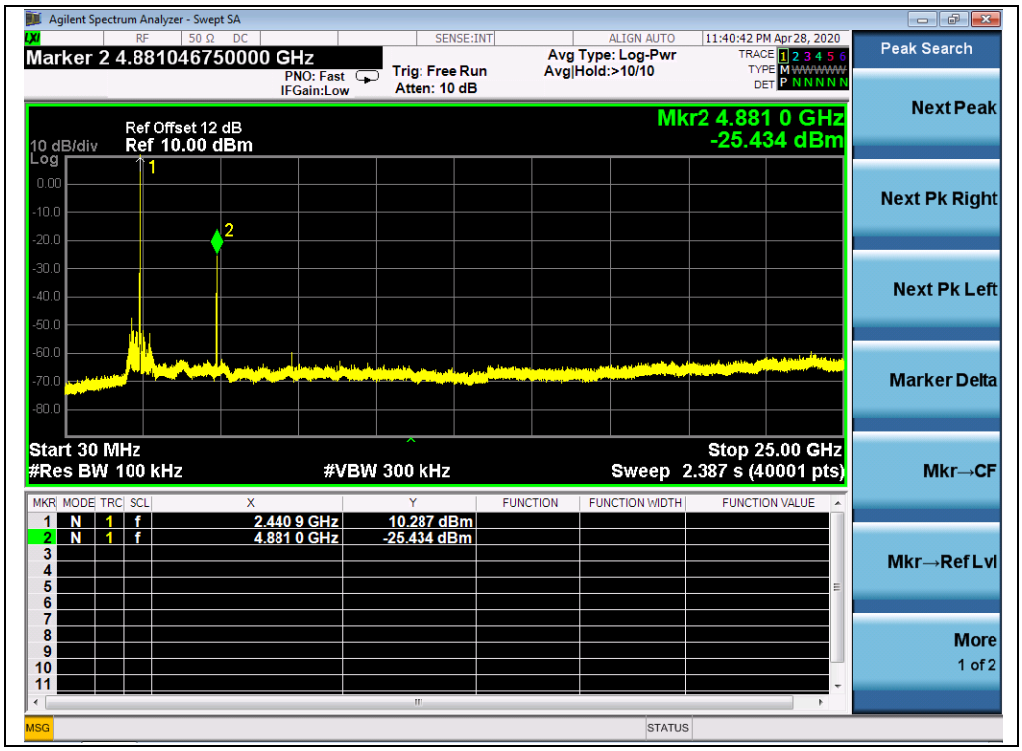
(Channel = 1, 30MHz to 25GHz, GFSK Mode)



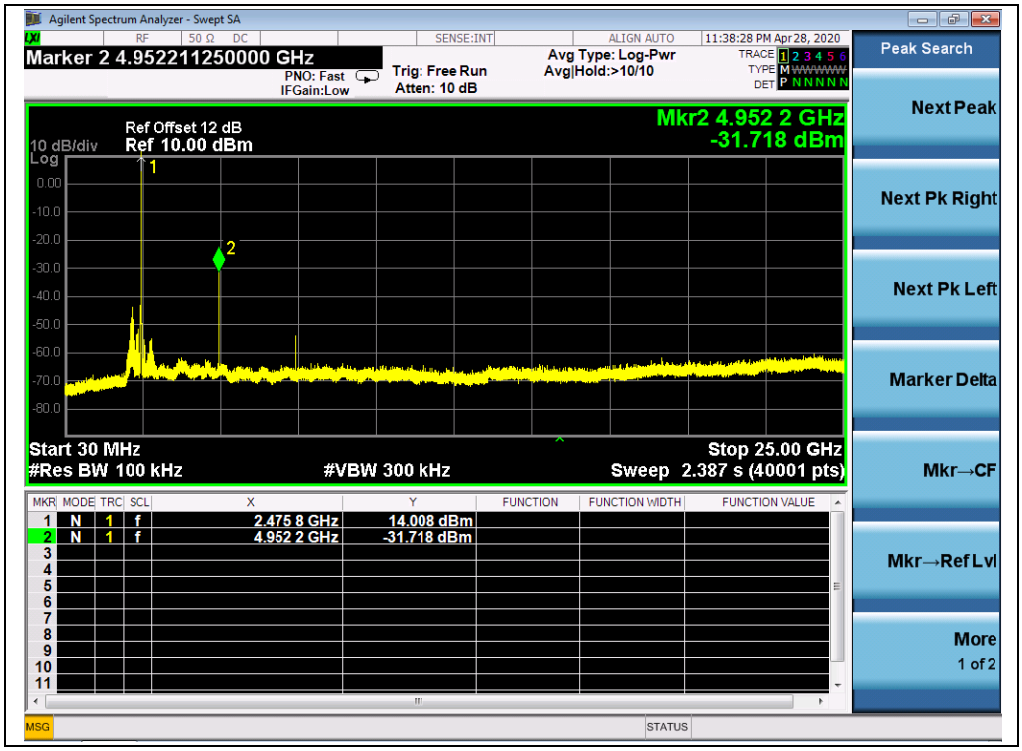
(Channel = 1, Band edge,GFSK Mode)



