TEST REPORT

Dt&C

DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2003-0061(1)

2. Customer

- Name : eWBM Co.,Ltd.
- Address (FCC) : 1-405, 134-16, Jungni-cheon-ro, Icheon-si, Gyeonggi-do, South Korea
- Address (IC) : 1-405, 134-16, Jungnicheon-ro, Icheon-si Gyeonggi-do 17373 Korea (Republic Of)

3. Use of Report : FCC & IC Original Grant

4. Product Name / Model Name : eLR100-UL-00 / eLR100-UL-00

   FCC ID : 2ARG9-ELR100 / IC : 25891-ELR100

5. Test Method Used : KDB558074 D01v05r02, ANSI C63.10-2013

   Test Specification : FCC Part 15.247

   RSS-247 Issue 2 (2017-02), RSS-GEN Issue 5 (2019-03)

6. Date of Test : 2019.01.02 ~ 2020.03.05

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : JaeHyeok Bang (Signature)	Reviewed by Name : JaeJin Lee (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2020 . 03 . 16 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2003-0061	Mar. 06, 2020	Initial issue	JaeHyeok Bang	JaeJin Lee
DRTFCC2003-0061(1)	Mar. 16, 2020	Product Name Changed	JaeHyeok Bang	JaeJin Lee

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1.General Information

1.1 Testing Laboratory

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014. **- FCC & IC MRA Accredited Test Firm No. : KR0034** **- ISED #: 5740A**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.2 Details of Applicant

Applicant	:	eWBM Co., Ltd.
Address(FCC)	:	1-405, 134-16, Jungni-cheon-ro, Icheon-si, Gyeonggi-do, South Korea
Address(IC)	:	1-405, 134-16, Jungnicheon-ro, Icheon-si Gyeonggi-do 17373 Korea (Republic Of)
Contact person(FCC/IC)	:	Kyu Hyun Jung

1.3 Description of EUT

EUT	eLR100-UL-00
Model Name	eLR100-UL-00
Add Model Name	NA
Hardware Version	Ver 0.06
Software Version	Ver 1.0
Serial Number	Identical prototype
Power Supply	DC 3.3 V
Frequency Range	902.3 ~ 914.9 MHz
Modulation Technique	LoRa
Number of Channels	64
Antenna Type	Antenna Type: DIPOLE ANTENNA Gain: 1.85 dBi (PK)

1.4 Declaration by the manufacturer

- N/A

1.5 Test conditions

Ambient Condition	
▪ Temperature	+22 ℃ ~ +24 ℃
▪ Relative Humidity	43 % ~ 45 %

1.6 Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	19/06/26	20/06/26	MY50410163
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48010133
DC Power Supply	Agilent Technologies	66332A	19/06/25	20/06/25	MY43001172
Multimeter	FLUKE	17B+	19/12/16	20/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
ANEROID BAROMETER	SATO	790 mmHg	19/05/27	20/05/27	891827
Loop Antenna	Schwarzbeck	FMZB1513	20/02/19	22/02/19	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-Lindgren	3117	18/05/10	20/05/10	00140394
PreAmplifier	tsj	8447D	19/12/16	20/12/16	2944A07774
PreAmplifier	tsj	8449B	19/06/27	20/06/27	3008A02108
Highpass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	19/06/24	20/06/24	7
Band Pass Filter	Wainwright Instruments	WRCT800/960.0-2/40-8SSK	19/06/27	20/06/27	32
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A MA2411B	19/06/27	20/06/27	1338004 1306053
LISN	ROHDE&SCHWARZ	ENV216	19/12/06	20/12/06	101979
RECEIVER	ROHDE&SCHWARZ	ESR	19/12/17	20/12/17	101767
TRANSIENT LIMITER	EMCIS	TL-B0930A	19/08/30	20/08/30	11002
SINGLE-PHASE MASTER	NF	4420	19/09/17	20/09/17	3049354420023
Cable	DT&C	Cable	20/01/16	21/01/16	RF-56
Cable	DTNC	Cable	20/01/16	21/01/16	M-01
Cable	HUBER+SUHNER	SUCOFLEX 104	20/01/16	21/01/16	M-03
Cable	Junkosha	MWX315	20/01/16	21/01/16	M-05
Cable	Junkosha	MWX221	20/01/16	21/01/16	M-06

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017
Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

1.7 Summary of Test Results(Hybrid systems)

FCC Part RSS Std.	Parameter	Limit (Using in 902-928 MHz)	Test Condition	Status Note 1
15.247(a) RSS-247(5.1)	Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.	Conducted	C
	Number of Hopping Frequencies	>= 25 hops		C
	20 dB Bandwidth	< 500 kHz		C
15.247(f) RSS-247(5.3)	Dwell Time	=< 0.4 seconds		C
15.247(f) RSS-247(5.3)	Power spectral density	< 8 dBm/3 kHz		C
15.247(b) RSS-247(5.4)	Transmitter Output Power	Refer to the clause 2 in test report		C
15.247(d) RSS-247(5.5)	Conducted Spurious Emissions	20 dBc in any 100 kHz BW		C
RSS Gen(6.7)	Occupied Bandwidth (99 %)	N/A		C
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits RSS-Gen 8.9	Radiated	C Note3
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits RSS-Gen(8.8)	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This test item was performed in each axis and the worst case data was reported.

1.8 Conclusion of worst-case and operation mode

The field strength of spurious emission was measured in three orthogonal EUT positions(X-axis, Y-axis and Z-axis).

Tested frequency information,

- Hopping Function: Enable

	TX Frequency (MHz)
Hopping Band	902.30 ~ 914.90 MHz

- Hopping Function: Disable

Channel	TX Frequency (MHz)
Lowest Channel	902.30
Middle Channel	908.70
Highest Channel	914.90

Operation test setup for EUT

- Test Software Version: Tera Term Version 4.87(SVN#5897)
- Power setting: 14

2. Maximum Peak Output Power Measurement

2.1 Test Setup

Refer to the APPENDIX I.

2.2 Limit

▣ FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following :

1. §15.247(b)(2), For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

▣ IC Requirements

1. RSS-247(5.4)(a), For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

2.3 Test Procedure

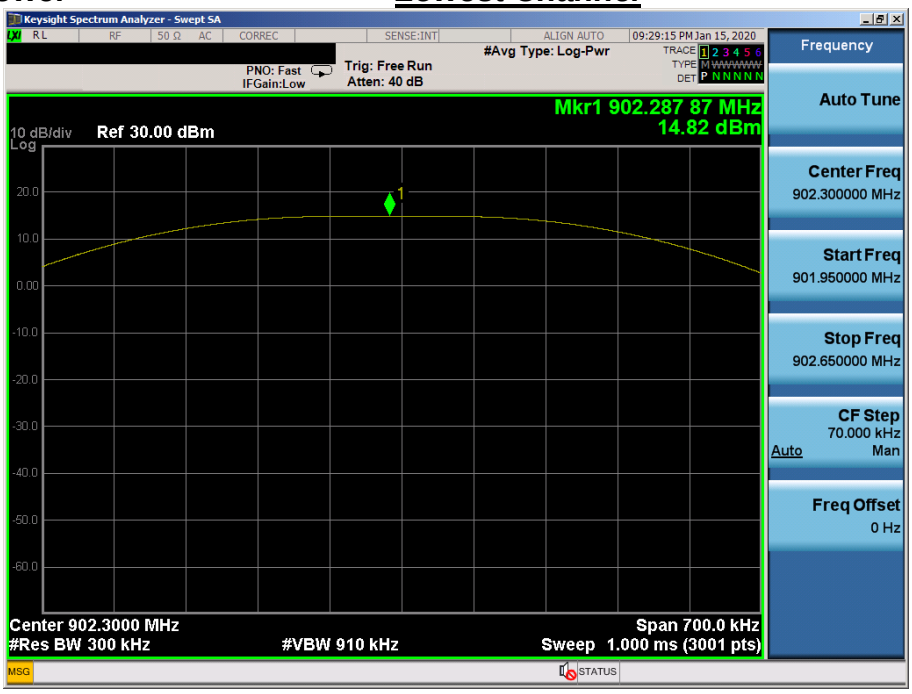
1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
2. The peak output power of the fundamental frequency was measured with the spectrum analyzer using;
   Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 20 dB BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

2.4 Test Results

Tested Channel	Burst Average Output Power		Peak Output Power	
	dBm	mW	dBm	mW
Lowest	**14.08**	**25.53**	**14.82**	**30.34**
Middle	14.01	25.23	14.81	30.27
Highest	13.93	24.72	14.77	29.99

