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Dates of Tests: Jun 09, 2020 ~ Jun 12, 2020

Test Report S/N: LR500112006M

Test Site : LTA CO., LTD.

## CERTIFICATION OF COMPLIANCE

FCC ID

**2ARHH-KCTM-2000**

APPLICANT

**KC industrial Co.,Ltd.**

Equipment Class	:	Part 15 Spread Spectrum Transmitter
Manufacturing Description	:	RFID Reader Module
Manufacturer	:	KC industrial Co.,Ltd.
Model name	:	KCTM-2000
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	FCC Part 15.247 Subpart C ; ANSI C-63.4-2014 / ANSI C-63.10-2013
Frequency Range	:	902.75 ~ 927.25 MHz
RF power	:	Max 28.88 dBm – Conducted
Data of issue	:	June 12, 2020

This test report is issued under the authority of:

Ja-Beom Koo, Manager

The test was supervised by:

Eun-Hwan Jung, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

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## 1. General information

### 1-1 Test Performed

Company name : LTA Co., Ltd.  
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 449-822  
 Web site : <http://www.ltalab.com>  
 E-mail : [chahn@ltalab.com](mailto:chahn@ltalab.com)  
 Telephone : +82-31-323-6008  
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

### 1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2020-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	2021-04-11	FCC CAB
VCCI	JAPAN	C-4948,	2020-09-10	VCCI registration
VCCI	JAPAN	T-2416,	2020-09-10	VCCI registration
VCCI	JAPAN	R-4483(10 m),	2020-10-15	VCCI registration
VCCI	JAPAN	G-847	2021-12-13	VCCI registration
IC	CANADA	5799A-1	2021-06-16	IC filing
KOLAS	KOREA	NO.551	2021-08-20	KOLAS accredited Lab.

## 2. Information about test item

### 2-1 Client & Manufacturer

Client Company name : KC industrial Co.,Ltd.  
 Address : 19F, 534, Teheran-ro, Gangnam-gu, Seoul, Republic of Korea  
 Tel / Fax : +82-70-5008-7237 / +82-010-4564-5539  
 Manufacturer : KC industrial Co.,Ltd.  
 Address : 19F, 534, Teheran-ro, Gangnam-gu, Seoul, Republic of Korea  
 Tel / Fax : +82-70-5008-7237 / +82-010-4564-5539

### 2-2 Equipment Under Test (EUT)

Model name : KCTM-2000  
 Serial number : Identical prototype  
 Date of receipt : June 09, 2020  
 EUT condition : Pre-production, not damaged  
 Antenna type : Patch Antenna (Max Gain : 3.1 dBi)  
 Frequency Range : 902.75 ~ 927.25 MHz  
 RF output power : Max 28.88 dBm – Conducted  
 Type of Modulation : FSK  
 Power Source : 4 Vdc

### 2-3 Tested frequency

Bluetooth	LOW	MID	HIGH
Frequency (MHz) – 900 MHz RFID	902.75	915.25	927.25

### 2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	-	MS-1736	MSI

### 3. Test Report

#### 3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	$\geq 2/3$ of 20dB BW	Conducted	C
15.247(a)	Number of Hopping Frequencies	$\geq 15$ channels		C
15.247(a)	20 dB Bandwidth 99% Bandwidth	less than 250 kHz		C
15.247(a)	Dwell Time	$\leq 0.4$ seconds		C
15.247(b)	Transmitter Output Power	$\leq 1$ W for 1Mbps $\leq 125$ mW for 2,3Mbps		C
15.247(d)	Conducted Spurious emission	$> 20$ dBc		C
15.247(d)	Band Edge	$> 20$ dBc		C
15.249 / 15.209	Field Strength of Harmonics	$< 54$ dBuV (at 3m)	Radiated	C
15.109	Field Strength	—		C
15.207 / 15.107	AC Conducted Emissions	EN 55022	Line Conducted	N/A
15.203	Antenna requirement	—	—	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: This product operates only with battery and does not operate during charging.

#### Note 1: Antenna Requirement

→ The **KC industrial Co.,Ltd. FCC ID: 2ARHH-KCTM-2000** unit complies with the requirement of §15.203.

The antenna type is PCB Pattern antenna.

The sample was tested according to the following specification:

- \*FCC Parts 15.247; ANSI C-63.4-2014;ANSI C-63.10-2013
- \*FCC KDB Publication No. 558074 D01 v03r05
- \*FCC TCB Workshop 2012, April

## 3.2 Frequency Hopping System Requirements

### 3.2.1 Standard Applicable

According to FCC Part 15.247(a)(1), The 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.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(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.

### 3.3 TECHNICAL CHARACTERISTIC TEST

#### 3.3.1 Carrier Frequency Separation

##### Procedure:

The test follows ANSI C-63.10. 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 = 2~ 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 100 kHz (1% of the span or more)      Sweep = auto

VBW = 100 kHz      Detector function = peak

Trace = max hold

##### Measurement Data: Port 1

Test Results	
Carrier Frequency Separation (MHz)	Result
0.999	Complies

##### Measurement Data: Port 2

Test Results	
Carrier Frequency Separation (MHz)	Result
0.999	Complies

- See next pages for actual measured spectrum plots.

##### Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of 20 dB bandwidth of the hopping channel, whichever is greater.

##### Measurement Setup

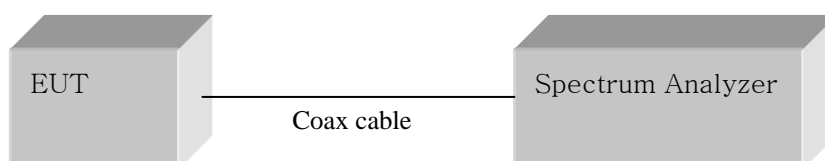
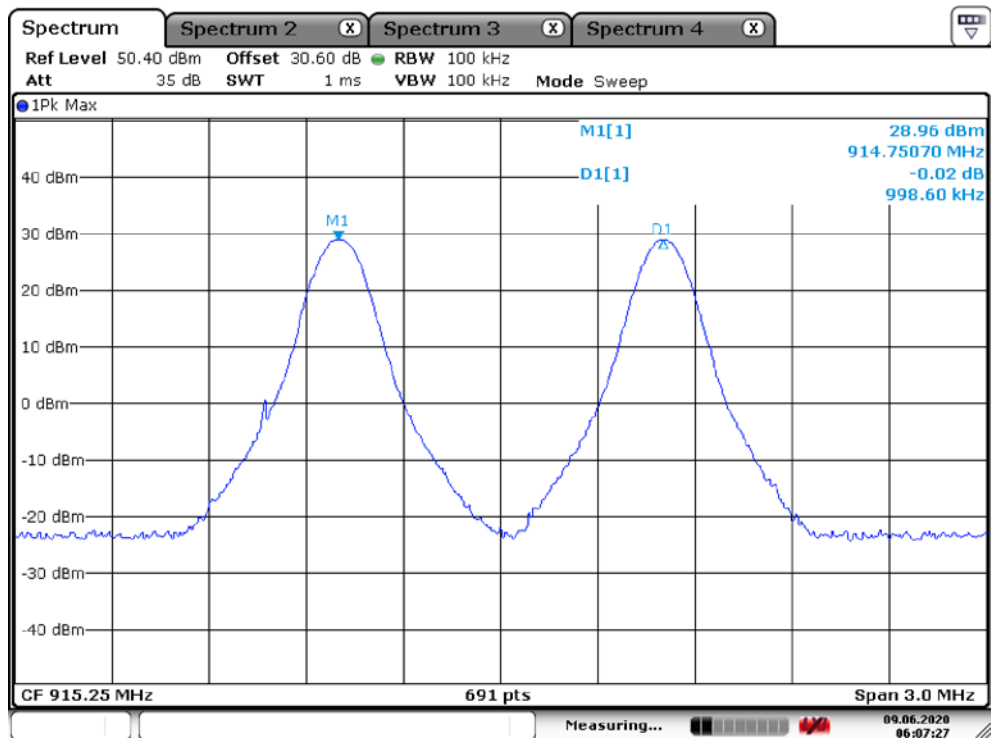
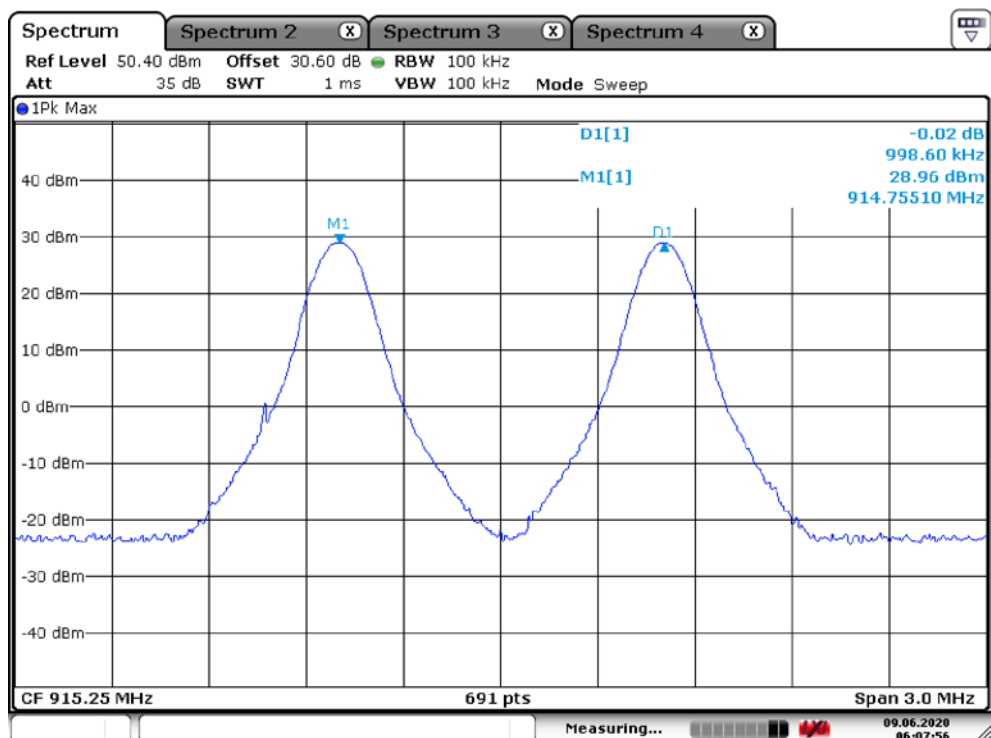


Figure 1: Measurement setup for the carrier frequency separation

## Carrier Frequency Separation



Port 1



Port 2



### 3.3.2 Number of Hopping Frequencies

#### Procedure:

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

The spectrum analyzer is set to (Bluetooth):

Frequency range      Start = 902.75 MHz,    Stop = 927.25 MHz

RBW = 100 kHz (1% of the span or more)      Sweep = auto

VBW = 100 kHz (VBW  $\geq$  RBW)      Detector function = peak

Trace = max hold      Span > 40 MHz

**Measurement Data :**    **Complies**

<b>Total number of Hopping Channels</b>	50 (RFID)
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- See next pages for actual measured spectrum plots.

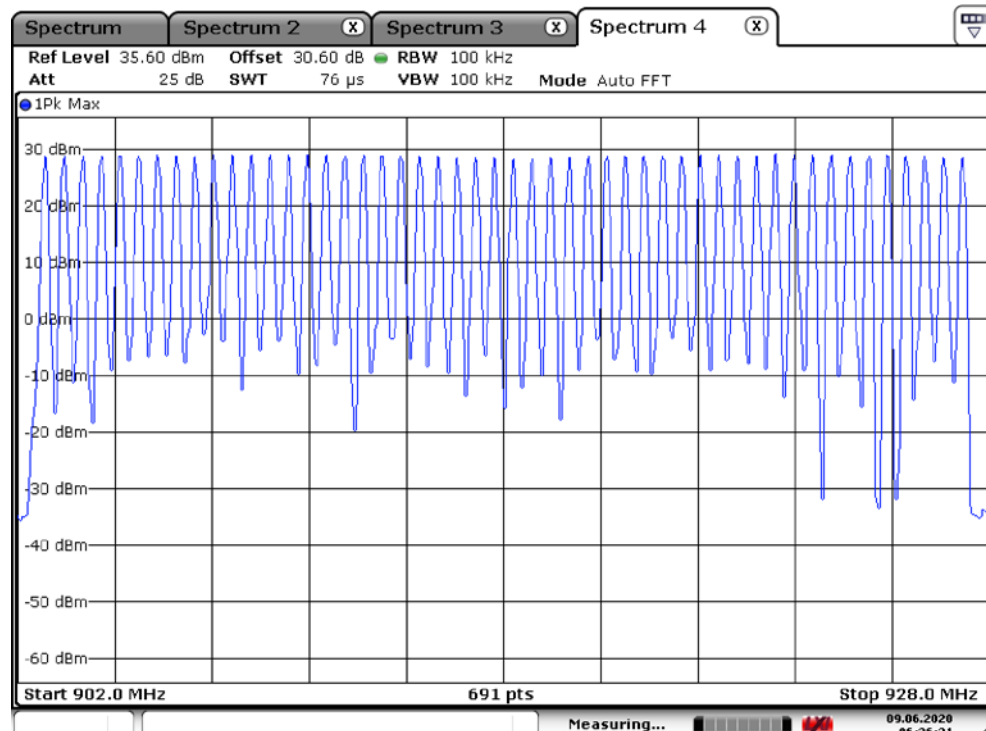
#### Minimum Standard:

Have at least 50 channels below 250 kHz bandwidth

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

### Number of Hopping Frequencies (RFID)



### 3.3.3 20 dB Bandwidth

#### Procedure:

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is ( as close as possible to ) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to RFID :

Center frequency = the highest, middle and the lowest channels

Span = 3 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 30 kHz

Sweep = auto

VBW = 30 kHz (VBW  $\geq$  RBW)

Detector function = peak

Trace = max hold

#### Measurement Data: Port 1

Frequency (MHz)	Channel No.	Test Results(MHz)	
		20dB Bandwidth	99% Bandwidth
902.75	1	0.125	0.133
915.25	26	0.125	0.133
927.25	50	0.122	0.130

#### Measurement Data: Port 2

Frequency (MHz)	Channel No.	Test Results(MHz)	
		20dB Bandwidth	99% Bandwidth
902.75	1	0.125	0.136
915.25	26	0.127	0.130
927.25	50	0.122	0.127

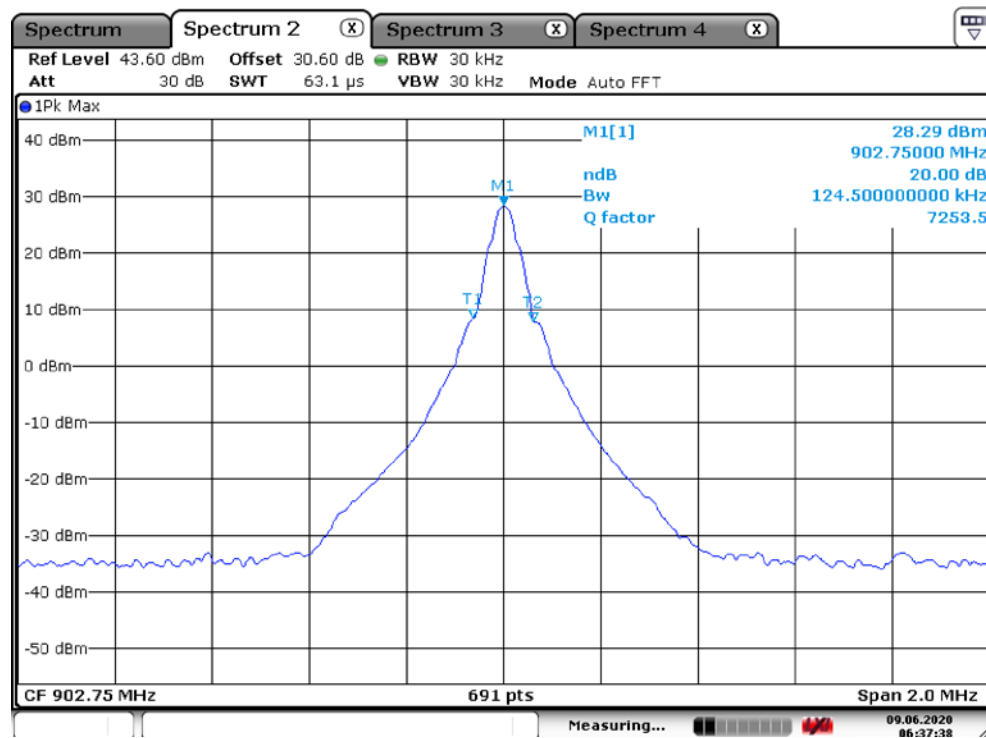
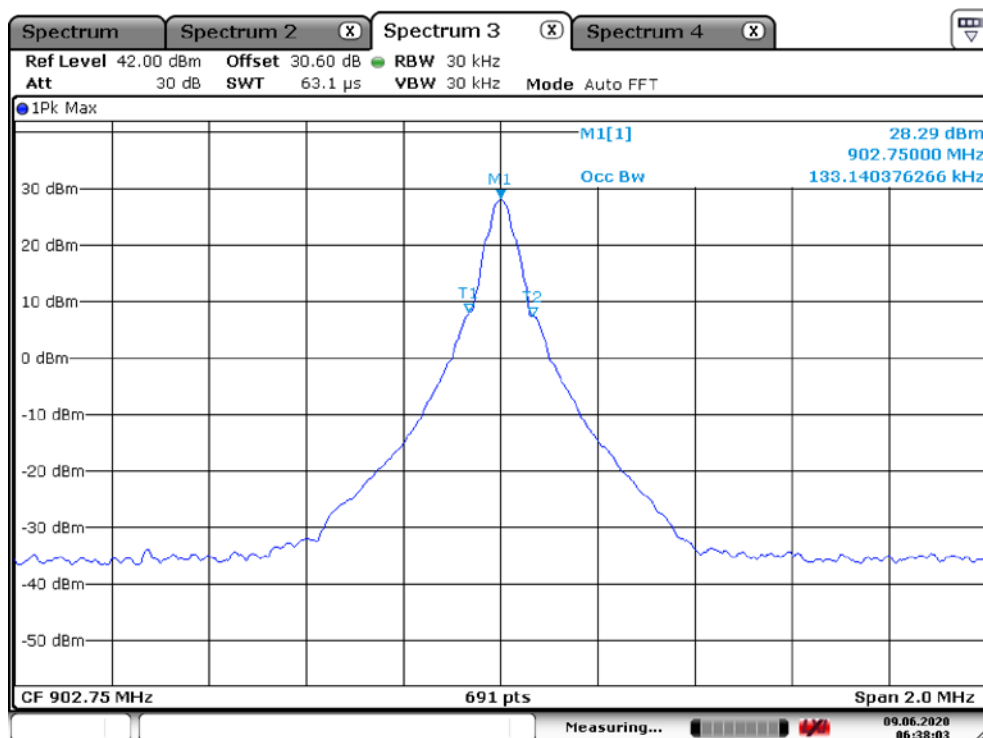
- See next pages for actual measured spectrum plots.