(Channel = 1, Band edge with hopping on, GFSK Mode)



(Channel = 10, 30MHz to 25GHz, GFSK Mode)



(Channel = 20, 30MHz to 25GHz, GFSK Mode)

(Channel = 20, Band edge,GFSK Mode)

(Channel = 20, Band edge with hopping on, GFSK Mode)

2.10. Conducted Emission

2.10.1. Requirement

According to FCC section 15.207, for an intentional radiator that 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 within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

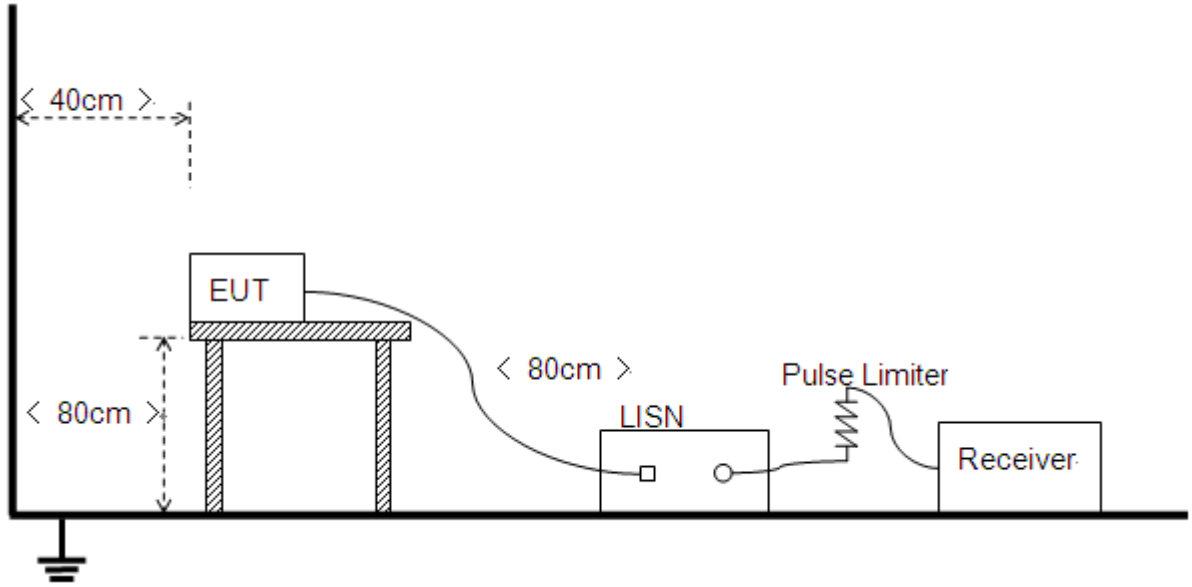
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.10.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth EUT is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

2.10.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hzwere considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test Setup:

Test Mode:EUT+ADAPTER+2.4G TX

Test Voltage:AC 120V/60Hz

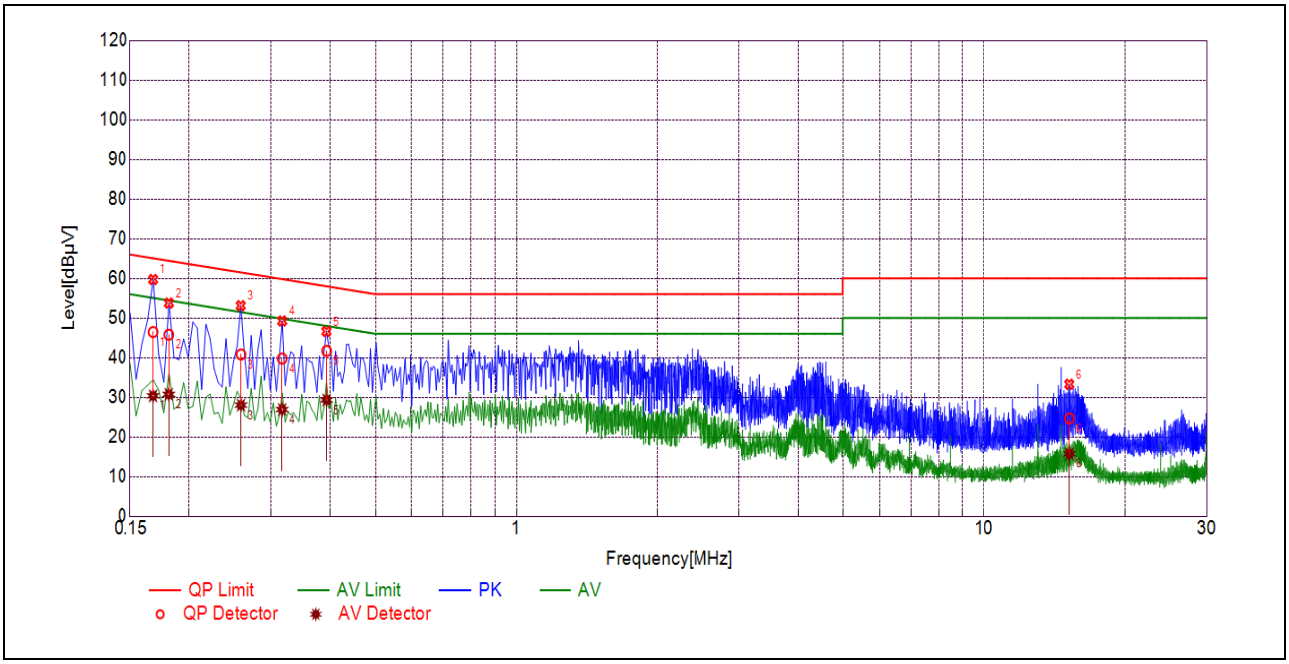
The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