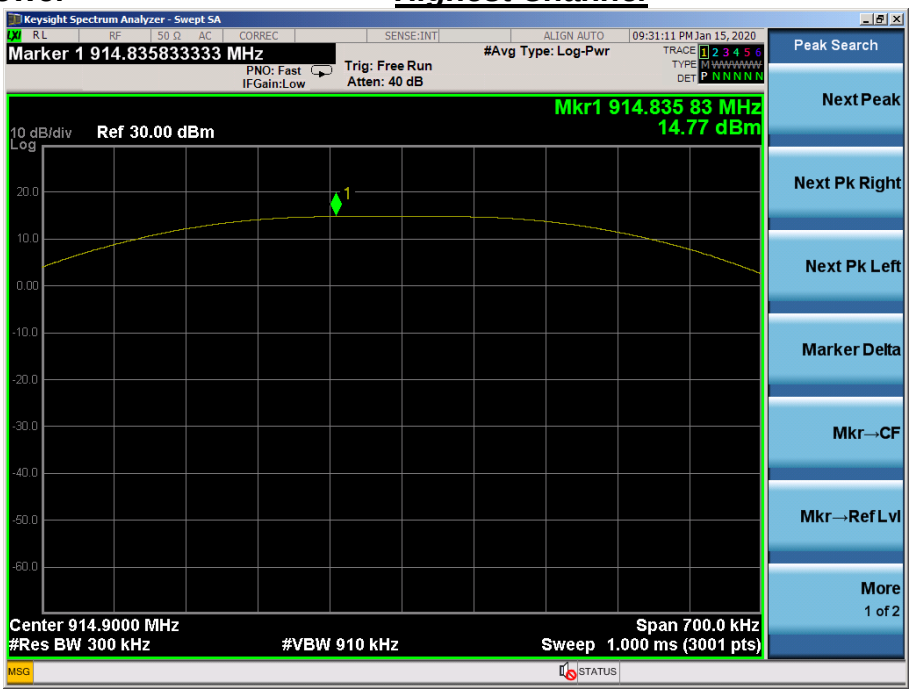
Note 1: See next pages for actual measured spectrum plots.

Peak Output Power ***Lowest Channel***



Peak Output Power ***Middle Channel***

Peak Output Power ***Highest Channel***



3. 20dBc BW & Occupied BW

3.1 Test Setup

Refer to the APPENDIX I.

3.2 Limit

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.

3.3 Test Procedure

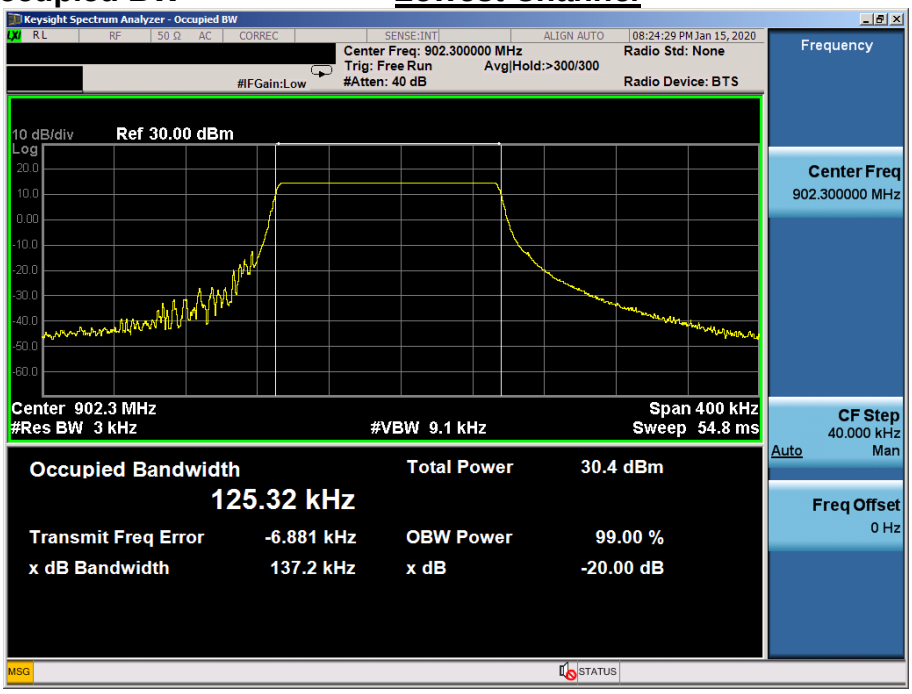
1. The 20 dB bandwidth were measured with a spectrum analyzer connected to RF antenna Connector (conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting: RBW shall be in the range of 1% to 5% of the 20 dB bandwidth and VBW ≥ 3 × RBW, Span = between two times and five times the 20 dB bandwidth.

3.4 Test Results

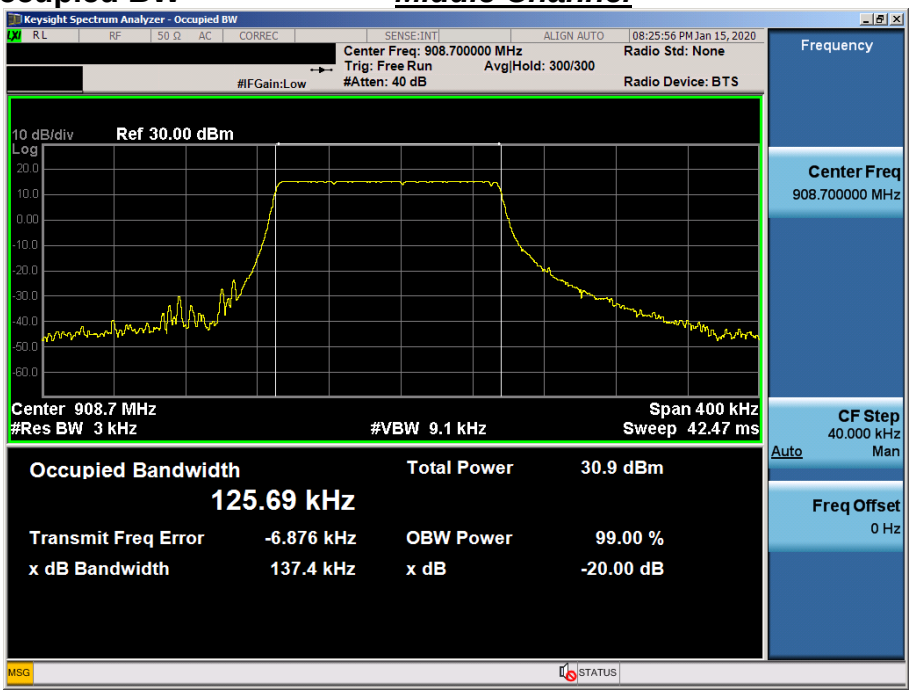
Tested Channel	20dBc BW (kHz)	Occupied BW (kHz)
Lowest	137.20	125.32
Middle	137.40	125.69
Highest	137.40	125.70

Note 1: See next pages for actual measured spectrum plots.

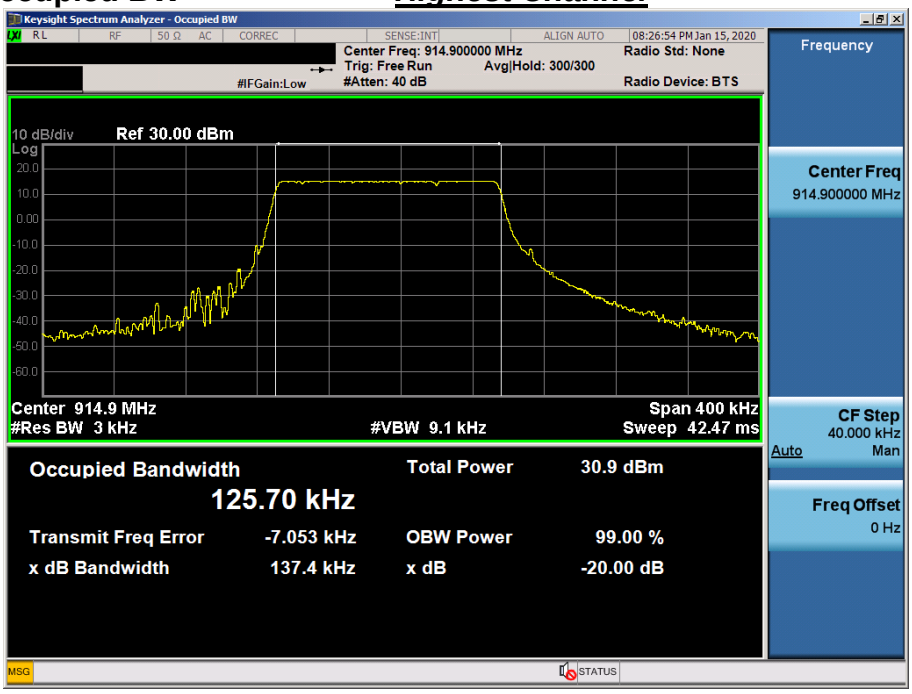
20dBc BW & Occupied BW ***Lowest Channel***



20dBc BW & Occupied BW ***Middle Channel***



20dBc BW & Occupied BW ***Highest Channel***



4. Carrier Frequency Separation

4.1 Test Setup

Refer to the APPENDIX I.

4.2 Limit

Limit : ≥ 25 kHz or ≥ 20 dB BW whichever is greater.