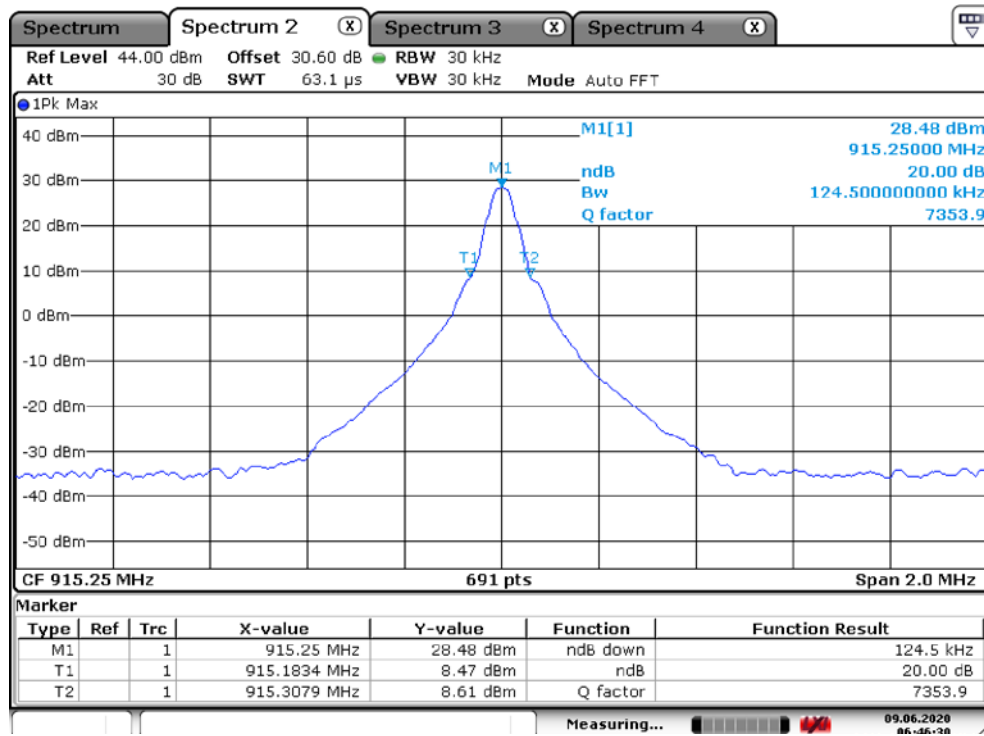
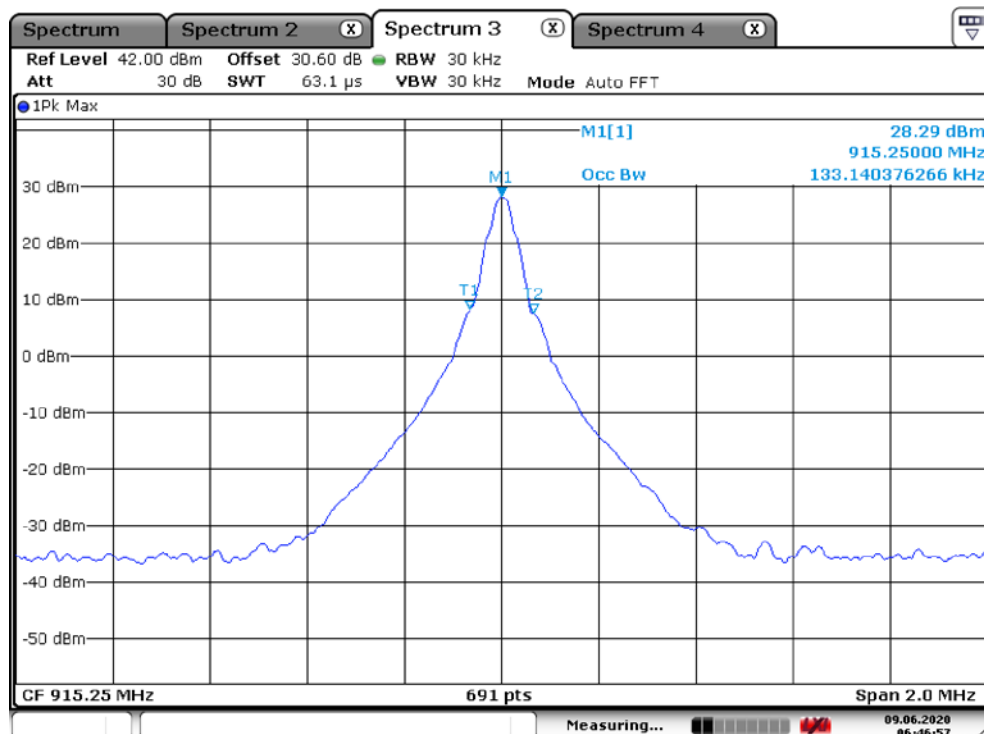
#### Minimum Standard:

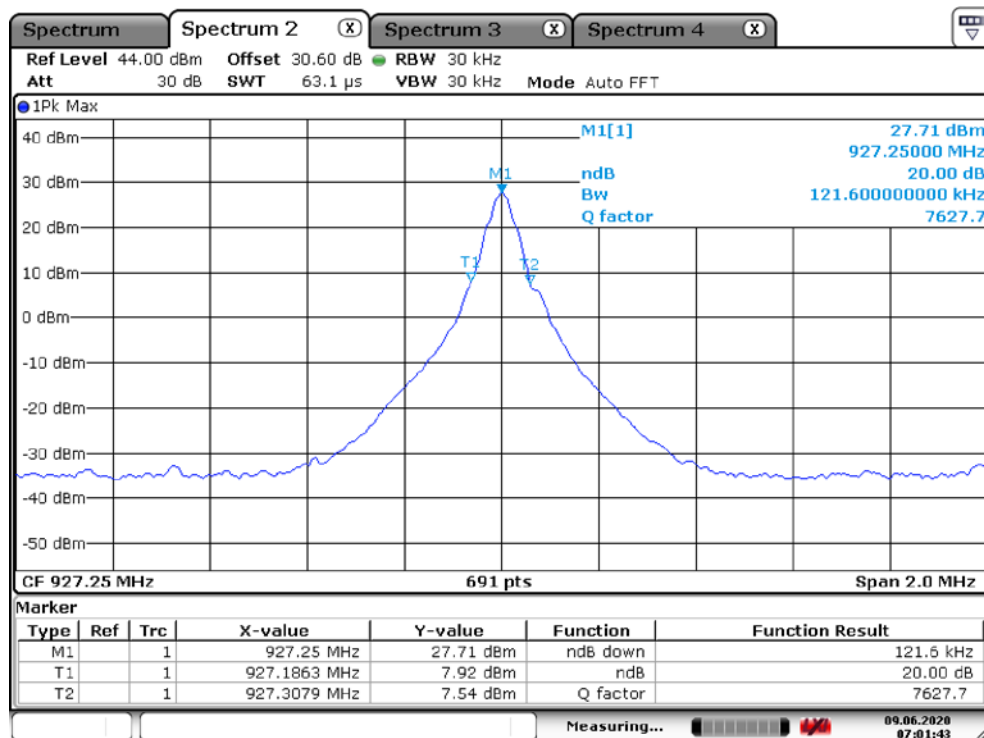
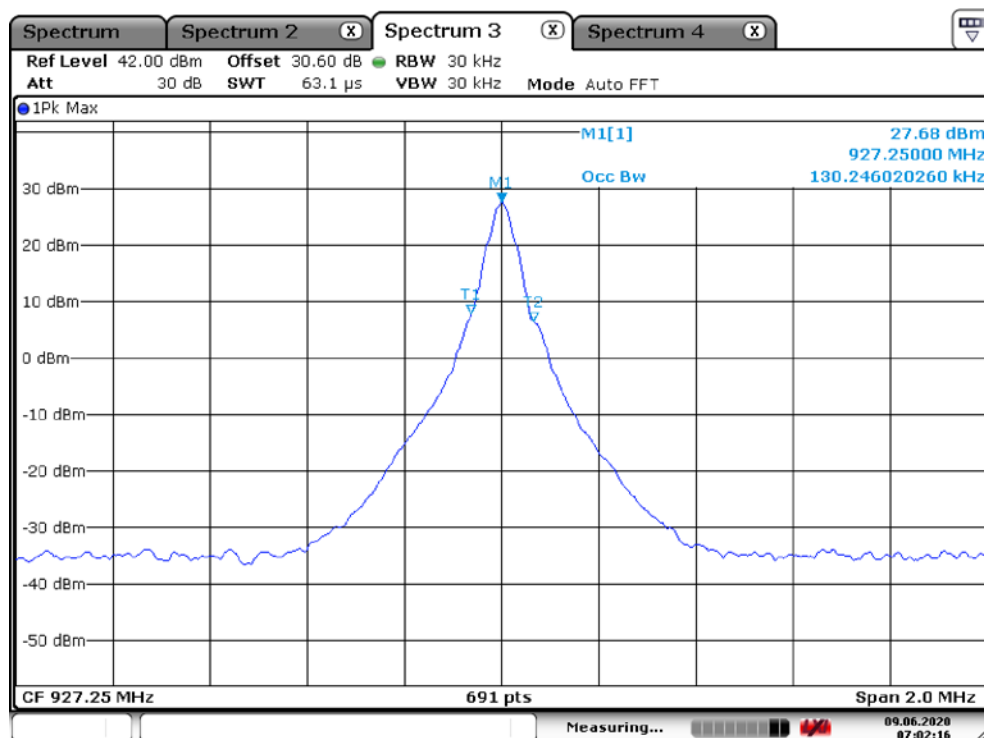
less than 250 kHz

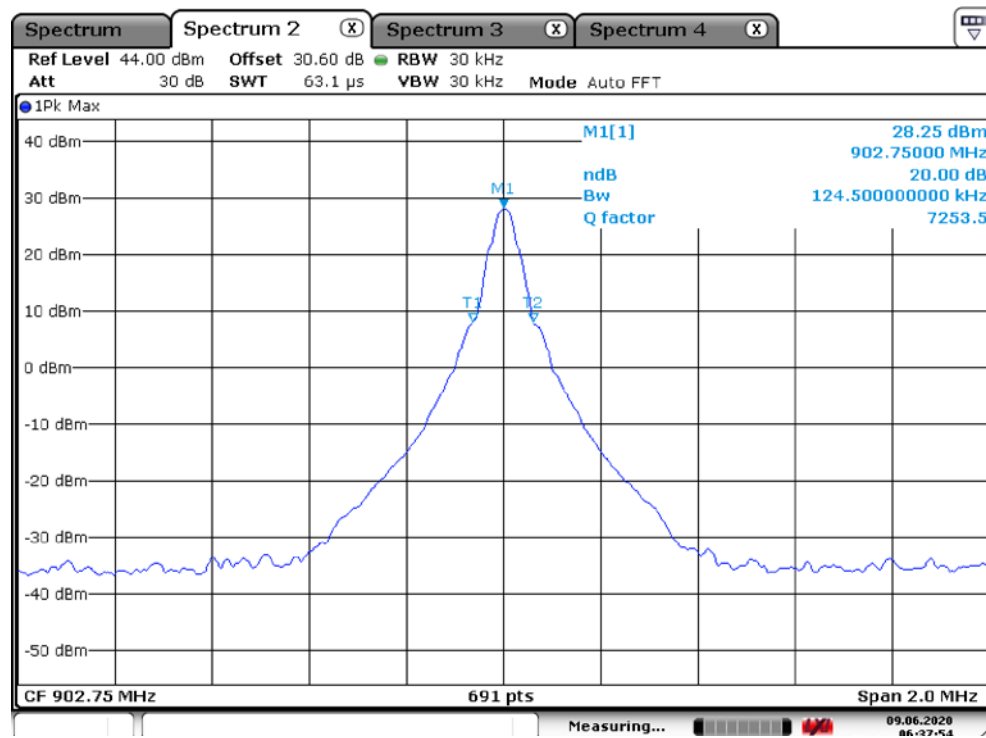
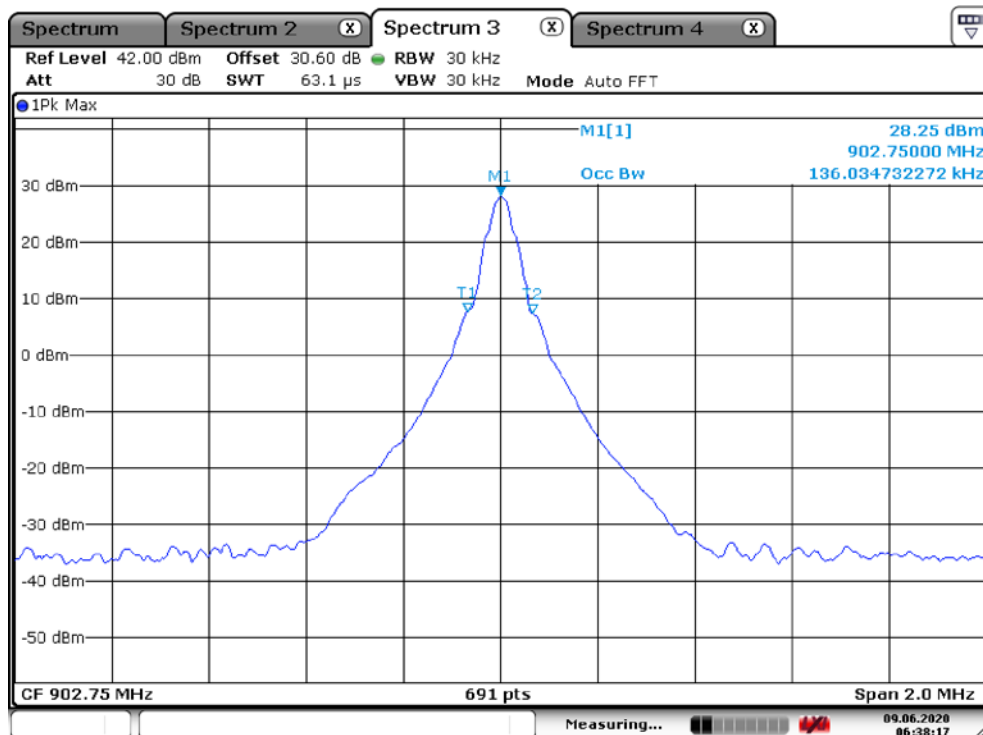
#### Measurement Setup