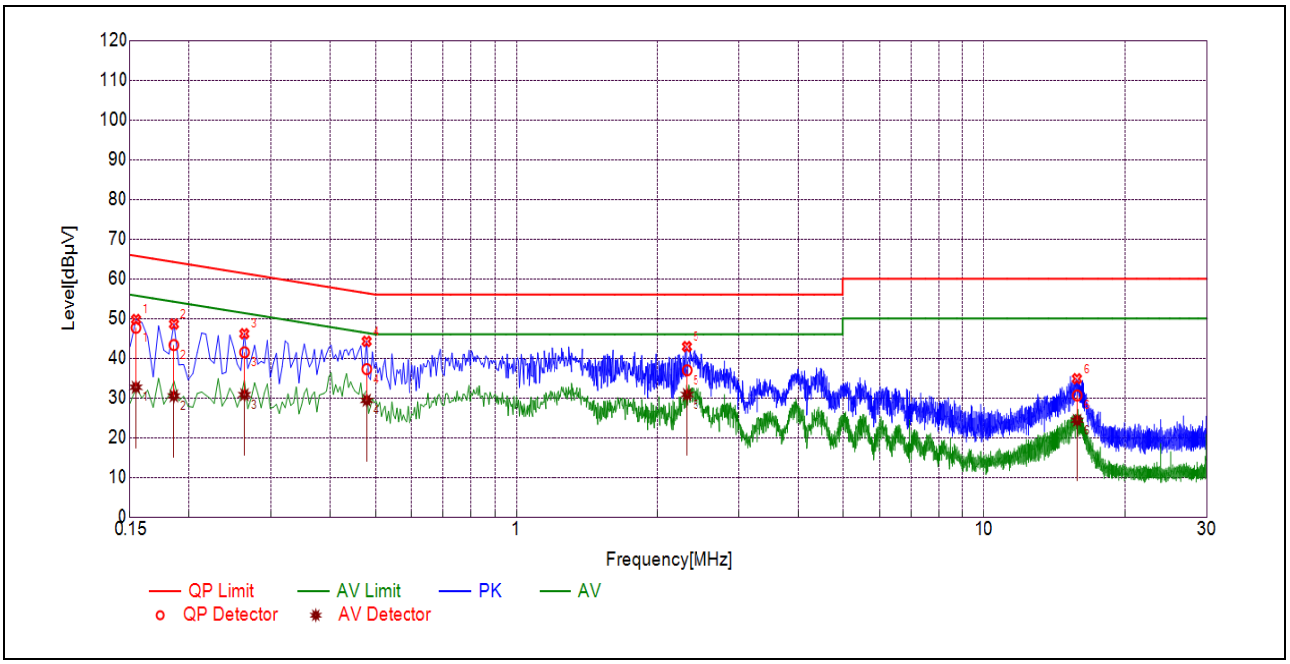
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1679	46.46	30.37	65.06	55.06	Line	PASS
2	0.1813	45.78	30.75	64.43	54.43		PASS
3	0.2582	40.80	28.02	61.49	51.49		PASS
4	0.3164	39.77	26.91	59.80	49.80		PASS
5	0.3932	41.72	29.32	57.99	47.99		PASS
6	15.2306	24.67	15.76	60.00	50.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1544	47.66	32.68	65.76	55.76	Neutral	PASS
2	0.1859	43.31	30.51	64.22	54.22		PASS
3	0.2627	41.49	30.82	61.34	51.34		PASS
4	0.4787	37.25	29.40	56.36	46.36		PASS
5	2.3168	36.96	30.84	56.00	46.00		PASS
6	15.8076	30.62	24.36	60.00	50.00		PASS