4.3 Procedure

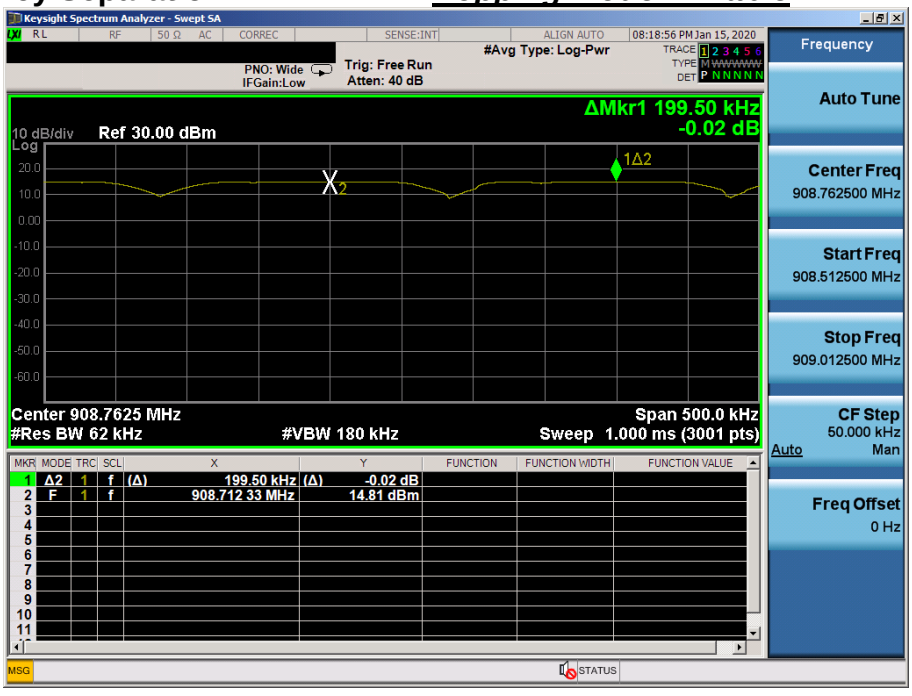
The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.
After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.
The spectrum analyzer is set to :

Span = wide enough to capture the peaks of two adjacent channels
RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW ≥ RBW Sweep = auto
Detector function = peak Trace = max hold

4.4 Test Results:

Hopping Mode	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (kHz)
Enable	908.71233	908.91180	199.50

Carrier Frequency Separation ***Hopping mode : Enable***



5. Number of Hopping Frequencies

5.1 Test Setup

Refer to the APPENDIX I.

5.2 Limit

Limit: >= 50 hops

5.3 Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, two frequency ranges for FH mode within the 902.3 ~ 914.9 MHz were examined.

The spectrum analyzer is set to :

Span = 18 MHz Start Frequency = 900 MHz, Stop Frequency = 918 MHz

RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

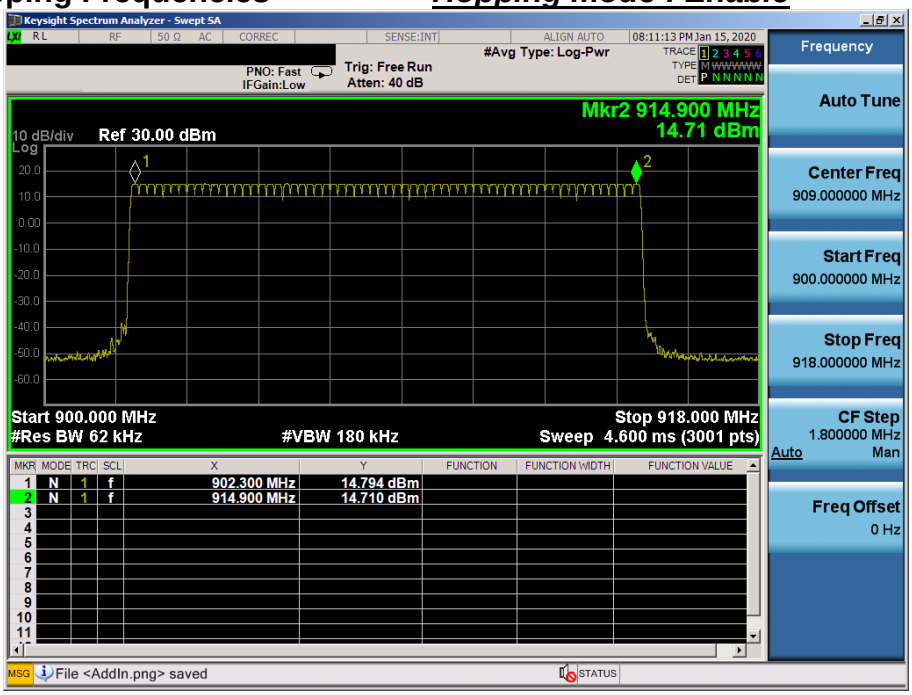
VBW ≥ RBW Sweep = auto

Detector function = peak Trace = max hold

5.4 Test Results:

Hopping mode	Test Result (Total Hops)
Enable	64

Number of Hopping Frequencies ***Hopping mode : Enable***



6. Time of Occupancy (Dwell Time)

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

The frequency hopping operation of the **hybrid system**, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

6.3 Test Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to :

Center frequency = 908.7 MHz Span = zero

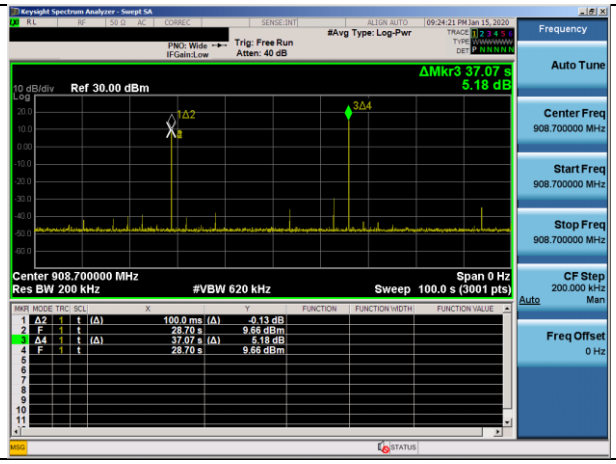
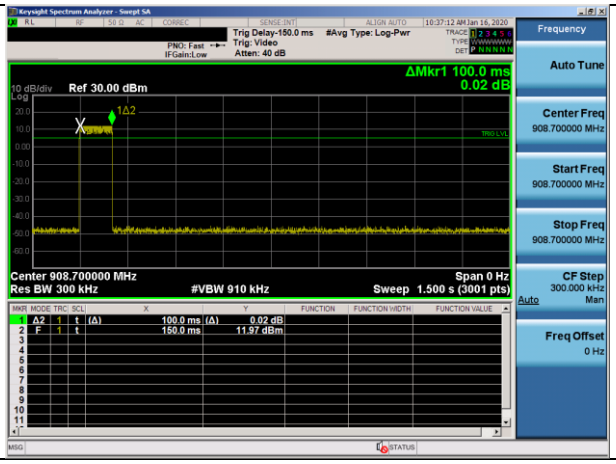
RBW = 100 kHz (RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel)

VBW ≥ RBW Detector function = peak

Trace = max hold

6.4 Test Results

Channel Frequency (MHz)	Number of hopping channel in 25.6s	Pulse width(ms)	Average time of occupancy (ms)
908.7	1	100	100

Number of hopping channel	Pulse width
	

7. Maximum Power Spectral Density

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.3 Test Procedure

KDB 558074 D01 15.247 Meas Guidance v05r02 Section 8.4

ANSI C63.10-2013 Section 11.10.3

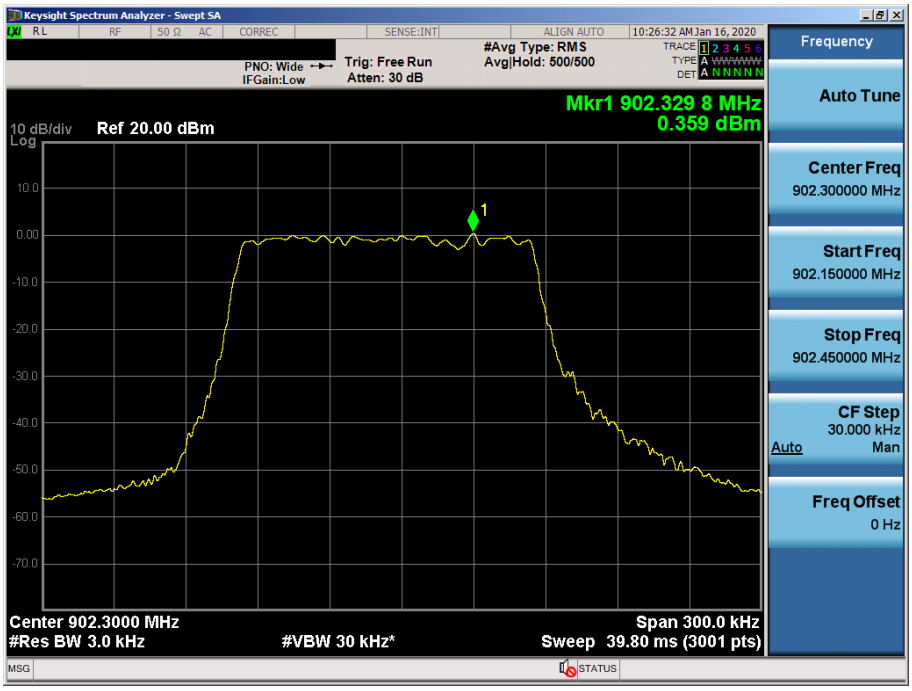
Method AVGPSD-1 uses trace averaging with EUT transmitting at full power throughout each sweep. The following procedure may be used when the maximum (average) conducted output power was used to determine compliance to the fundamental output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has a power averaging (rms) detector, then it must be used; otherwise, use the Sample detector. The EUT must be configured to transmit continuously (D≥98%), or else sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level(no transmitter OFF time to be considered):