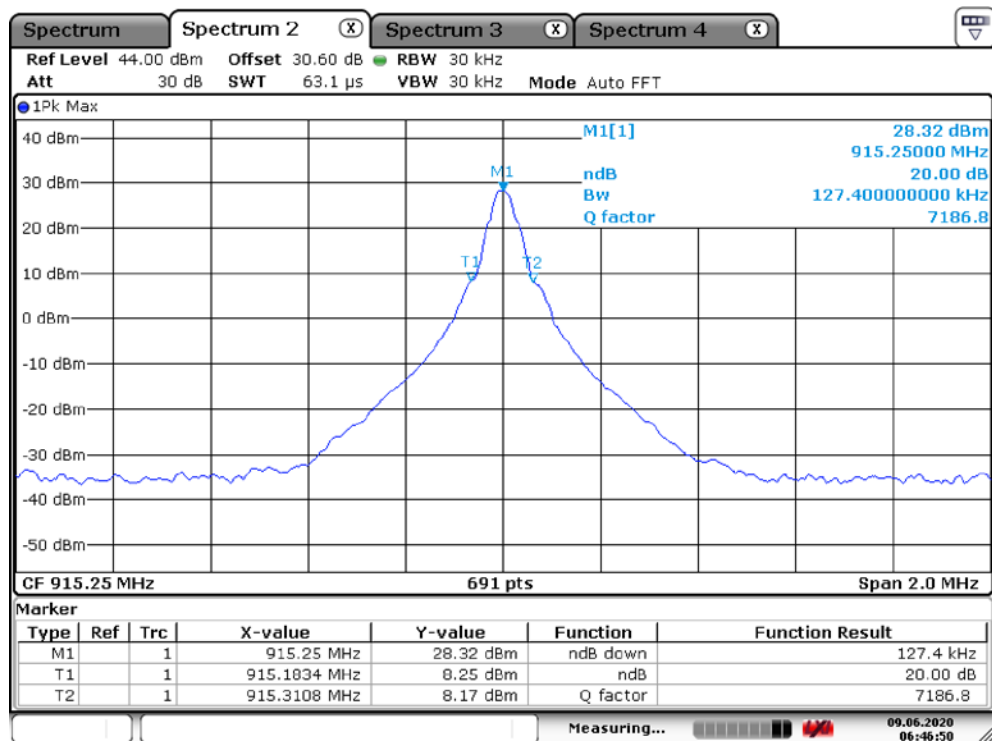
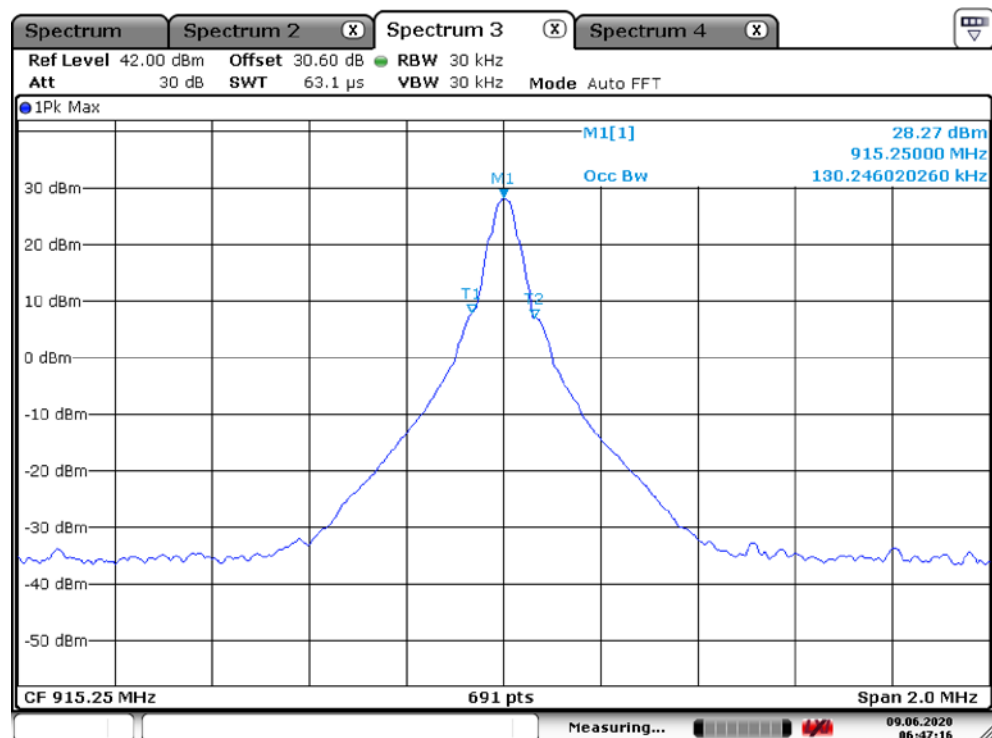
Same as the Chapter 3.3.1 (Figure 1)

**Channel 1 of RFID mode-Port 1****20 dB Bandwidth****99% Bandwidth**

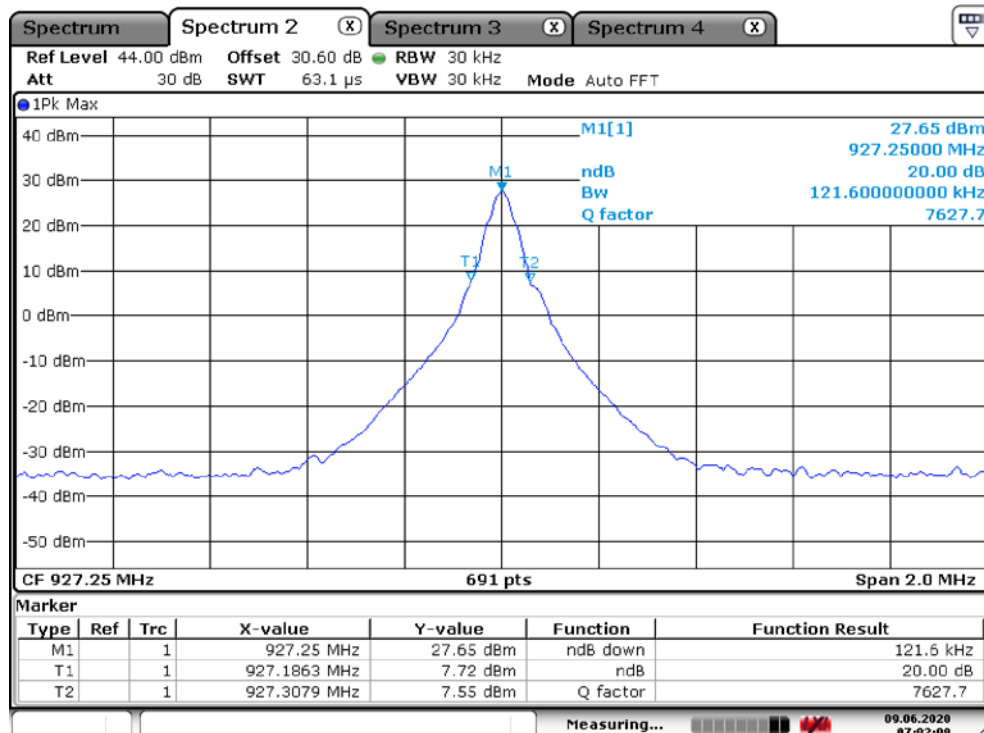
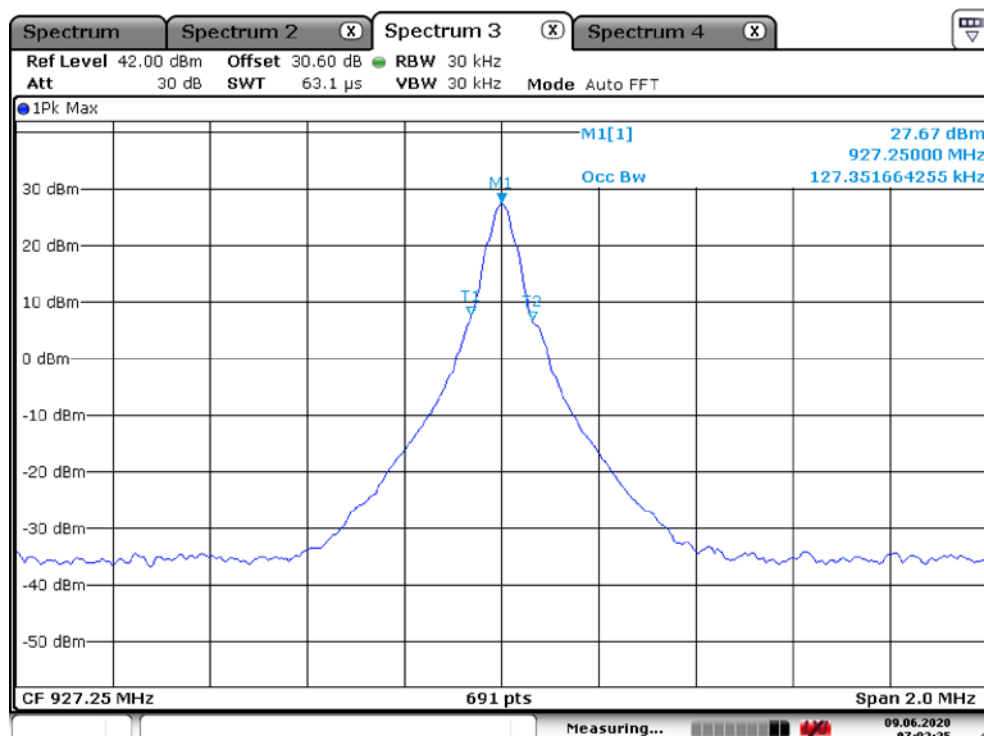
**Channel 26 of RFID mode-Port 1****20 dB Bandwidth****99% Bandwidth**

**Channel 50 of RFID mode-Port 1****20 dB Bandwidth****99% Bandwidth**

**Channel 1 of RFID mode-Port 2****20 dB Bandwidth****99% Bandwidth**

**Channel 26 of RFID mode-Port 2****20 dB Bandwidth****99% Bandwidth**



**Channel 50 of RFID mode-Port 2****20 dB Bandwidth****99% Bandwidth**

### 3.3.4 Time of Occupancy (Dwell Time)

#### Procedure:

The test follows ANSI C-63.10. 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 = 915 MHz

Span = zero

RBW = 1 MHz

VBW = 1 MHz (VBW  $\geq$  RBW)

Trace = max hold

Detector function = peak

#### Measurement Data (RFID):

Mode	Length (ms)	Number	Dwell Time (ms)	Limit (msec)
RFID	120.29	2	240.58	400

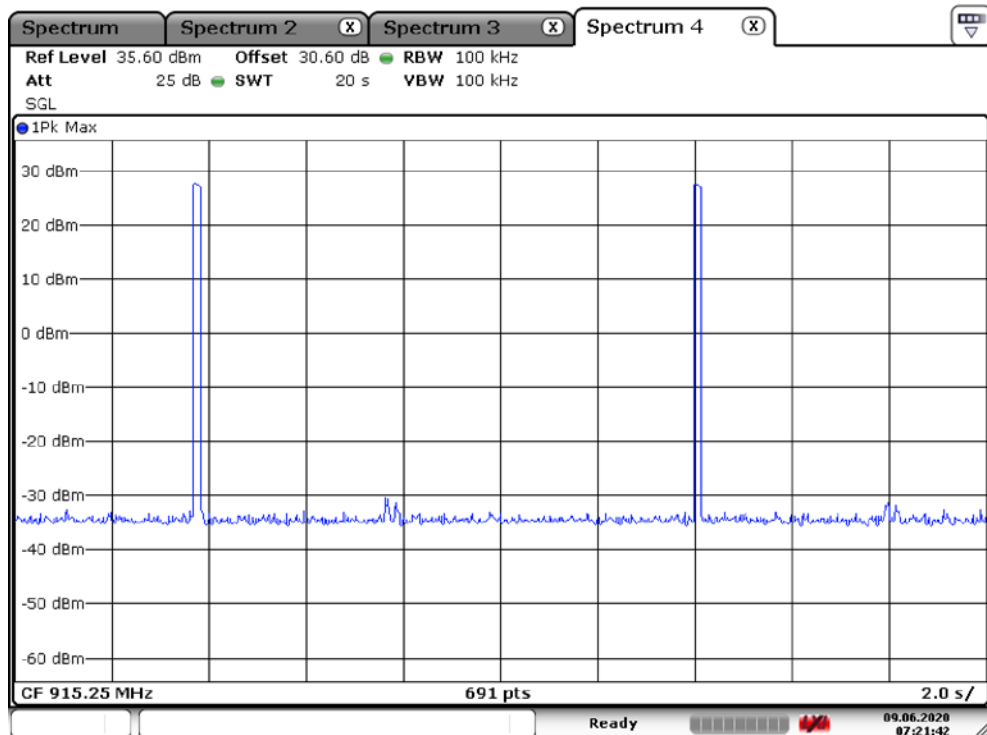
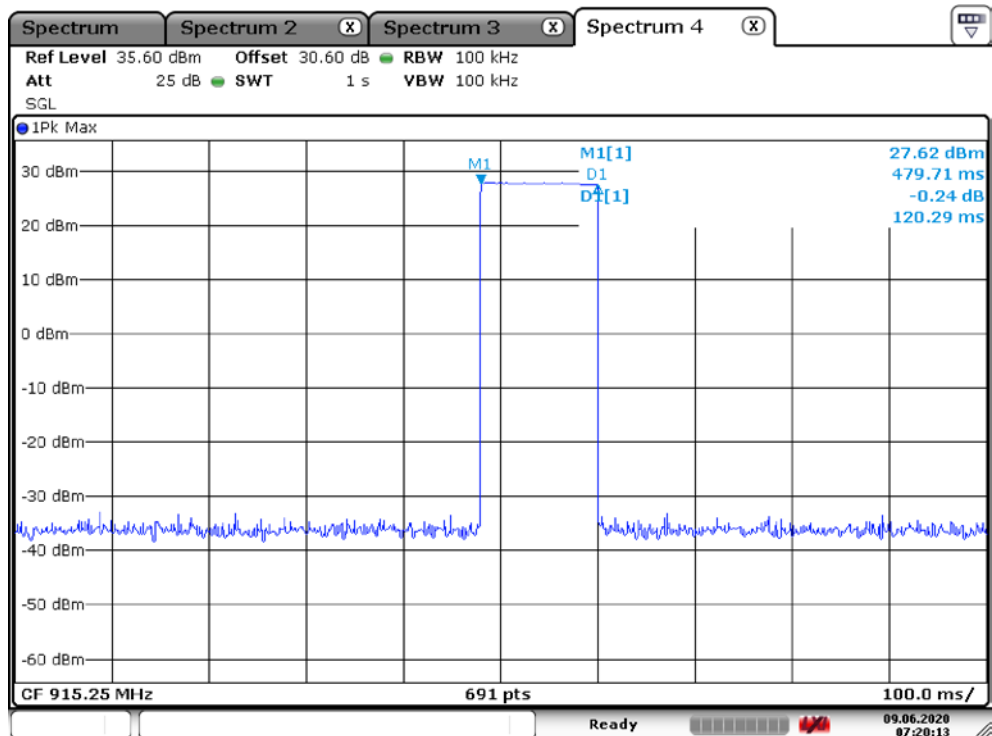
- See next pages for actual measured spectrum plots.

#### Minimum Standard:

the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)



### 3.3.5 Transmitter Output Power

#### Procedure:

The test follows ANSI C-63.10. The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

Span = 10 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 3 MHz (VBW  $\geq$  RBW)

Detector function = peak

Trace = max hold

Sweep = auto

#### Measurement Data : Port 1

Frequency (MHz)	Ch.	Test Results		
		dBm	mW	Result
902.75	1	28.82	762.08	Complies
915.25	26	28.88	772.68	Complies
927.25	50	28.95	785.24	Complies

#### Measurement Data : Port 2

Frequency (MHz)	Ch.	Test Results		
		dBm	mW	Result
902.75	1	28.77	753.36	Complies
915.25	26	28.81	760.33	Complies
927.25	50	28.88	772.68	Complies

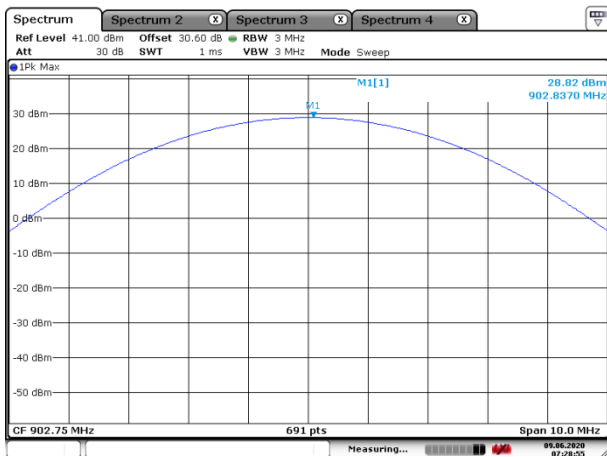
- See next pages for actual measured spectrum plots.