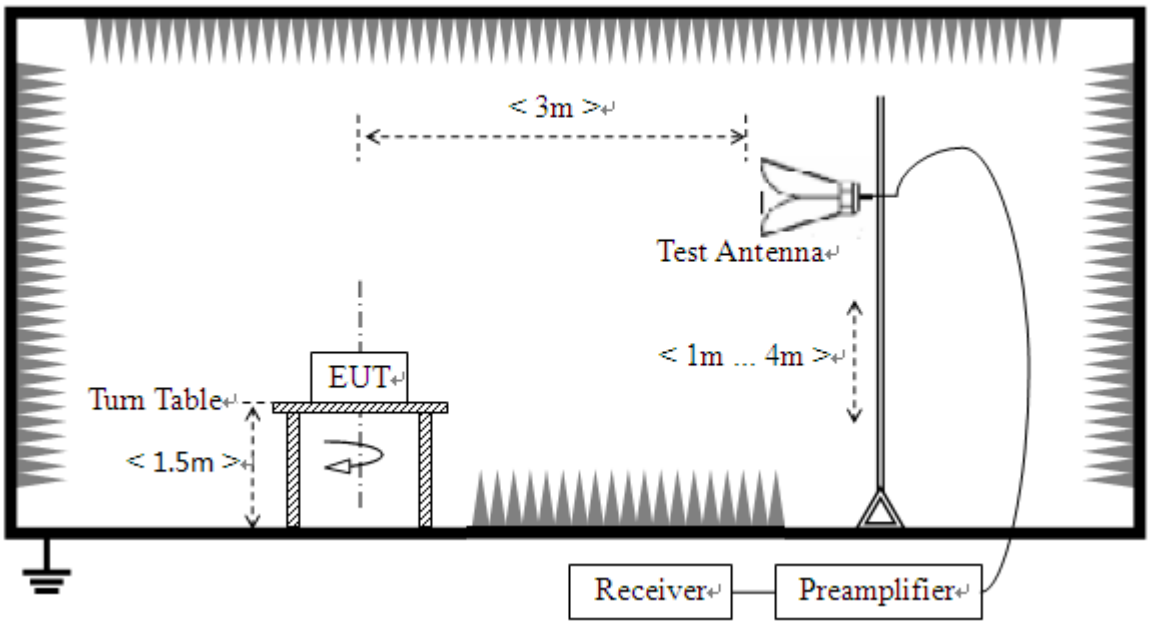
2.11. Restricted Frequency Bands

2.11.1. Requirement

According to FCC section 15.247(d), in any 100kHz 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 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 in 15.209(a).

2.11.2. Test Description

Test Setup:



The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.
For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

2.11.3. Test Procedure

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz, 100 KHz for f < 1GHz
VBW = 3 MHz
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.11.4. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; AT =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain
AFactor: Antenna Factor at 3m

For average measurement: Use duty cycle correction factor method per 15.35(c)
Duty cycle = On Time/100ms
On Time = N_1*L_1+ N_2*L_2+…+N_{n-1}*L_{N-1}+ N_n*L_n
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
The average levels were calculated from the peak level corrected with duty cycle correctionfactor (-29.74dB) derived from 20log (dwell time/100ms). This correction is only for signals that hopwith the fundamental signal, such as band-edge and harmonic.Other spurious signals that areindependent of the hopping signal would not use this correction.

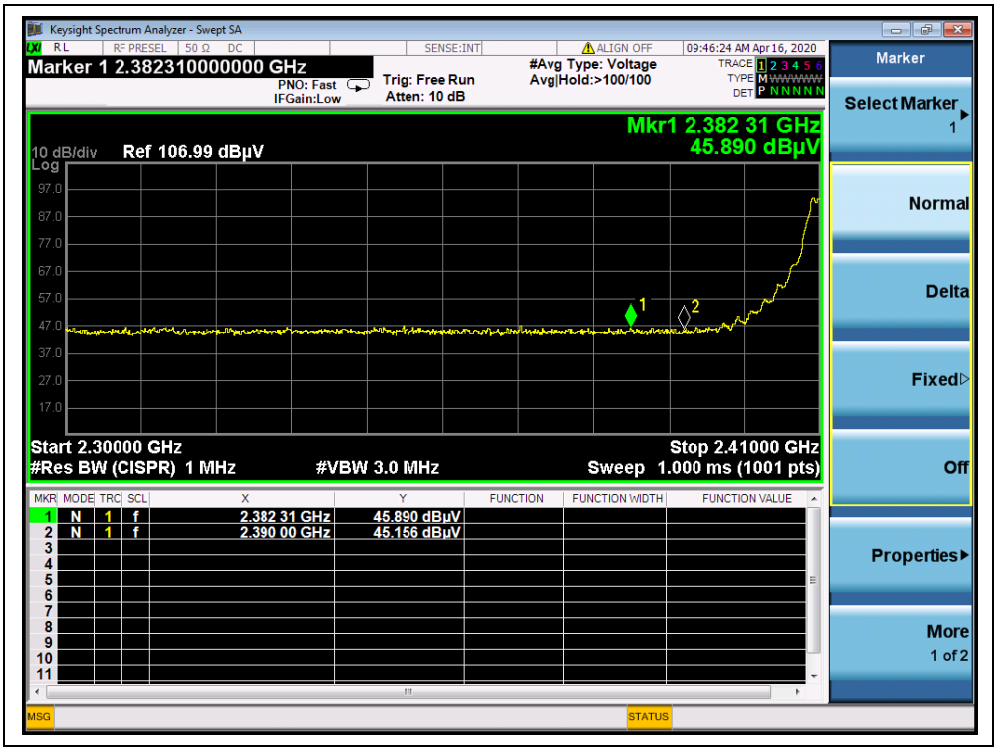
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (Horizontal) was recorded in this test report.

