Test Report

Date : 2020-09-08
No. : HM20090001

Applicant: AB CIRCLE LIMITED
Room 609, Cross Office Uchisaiwaicho,
1-18-6, Nishi-Shimbashi, Minatoku,
Tokyo, Japan 105-003

Manufacturer: AB CIRCLE LIMITED
Room 609, Cross Office Uchisaiwaicho,
1-18-6, Nishi-Shimbashi, Minatoku,
Tokyo, Japan 105-003

Description of Sample(s): Submitted sample(s) said to be

Product:	Contactless Smart Card Reader
Brand Name:	AB Circle Limited
Model No.:	CIR415A
FCC ID:	2AUVM-CIR415A

Date Samples Received: 2020-07-02

Date Tested: 2020-08-24 to 2020-08-27

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2018 and ANSI C63.10:2013 for FCC Certification.

Conclusions: The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remarks: Bluetooth Low Energy (BLE) only

LEUNG Kwun Hang, Joey
Authorized Signatory

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1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
Head Office: 10 Dai Wang Street, Taipo Industrial Estate, Tai Po, N.T., Hong Kong
Telephone: 852 2666 1888
Fax: 852 2664 4353

1.2 Equipment Under Test [EUT]

Description of Sample(s)

Product:	Contactless Smart Card Reader
Manufacturer:	AB CIRCLE LIMITED Room 609, Cross Office Uchisaiwaicho, 1-18-6, Nishi-Shimbashi, Minatoku, Tokyo, Japan 105-003
Brand Name:	AB Circle Limited
Model Number:	CIR415A
Rating:	5Vd.c of USB port of EUT PC=120Va.c.

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a 2.4GHz BLE RFID Card reader. The tests were conducted under RF Test mode to maintain continuous transmission (>98% duty cycle) during test. The transmission signal is digital modulated with channel frequency range 2402-2480MHz. The R.F. signal was modulated by IC; the type of modulation used was GFSK. The testing frequency was controlled by test software - nRFgo Studio used during tests.

1.3 Date of Order

2020-07-02

1.4 Submitted Sample(s):

2 Samples

1.5 Test Duration

2020-08-24 to 2020-08-27

1.6 Country of Origin

China

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1.7 RF Module Details

Module Model Number: nRF52832
Module FCC ID: N/A
Module Transmission Type: Bluetooth Low Energy (BLE)
Modulation: GFSK
Data Rates: 1Mbps (Max)
Frequency Range: 2400-2483.5MHz
Carrier Frequencies: 2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

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2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2018 Regulations and ANSI C63.10:2013 for FCC Certification.
According FCC KDB 558074 DTS Measurement Guidance, Duty cycle ≧98%.
The device was realized by test software.

2.2 Test Standards and Results Summary Tables

EMISSION
Results Summary

Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Maximum Peak Output Power	FCC 47CFR 15.247(b)(3)	ANSI C63.10: 2013	N/A	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A	☒	☐	☐
Power Spectral Density	FCC 47CFR 15.247(e)	ANSI C63.10: 2013	N/A	☒	☐	☐
6dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	☒	☐	☐
Band Edge Emissions (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐
RF Exposure	FCC 47CFR 15.247(i)	N/A	N/A	☒	☐	☐

Note: N/A - Not Applicable

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3.0 Test Results

3.1 Emission

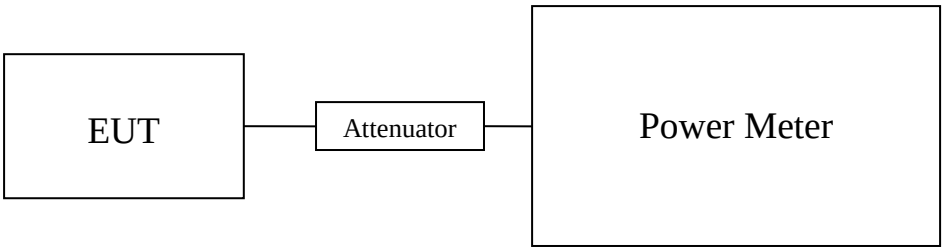
3.1.1 Maximum Peak Output Power

Test Requirement:	FCC 47CFR 15.247(b)(3)
Test Method:	ANSI C63.10: 2013
Test Date:	2020-08-24
Mode of Operation:	Tx mode

Test Method:

The RF output of the EUT was connected to the Power Meter. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in Watt.

Test Setup:



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Limits for Peak Output Power of Fundamental & Harmonics Emissions [FCC 47CFR 15.247]:

For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt (30dBm)

Results of Tx Mode: Pass (TX Unit)
Maximum conducted peak power (EIRP)

Channel	Frequency(MHz)	Output Power(Watt)
0	2402	0.00170
19	2440	0.00103
39	2480	0.00074

Calculated measurement uncertainty	:	30MHz to 1GHz	4.4dB
		1GHz to 26GHz	4.6dB

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3.1.2 Radiated Emissions

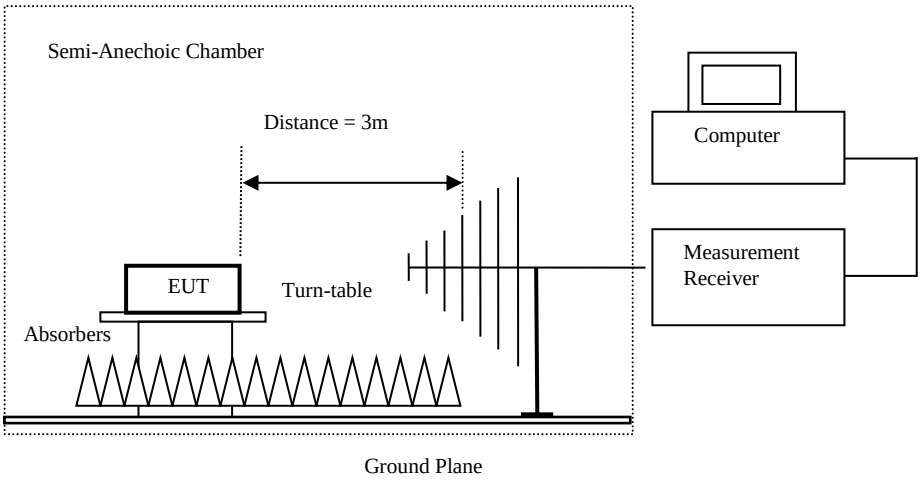
Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2020-08-27
Mode of Operation:	Tx mode

Test Method:

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The measured field strength would be calculated as EIRP.

Semi-anechoic chamber located at STC filed with Industry Canada File Number: 4789A

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.
-For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