<b>Minimum Standard:</b>	1 Watt
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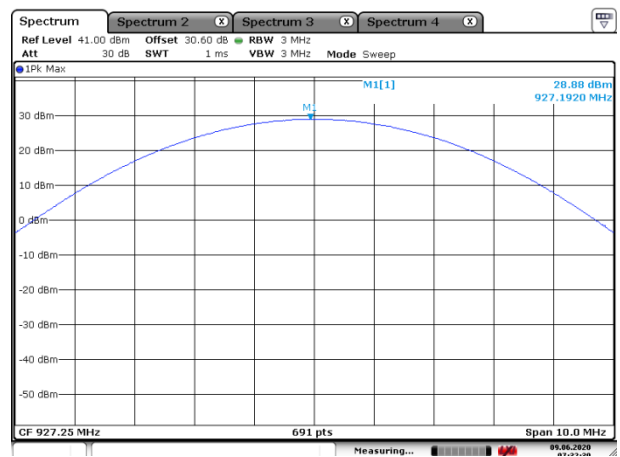
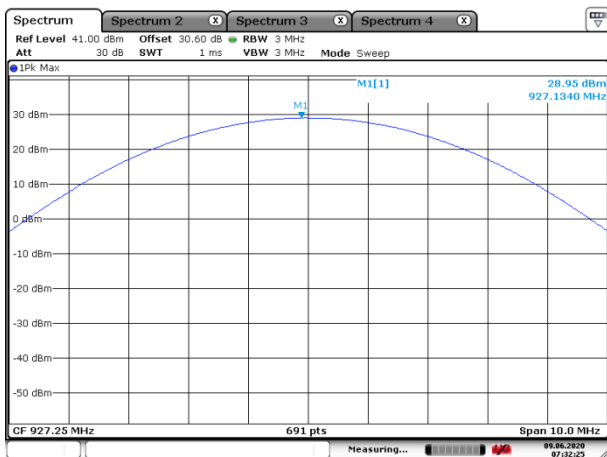
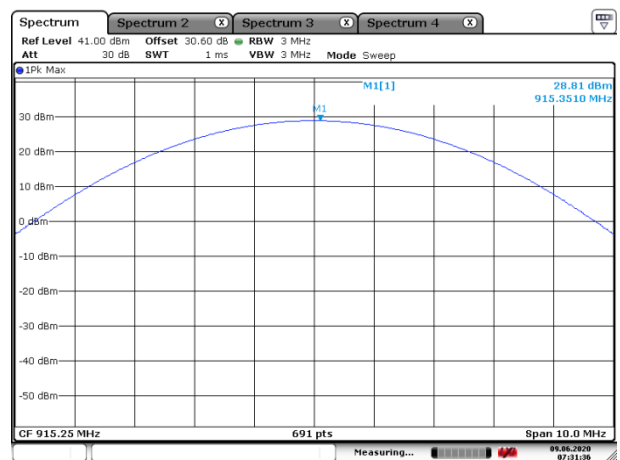
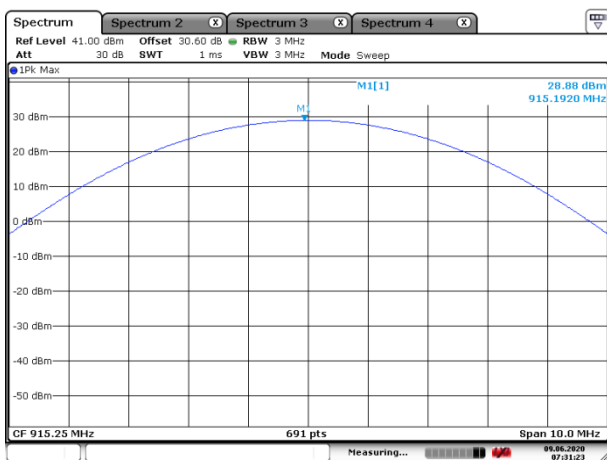
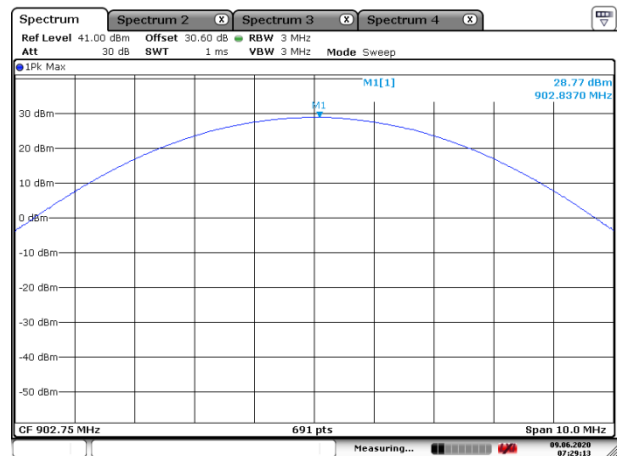
#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

## Port 1(Low/Middle/High)



## Port 2(Low/Middle/High)



### 3.3.6 Band Edge

#### Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

#### The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 300 kHz

Span = 10~30 MHz

Detector function = peak

Trace = max hold

Sweep = auto

#### Measurement Data: **Complies**

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

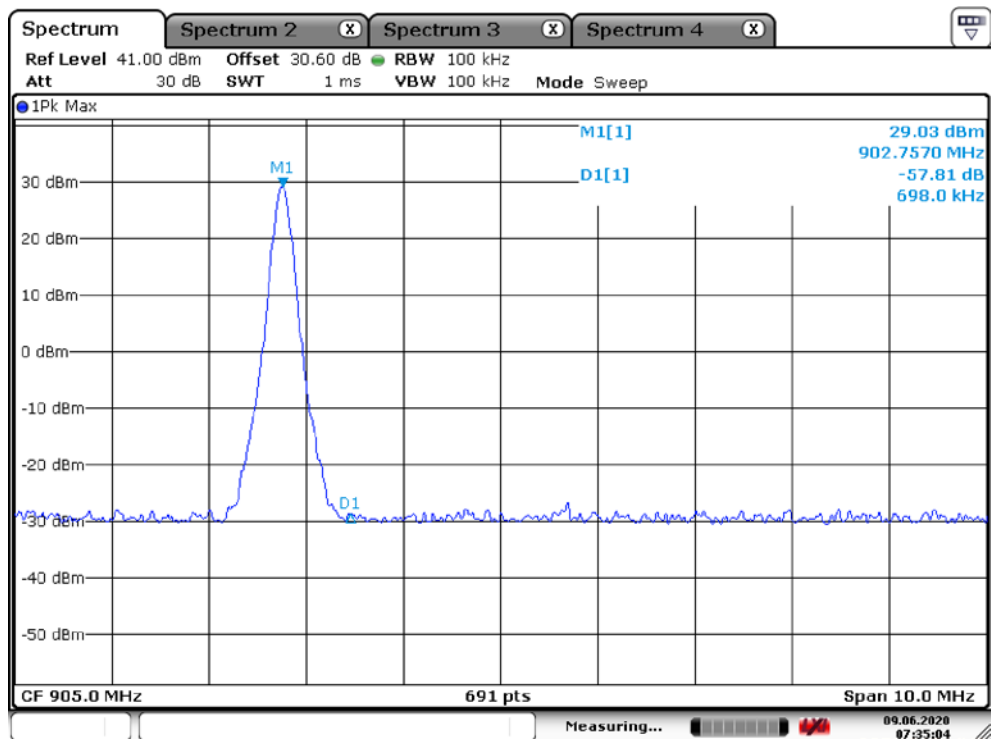
<b>Minimum Standard:</b>	$\leq 20$ dBc
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#### Measurement Setup

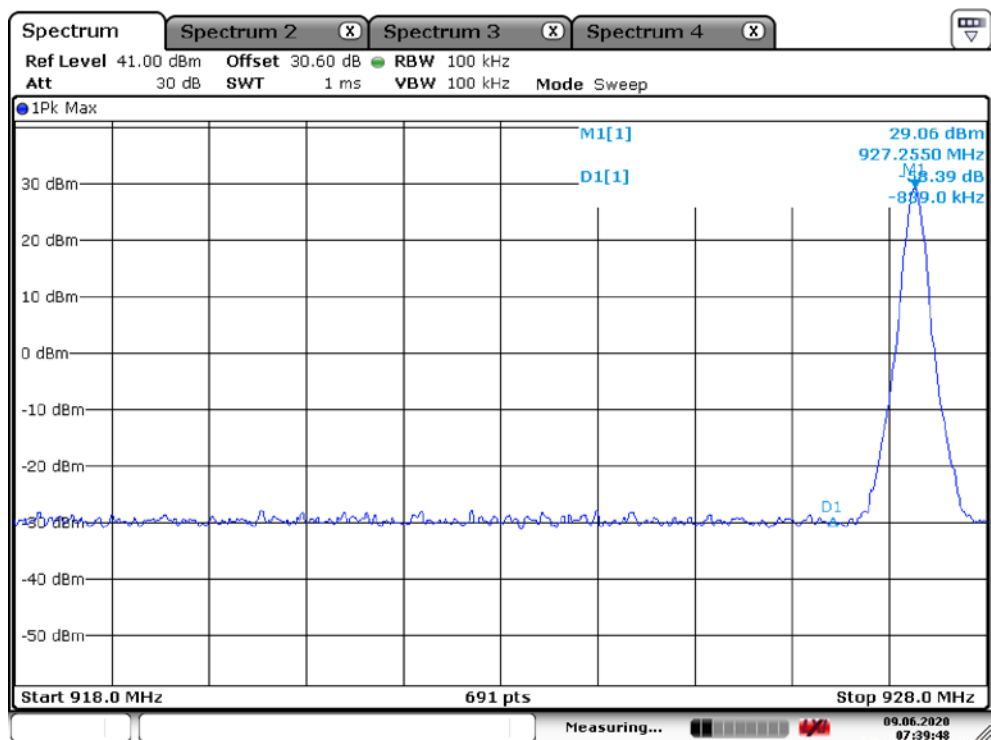
Same as the Chapter 3.3.1 (Figure 1)

## Port 1

### Lower edge

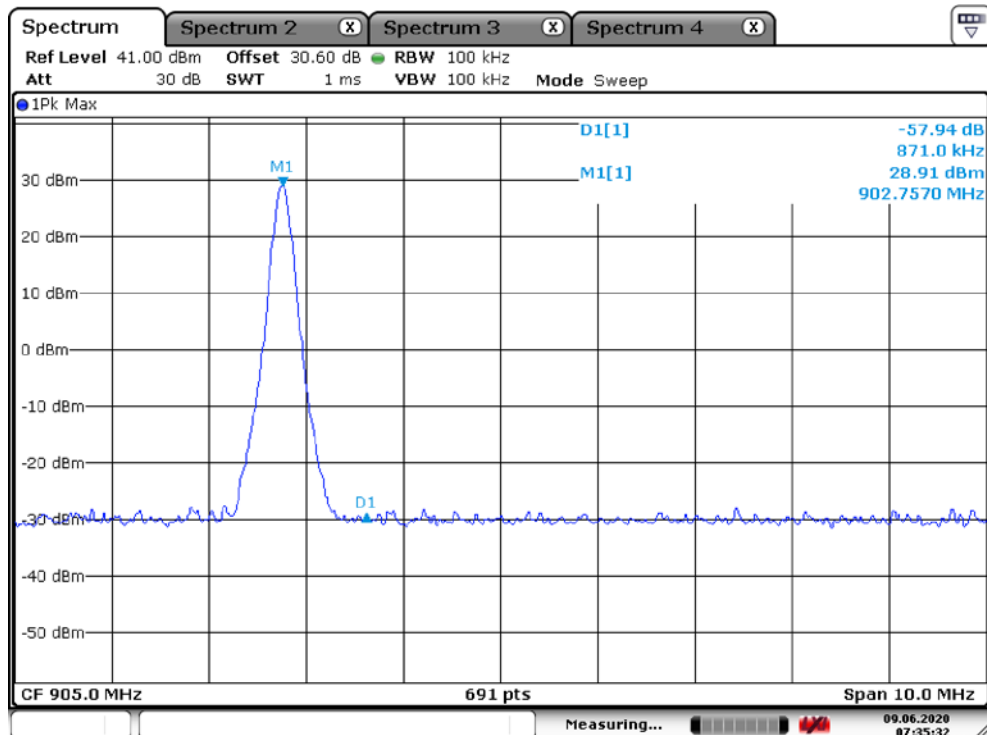


### Upper edge

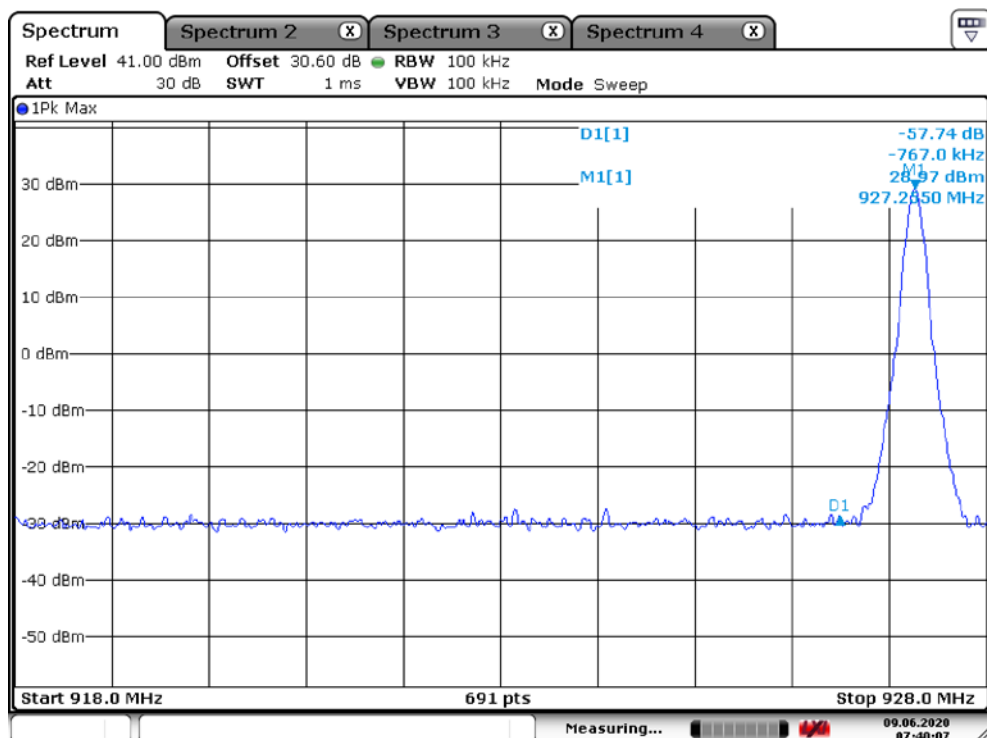


## Port 1

### Lower edge



### Upper edge





### 3.3.7 Conducted Spurious Emissions

#### Procedure:

The test follows ANSI C-63.10. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz

Sweep = auto

VBW = 100 kHz

Detector function = peak

Trace = max hold

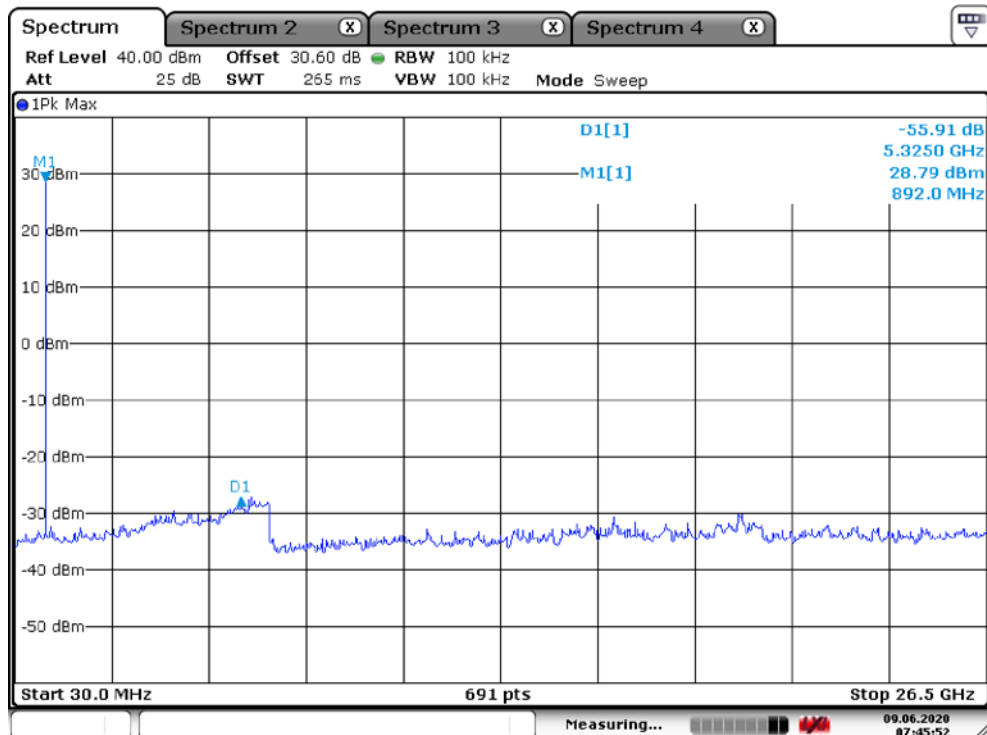
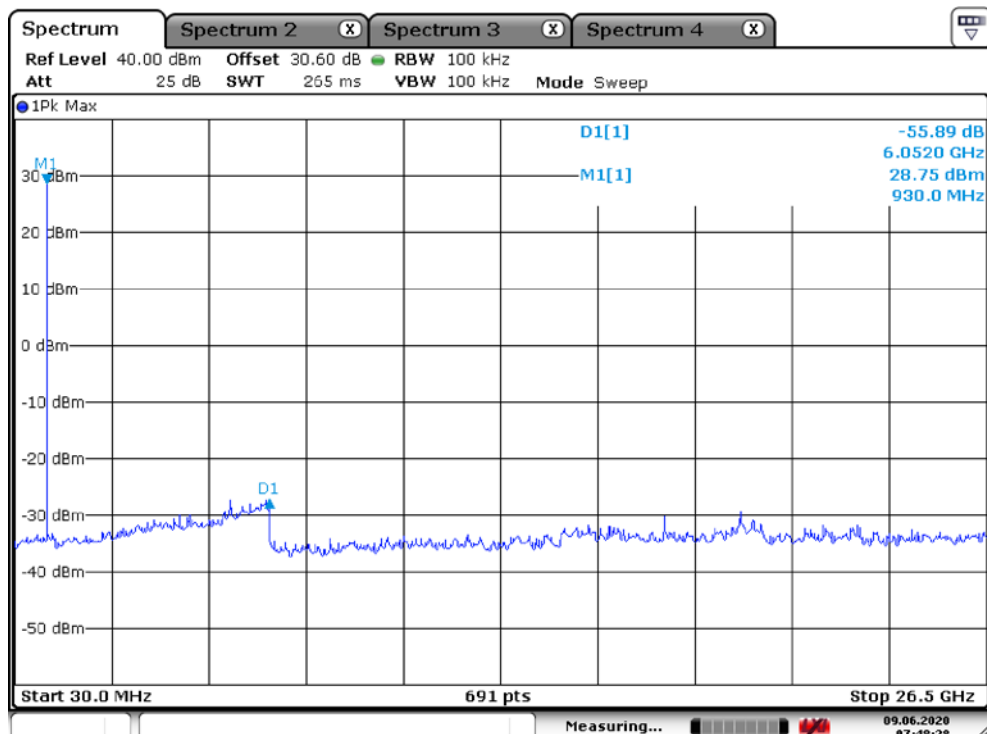
#### Measurement Data: **Complies**