GFSK Mode

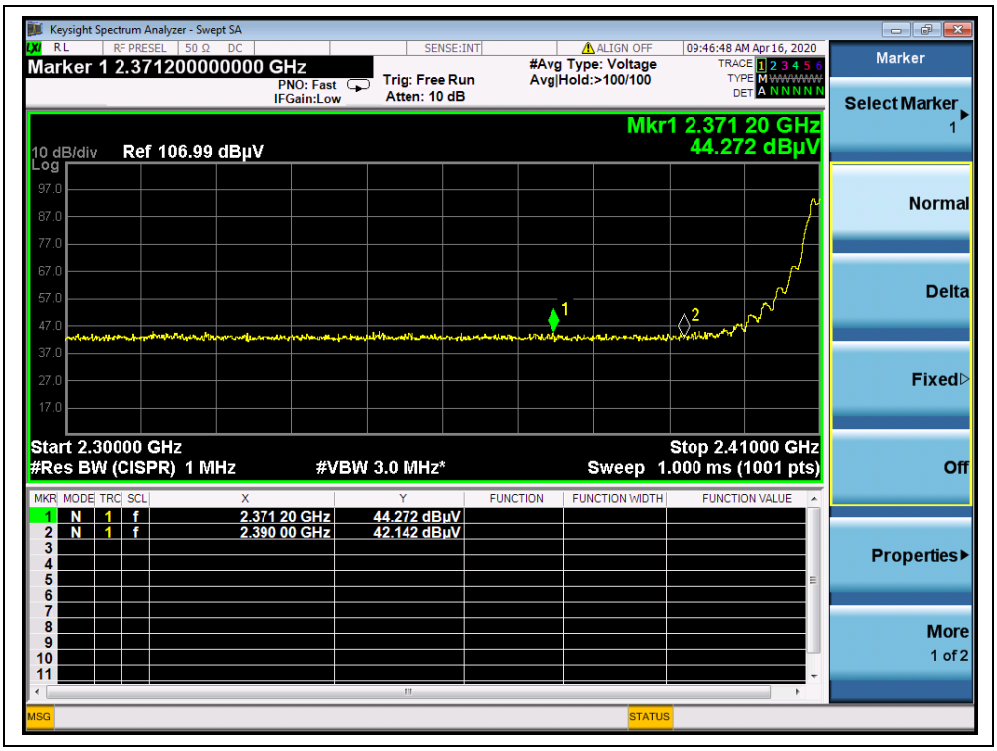
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2382.31	PK	45.89	-29.67	32.56	48.78	74	PASS
1	2371.12	AV	44.27	-29.67	32.56	47.16	54	PASS
20	2483.50	PK	54.57	-29.67	32.56	57.46	74	PASS
20	2483.50	AV	45.05	-29.67	32.56	47.94	54	PASS

B. Test Plots:



(PEAK, Channel = 1,GFSK)



(AVG, Channel = 1,GFSK)

(PEAK, Channel = 20,GFSK)

(AVG, Channel = 20, GFSK)

2.12. Radiated Emission

2.12.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

Note:

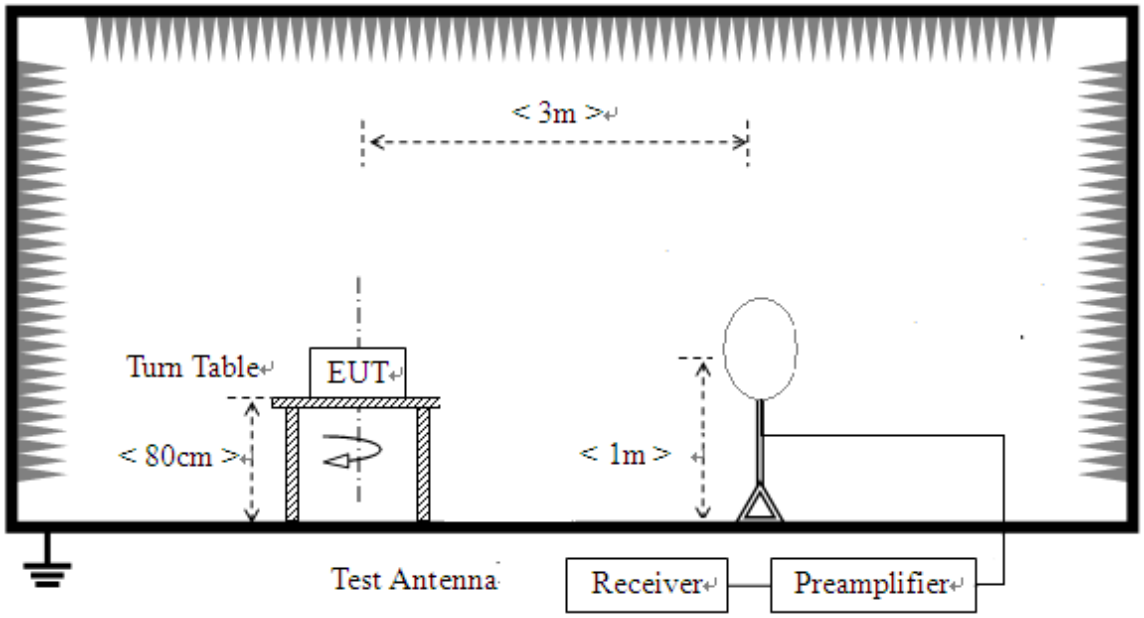
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