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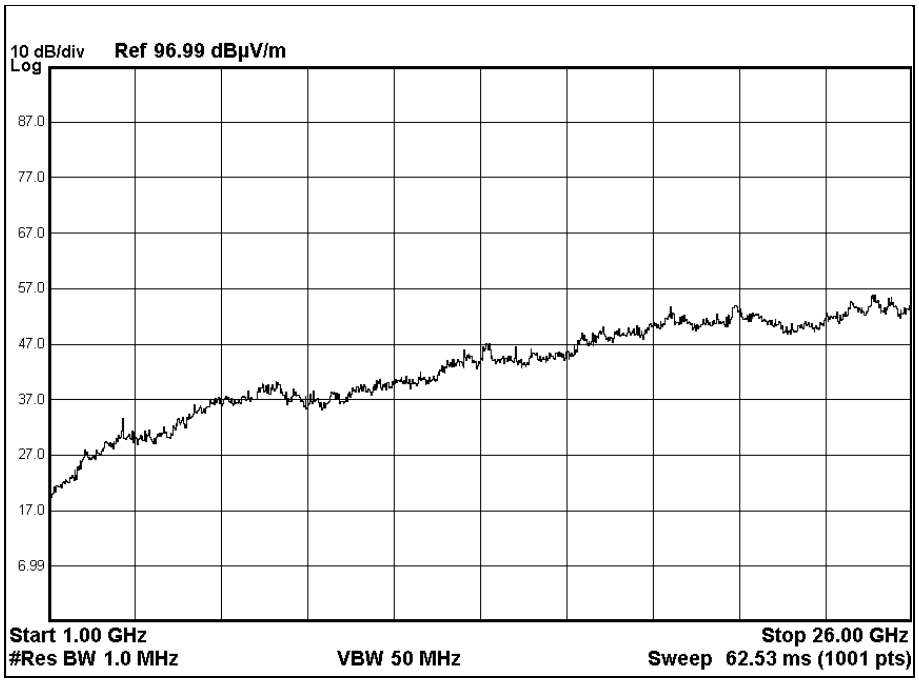
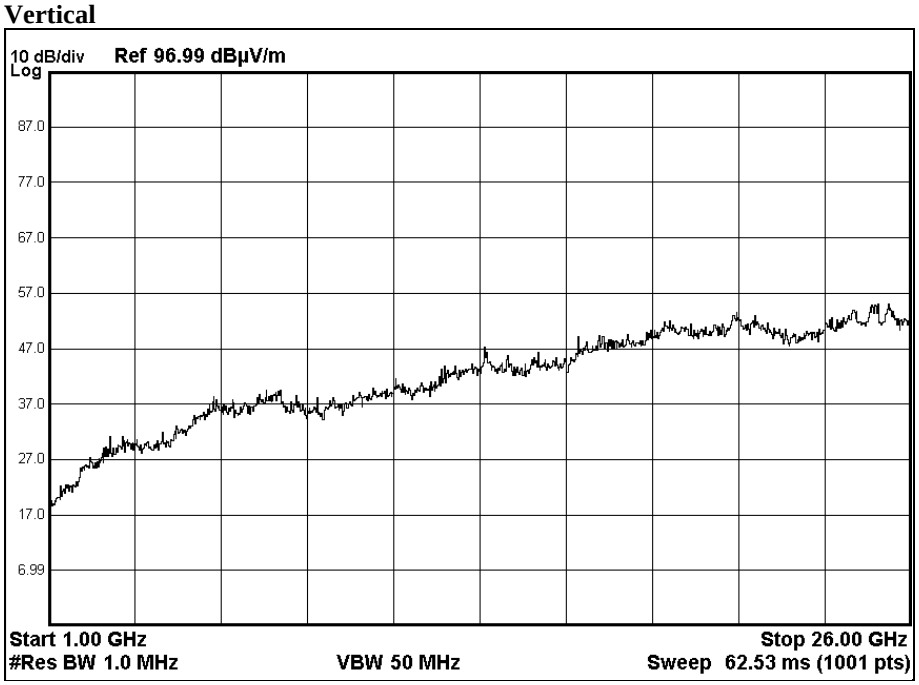
Result of Tx mode (2402.0 MHz)
Horizontal



Vertical



Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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Result of Tx mode (2402.0 MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-1.3	32.1	30.8	74.0	43.2	Vertical
7206.0	-2.3	38.6	36.3	74.0	37.7	Vertical
9608.0	-3.7	41.3	37.6	74.0	36.4	Vertical
12010.0	-3.4	43.5	40.1	74.0	33.9	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-4.1	32.1	28.0	54.0	26.0	Vertical
7206.0	-6.1	38.6	32.5	54.0	21.5	Vertical
9608.0	-6.6	41.3	34.7	54.0	19.3	Vertical
12010.0	-6.7	43.5	36.8	54.0	17.2	Vertical

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-3.1	32.1	29.0	74.0	45.0	Horizontal
7206.0	-3.2	38.6	35.4	74.0	38.6	Horizontal
9608.0	-3.8	41.3	37.5	74.0	36.5	Horizontal
12010.0	-3.6	43.5	39.9	74.0	34.1	Horizontal

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-4.3	32.1	27.8	54.0	26.2	Horizontal
7206.0	-5.9	38.6	32.7	54.0	21.3	Horizontal
9608.0	-6.8	41.3	34.5	54.0	19.5	Horizontal
12010.0	-6.7	43.5	36.8	54.0	17.2	Horizontal

Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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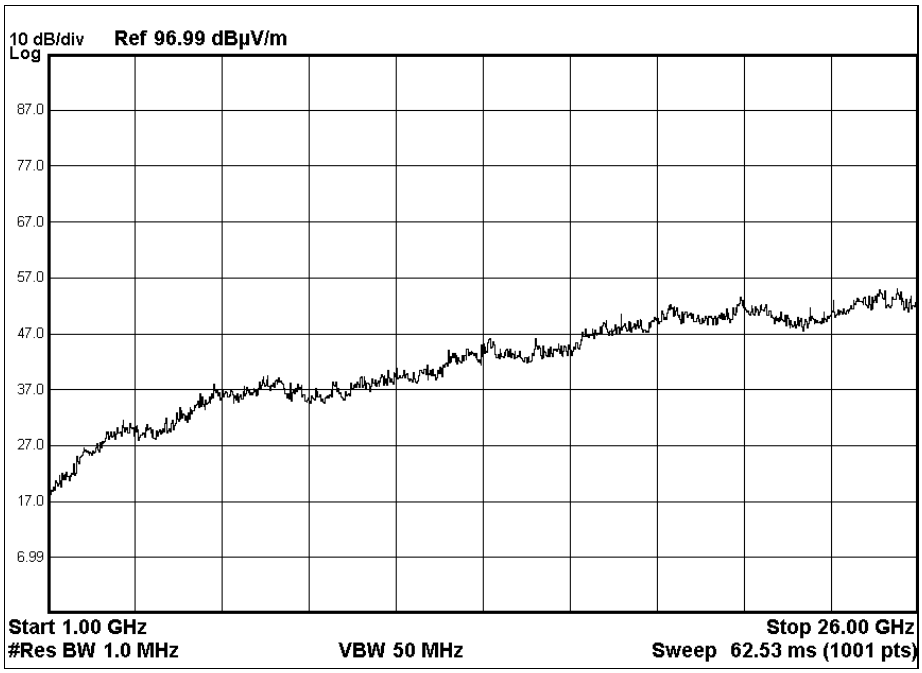
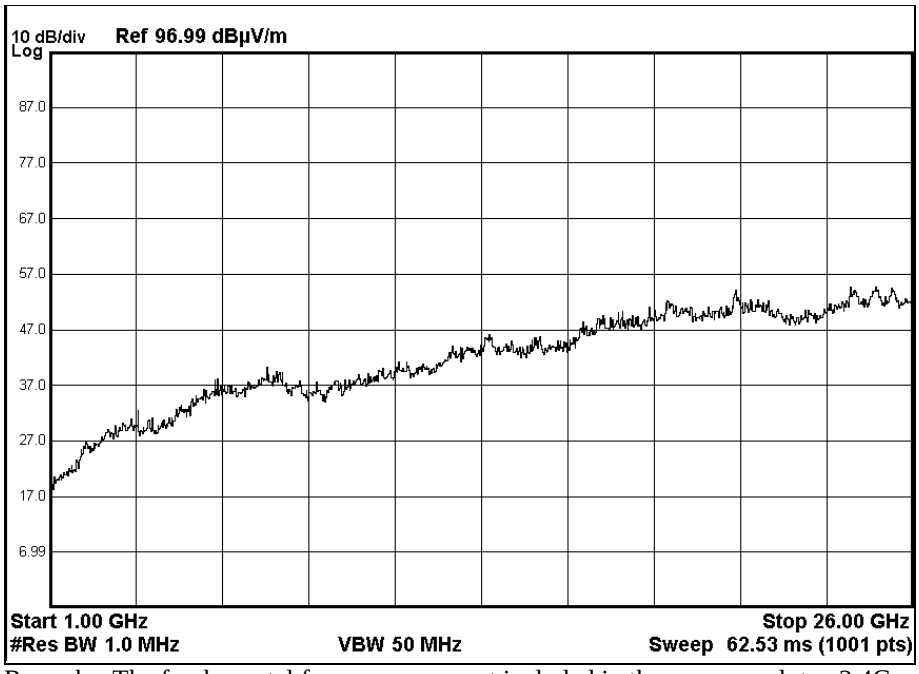
Result of Tx mode (2440.0 MHz)
Horizontal



Vertical



Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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Result of Tx mode (2440.0 MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4880.0	-3.6	32.1	28.5	74.0	45.5	Vertical
7320.0	-3.8	38.6	34.8	74.0	39.2	Vertical
9760.0	-4.6	41.3	36.7	74.0	37.3	Vertical
12200.0	-4.2	43.5	39.3	74.0	34.7	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4880.0	-5.8	32.1	26.3	54.0	27.7	Vertical
7320.0	-6.3	38.6	32.3	54.0	21.7	Vertical
9760.0	-5.7	41.3	35.6	54.0	18.4	Vertical
12200.0	-6.8	43.5	36.7	54.0	17.3	Vertical

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4880.0	-3.6	32.1	28.5	74.0	45.5	Vertical
7320.0	-3.8	38.6	34.8	74.0	39.2	Vertical
9760.0	-4.6	41.3	36.7	74.0	37.3	Vertical
12200.0	-4.2	43.5	39.3	74.0	34.7	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4880.0	-5.8	32.1	26.3	54.0	27.7	Vertical
7320.0	-6.3	38.6	32.3	54.0	21.7	Vertical
9760.0	-5.7	41.3	35.6	54.0	18.4	Vertical
12200.0	-6.8	43.5	36.7	54.0	17.3	Vertical

Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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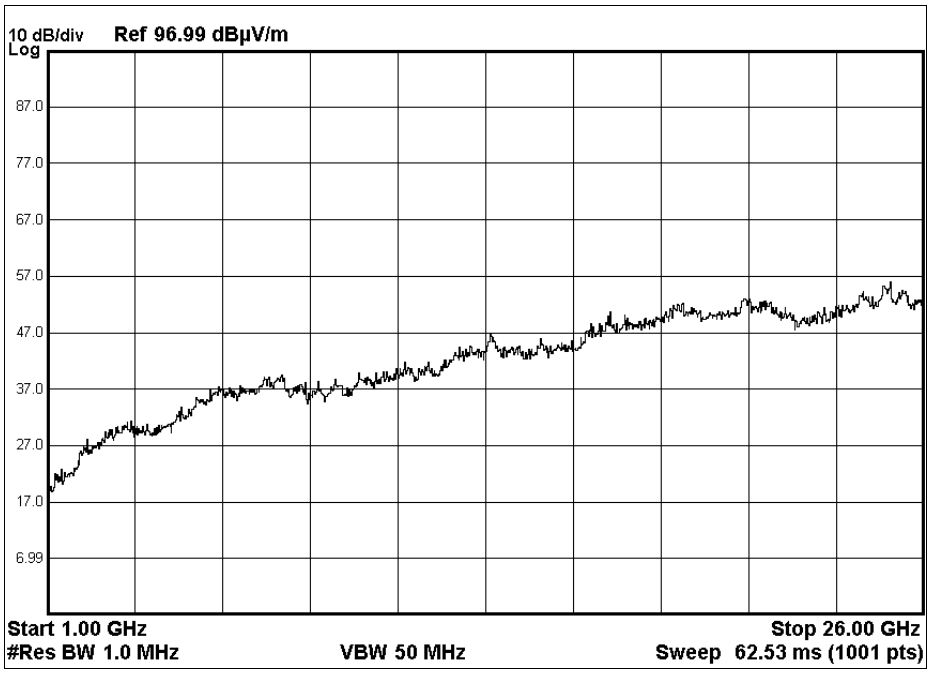
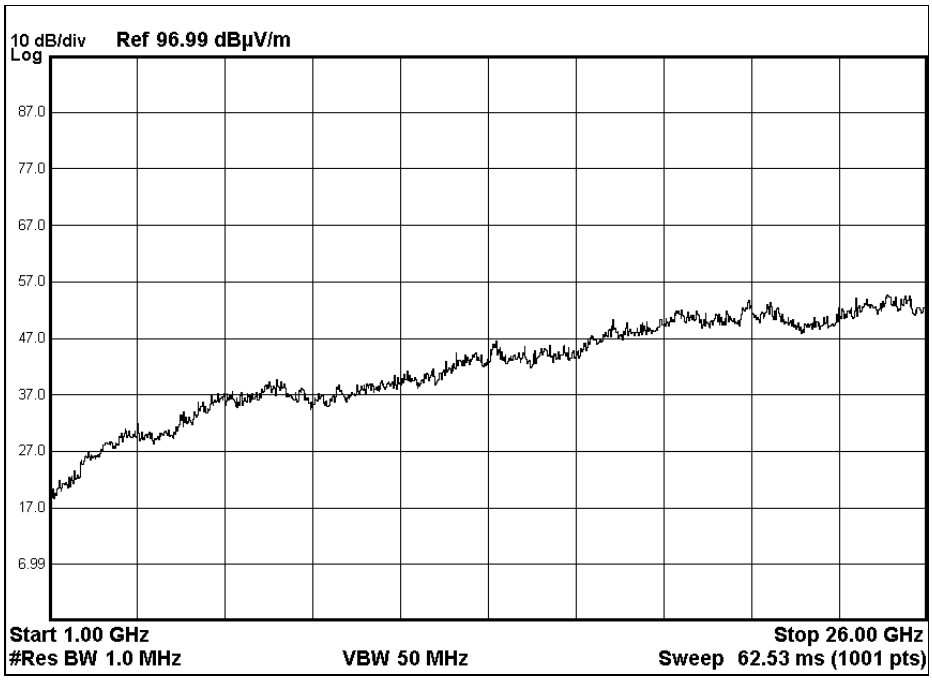
Result of Tx mode (2480.0 MHz)
Horizontal



Vertical



Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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Result of Tx mode (2480.0 MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-3.4	32.2	28.8	74.0	45.2	Vertical
7440.0	-4.9	38.6	33.7	74.0	40.3	Vertical
9920.0	-5.1	42.1	37.0	74.0	37.0	Vertical
12400.0	-5.6	44.1	38.5	74.0	35.5	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-5.3	32.2	26.9	54.0	27.1	Vertical
7440.0	-6.7	38.6	31.9	54.0	22.1	Vertical
9920.0	-6.1	42.1	36.0	54.0	18.0	Vertical
12400.0	-6.3	44.1	37.8	54.0	16.2	Vertical

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-3.4	32.2	28.8	74.0	45.2	Vertical
7440.0	-4.9	38.6	33.7	74.0	40.3	Vertical
9920.0	-5.1	42.1	37.0	74.0	37.0	Vertical
12400.0	-5.6	44.1	38.5	74.0	35.5	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-5.3	32.2	26.9	54.0	27.1	Vertical
7440.0	-6.7	38.6	31.9	54.0	22.1	Vertical
9920.0	-6.1	42.1	36.0	54.0	18.0	Vertical
12400.0	-6.3	44.1	37.8	54.0	16.2	Vertical

Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

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Remarks:
No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz
* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty	:	9kHz-30MHz	3.3dB
		30MHz -1GHz	4.6dB
		1GHz -26GHz	4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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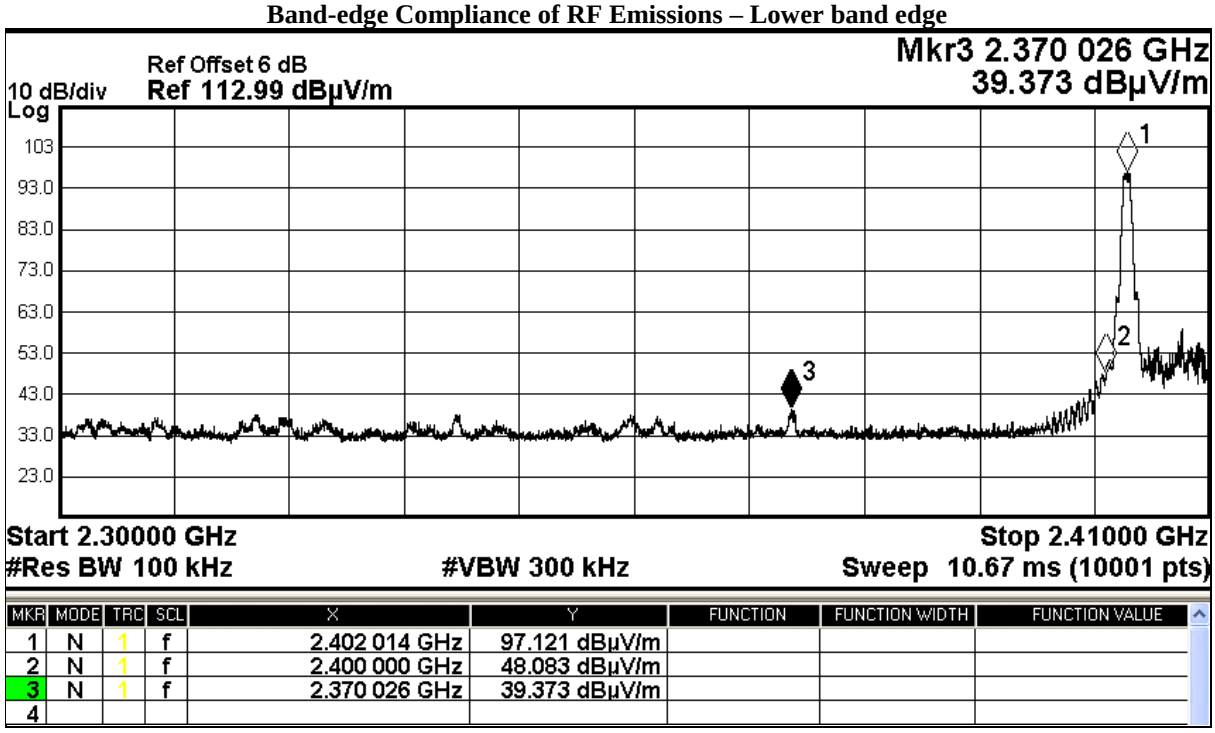
Band Edge Measurement:
Limit：
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).