1. Set instrument center frequency to channel center frequency.
2. Set span to at lest 1.5 times the OBW.
3. Set the RBW : **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW ≥ **3 x RBW.**
5. Detector = power averaging (rms) or sample detector (when rms not available)
6. Sweep time = **auto couple.**
7. Trace mode = **Average.**
8. Allow trace to fully stabilize.
9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

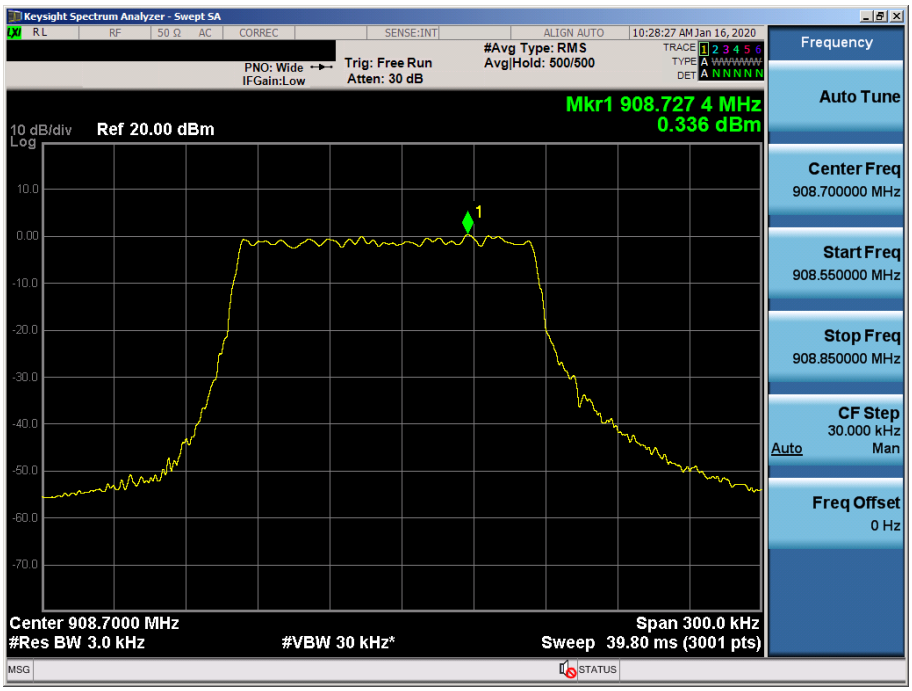
7.4 Test Results

Test Mode	Tested Channel	PSD [dBm]
TM 1	Lowest	0.36
	Middle	0.34
	Highest	0.20

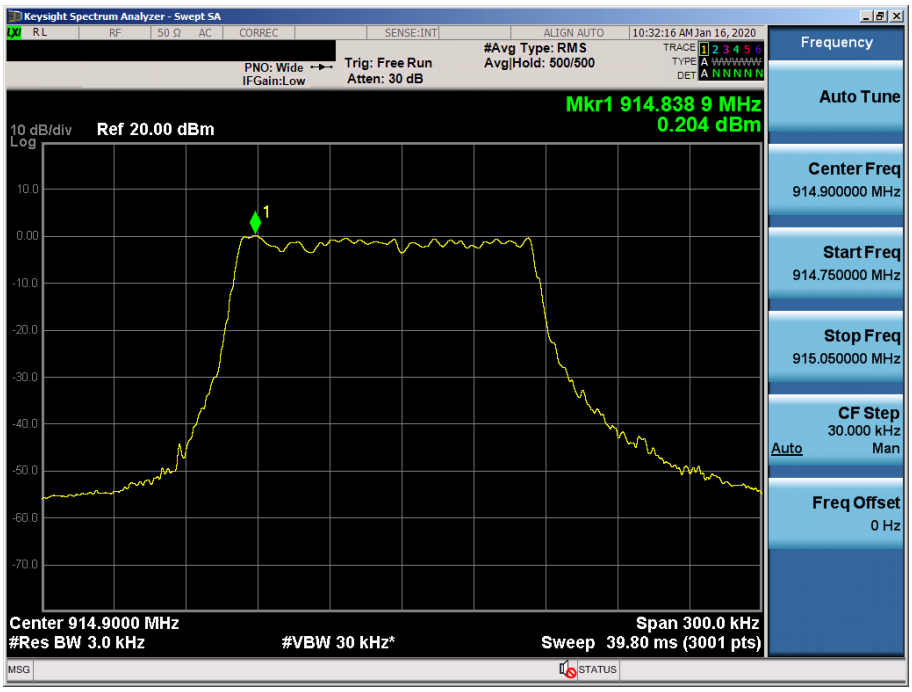
Maximum PKPSD TM 1 Test Channel : Lowest



Maximum PKPSD TM 1 Test Channel : Middle



Maximum PKPSD TM 1 Test Channel : Highest



8. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

8.1 Test Setup

Refer to the APPENDIX I.

8.2 Limit

According to §15.247(d), 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 section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 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)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

8.3 Test Procedures

8.3.1 Test Procedures for Radiated Spurious Emissions

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
   The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
3. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
4. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.

NOTE 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.

NOTE 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1 GHz.

8.3.2 Test Procedures for Conducted Spurious Emissions

1. The transmitter output was connected to the spectrum analyzer.
2. The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
3. The conducted spurious emission was tested each ranges were set as below.

Frequency range : 9 kHz ~ 30 MHz
RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

Frequency range : 30 MHz ~ 10 GHz
RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

8.4 Test Results

8.4.1 Radiated Emission

Note 1: Attached plot of worst data, refer to the APPENDIX II.

9kHz ~ 10GHz Data

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2706.980	V	Y	PK	51.14	2.84	N/A	53.98	74.00	20.02
2706.719	V	Y	AV	46.35	2.84	N/A	49.19	54.00	4.81
3609.219	H	Y	PK	50.42	3.55	N/A	53.97	74.00	20.03
3609.163	H	Y	AV	46.53	3.55	N/A	50.08	54.00	3.92
4511.830	V	Y	PK	48.26	5.57	N/A	53.83	74.00	20.17
4511.210	V	Y	AV	41.69	5.57	N/A	47.26	54.00	6.74
8120.681	H	Y	PK	47.88	9.51	N/A	57.39	74.00	16.61
8120.223	H	Y	AV	40.65	9.51	N/A	50.16	54.00	3.84
9022.618	H	Y	PK	45.58	10.50	N/A	56.08	74.00	17.92
9022.604	H	Y	AV	35.73	10.50	N/A	46.23	54.00	7.77

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2726.099	V	Y	PK	50.01	2.83	N/A	52.84	74.00	21.16
2726.129	V	Y	AV	45.25	2.83	N/A	48.08	54.00	5.92
3634.830	H	Y	PK	51.27	3.47	N/A	54.74	74.00	19.26
3634.985	H	Y	AV	46.88	3.47	N/A	50.35	54.00	3.65
4543.060	V	Y	PK	47.60	5.75	N/A	53.35	74.00	20.65
4543.421	V	Y	AV	41.40	5.76	N/A	47.16	54.00	6.84
8178.365	H	Y	PK	47.24	9.58	N/A	56.82	74.00	17.18
8178.279	H	Y	AV	40.06	9.58	N/A	49.64	54.00	4.36
9086.958	H	Y	PK	44.41	10.55	N/A	54.96	74.00	19.04
9086.963	H	Y	AV	33.52	10.55	N/A	44.07	54.00	9.93

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2744.697	V	Y	PK	48.32	2.81	N/A	51.13	74.00	22.87
2744.788	V	Y	AV	44.79	2.81	N/A	47.60	54.00	6.40
3659.550	H	Y	PK	50.32	3.39	N/A	53.71	74.00	20.29
3659.679	H	Y	AV	45.33	3.39	N/A	48.72	54.00	5.28
4574.829	V	Y	PK	47.18	5.95	N/A	53.13	74.00	20.87
4574.777	V	Y	AV	40.01	5.95	N/A	45.96	54.00	8.04
8233.517	H	Y	PK	46.38	9.64	N/A	56.02	74.00	17.98
8234.470	H	Y	AV	38.31	9.64	N/A	47.95	54.00	6.05
9149.423	H	Y	PK	44.41	10.60	N/A	55.01	74.00	18.99
9149.418	H	Y	AV	33.39	10.60	N/A	43.99	54.00	10.01

▪ **Note.**

1. The radiated emissions were investigated 9kHz to 10GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor

   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.

   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**

   When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.
3. Sample Calculation.