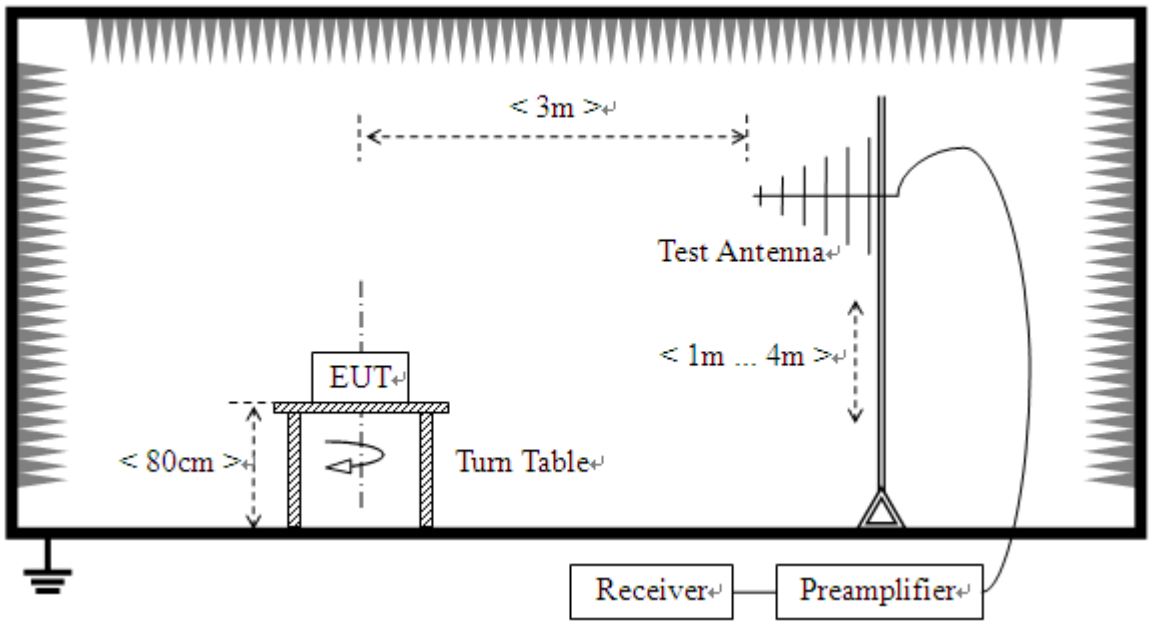
2.12.2. Test Description

Test Setup:

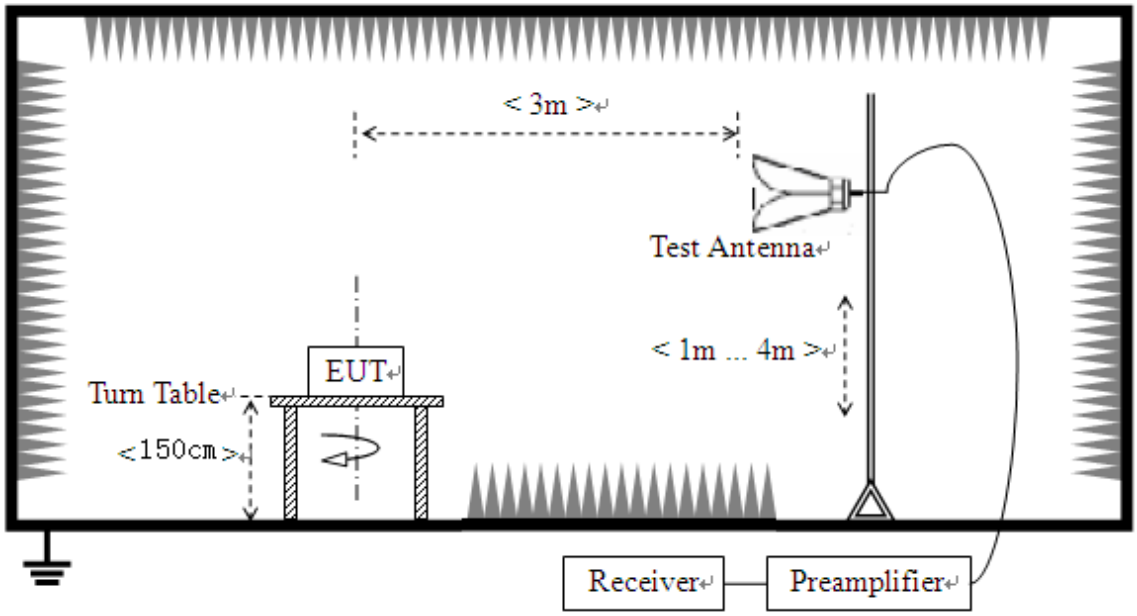
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane,For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test 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 test antenna elevation shall be that which maximizes the emissions. The test 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.The emission levels at both horizontal and vertical polarizations should be tested.