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

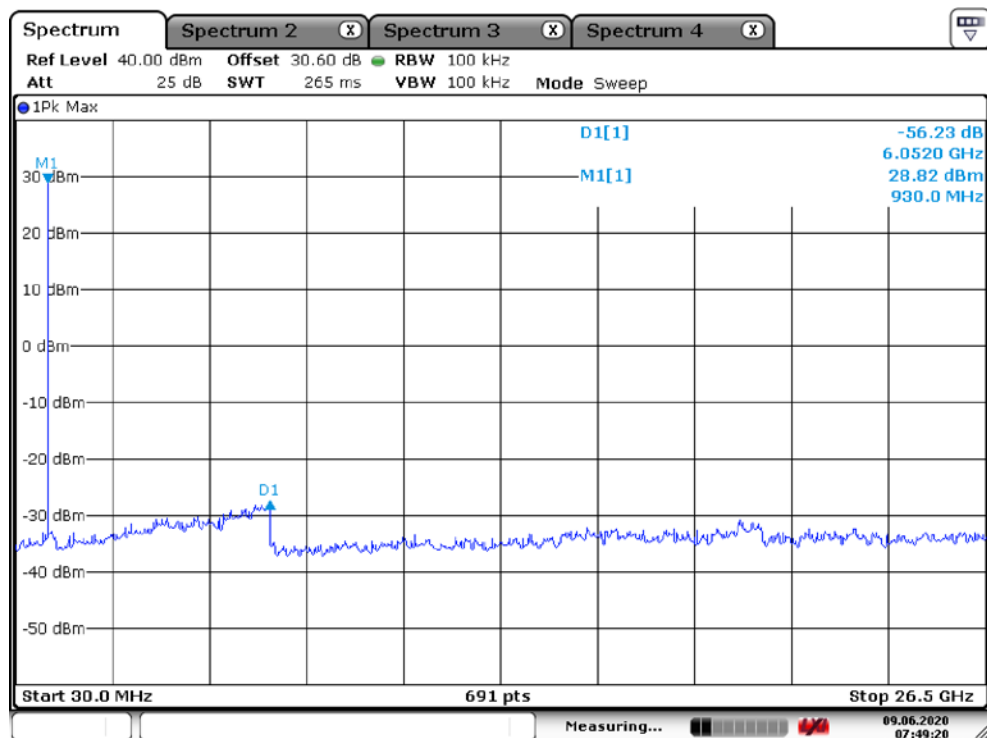
<b>Minimum Standard:</b>	$\leq 20$ dBc
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#### Measurement Setup

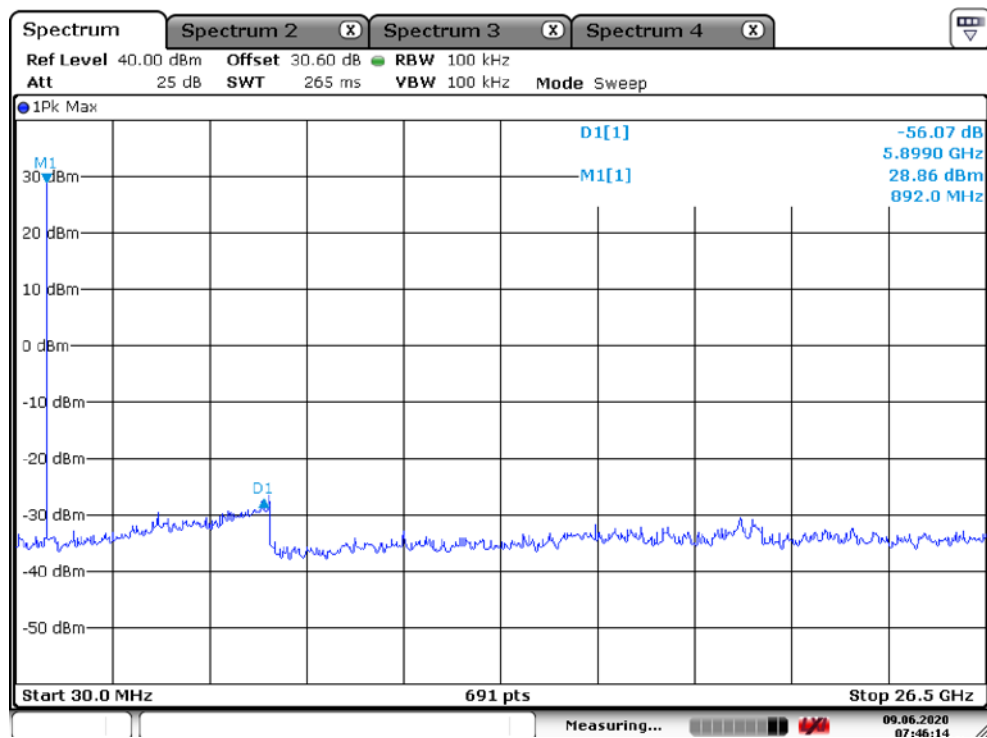
Same as the Chapter 3.3.1 (Figure 1)

**Unwanted Emission – Low channel (Port 1)****Frequency Range = 30 MHz ~ 26.5 GHz****Unwanted Emission – Middle channel****Frequency Range = 30 MHz ~ 26.5 GHz**

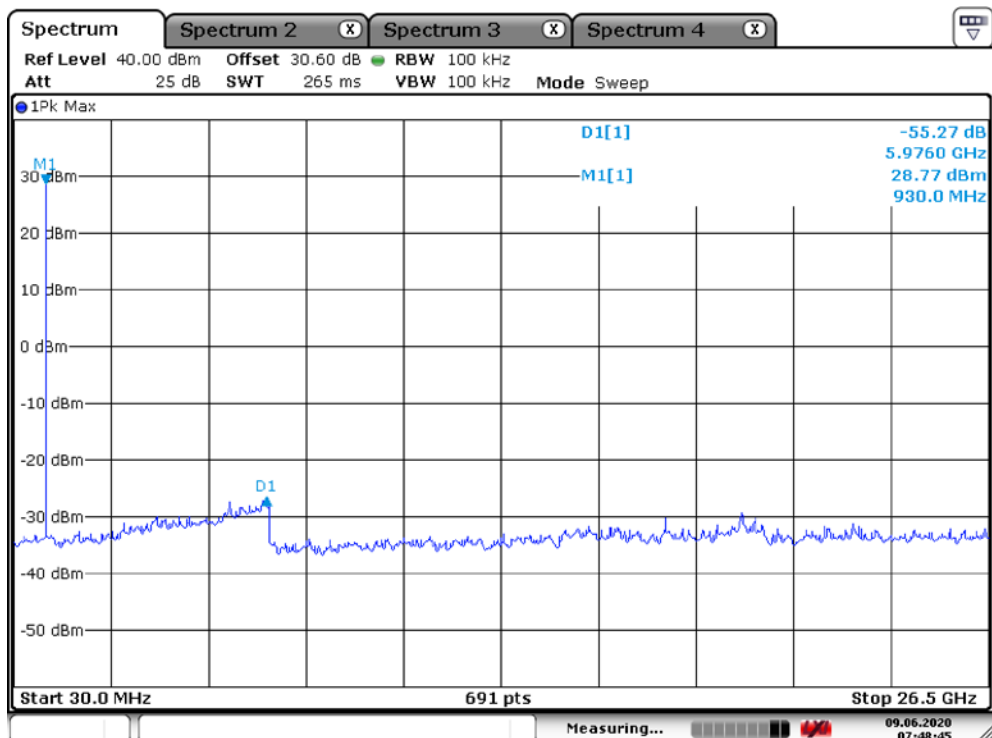
**Unwanted Emission – High channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



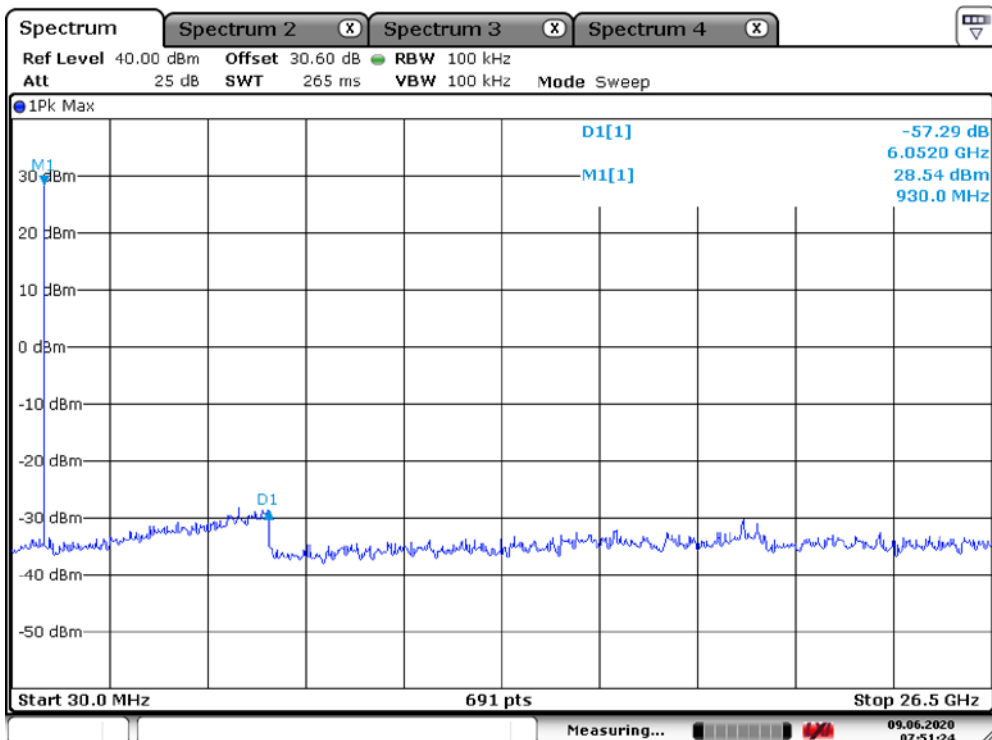
**Unwanted Emission – Low channel (Port 2)**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



**Unwanted Emission – Middle channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



**Unwanted Emission – High channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



### 3.3.8 Radiated Spurious Emissions

#### Procedure:

Radiated emissions from the EUT were measured according to the dictates of ANSI C-63.10. The EUT was placed on a 0.8 m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

- (a) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 3 m 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 30 MHz, Bi-Log Test Antenna (30 MHz to 1 GHz) and Horn Test Antenna (above 1 GHz) are used. Test Antenna is 3 m away from the EUT. Test Antenna height is carried from 1 m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10<sup>th</sup> harmonic.

RBW = 120 kHz ( 30 MHz ~ 1 GHz)

= 1 MHz (1 GHz ~ 10<sup>th</sup> harmonic )

Span = 100 MHz

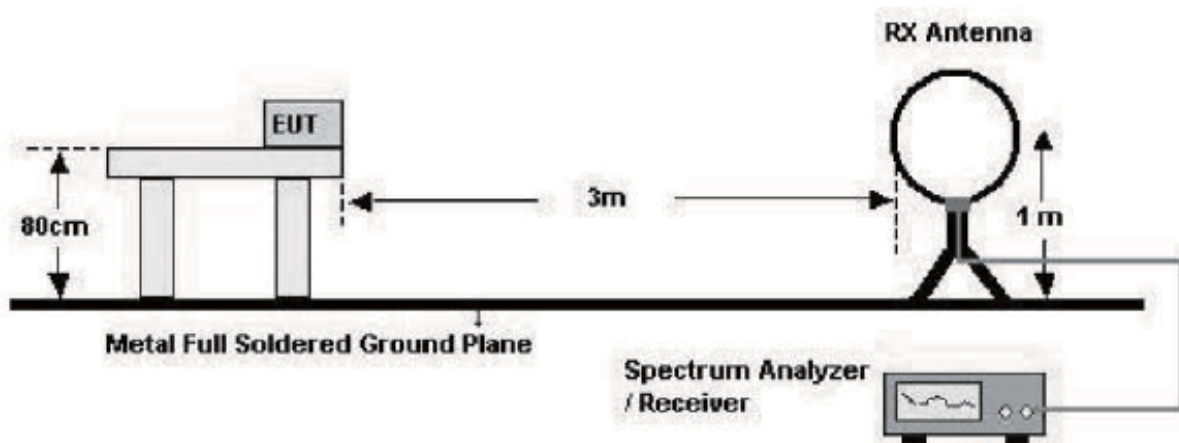
Trace = max hold

VBW  $\geq$  RBW

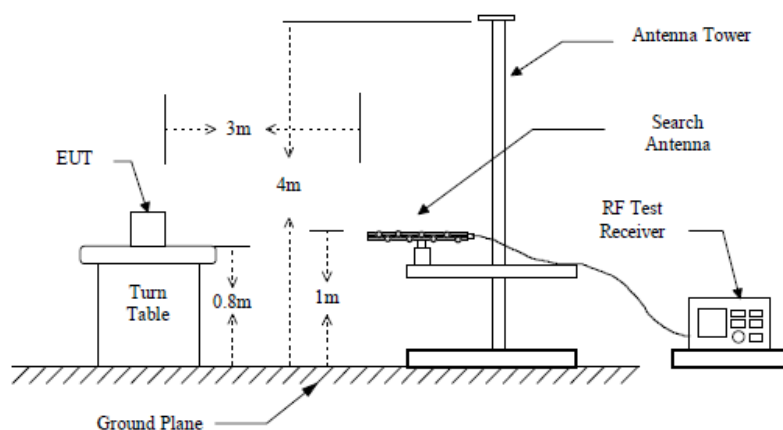
Detector function = peak

Sweep = auto

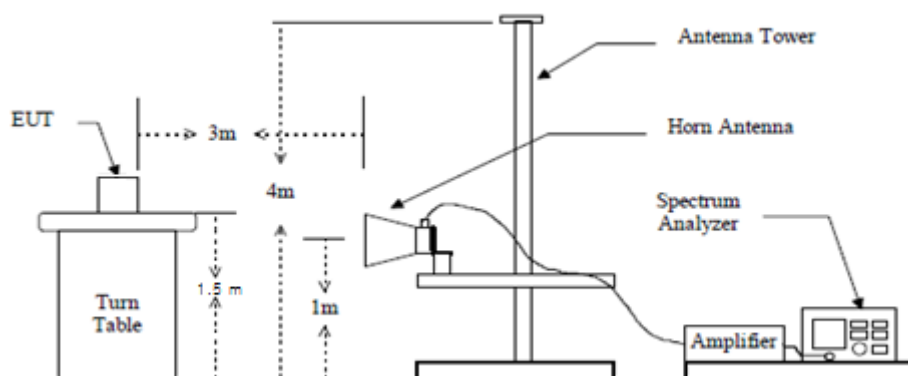
**below 30 MHz**



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



**Measurement Data:** **Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30 MHz.
- Checked with a red circle is the fundamental frequency.

**Minimum Standard: FCC Part 15.209(a)**

Frequency (MHz)	Limit (uV/m) @ 3m
0.009 ~ 0.490	2400/F(kHz) (@ 300m)
0.490 ~ 1.705	24000/F(kHz) (@ 30m)
1.705 ~ 30	30(@ 30m)
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

\*\* 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.

**Radiated Emissions-Port 1**

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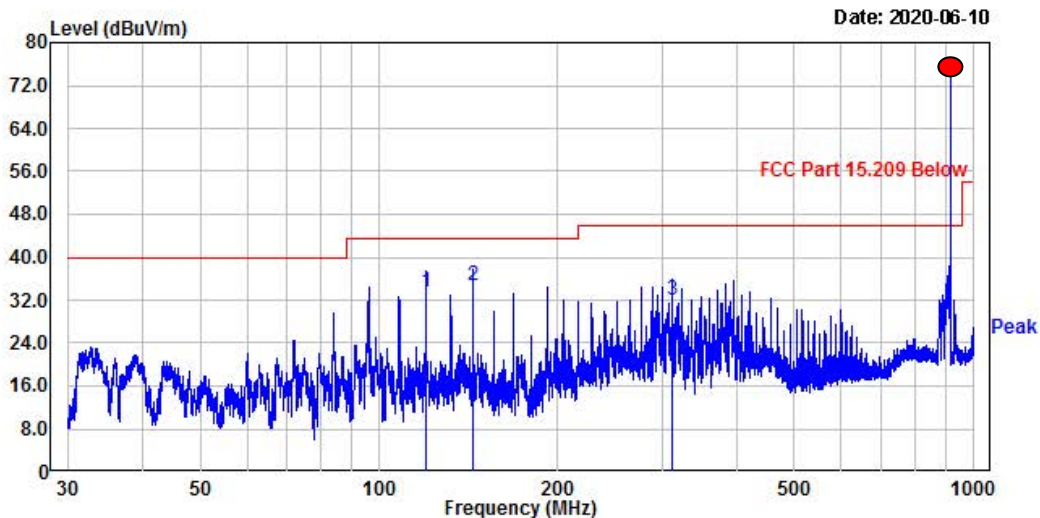
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode L

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.17	50.35	-16.89	33.46	43.52	10.06	400	46	horizontal
2.	144.21	49.87	-15.05	34.82	43.52	8.70	100	57	horizontal
3.	312.04	45.68	-13.67	32.01	46.02	14.01	100	12	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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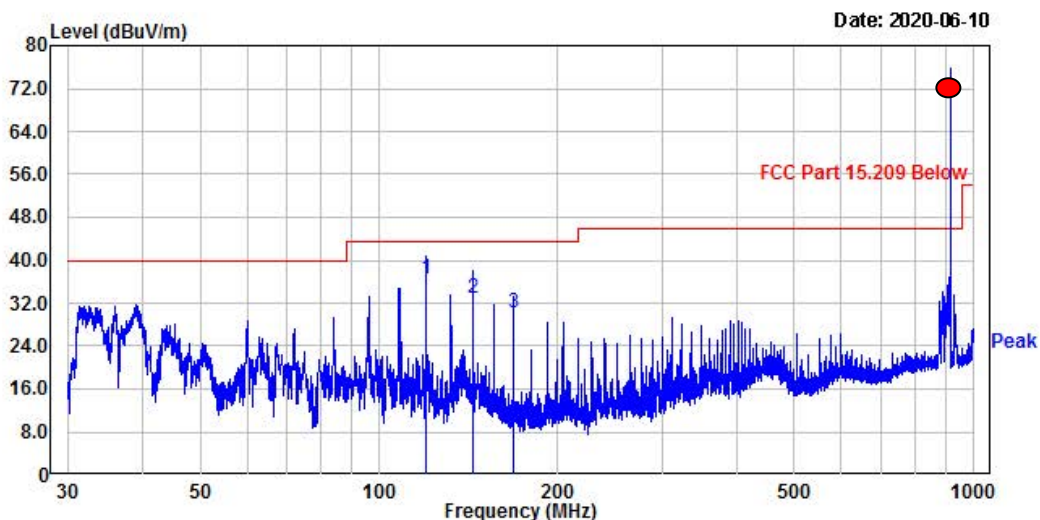
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode L

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	53.44	-16.89	36.55	43.52	6.97	100	6	vertical
2.	144.15	47.92	-15.06	32.86	43.52	10.66	100	0	vertical
3.	168.19	45.62	-15.30	30.32	43.52	13.20	100	6	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain





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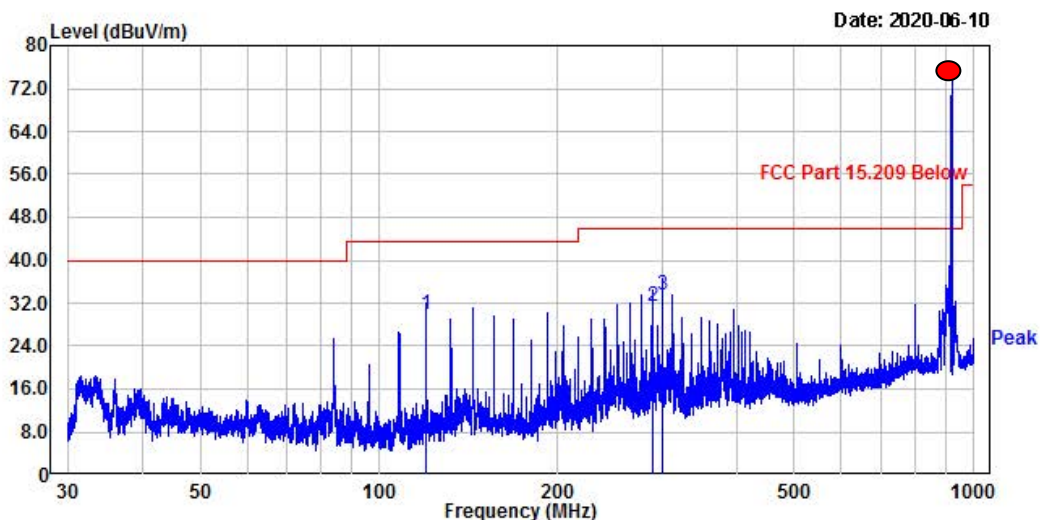
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode M

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	46.81	-16.89	29.92	43.52	13.60	400	256	horizontal
2.	288.37	45.77	-14.29	31.48	46.02	14.54	400	42	horizontal
3.	300.37	47.53	-13.87	33.66	46.02	12.36	400	54	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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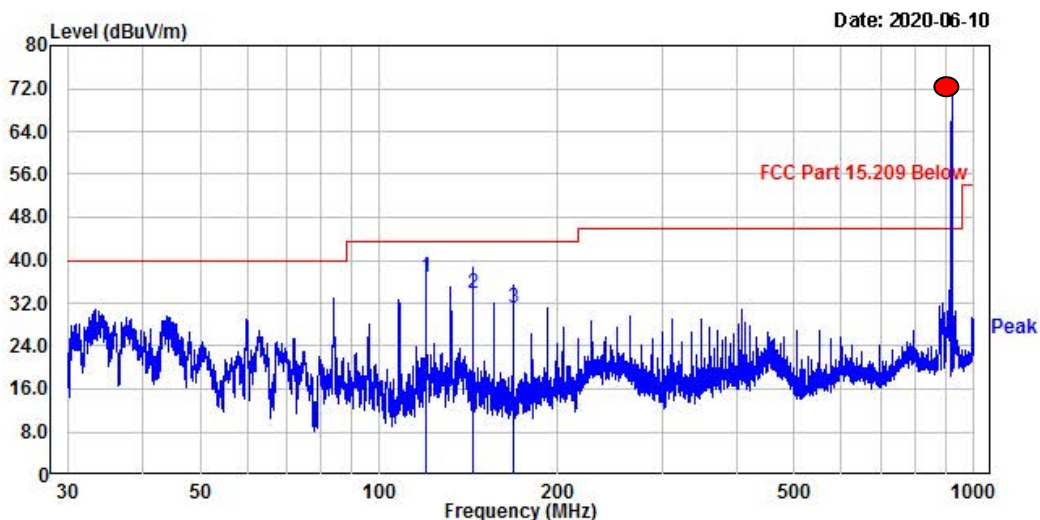
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode M

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	53.67	-16.89	36.78	43.52	6.74	100	84	vertical
2.	144.21	48.92	-15.05	33.87	43.52	9.65	100	94	vertical
3.	168.19	46.33	-15.30	31.03	43.52	12.49	100	94	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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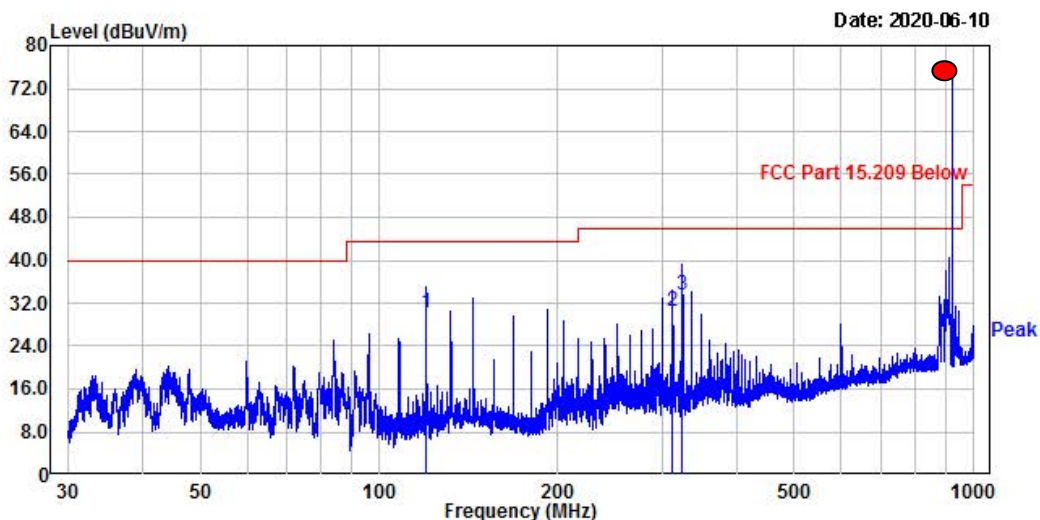
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode H

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	47.13	-16.89	30.24	43.52	13.28	400	278	horizontal
2.	312.32	44.03	-13.66	30.37	46.02	15.65	100	52	horizontal
3.	324.46	47.09	-13.45	33.64	46.02	12.38	100	62	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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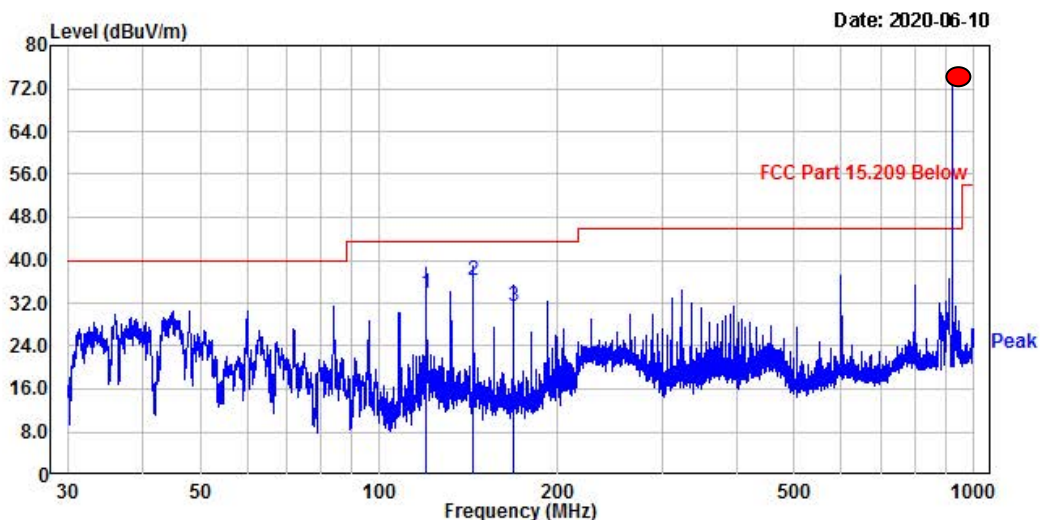
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode H

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	50.66	-16.89	33.77	43.52	9.75	100	355	vertical
2.	144.21	51.42	-15.05	36.37	43.52	7.15	100	151	vertical
3.	168.19	46.77	-15.30	31.47	43.52	12.05	100	113	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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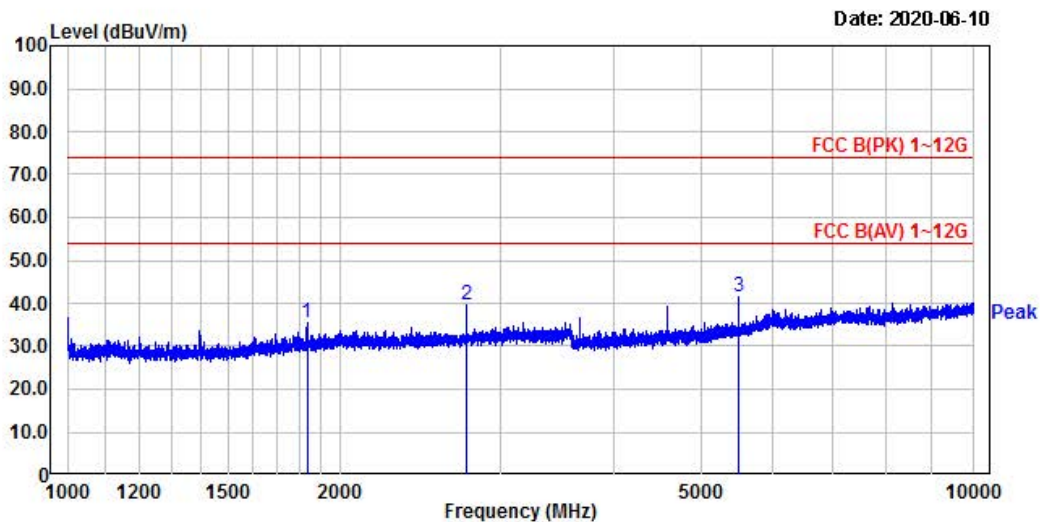
EUT/Model No.: KCTM-2000

Temp/Humi: 25 'C / 40 % R.H.

Test Mode : Wireless mode\_PORT L

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV		PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV	dB	dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1835.48	42.59	-----	-6.97	35.62	-----	74.00	-----	38.38	-----	100	206	horizontal
2.	2753.44	43.95	-----	-4.30	39.65	-----	74.00	-----	34.35	-----	100	113	horizontal
3.	5508.08	39.23	-----	2.43	41.66	-----	74.00	-----	32.34	-----	100	53	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain





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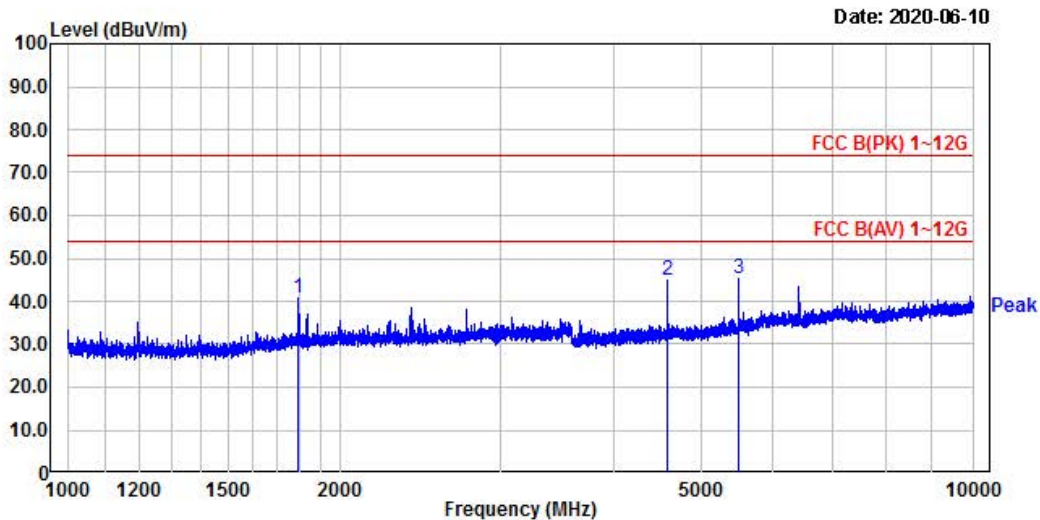
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT L

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1797.84	48.86	-----	-7.28	48.78	-----	74.00	-----	33.22	-----	100	62	vertical
2.	4589.34	44.92	-----	0.02	44.94	-----	74.00	-----	29.06	-----	100	94	vertical
3.	5506.49	42.86	-----	2.42	45.28	-----	74.00	-----	28.72	-----	100	94	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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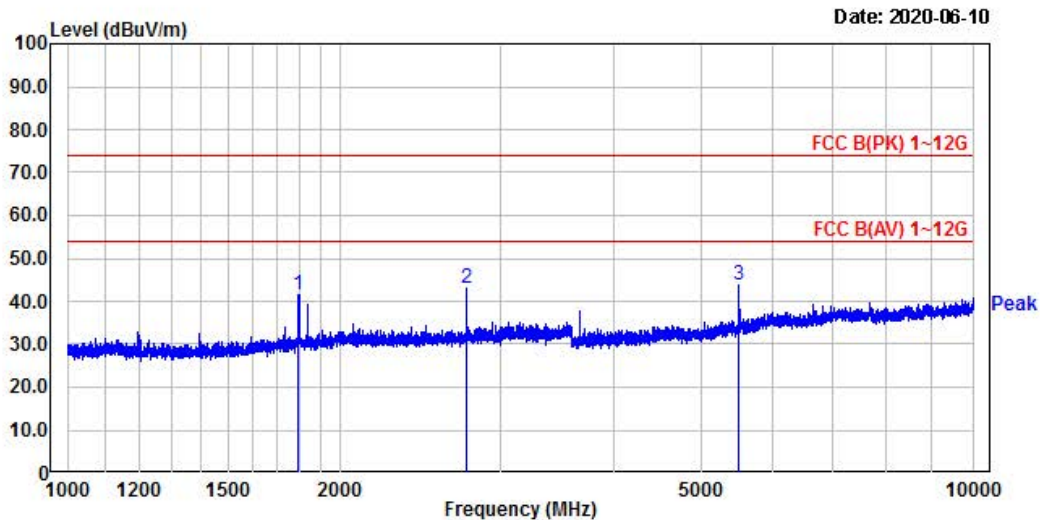
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT M