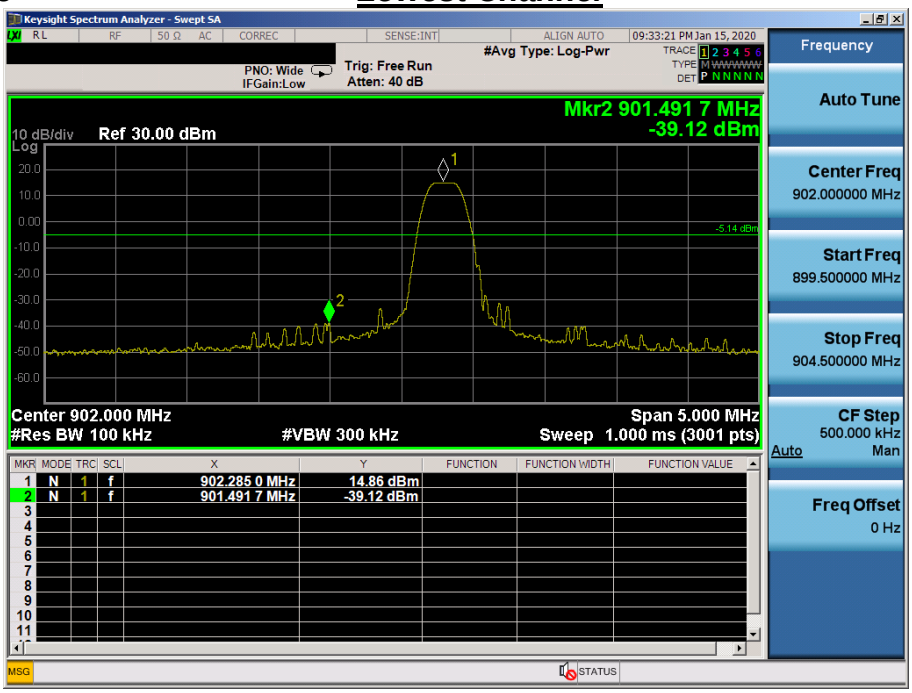
   Margin = Limit – Result / Result = Reading + T.F + D.C.F / T.F = AF + CL – AG

   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

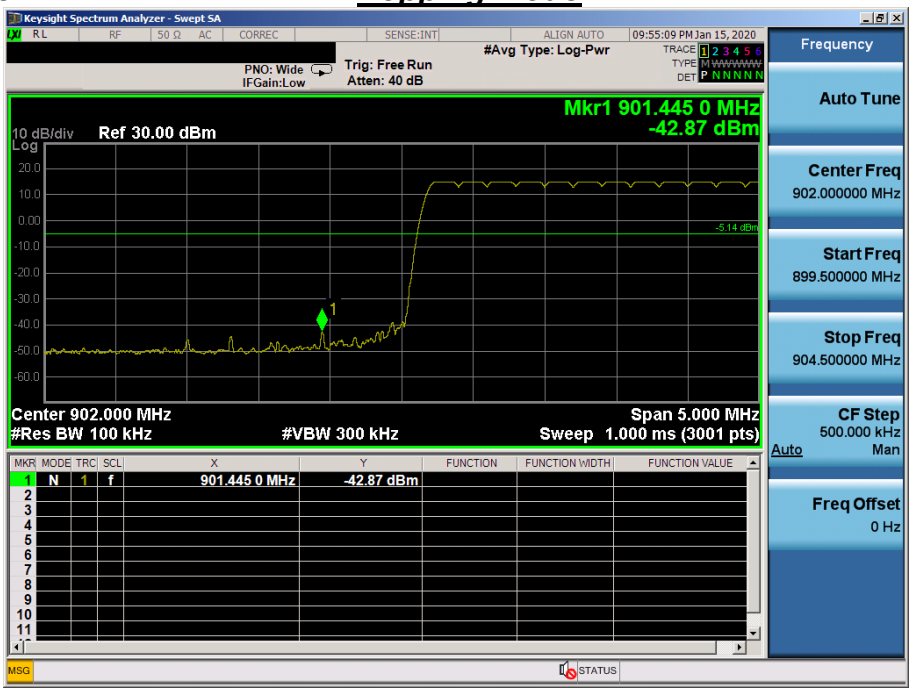
   DCF = Duty Cycle Correction Factor.
4. * is fundamental frequency.