Frequency Range [MHz]	Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	49.0

Band-edge Compliance of RF Emissions – Lower band edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.402 014 GHz	97.121 dBµV/m			
2	N	1	f	2.400 000 GHz	48.083 dBµV/m			
3	N	1	f	2.370 026 GHz	39.373 dBµV/m			
4								

Remarks: Test plots shown the pre-scan information, please refer the Field Strength of Band edge Emission for final measurement result.

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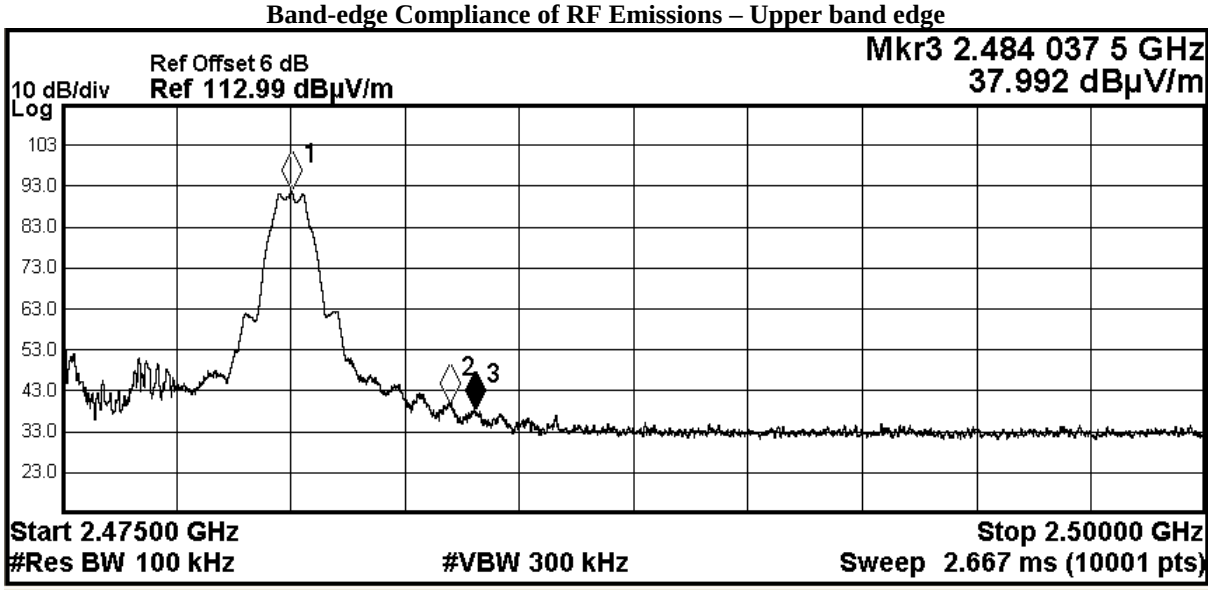
Band-edge Compliance of RF Emissions Measurement:

Frequency Range [MHz]	Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	52.0

Band-edge Compliance of RF Emissions – Upper band edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.480 012 5 GHz	91.843 dBµV/m			
2	N	1	f	2.483 500 0 GHz	39.849 dBµV/m			
3	N	1	f	2.484 037 5 GHz	37.992 dBµV/m			
4								

Remarks: Test plots shown the pre-scan information, please refer the Field Strength of Band edge Emission for final measurement result.

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Radiated Emissions Band-edge and Restricted Band Result:

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
2370.0	11.5	27.9	39.4	74.0	34.6	Vertical
2484.0	10.1	27.9	38.0	74.0	36.0	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
2370.0	1.1	27.9	29.0	54.0	25.0	Vertical
2484.0	0.9	27.9	28.8	54.0	25.2	Vertical

Remarks: Test plots shown the pre-scan information, please refer the Field Strength of Band edge Emission for final measurement result.

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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of Tx mode (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the Limits						

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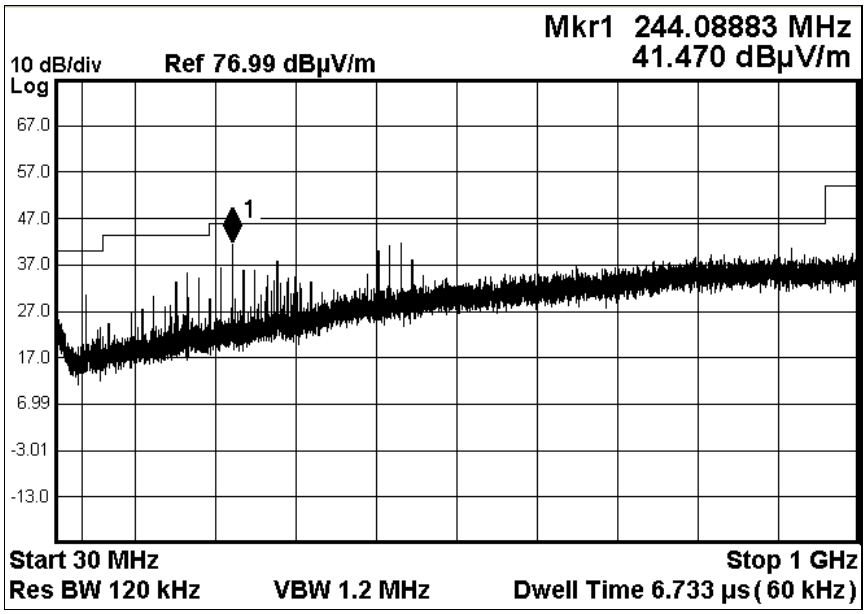
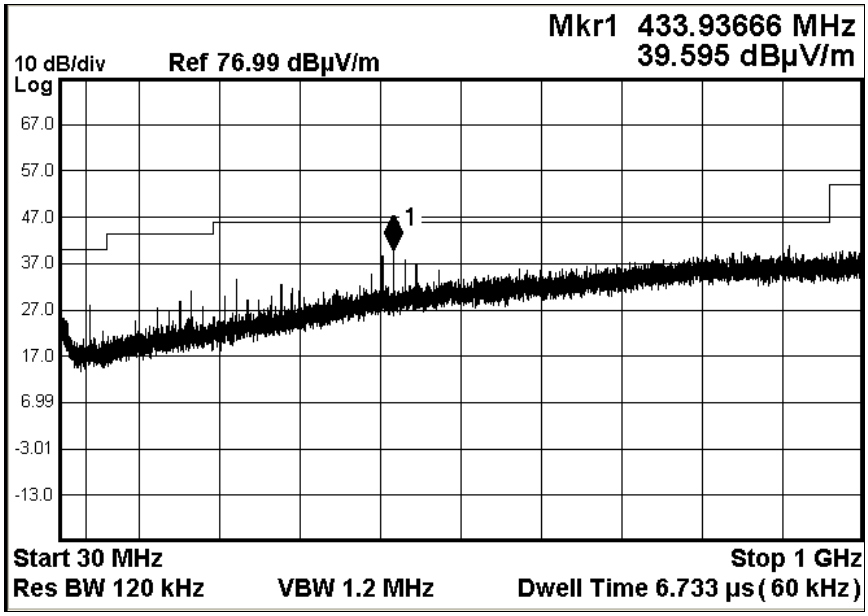
Pre-scan result of Tx mode (30MHz – 1GHz):
Horizontal



Vertical



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Result of Tx mode (30MHz – 1GHz): PASS

Field Strength of Fundamental and Harmonics Emissions Quasi-Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
168.0	27.3	10.0	37.3	73.3	100	Horizontal
191.3	28.3	10.3	38.6	85.1	150	Horizontal
230.2	28.4	12.0	40.4	104.7	150	Horizontal
243.8	28.6	12.6	41.2	114.8	200	Horizontal
434.0	25.4	17.5	42.9	139.6	200	Horizontal
664.5	20.2	18.2	38.4	83.2	200	Vertical

Remarks:

The pre-scan results are for reference, the frequencies found will perform final measurement which shown on the table below the graphs, therefore, there may be some different in measured frequencies and field strength shown on the graph and the table.