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV		PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV	dB	dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1795.25	48.79	-----	-7.29	41.50	-----	74.00	-----	32.50	-----	100	12	horizontal
2.	2757.40	47.15	-----	-4.28	42.87	-----	74.00	-----	31.13	-----	100	129	horizontal
3.	5516.01	41.30	-----	2.47	43.77	-----	74.00	-----	30.23	-----	100	70	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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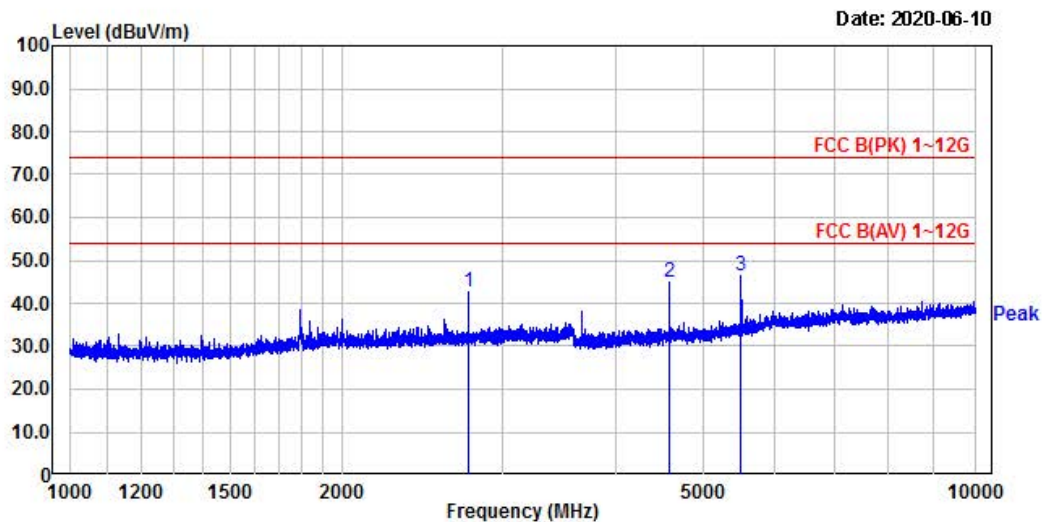
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT M

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	2758.20	46.88	-----	-4.28	42.60	-----	74.00	-----	31.40	-----	100	34	vertical
2.	4597.27	44.74	-----	0.05	44.79	-----	74.00	-----	29.21	-----	100	94	vertical
3.	5516.01	44.06	-----	2.47	46.53	-----	74.00	-----	27.47	-----	100	94	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain





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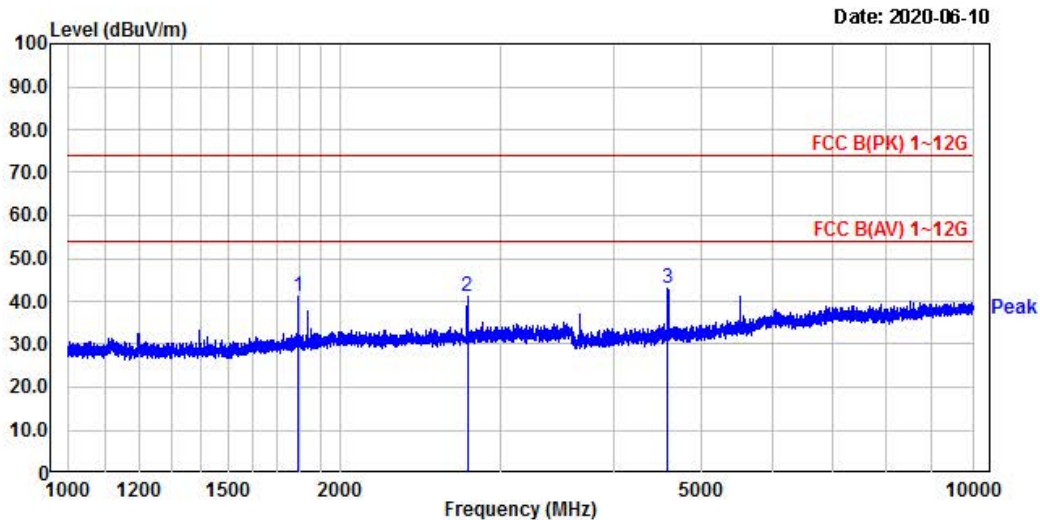
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT H

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	dB	dB	cm	deg	
1.	1795.77	48.42	-----	-7.29	41.13	-----	74.00	-----	32.87	-----	100	0	horizontal
2.	2760.58	45.26	-----	-4.27	40.99	-----	74.00	-----	33.01	-----	100	98	horizontal
3.	4601.24	42.98	-----	0.05	43.03	-----	74.00	-----	30.97	-----	100	43	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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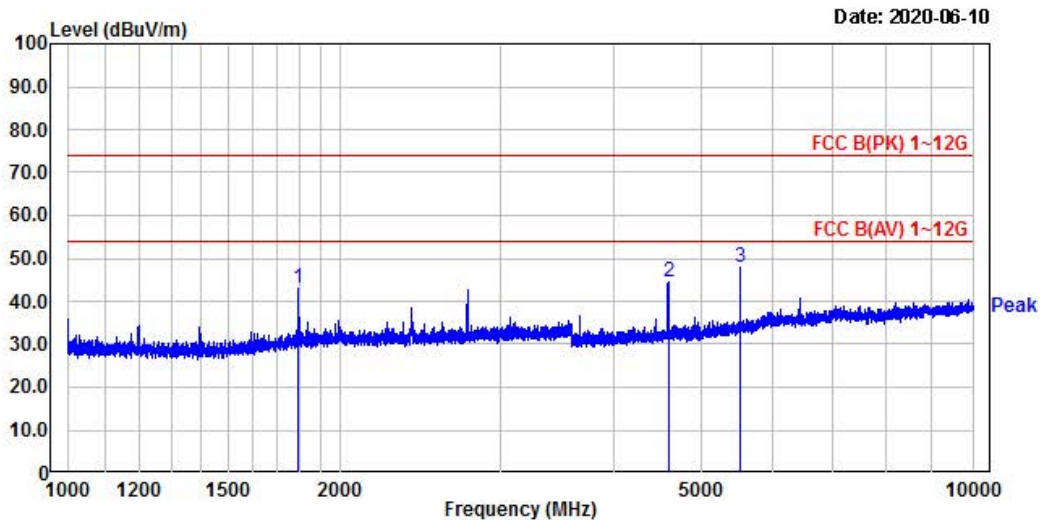
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT H

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1796.80	50.40	-----	-7.28	43.12	-----	74.00	-----	30.88	-----	100	84	vertical
2.	4602.57	44.36	-----	0.06	44.42	-----	74.00	-----	29.58	-----	100	39	vertical
3.	5522.36	45.49	-----	2.49	47.98	-----	74.00	-----	26.02	-----	100	144	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

**Radiated Emissions-Port 2**

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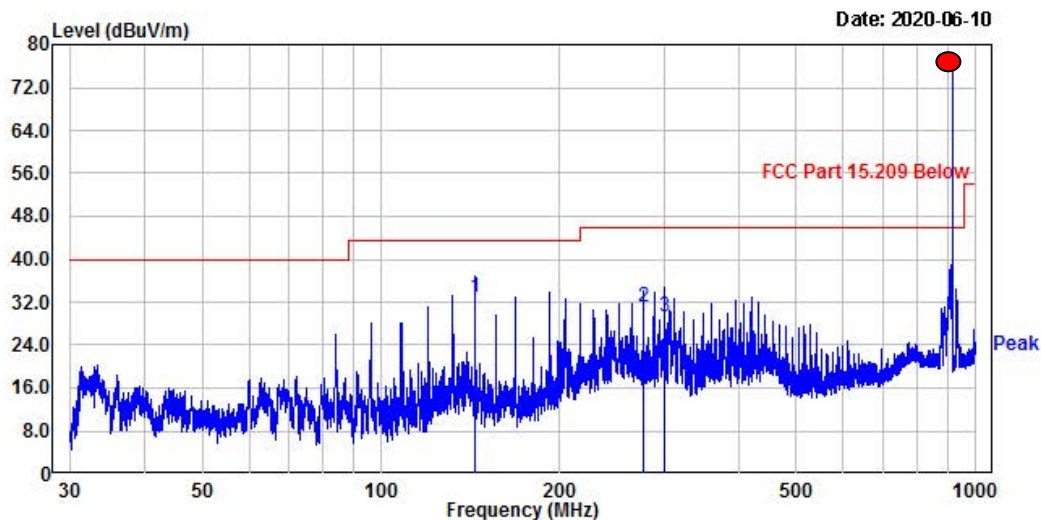
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode L-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	144.21	48.01	-15.05	32.96	43.52	10.56	400	37	horizontal
2.	276.37	45.95	-14.71	31.24	46.02	14.78	400	82	horizontal
3.	300.37	43.22	-13.87	29.35	46.02	16.67	400	26	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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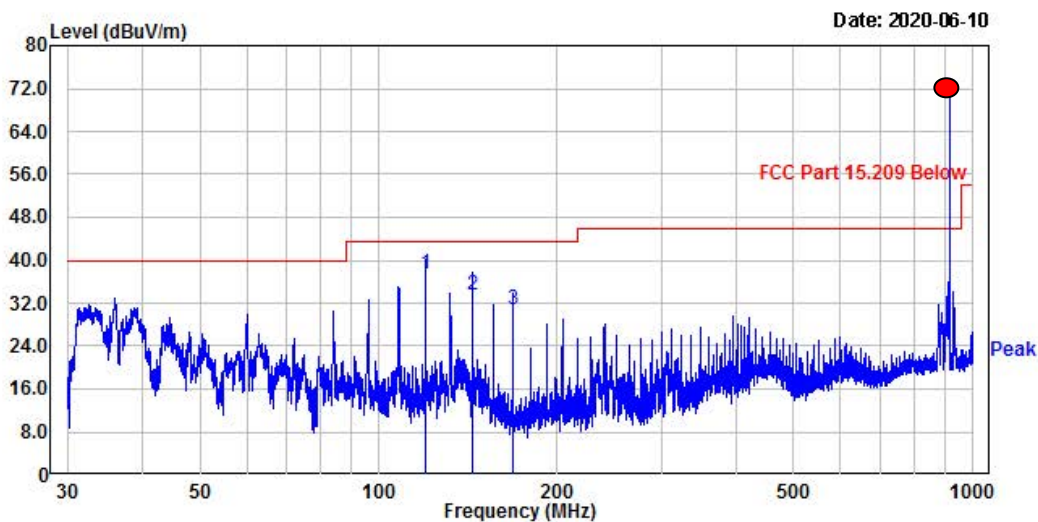
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode L-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	54.19	-16.89	37.30	43.52	6.22	100	3	vertical
2.	144.15	48.62	-15.06	33.56	43.52	9.96	100	360	vertical
3.	168.19	46.02	-15.30	30.72	43.52	12.80	100	23	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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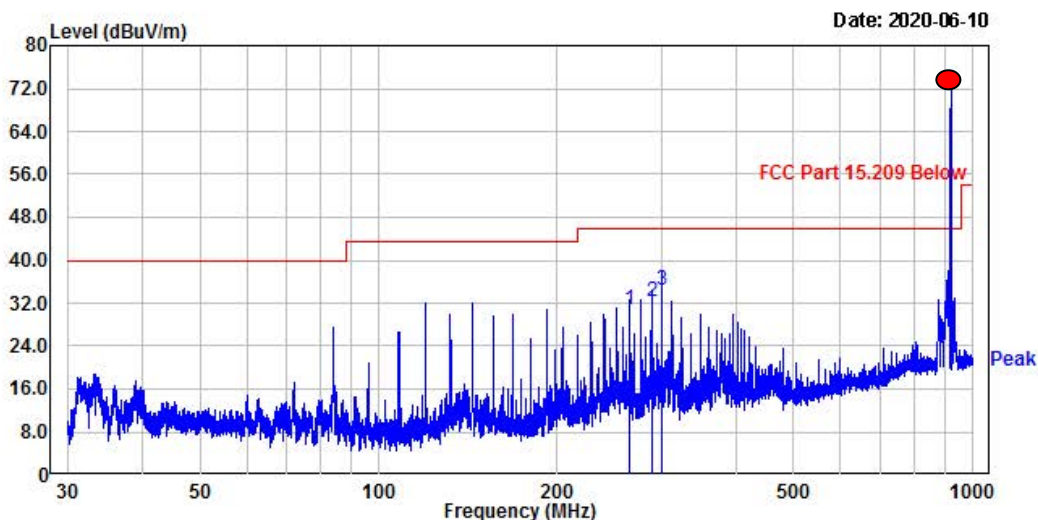
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode M-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	264.05	45.95	-15.14	30.81	46.02	15.21	400	252	horizontal
2.	288.37	46.71	-14.29	32.42	46.02	13.60	400	55	horizontal
3.	300.37	48.14	-13.87	34.27	46.02	11.75	400	68	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain





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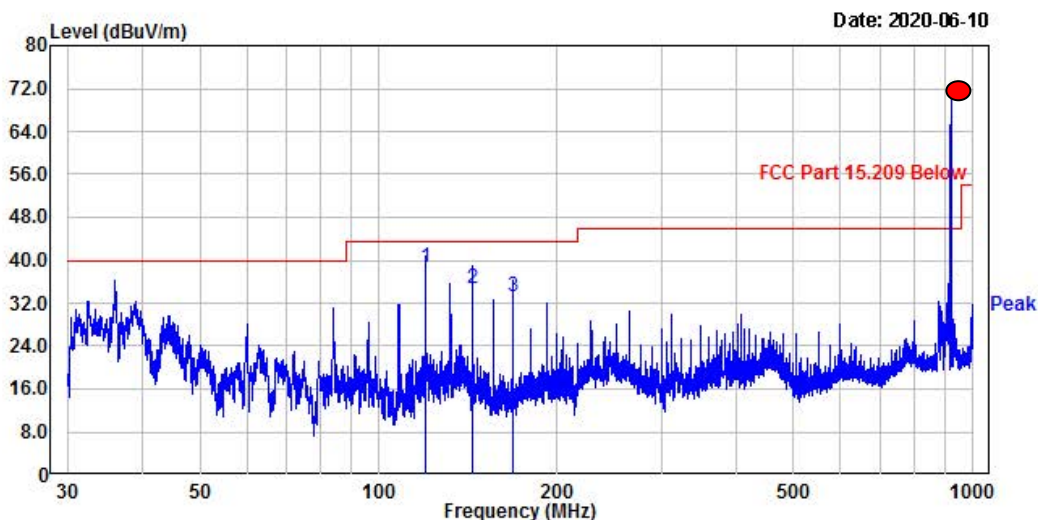
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode M-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	55.43	-16.89	38.54	43.52	4.98	100	57	vertical
2.	144.21	49.91	-15.05	34.86	43.52	8.66	100	116	vertical
3.	168.19	48.36	-15.30	33.06	43.52	10.46	100	116	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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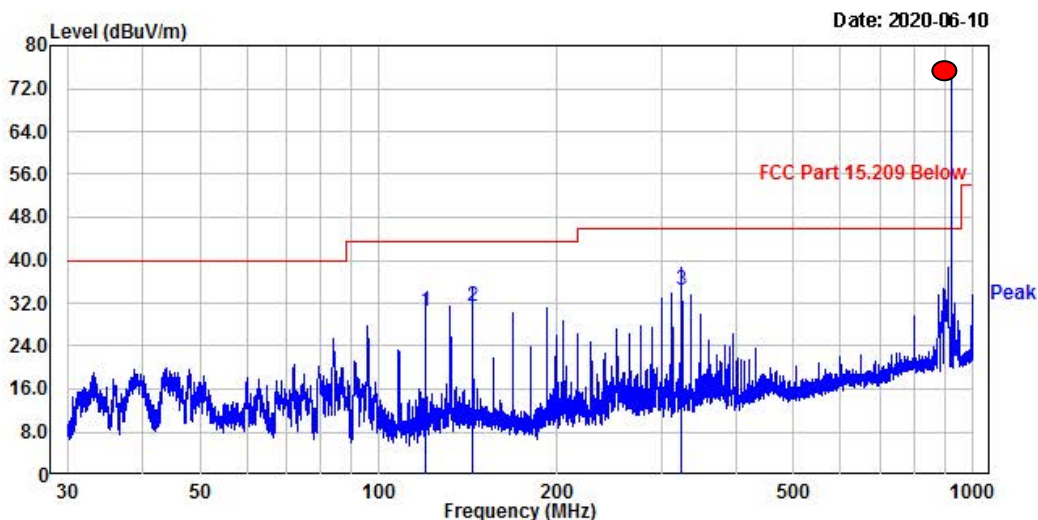
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode H-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	47.30	-16.89	30.41	43.52	13.11	400	265	horizontal
2.	144.15	46.55	-15.06	31.49	43.52	12.03	100	266	horizontal
3.	324.46	48.01	-13.45	34.56	46.02	11.46	100	83	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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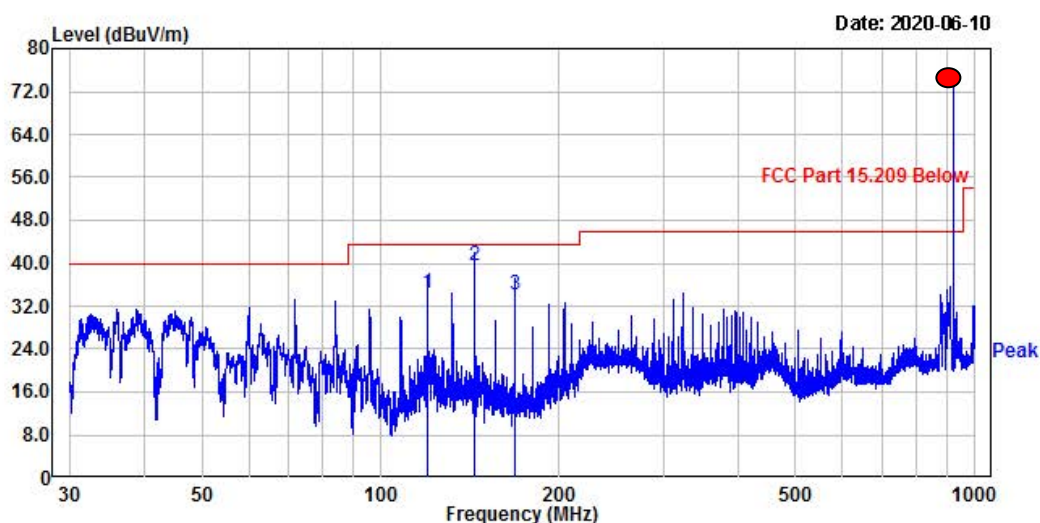
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode H-2