8.4.2 Conducted Spurious Emissions

Low Band-edge ***Lowest Channel***

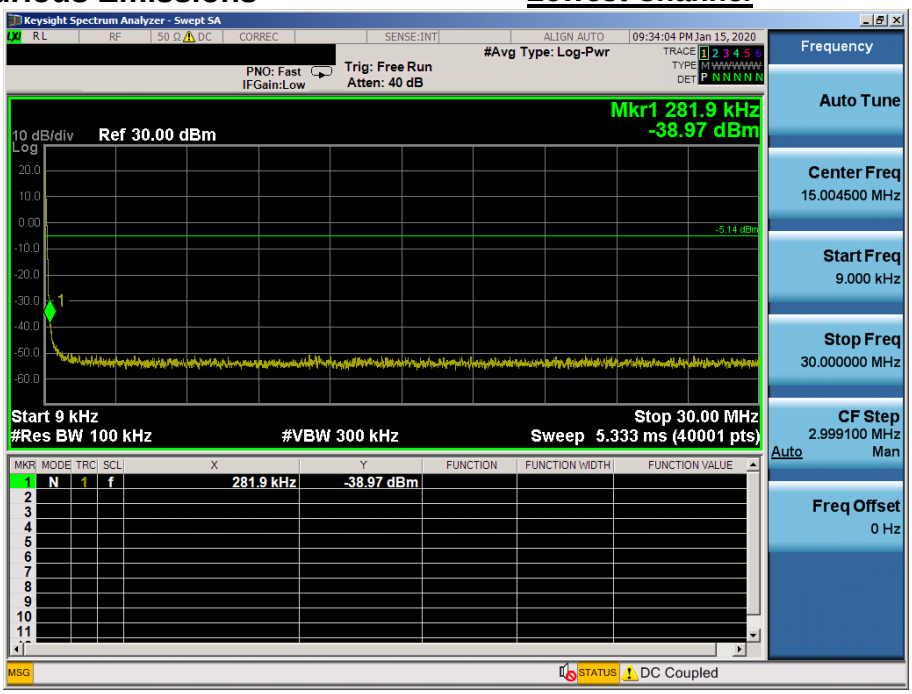


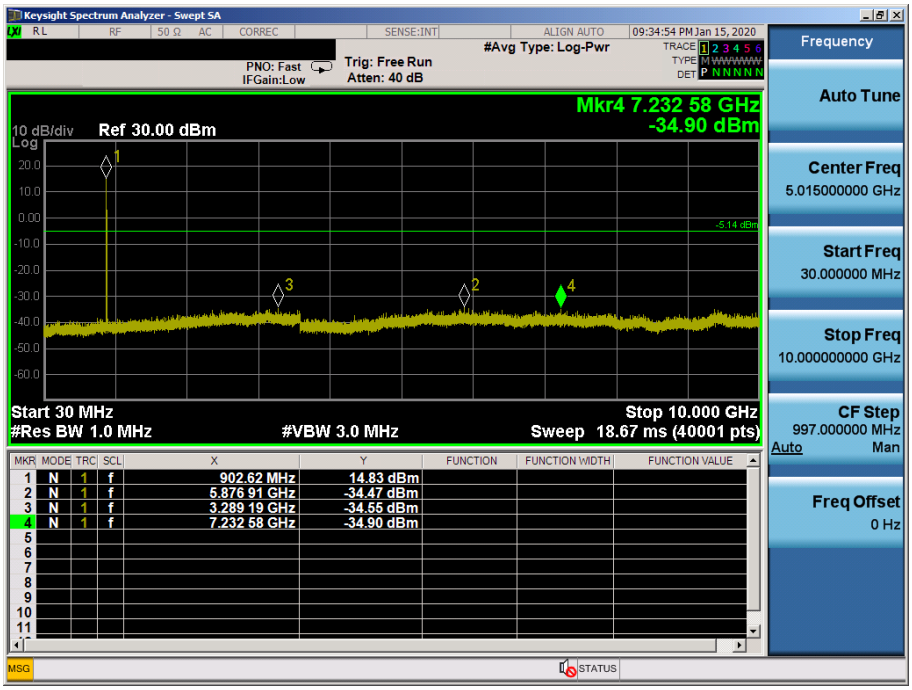
Low Band-edge ***Hopping mode***



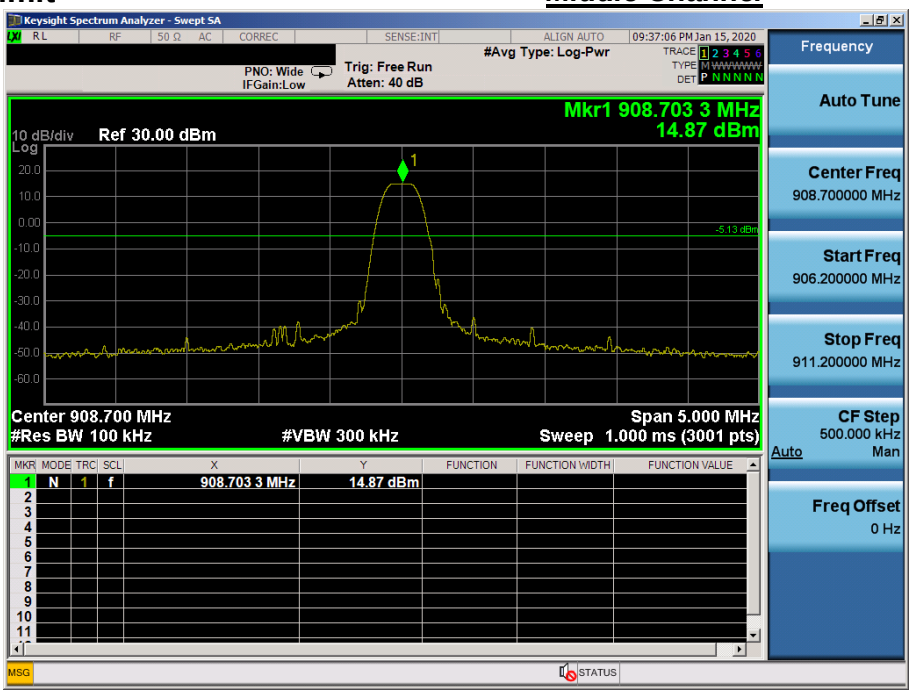
Conducted Spurious Emissions

Lowest Channel



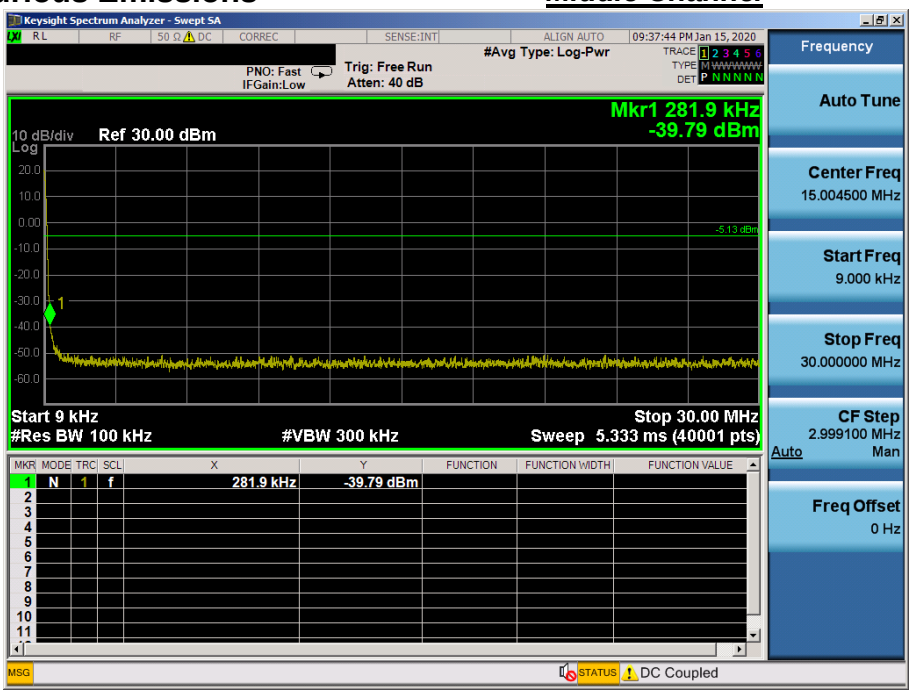


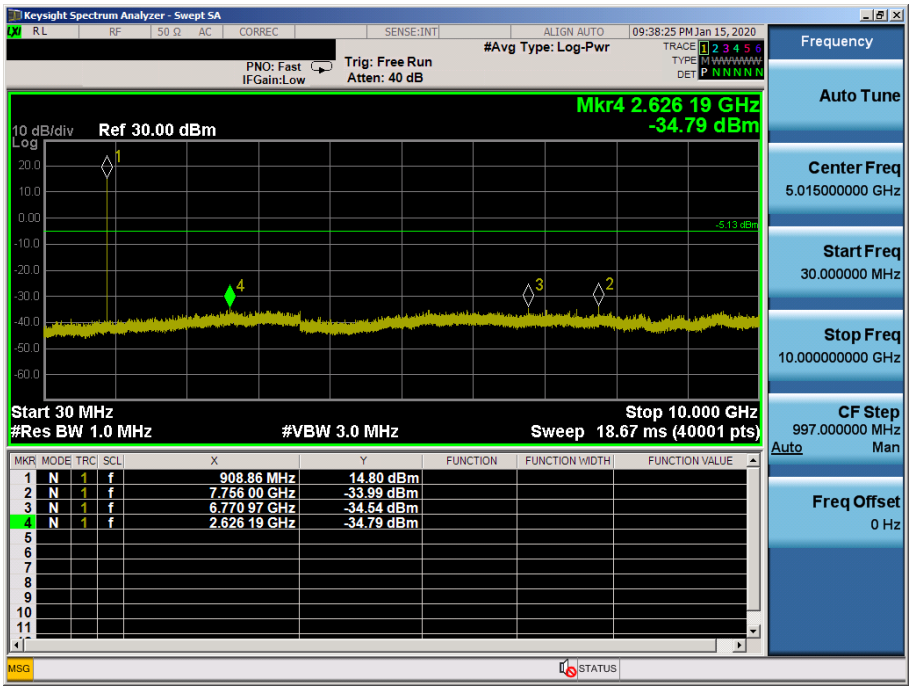
Reference for limit ***Middle Channel***



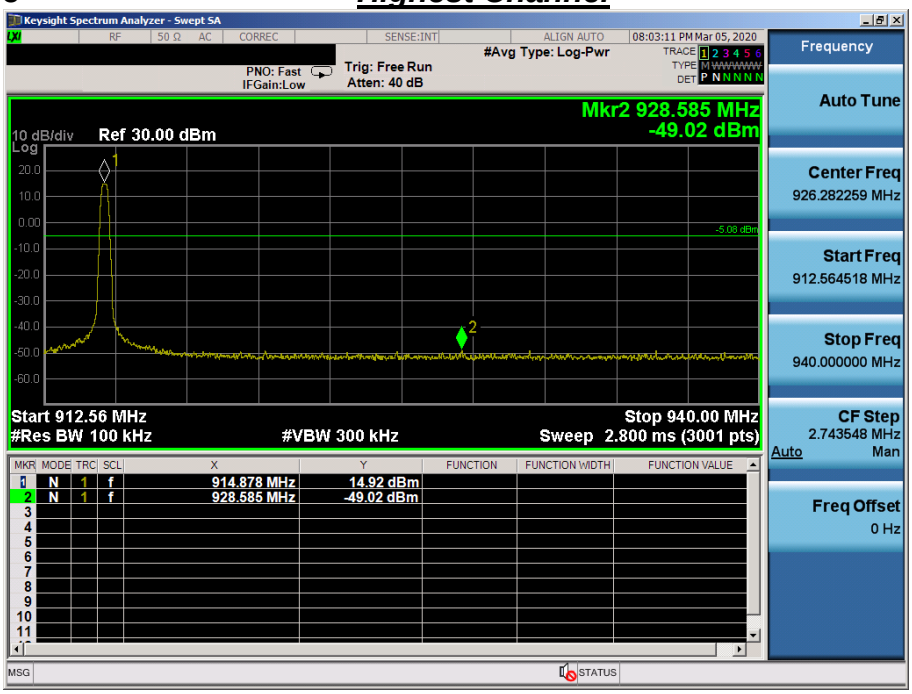
Conducted Spurious Emissions

Middle Channel

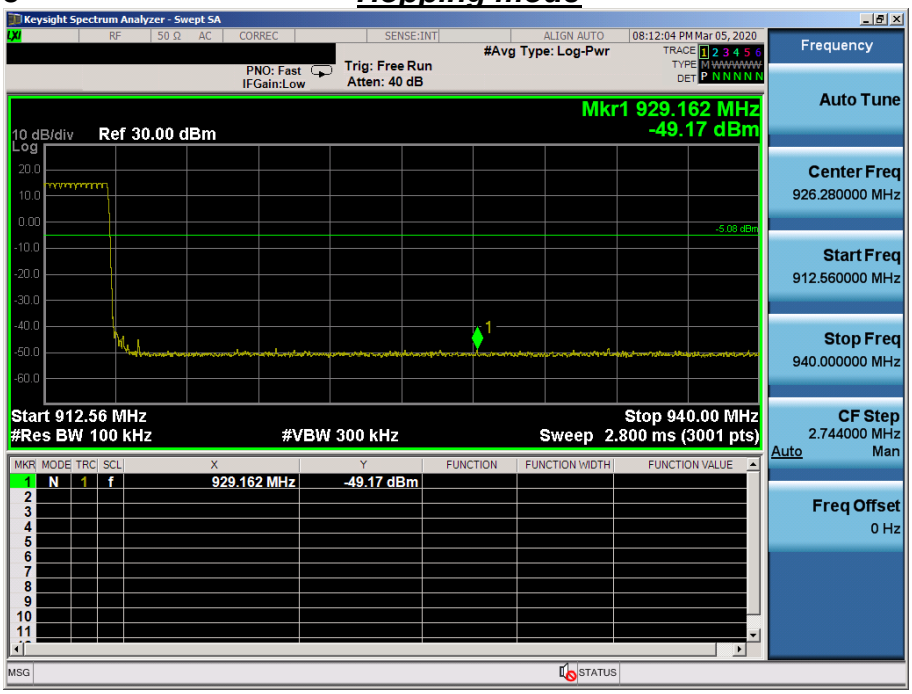




High Band-edge ***Highest Channel***

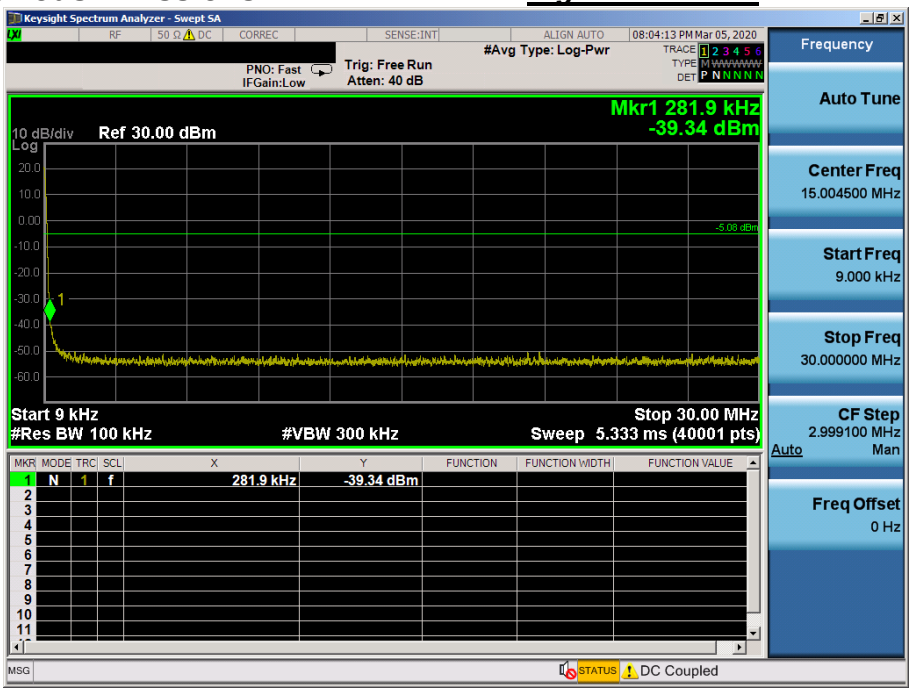


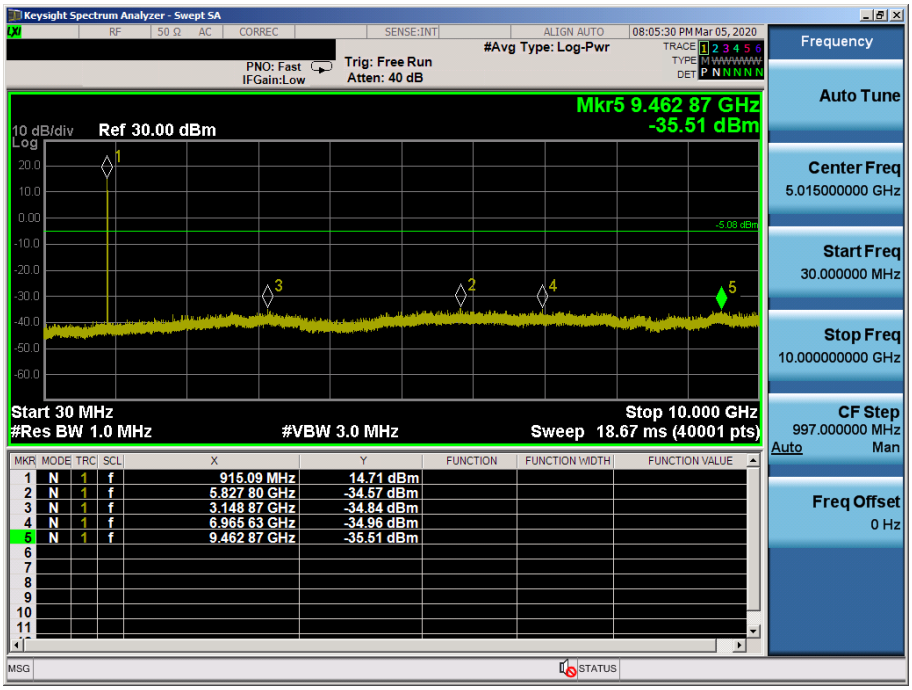
High Band-edge ***Hopping mode***



Conducted Spurious Emissions

Highest Channel





9. Transmitter AC Power Line Conducted Emission

9.1 Test Setup

See test photo graphs for the actual connections between EUT and support equipment.

9.2 Limit

According to §15.207(a) 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 or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

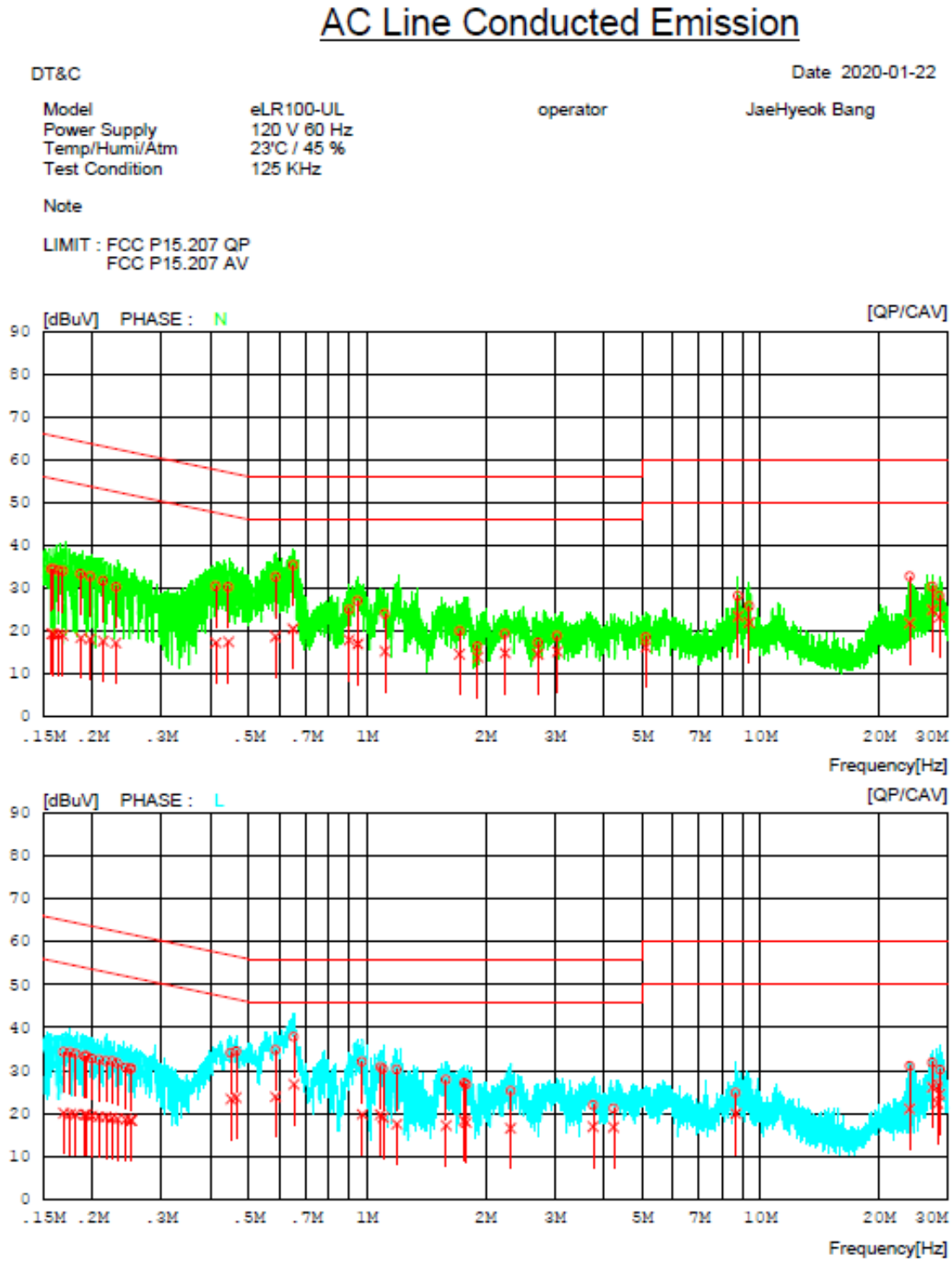
9.3 Test Procedures

Conducted emissions from the EUT were measured according to the ANSI C63.10.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

9.4. Test Results

AC Line Conducted Emissions (Graph) = Middle channel



AC Line Conducted Emissions (List) = Middle channel

AC Line Conducted Emission

DT&C

Date 2020-01-22

Model	eLR100-UL	operator	JaeHyeok Bang
Power Supply	120 V 60 Hz		
Temp/Humi/Atm	23'C / 45 %		
Test Condition	125 KHz		

Note

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING CAV	C.FACTOR	RESULT QP	RESULT CAV	LIMIT QP	LIMIT CAV	MARGIN QP	MARGIN CAV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15750	14.36	-0.63	20.02	34.38	19.39	65.59	55.59	31.21	36.20	N
2	0.15973	14.40	-0.77	20.06	34.46	19.29	65.48	55.48	31.02	36.19	N
3	0.16429	14.01	-0.96	20.12	34.13	19.16	65.24	55.24	31.11	36.08	N
4	0.16850	13.78	-1.16	20.19	33.97	19.03	65.03	55.03	31.06	36.00	N
5	0.18701	13.18	-1.70	20.09	33.27	18.39	64.17	54.17	30.90	35.78	N
6	0.19784	12.75	-1.91	20.01	32.76	18.10	63.70	53.70	30.94	35.60	N
7	0.21322	11.70	-2.31	19.95	31.65	17.64	63.08	53.08	31.43	35.44	N
8	0.23014	10.37	-2.68	19.88	30.25	17.20	62.44	52.44	32.19	35.24	N
9	0.41270	10.31	-2.93	20.19	30.50	17.26	57.59	47.59	27.09	30.33	N
10	0.44450	10.03	-2.78	20.20	30.23	17.42	56.98	46.98	26.75	29.56	N
11	0.58547	12.41	-1.53	20.24	32.65	18.71	56.00	46.00	23.35	27.29	N
12	0.64850	15.20	0.37	20.19	35.39	20.56	56.00	46.00	20.61	25.44	N
13	0.90109	4.86	-2.25	20.14	25.00	17.89	56.00	46.00	31.00	28.11	N
14	0.94781	6.94	-3.16	20.14	27.08	16.98	56.00	46.00	28.92	29.02	N
15	1.11093	3.87	-4.80	20.08	23.95	15.28	56.00	46.00	32.05	30.72	N
16	1.71843	-0.10	-5.49	20.07	19.97	14.58	56.00	46.00	36.03	31.42	N
17	1.91317	-3.70	-6.13	20.08	16.38	13.95	56.00	46.00	39.62	32.05	N
18	2.24405	-0.83	-5.22	20.10	19.27	14.88	56.00	46.00	36.73	31.12	N
19	2.72076	-2.82	-5.51	20.11	17.29	14.60	56.00	46.00	38.71	31.40	N
20	3.04814	-1.18	-4.88	20.08	18.90	15.20	56.00	46.00	37.10	30.80	N
21	5.11984	-1.71	-3.95	20.19	18.48	16.24	60.00	50.00	41.52	33.76	N
22	8.78387	7.43	2.81	20.70	28.13	23.51	60.00	50.00	31.87	26.49	N
23	9.37145	4.99	1.17	20.80	25.79	21.97	60.00	50.00	34.21	28.03	N
24	23.98642	12.04	1.11	20.69	32.73	21.80	60.00	50.00	27.27	28.20	N
25	27.37350	9.81	4.38	20.54	30.35	24.92	60.00	50.00	29.65	25.08	N
26	28.53584	7.63	2.65	20.54	28.17	23.19	60.00	50.00	31.83	26.81	N
27	0.16930	14.06	-0.19	20.20	34.26	20.01	64.99	54.99	30.73	34.98	L
28	0.17619	14.00	-0.32	20.16	34.16	19.84	64.66	54.66	30.50	34.82	L
29	0.18150	13.65	-0.42	20.12	33.77	19.70	64.42	54.42	30.65	34.72	L
30	0.19150	13.22	-0.35	20.06	33.28	19.71	63.97	53.97	30.69	34.26	L
31	0.19334	13.29	-0.36	20.04	33.33	19.68	63.89	53.89	30.56	34.21	L
32	0.19983	12.74	-0.71	20.00	32.74	19.29	63.62	53.62	30.88	34.33	L
33	0.20822	12.53	-0.81	19.97	32.50	19.16	63.28	53.28	30.78	34.12	L
34	0.21685	12.22	-0.81	19.93	32.15	19.12	62.94	52.94	30.79	33.82	L
35	0.22477	12.19	-1.06	19.90	32.09	18.84	62.64	52.64	30.55	33.80	L
36	0.23179	11.77	-1.22	19.87	31.64	18.65	62.39	52.39	30.75	33.74	L
37	0.24350	10.80	-1.34	19.84	30.64	18.50	61.98	51.98	31.34	33.48	L
38	0.25194	10.58	-1.48	19.81	30.39	18.33	61.69	51.69	31.31	33.36	L
39	0.25002	10.44	-1.49	19.81	30.25	18.32	61.76	51.76	31.51	33.44	L
40	0.45050	13.88	3.08	20.21	34.09	23.29	56.87	46.87	22.78	23.58	L
41	0.46482	14.16	3.48	20.22	34.38	23.70	56.61	46.61	22.23	22.91	L
42	0.58550	14.48	3.58	20.24	34.72	23.82	56.00	46.00	21.28	22.18	L
43	0.65174	17.62	6.55	20.19	37.81	26.74	56.00	46.00	18.19	19.26	L
44	0.97259	11.87	-0.42	20.14	32.01	19.72	56.00	46.00	23.99	26.28	L
45	1.08240	10.65	-0.39	20.10	30.75	19.71	56.00	46.00	25.25	26.29	L
46	1.09920	10.24	-1.07	20.09	30.33	19.02	56.00	46.00	25.67	26.98	L
47	1.19098	10.15	-2.59	20.05	30.20	17.46	56.00	46.00	25.80	28.54	L
48	1.58845	7.75	-2.86	20.06	27.81	17.20	56.00	46.00	28.19	28.80	L

10. Antenna Requirement

10.1 Procedure

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

10.2 Conclusion

: **Comply**

The antenna employs a unique antenna connector. (Refer to Internal Photo file.)
Therefore this EUT complies with the requirement of §15.203.

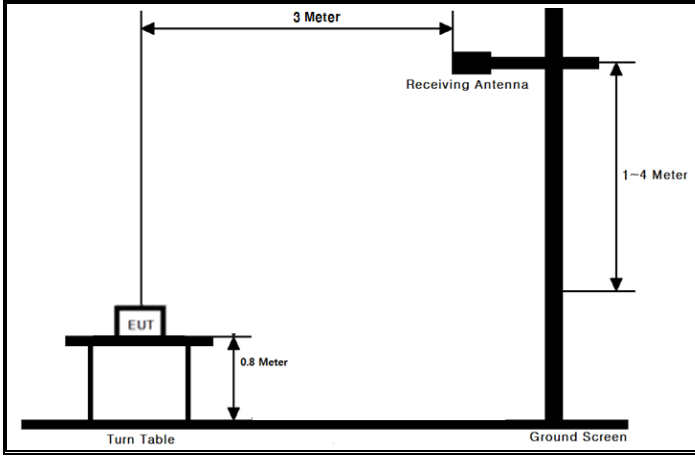
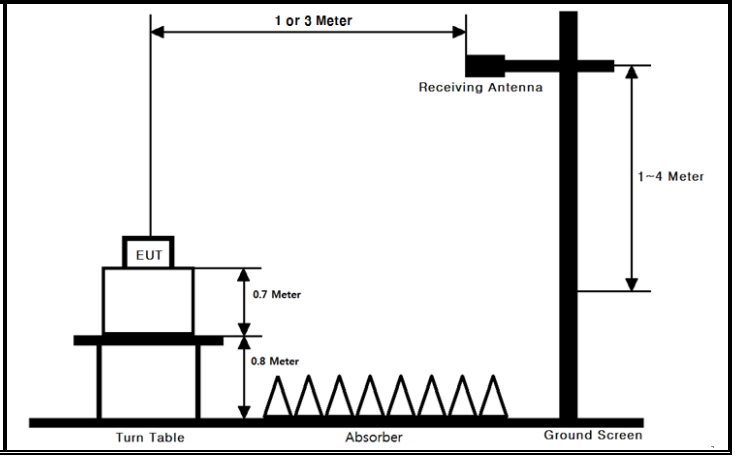
Minimum Standard:

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.

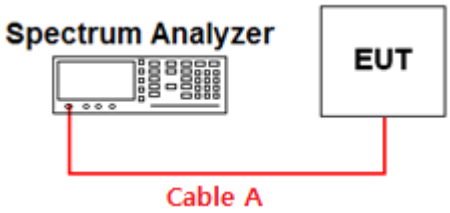
APPENDIX I

Test set up diagrams

- **Radiated Measurement**

Below 1GHz	Above 1GHz
	

- **Conducted Measurement**



Frequency (MHz)	Path Loss (dB)	Frequency (MHz)	Path Loss (dB)
30	0.66	5000	1.33
500	0.74	10000	2.09
902.3 & 908.7 & 914.9	0.95	-	-
1000	0.97	-	-

Note 1 : The path loss from EUT to Spectrum analyzer were measured and used for test.

Path loss (S/A's Correction factor) = Cable A

APPENDIX II

Unwanted Emissions (Radiated) Test Plot

Lowest & Y & Hor **Detector Mode : AV**