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : (9kHz – 30MHz): 2.4dB
(30MHz – 18GHz): 5.0dB
(18GHz - 26GHz): 5.24dB

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3.1.4 Power Spectral Density

Test Requirement:	FCC 47CFR 15.247(e)
Test Method:	ANSI C63.10:2013
Test Date:	2020-08-24
Mode of Operation:	Tx mode

Test Method:

The RF output of the EUT was connected to the spectrum analyzer. Set the fundamental frequency as the center frequency of the spectral analyzer. Use RBW=3kHz , VBW= 10kHz , Set the span to 1.5 times the DTS channel bandwidth. Detector = peak, Sweep time = auto couple , Trace mode = max hold.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

Test Limit:
The maximum power spectral density (PSD) shall not exceeded 8dBm in any 3kHz band.

Results of Tx mode : Pass
Maximum power spectral density

Transmitter Frequency (MHz)	Maximum Power spectral density level / 3kHz band (dBm)	Maximum Power spectral density / 3kHz band limit
2402.0	-25.6	**8dBm**
2440.0	-28.2	**8dBm**
2480.0	-30.5	**8dBm**

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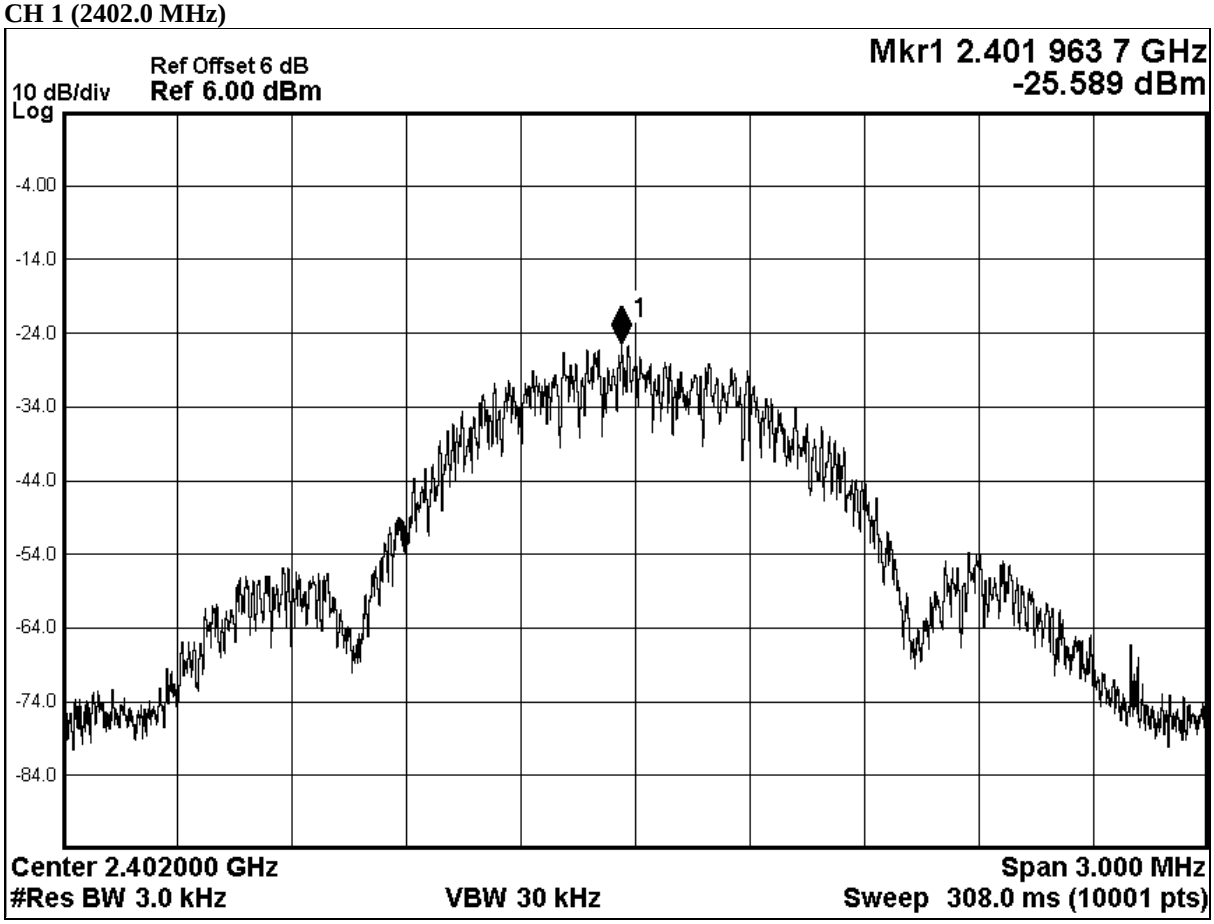
Tx mode
CH 1 (2402.0 MHz)



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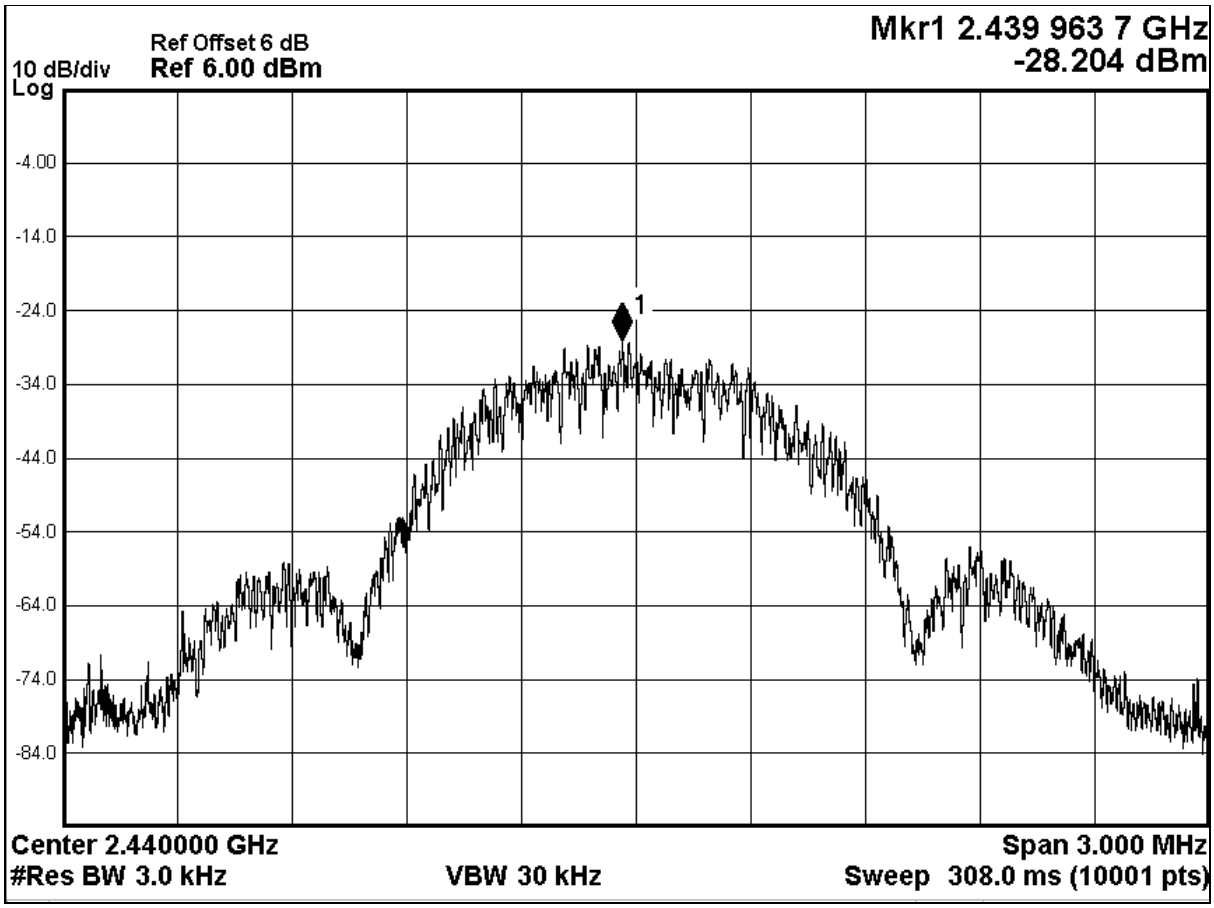
Tx mode
CH 7 (2440.0 MHz)



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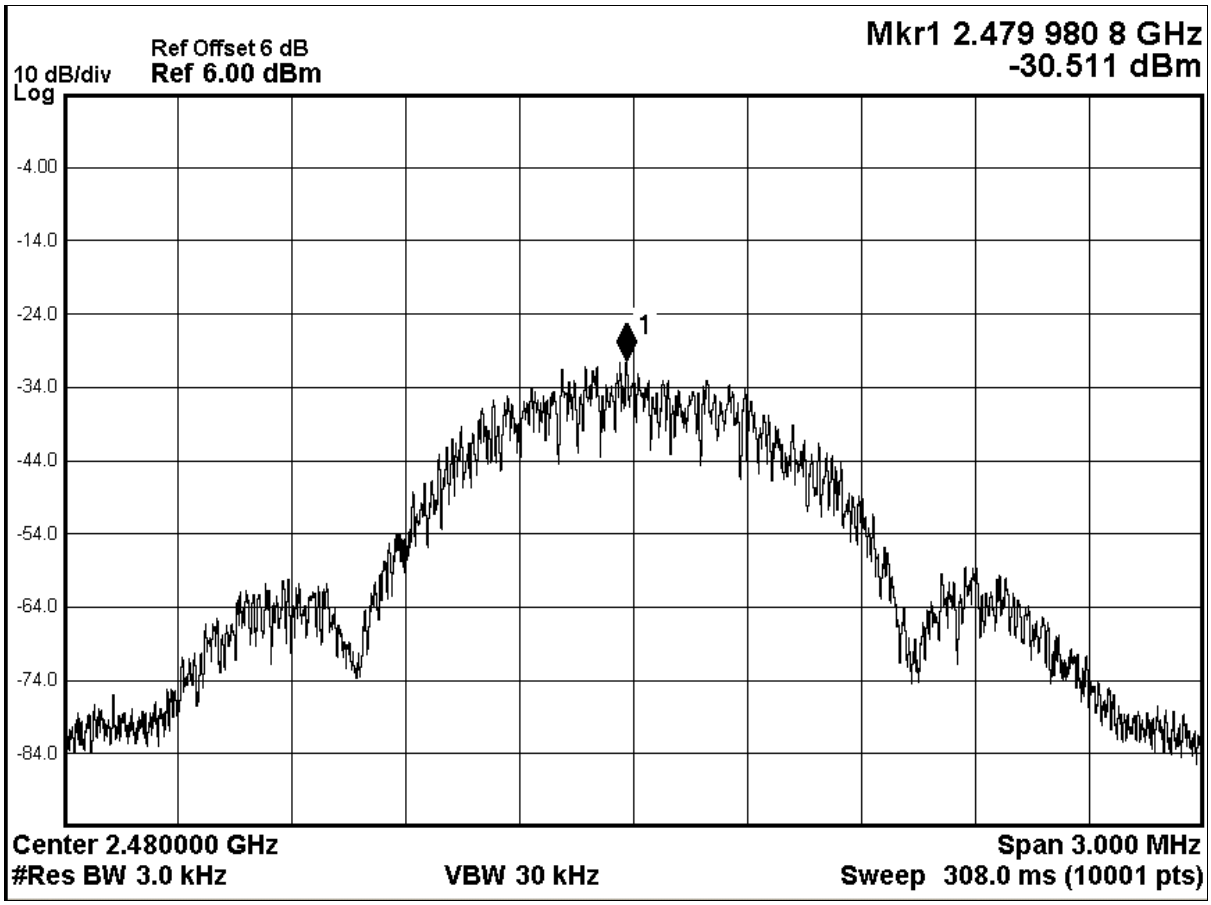
Tx mode
CH 13 (2480.0 MHz)



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3.1.5 6dB Spectrum Bandwidth Measurement

Test Requirement:	FCC 47CFR 15.247(a)(2)
Test Method:	ANSI C63.10:2013
Test Date:	2020-08-27
Mode of Operation:	Tx mode

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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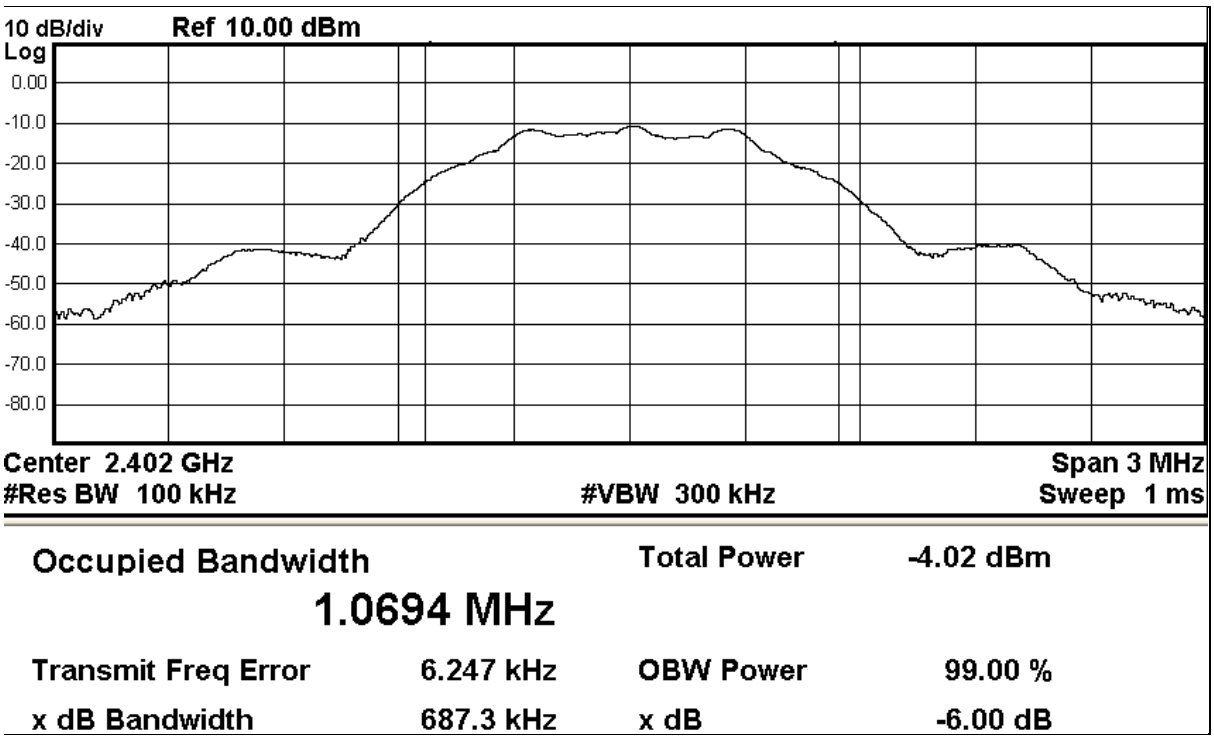
Limits for 6dB Spectrum Bandwidth Measurement:

Center Frequency [MHz]	6dB Bandwidth [kHz]	FCC Limits [kHz]
2402.0	687.3	> 500

6dB Bandwidth of Fundamental Emission on 802.11b (2402MHz)



Occupied Bandwidth		Total Power	-4.02 dBm
1.0694 MHz			
Transmit Freq Error	6.247 kHz	OBW Power	99.00 %
x dB Bandwidth	687.3 kHz	x dB	-6.00 dB

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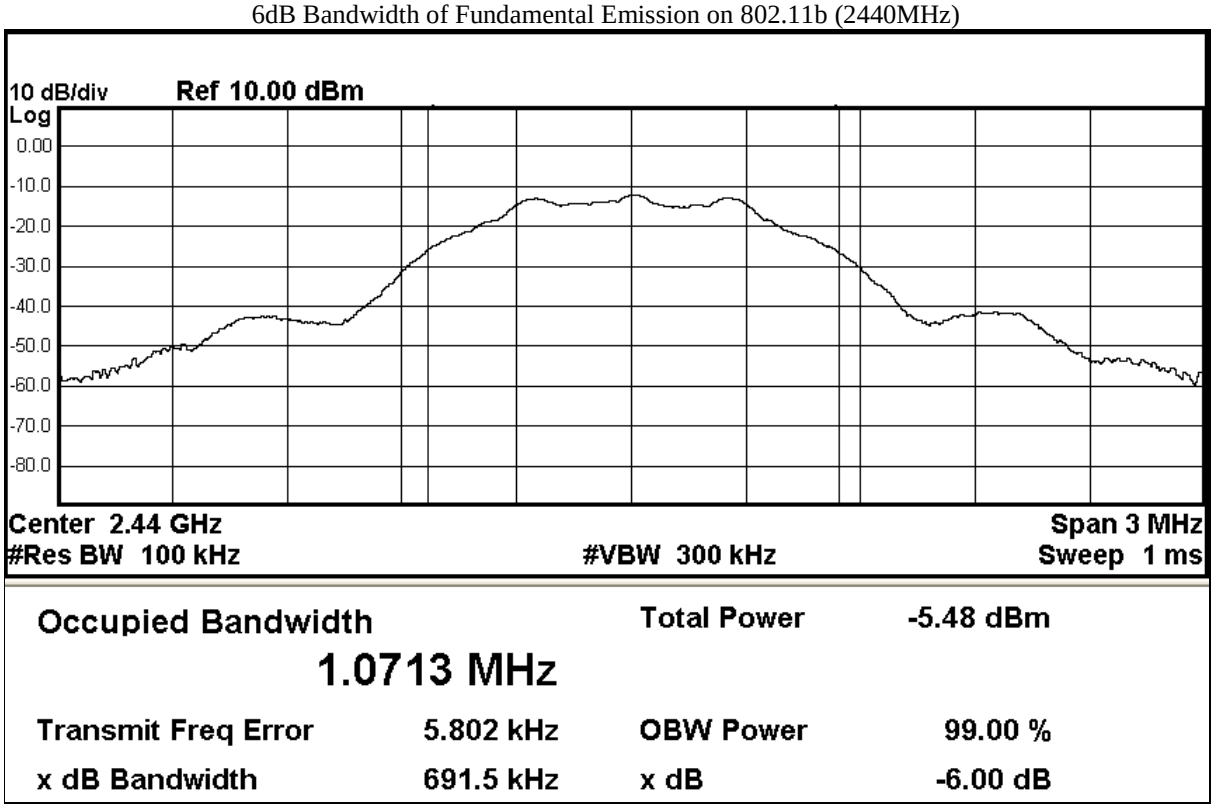
Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [kHz]	FCC Limits [kHz]
2440.0	691.5	> 500

6dB Bandwidth of Fundamental Emission on 802.11b (2440MHz)



Occupied Bandwidth		Total Power	-5.48 dBm
1.0713 MHz			
Transmit Freq Error	5.802 kHz	OBW Power	99.00 %
x dB Bandwidth	691.5 kHz	x dB	-6.00 dB

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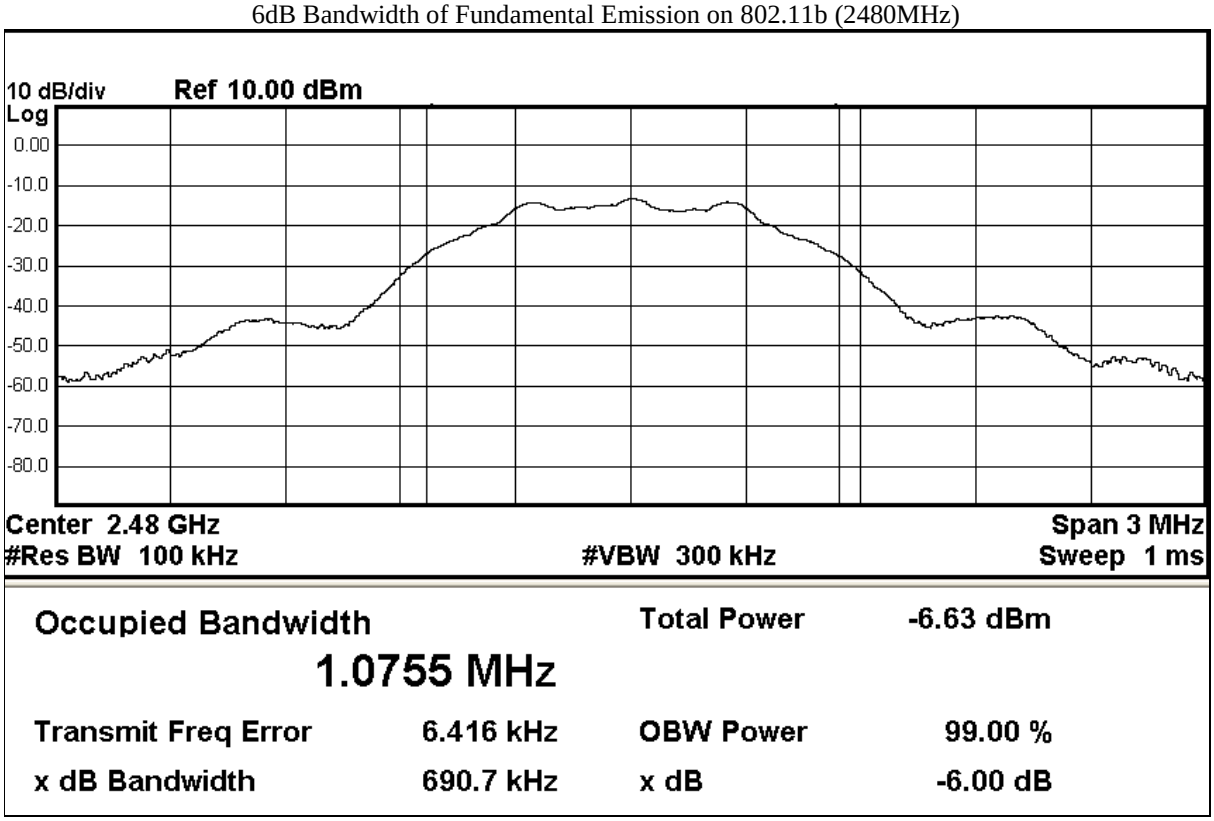
Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [kHz]	FCC Limits [kHz]
2480.0	690.7	> 500

6dB Bandwidth of Fundamental Emission on 802.11b (2480MHz)



Occupied Bandwidth		Total Power	-6.63 dBm
1.0755 MHz			
Transmit Freq Error	6.416 kHz	OBW Power	99.00 %
x dB Bandwidth	690.7 kHz	x dB	-6.00 dB

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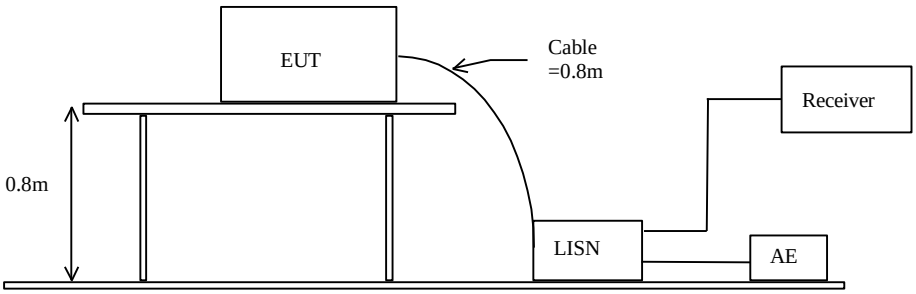
3.1.7 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207 Class B
Test Method:	ANSI C63.10: 2013
Test Date:	2020-07-09
Mode of Operation:	*TX mode connected to PC

Test Method:

The test was performed in accordance with ANSI C63.10: 2013, with the following: initial measurements were performed in peak and average detection modes on the live line, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



Remarks: The antenna (13.56MHz, RFID) of the EUT was terminated with 50 ohm resistive load

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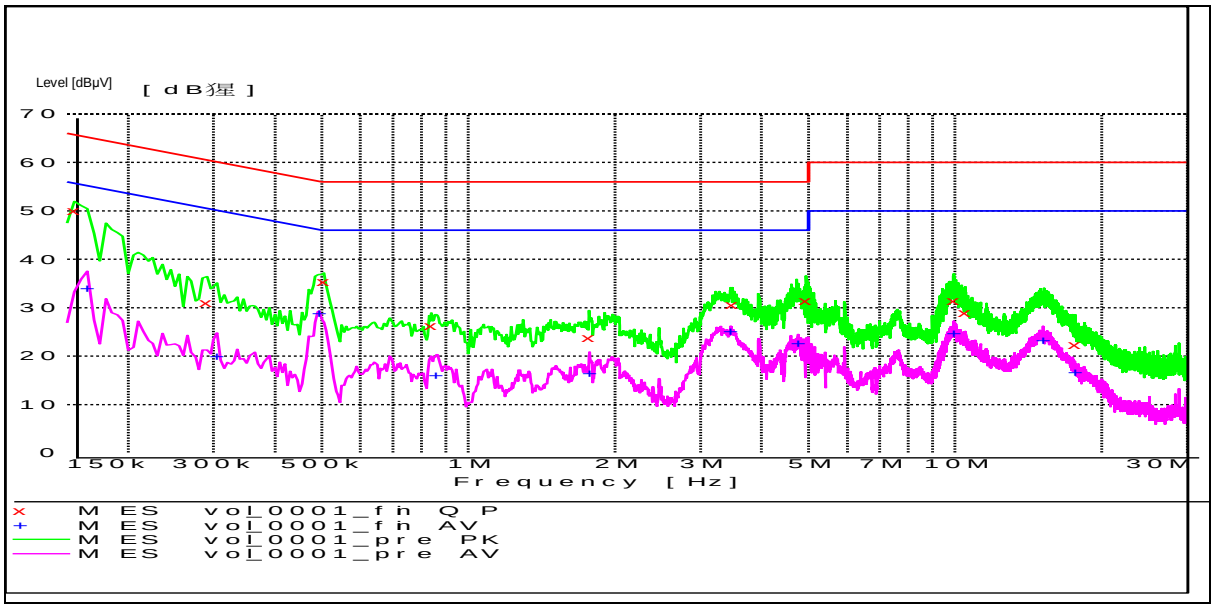
Limits for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of TX mode (Neutral): PASS
Please refer to the following diagram for individual results.



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MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.150000	48.10	9.9	66	17.9	L1	GND
0.260000	33.10	9.9	61	28.3	L1	GND
0.495000	35.00	10.0	56	21.1	L1	GND
0.905000	25.00	10.0	56	31.0	L1	GND
1.790000	24.00	10.0	56	32.0	L1	GND
3.360000	30.60	10.1	56	25.4	L1	GND
3.940000	26.10	10.2	56	29.9	L1	GND
9.950000	30.90	10.4	60	29.1	L1	GND
10.415000	29.30	10.5	60	30.7	L1	GND
17.835000	20.70	10.3	60	39.3	L1	GND

MEASUREMENT RESULT: "vol_0001_fin AV"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.150000	29.90	9.9	56	26.1	L1	GND
0.360000	21.50	10.0	49	27.3	L1	GND
0.500000	28.30	10.0	46	17.7	L1	GND
0.895000	18.30	10.0	46	27.7	L1	GND
1.970000	16.10	10.0	46	29.9	L1	GND
3.360000	25.90	10.1	46	20.1	L1	GND
3.955000	19.40	10.2	46	26.6	L1	GND
9.930000	24.60	10.4	50	25.4	L1	GND
10.425000	23.40	10.5	50	26.6	L1	GND
17.825000	14.80	10.3	50	35.2	L1	GND

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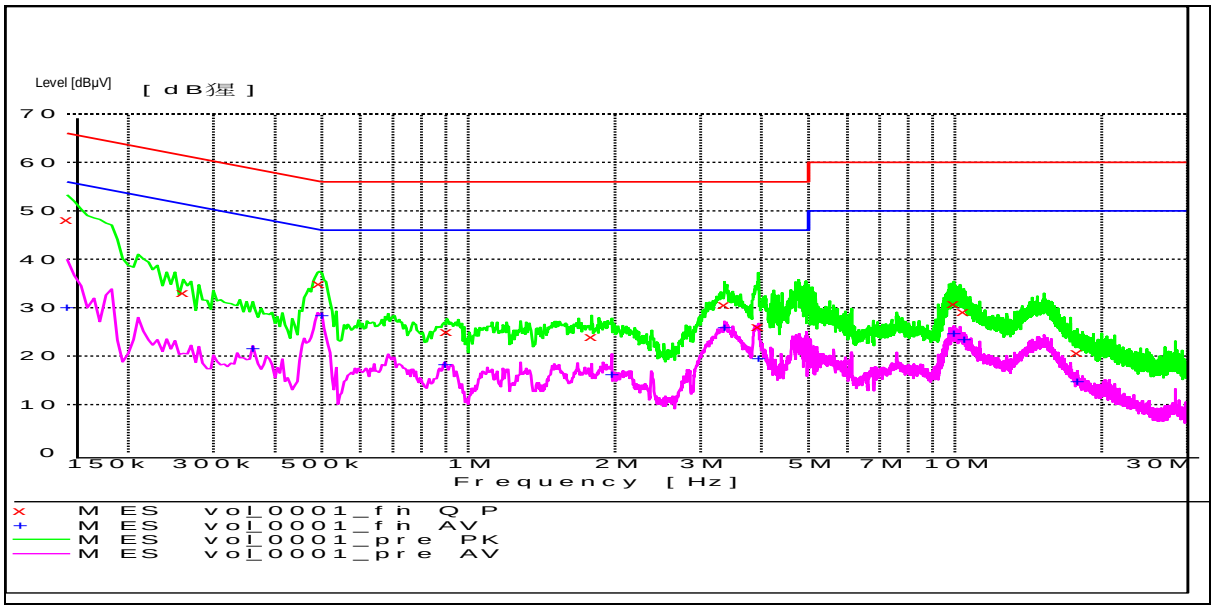
Results of TX mode (Neutral): PASS
Please refer to the following diagram for individual results.



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MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.155000	50.00	9.9	66	15.8	N	GND
0.290000	31.10	9.9	61	29.5	N	GND
0.505000	35.40	10.0	56	20.6	N	GND
0.840000	26.40	10.0	56	29.6	N	GND
1.770000	23.80	10.0	56	32.2	N	GND
3.490000	30.50	10.1	56	25.5	N	GND
4.940000	31.50	10.3	56	24.5	N	GND
9.940000	31.50	10.4	60	28.5	N	GND
10.500000	29.00	10.5	60	31.0	N	GND
17.685000	22.50	10.3	60	37.5	N	GND

MEASUREMENT RESULT: "vol_0001_fin AV"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.165000	34.00	9.9	55	21.2	N	GND
0.305000	19.90	10.0	50	30.2	N	GND
0.495000	28.70	10.0	46	17.4	N	GND
0.860000	16.00	10.0	46	30.0	N	GND
1.775000	16.30	10.0	46	29.7	N	GND
3.460000	25.00	10.1	46	21.0	N	GND
4.750000	22.60	10.3	46	23.4	N	GND
9.940000	24.70	10.4	50	25.3	N	GND
15.165000	23.10	10.7	50	26.9	N	GND
17.680000	16.60	10.3	50	33.4	N	GND

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3.1.6 RF Exposure

RF Exposure

Test Requirement:	FCC 47CFR 15.247(i)
Test Date:	2020-08-27
Mode of Operation:	Tx mode

Requirements:

In 15.247(i), an equipment shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the limits in §§ 1.1310 and 2.1093 of this chapter.
Applications to the Commission for construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities must contain a statement confirming compliance with the limits unless the facility, operation, or transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to KDB447498 D01 General RF Exposure Guidance v06, unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition.

Test Results:

RF Exposure Evaluation

N/A, the RF output of the EUT << SAR Exclusion Threshold.

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Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-Lindgren	FACT-3	--	2020/04/13	2021/04/13
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM336	PRECISION CONICAL DIPOLE	SEIBERSDORF LABORATORIES	PCD 3100	6236/M	2020/05/30	2022/05/30
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2020/05/13	2020/05/13
EM022	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2019/11/30	2021/11/30
EM276	BROADBAND HORN ANTENNA	A-INFOMW	JXTXLB-10180-SF	J2031090903007	2018/04/27	2020/04/27
EM218	ANECHOIC CHAMBER	ETS-Lindgren	FACT-3	--	2020/04/13	2021/04/13
EM219	BICONILOG ANTENNA	EMCO	3142C	00029071	2019/11/07	2021/11/07

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2020/06/30	2021/06/30
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2020/05/13	2021/05/13
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2020/01/13	2021/01/11

Remarks:

Remarks:-

CM Corrective Maintenance
N/A Not Applicable
TBD To Be Determined

******* End of Test Report *******

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2. Any report issued by the Company as a result of this application for testing service (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to his customer, supplier or other persons directly concerned. Subject to clause 3, the Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3. The Company shall be at liberty to disclose the testing-related documents and/or files anytime to any third-party accreditation and/or recognition bodies for audit or other related purposes. No liabilities whatsoever shall attach to the Company's act of disclosure.

4. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

5. The results in Report apply only to the sample as received and do not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.

6. When a statement of conformity to a specification or standard is provided, the ILAC-G8 Guidance document (and/or IEC Guide 115 in the electrotechnical sector) will be adopted as a decision rule for the determination of conformity unless it is inherent in the requested specification or standard, or otherwise specified in the Report.

7. In the event of the improper use the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

8. Sample submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

9. The Company will not be liable for or accept responsibility for any loss or damage howsoever arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

10. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

11. Subject to the variable length of retention time for test data and report stored hereinto as to otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of this test report for a period of three years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after the retention period. Under no circumstances shall we be liable for damages of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

12. Issuance records of the Report are available on the internet at www.stc.group. Further enquiry of validity or verification of the Reports should be addressed to the Company.