2.12.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.12.4. Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

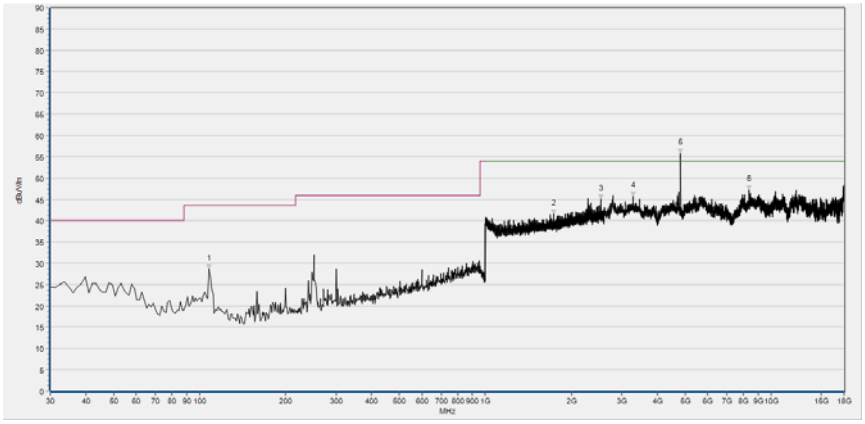
During the test, the total correction Factor AT and A_{Factor} were built in test software.

For average measurement: Use duty cycle correction factor method per 15.35(c)
Duty cycle = On Time/100ms
On Time = $N_1*L_1 + N_2*L_2 + \ldots + N_{n-1}*L_{N-1} + N_n*L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
The average levels were calculated from the peak level corrected with duty cycle correction factor (-29.74dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Note2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.
Note3: For the frequency, which started from 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

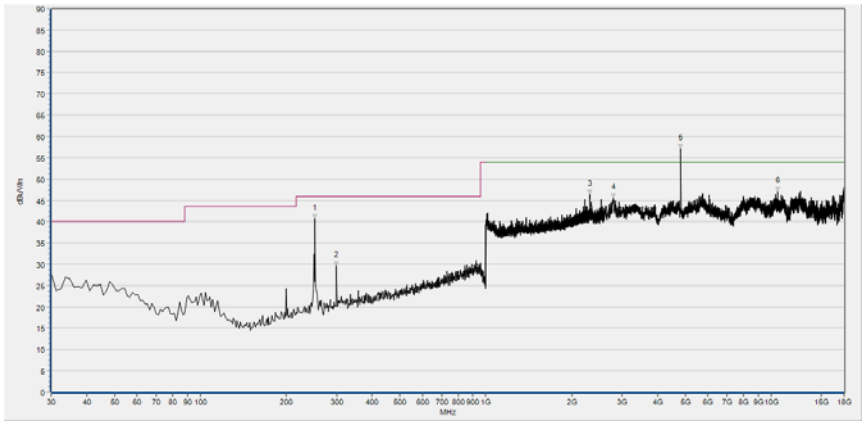
GFSK Mode

Plots for Channel = 1



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
107.697	28.70	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1729.892	41.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2536.615	45.12	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3283.324	45.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4819.900	58.38	N/A	40.95	74.00	N/A	54.00	Horizontal	PASS
8363.448	47.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

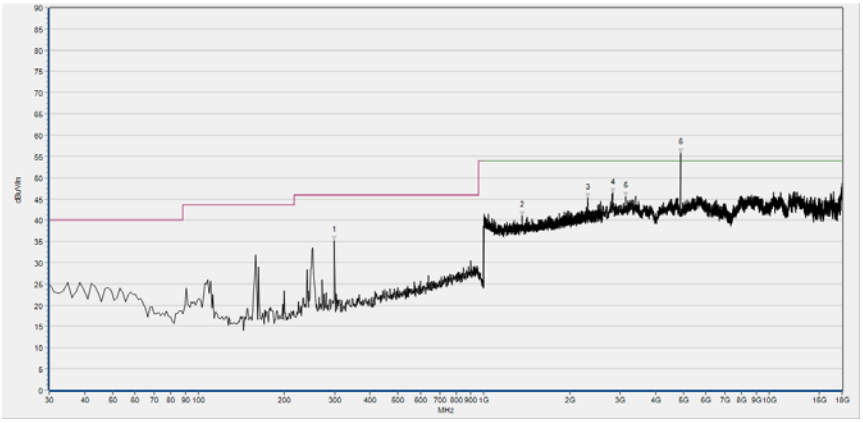
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 1)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
252.165	40.75	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
299.512	29.64	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2314.446	46.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2793.235	45.61	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4817.900	57.59	N/A	46.12	74.00	N/A	54.00	Vertical	PASS
10519.840	47.07	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

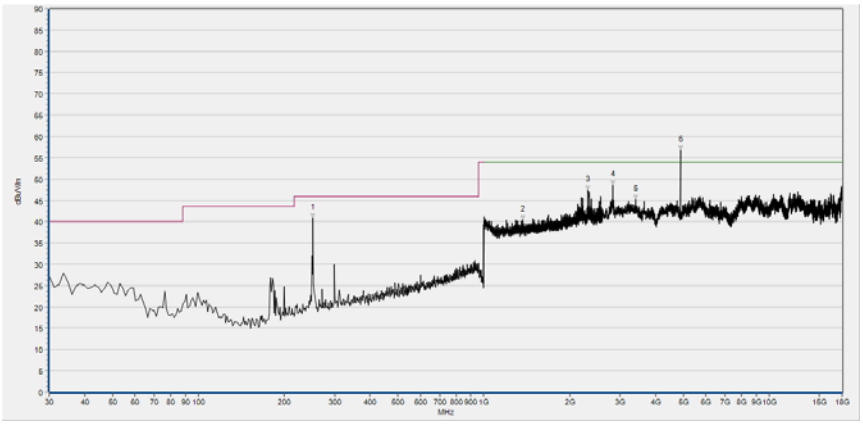
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 1)