Tested by: JUNG E H

Power :



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBμV/m	Limit dBμV/m	Margin dB	Height cm	Angle deg	Polarity
1.	120.12	51.43	-16.89	34.54	43.52	8.98	100	0	vertical
2.	144.15	54.61	-15.06	39.55	43.52	3.97	100	152	vertical
3.	168.19	49.39	-15.30	34.09	43.52	9.43	100	105	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain





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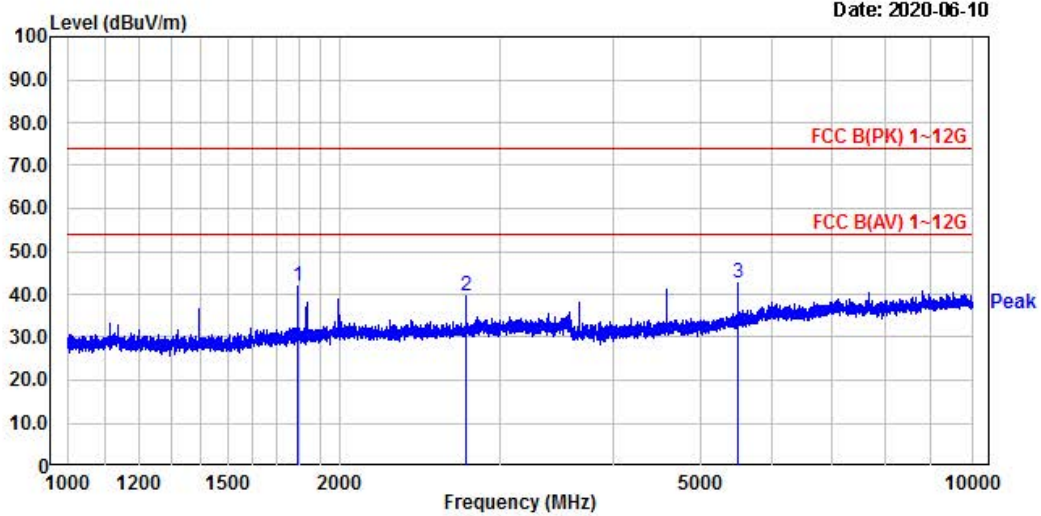
EUT/Model No.: KCTM-2000

Temp/Humi: 25 'C / 40 % R.H.

Test Mode : Wireless mode\_PORT L-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV		PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV	dB	dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1792.15	49.28	-----	-7.31	41.97	-----	74.00	-----	32.03	-----	100	14	horizontal
2.	2753.44	44.04	-----	-4.30	39.74	-----	74.00	-----	34.26	-----	100	244	horizontal
3.	5506.49	40.14	-----	2.42	42.56	-----	74.00	-----	31.44	-----	100	47	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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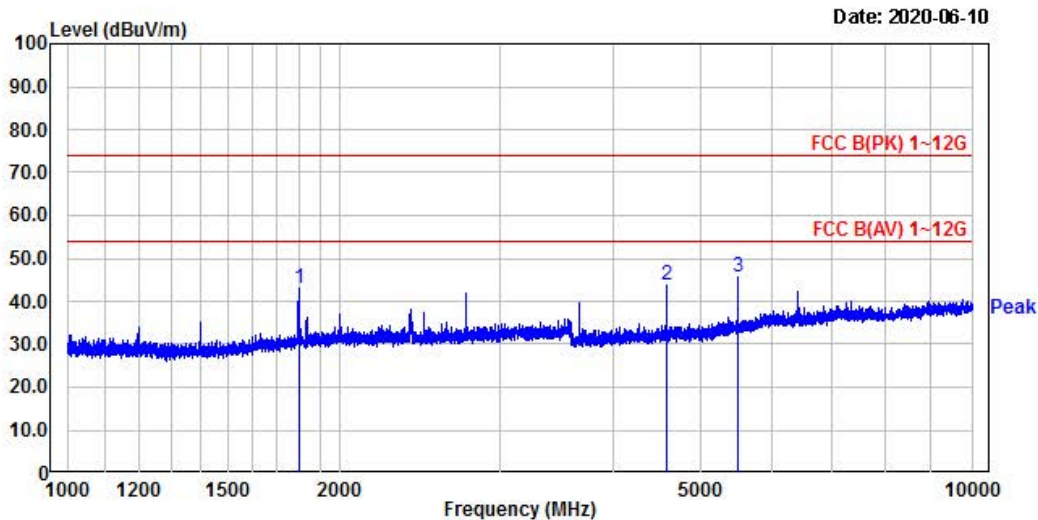
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT L-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1799.39	50.22	-----	-7.26	42.96	-----	74.00	-----	31.04	-----	100	229	vertical
2.	4589.34	43.87	-----	0.02	43.89	-----	74.00	-----	30.11	-----	100	180	vertical
3.	5506.49	43.24	-----	2.42	45.66	-----	74.00	-----	28.34	-----	100	76	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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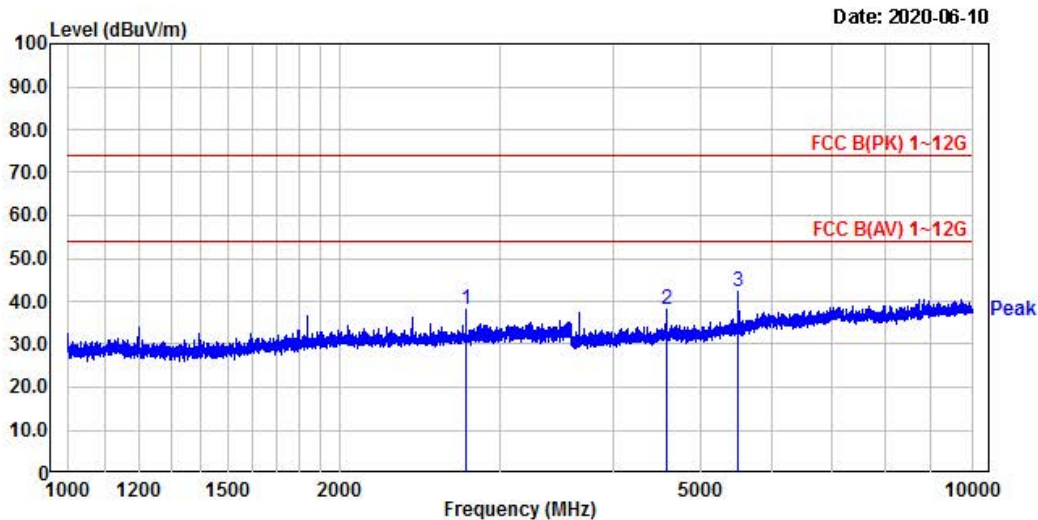
EUT/Model No.: KCTM-2000

Temp/Humi: 25 'C / 40 % R.H.

Test Mode : Wireless mode\_PORT M-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	2757.40	42.38	-----	-4.28	38.10	-----	74.00	-----	35.90	-----	100	242	horizontal
2.	4595.95	38.08	-----	0.04	38.12	-----	74.00	-----	35.88	-----	100	125	horizontal
3.	5516.01	39.62	-----	2.47	42.09	-----	74.00	-----	31.91	-----	100	73	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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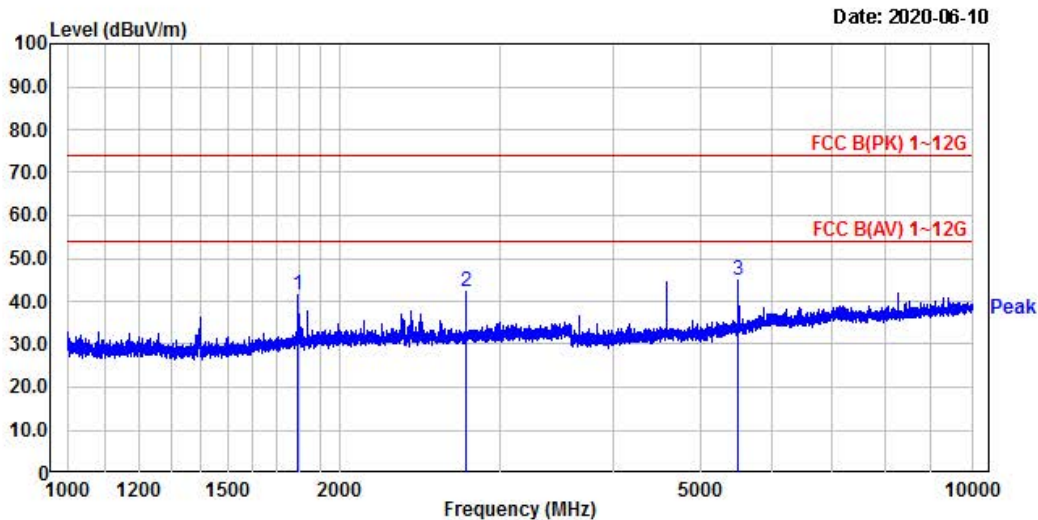
EUT/Model No.: KCTM-2000

Temp/Humi: 25 'C / 40 % R.H.

Test Mode : Wireless mode\_PORT M-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV		PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV	dB	dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	1792.67	48.86	-----	-7.31	41.55	-----	74.00	-----	32.45	-----	100	59	vertical
2.	2757.40	46.38	-----	-4.28	42.10	-----	74.00	-----	31.90	-----	100	212	vertical
3.	5516.01	42.45	-----	2.47	44.92	-----	74.00	-----	29.08	-----	100	164	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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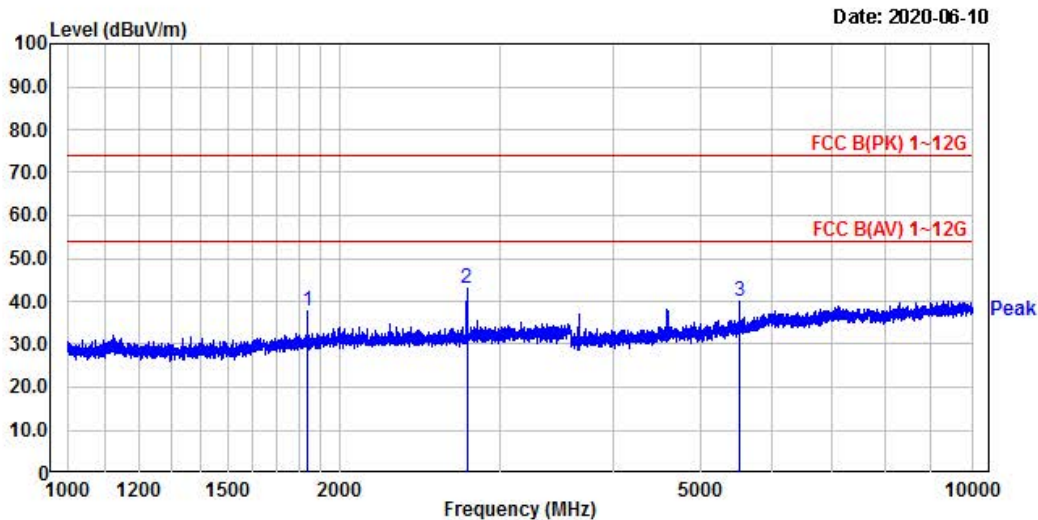
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT H-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
1.	1840.24	44.86	-----	-6.94	37.92	-----	74.00	-----	36.08	-----	100	231	horizontal
2.	2760.58	47.21	-----	-4.27	42.94	-----	74.00	-----	31.06	-----	100	289	horizontal
3.	5522.36	37.61	-----	2.49	40.10	-----	74.00	-----	33.90	-----	100	99	horizontal

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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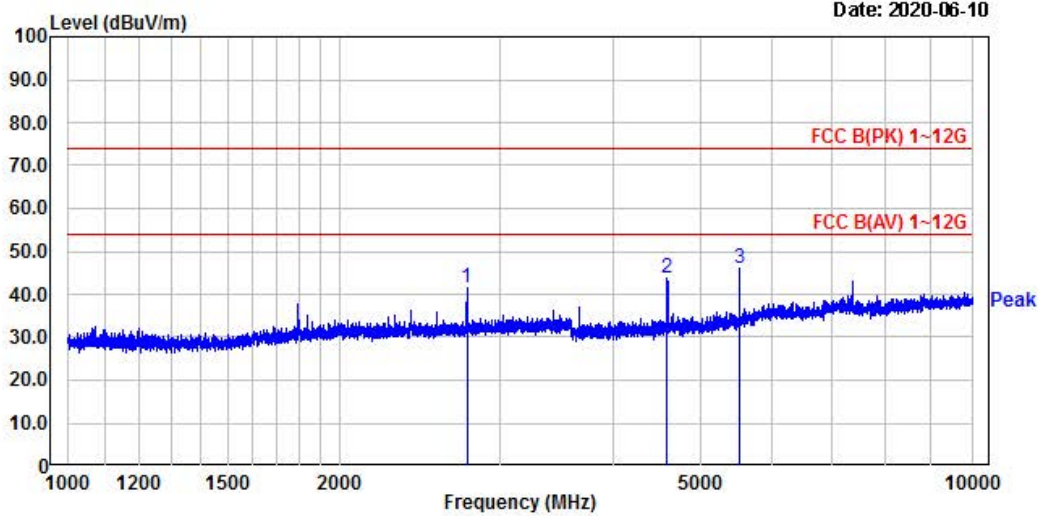
EUT/Model No.: KCTM-2000

Temp/Humi: 25 °C / 40 % R.H.

Test Mode : Wireless mode\_PORT H-2

Tested by: JUNG E H

Power :



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	2760.58	45.95	-----	-4.27	41.68	-----	74.00	-----	32.32	-----	100	212	vertical
2.	4601.24	43.67	-----	0.05	43.72	-----	74.00	-----	30.28	-----	100	168	vertical
3.	5522.36	43.54	-----	2.49	46.03	-----	74.00	-----	27.97	-----	100	105	vertical

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



### 3.3.9 AC Conducted Emissions

**Procedure:**

AC power line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2003.

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

**Measurement Data:** N/A

**Minimum Standard:** FCC Part 15.207(a)/EN 55022

Frequency Range	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

\* Note: This product operates only with battery and does not operate during charging.

## APPENDIX

## TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Next Cal. Date
1		Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2020-09-06
2		Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2021-03-20
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2021-03-20
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2020-09-06
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2020-09-06
6	■	EMI Test Receiver (~40 GHz)	ESU	100092	R&S	1 year	2021-03-20
7	■	RF Amplifier (~40 GHz)	PAM-840A	461314	HP	1 year	2021-03-20
8	■	RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2021-03-20
9	■	Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2020-08-04
10	■	DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2022-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2022-03-18
12	■	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2021-03-20
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2021-03-20
14		Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
15	■	DC Power Supply	6674A	3637A01657	Agilent	-	-
17	■	Power Meter	EPM-441A	GB32481702	HP	1 year	2021-03-20
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2020-09-06
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2020-09-06
20		Modulation Analyzer	8901B	3749A05878	HP	1 year	2020-09-06
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2020-09-06
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2022-03-18
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2020-09-06
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2021-03-20
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2021-03-20
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2021-03-20
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2021-03-20
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2021-03-20
29	■	Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2021-03-20
30	■	Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2021-03-20
31	■	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2 year	2021-02-26