Plot for Channel = 10



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
299.512	35.20	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1363.665	41.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2311.885	45.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2824.041	46.46	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3137.698	45.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4880.900	56.58	N/A	44.81	74.00	N/A	54.00	Horizontal	PASS

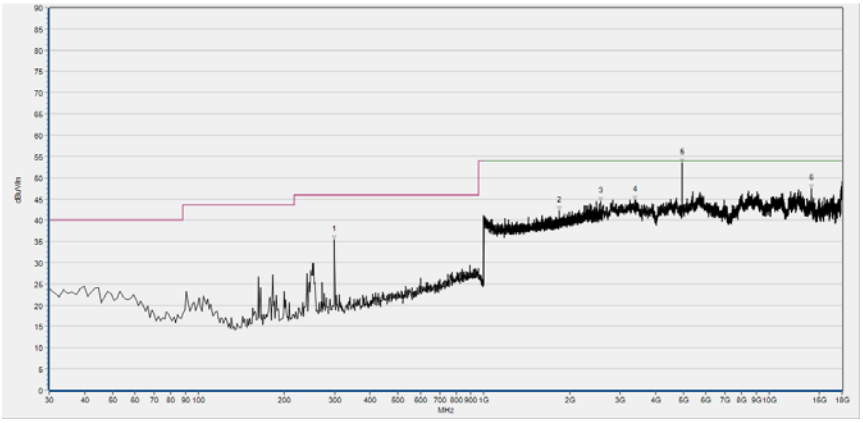
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 10)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
252.165	40.94	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1367.507	40.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2314.446	47.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2832.442	48.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3400.946	45.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4882.900	57.84	N/A	40.56	74.00	N/A	54.00	Vertical	PASS

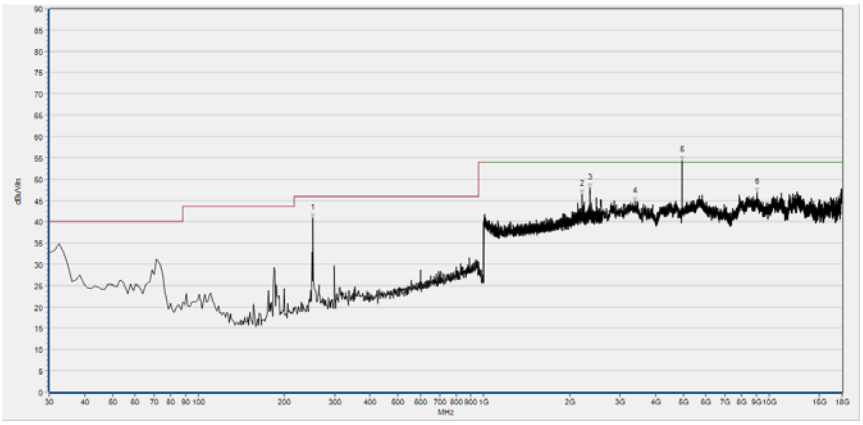
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 10)

Plot for Channel = 20



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
299.512	35.30	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1840.016	42.17	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2573.109	44.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3375.741	44.76	N/A	N/A	74.00	N/A	54.00	Horizontal	N/A
4951.900	53.94	N/A	42.05	74.00	N/A	54.00	Horizontal	PASS
14020.476	47.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 20)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
252.165	40.87	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2205.602	46.45	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2347.739	47.93	N/A	N/A	74.00	N/A	54.00	Vertical	N/A
3378.542	44.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4952.000	57.10	N/A	45.47	74.00	N/A	54.00	Vertical	PASS
9080.378	46.97	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 18GHz, Antenna Vertical, GFSK, channel 20)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Number of Hopping Frequency	±5%
Peak Output Power	±2.22dB
20dB Bandwidth	±5%
Carrier Frequency Separation	±5%
Time of Occupancy (Dwell time)	±5%
Conducted Spurious Emission	±2.77dB
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.MorlabLaboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013and CISPR Publication 22; the FCC designation number is CN1192,the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Attenuator 1	(N/A.)	10dB	Resent	N/A	N/A
EXA Signal Analyzer	MY53470836	N9010A	Agilent	2020.04.01	2021.03.31
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2020.04.01	2021.03.31
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2020.03.26	2021.03.25
LISN	812744	NSLK 8127	Schwarzbeck	2020.03.26	2021.03.25
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0

4.4Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal.Due
Receiver	MY54130016	N9038A	Agilent	2019.07.29	2020.07.28
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.05.24	2022.05.23
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable(N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2019.12.01	2020.12.01
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT