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Dates of Tests: August 10 2022 ~ February 01, 2023
 Test Report S/N: LR500112302C
 Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

2AON5A811-1

APPLICANT

Apulsetech Co., Ltd.

Equipment Class	:	PCB
Manufacturing Description	:	RFID Reader
Manufacturer	:	Apulsetech Co., Ltd.
Model name	:	a811-1
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	Part 22, 24, 27
LTE Band	:	Band 2, 4, 5
Data of issue	:	February 02, 2023

This test report is issued under the authority of:

The test was supervised by:

Ja-Beom Koo, Manager

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. 17159
 Web site : <http://www.ltalab.com>
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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	2023-09-28	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	2023-01-25	FCC CAB
VCCI	JAPAN	C-4948,	2023-09-10	VCCI registration
VCCI	JAPAN	T-2416,	2023-09-10	VCCI registration
VCCI	JAPAN	R-4483(10 m),	2023-08-15	VCCI registration
VCCI	JAPAN	G-847	2023-12-13	VCCI registration
IC	CANADA	5799A-1	2023-10-18	IC filing

2. Information about test item

2-1 Client & Manufacturer

Client Company name : Apulsetech Co., Ltd.
 Address : C-1211, Gwangmyeongtechnopark, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, Republic of Korea
 Tel / Fax : +82-10-9573-2073 / +82-70-4222-5686
 Manufacturer : Apulsetech Co., Ltd.
 Address : C-1211, Gwangmyeongtechnopark, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, Republic of Korea
 Tel / Fax : +82-10-9573-2073 / +82-70-4222-5686

2-2 Equipment Under Test (EUT)

Model name : a811-1
 Host Model Model name : a811-LTE
 Host Variant Model name : a811-4G
 Serial number : Identical prototype
 Date of receipt : August 10 2022
 EUT condition : Pre-production, not damaged
 Antenna type : Linear Polarized Antenna
 (Band 2 : 0.94 dBi, Band 4 : -1.564 dBi, Band 5 : 1.642 dBi)
 LTE Band : Band 2, 4, 5
 Type of Modulation : OFDM
 Power Source : DC 3.7 V

2-3 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
-	-	-	-

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status (note 1)
22.359			
24.238	Transmitter emission	Radiated	C
27.1509			

N/A : This product is battery-enabled and excludes the test.

The above equipment was tested by LTA Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 22, 24, 27. The test results of this report relate only to the tested sample identified in this report.

The tests were performed according to the method of measurements prescribed in KDB No.558074.

3.2 Technical Characteristics Test

3.2.1 Radiated Spurious Emissions

Procedure:

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defined in ANSI C63.10-2013.

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10th harmonic.

$$\text{RBW} = 120 \text{ kHz} \text{ (} 30 \text{ MHz } \sim 1 \text{ GHz) } \quad \text{VBW} \geq \text{RBW}$$

$$\equiv 1 \text{ MHz } \text{ (} 1 \text{ GHz } \sim 10^{\text{th}} \text{ harmonic) }$$

Trace = max hold

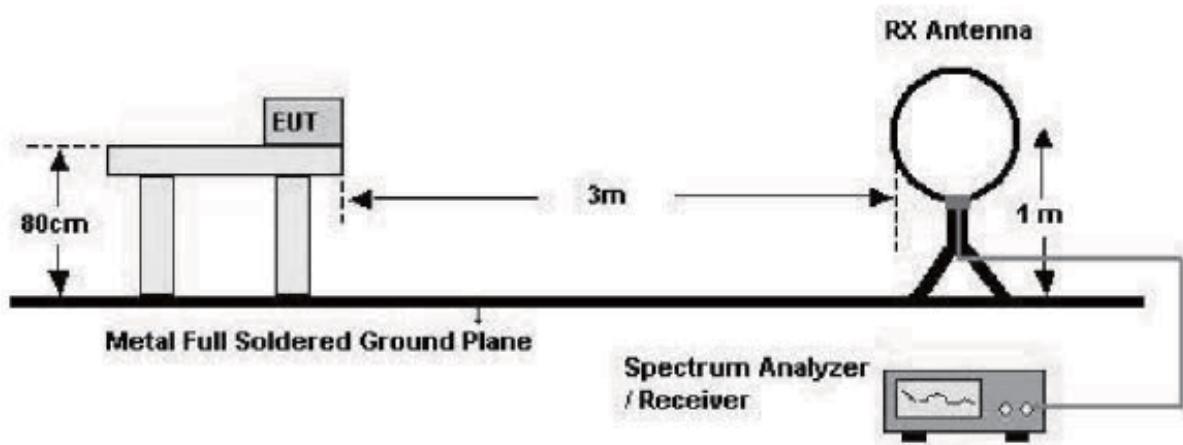
Detector function = peak

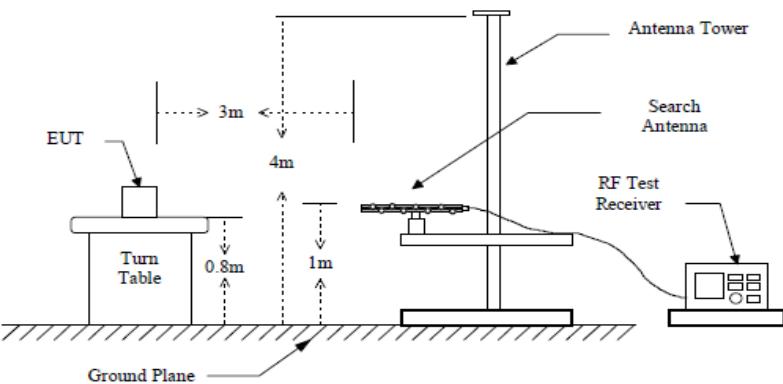
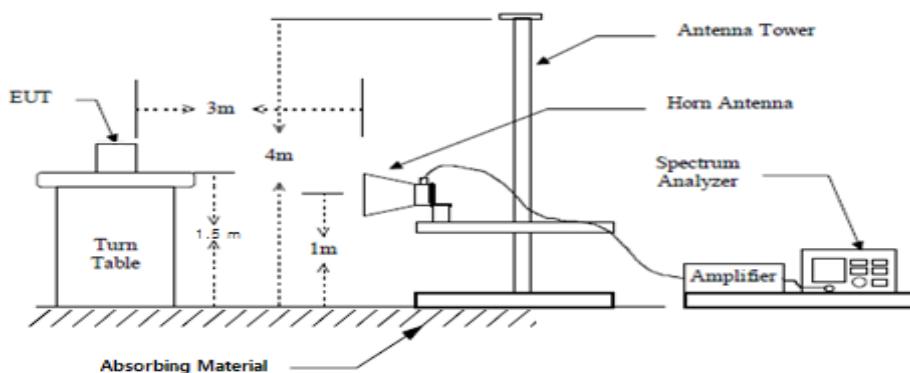
Sweep = auto

Duty cycle : 98.89 %

The EUT configured to transmit continuously ($D \geq 98\%$)/ Duty Factor = 0

below 30 MHz.



below 1 GHz (30 MHz to 1 GHz)**above 1 GHz****Measurement Data: Complies**

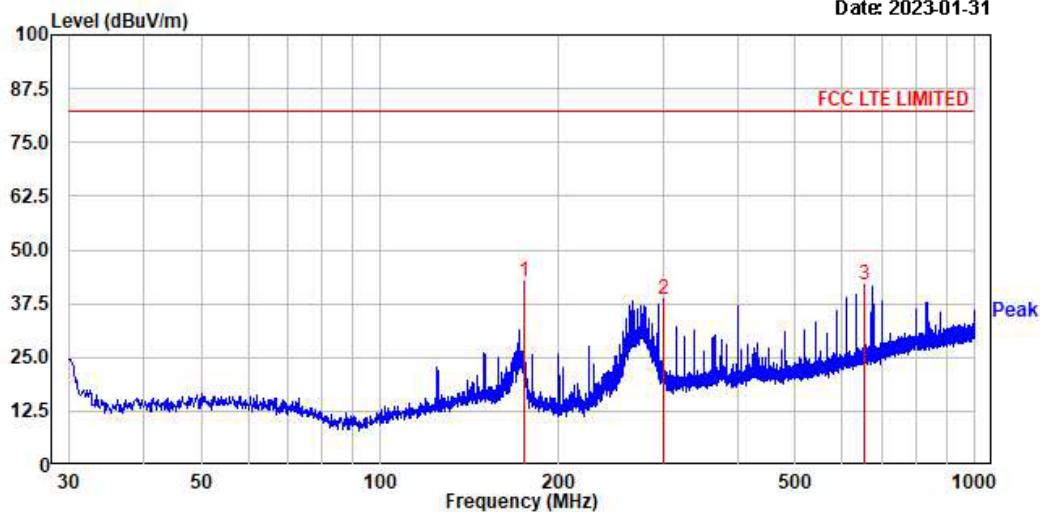
- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30MHz.
- The test results for the worst of the various operating modes are presented in accordance with 6.3.4 of ANSI C63.10.
- Checked with a red circle is the fundamental frequency.

Minimum Standard: FCC Part 15.209(a)

FCC	Limit (uV/m) @ 3 m
22.359	Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)
24.238	
27.1509	-13 dBm (82.23 dBuV/m)

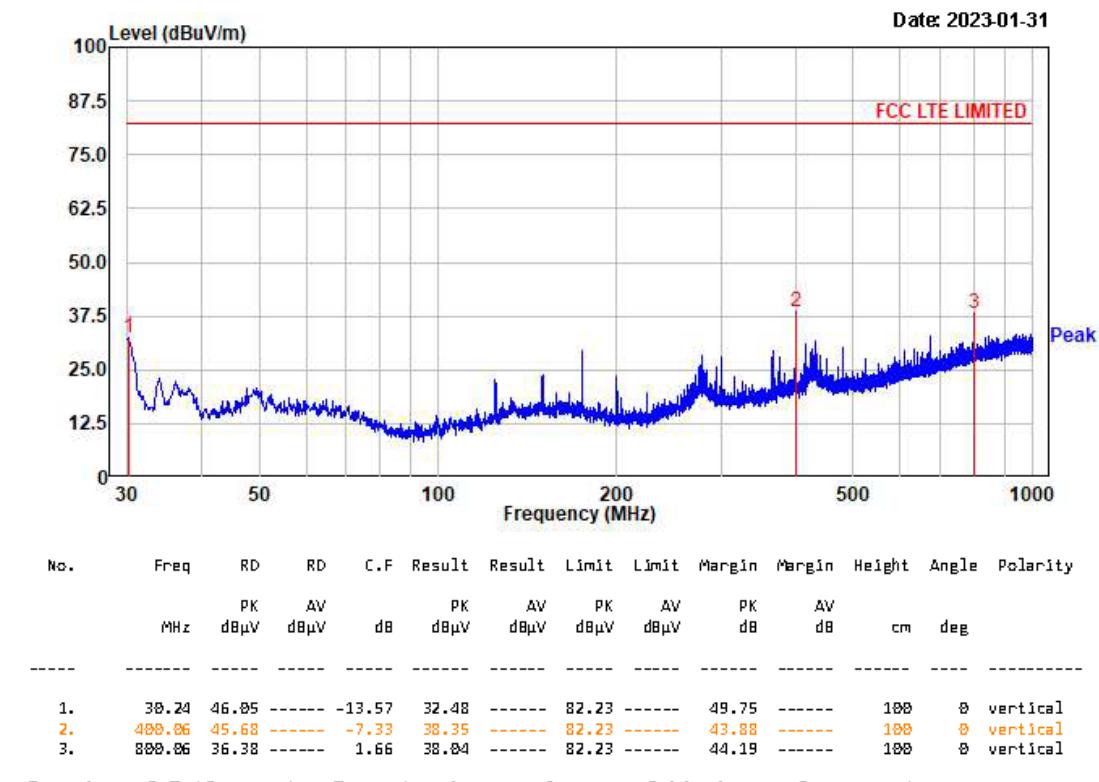
Radiated Emissions – LTE Band 2

Date: 2023-01-31

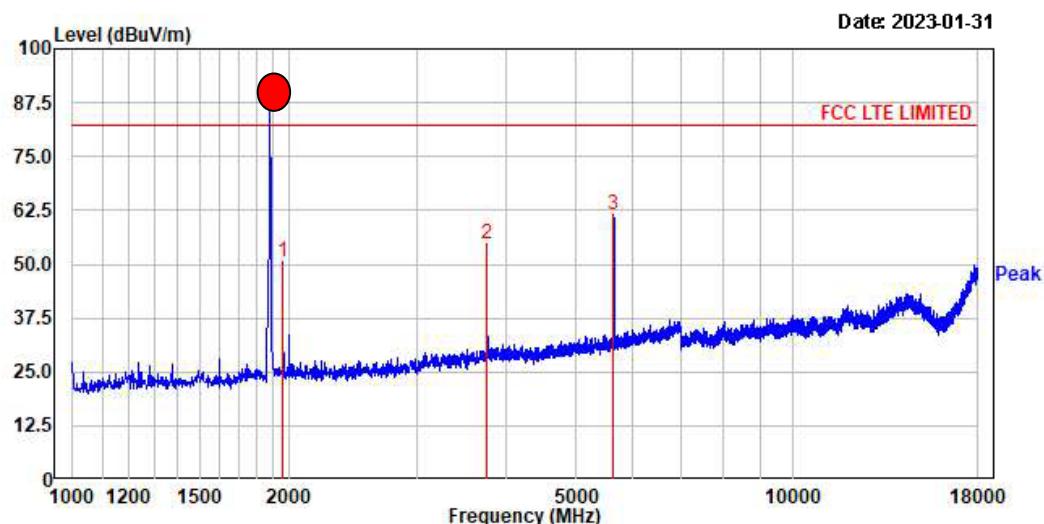


No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	PK	AV	PK	AV	PK	AV	PK	AV	cm	deg
1.	175.02	54.79	-----	-12.28	42.51	-----	82.23	-----	39.72	-----	200	360	horizontal
2.	388.02	48.34	-----	-9.80	38.54	-----	82.23	-----	43.69	-----	100	360	horizontal
3.	654.88	43.69	-----	-1.98	41.71	-----	82.23	-----	40.52	-----	122	360	horizontal

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

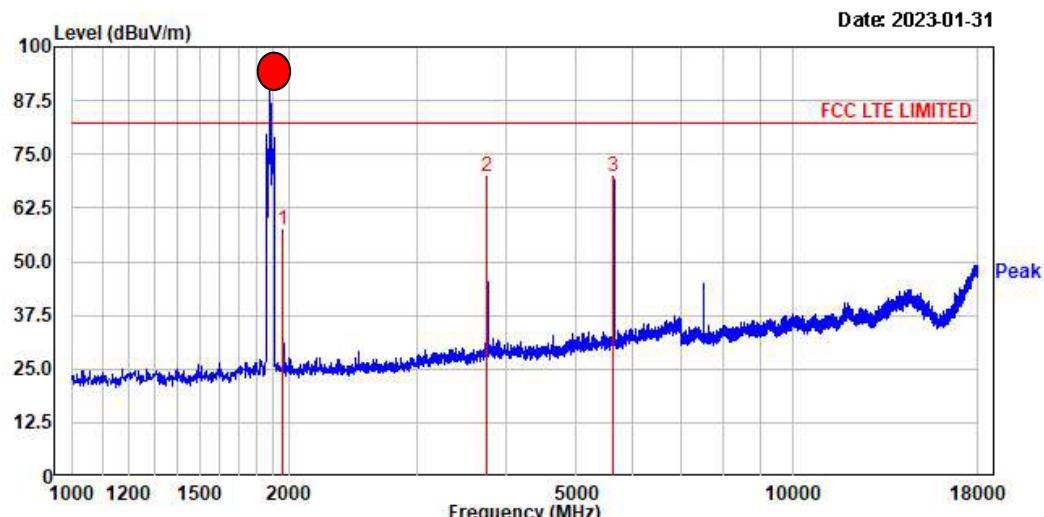


Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



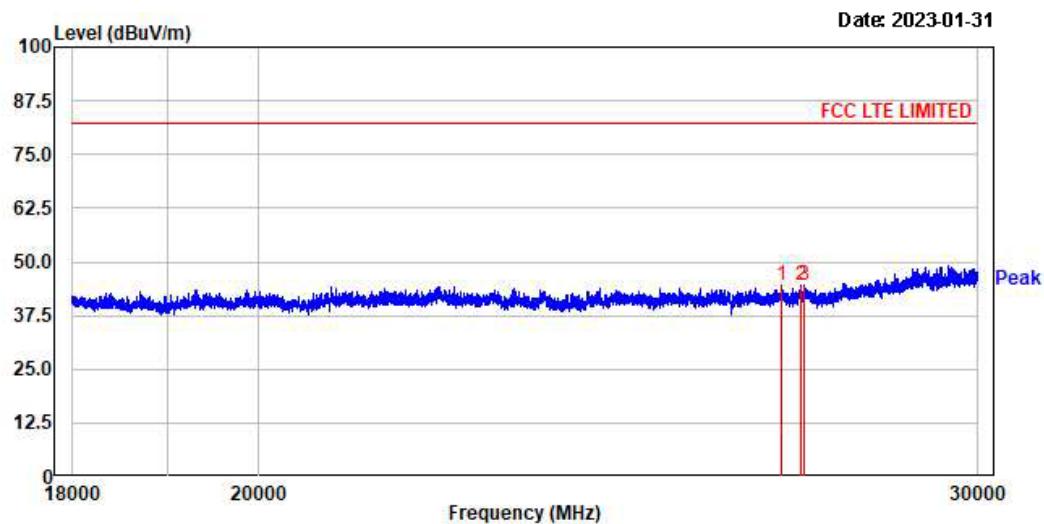
No.	Freq	RD	RD	C.F		Result	Result	Limit		Margin		Margin	Height	Angle	Polarity
				PK	AV			PK	AV	PK	AV				
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB	dB	cm	deg		
1.	1958.50	55.72	-----	-5.04	50.68	-----	82.23	-----	31.55	-----	100	122	horizontal		
2.	3758.25	52.70	-----	2.04	54.74	-----	82.23	-----	27.49	-----	100	108	horizontal		
3.	5638.88	55.58	-----	5.76	61.34	-----	82.23	-----	20.89	-----	100	91	horizontal		

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



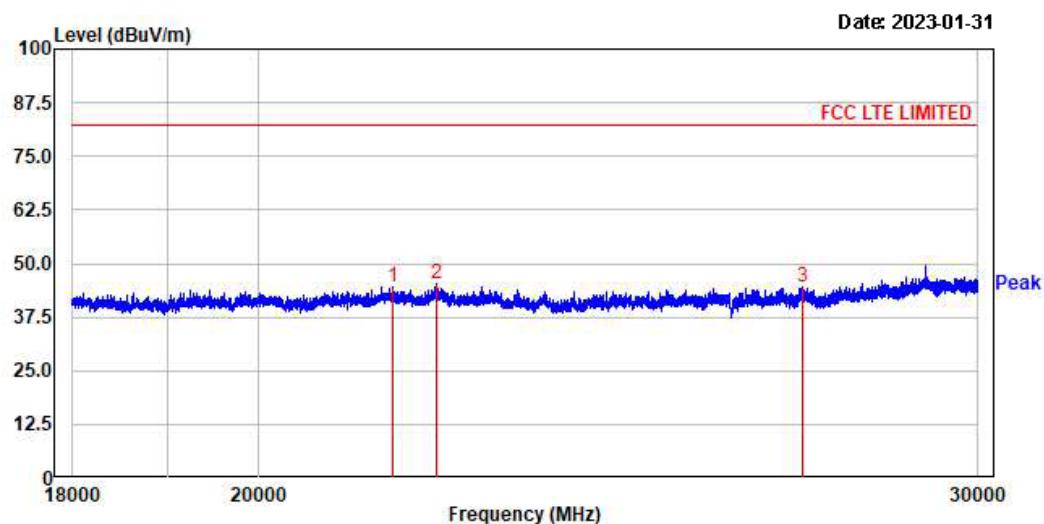
No.	Freq	RD	RD	C.F		Result	Result	Limit		Margin		Margin	Height	Angle	Polarity
				PK	AV			PK	AV	PK	AV				
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB	dB	cm	deg		
1.	1958.38	62.27	-----	-5.03	57.24	-----	82.23	-----	24.99	-----	100	0	vertical		
2.	3758.25	67.64	-----	2.04	69.68	-----	82.23	-----	12.55	-----	100	92	vertical		
3.	5638.88	64.11	-----	5.76	69.87	-----	82.23	-----	12.36	-----	100	92	vertical		

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



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
		MHz	PK dB μ V	AV dB μ V	dB	PK dB μ V	AV dB μ V	PK dB μ V	AV dB μ V	PK dB	AV dB	cm	deg
1.	26851.50	25.18	-----	19.33	44.51	-----	82.23	-----	37.72	-----	100	330	horizontal
2.	27165.00	24.88	-----	19.68	44.56	-----	82.23	-----	37.67	-----	100	219	horizontal
3.	27211.50	24.74	-----	19.67	44.41	-----	82.23	-----	37.82	-----	100	106	horizontal

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

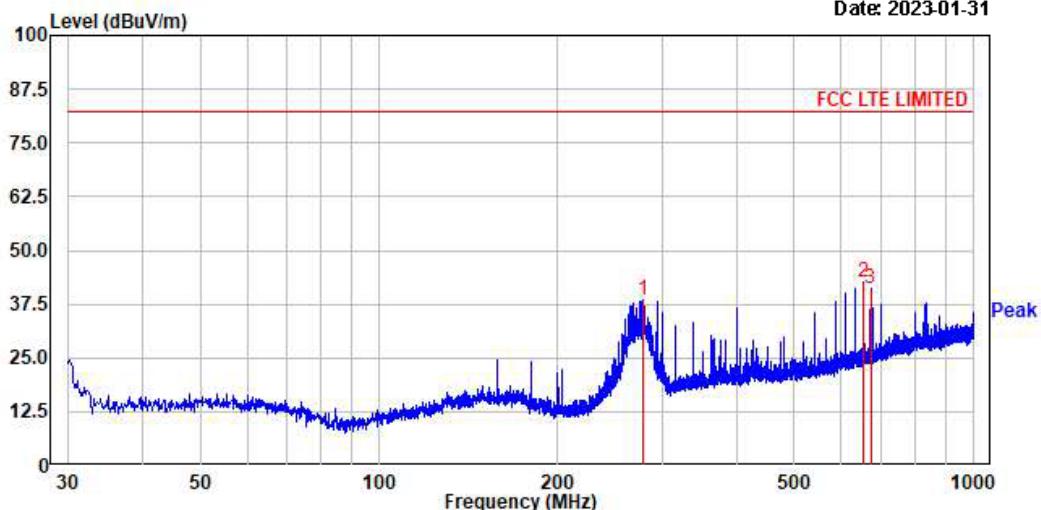


No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
		MHz	PK dB μ V	AV dB μ V	dB	PK dB μ V	AV dB μ V	PK dB μ V	AV dB μ V	PK dB	AV dB	cm	deg
1.	21565.50	28.60	-----	15.97	44.57	-----	82.23	-----	37.66	-----	100	0	vertical
2.	22114.50	28.99	-----	16.25	45.24	-----	82.23	-----	36.99	-----	100	300	vertical
3.	27172.50	24.97	-----	19.61	44.58	-----	82.23	-----	37.65	-----	100	3	vertical

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

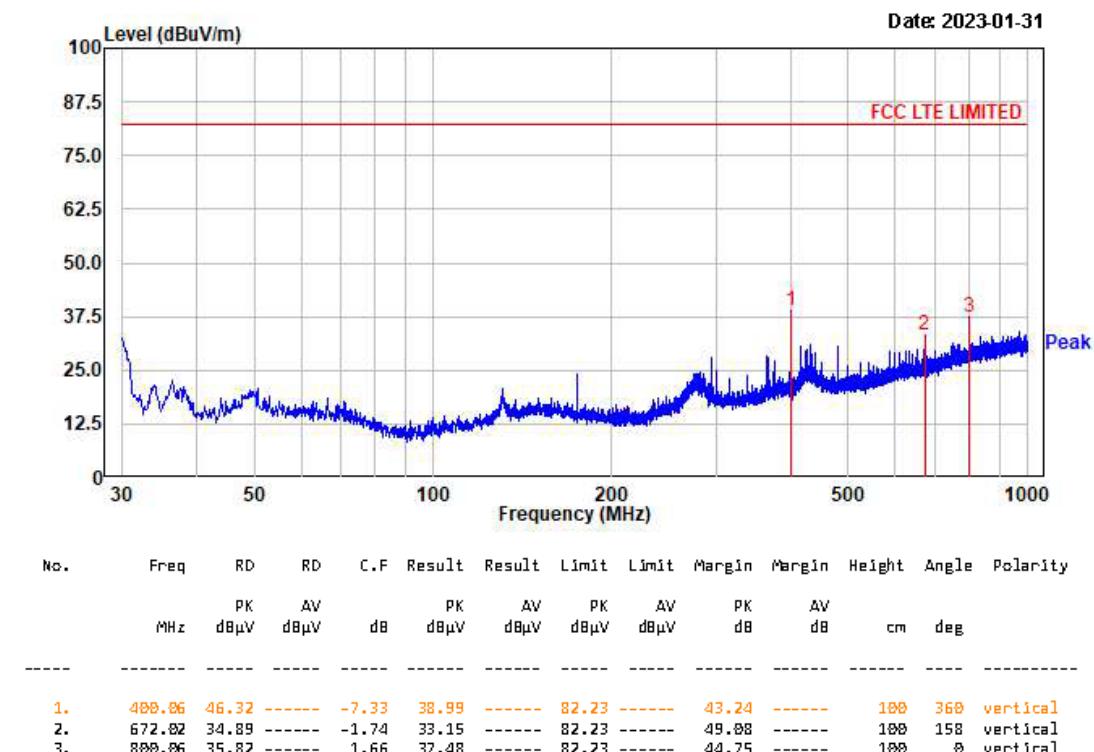
Radiated Emissions – LTE Band 4

Date: 2023-01-31

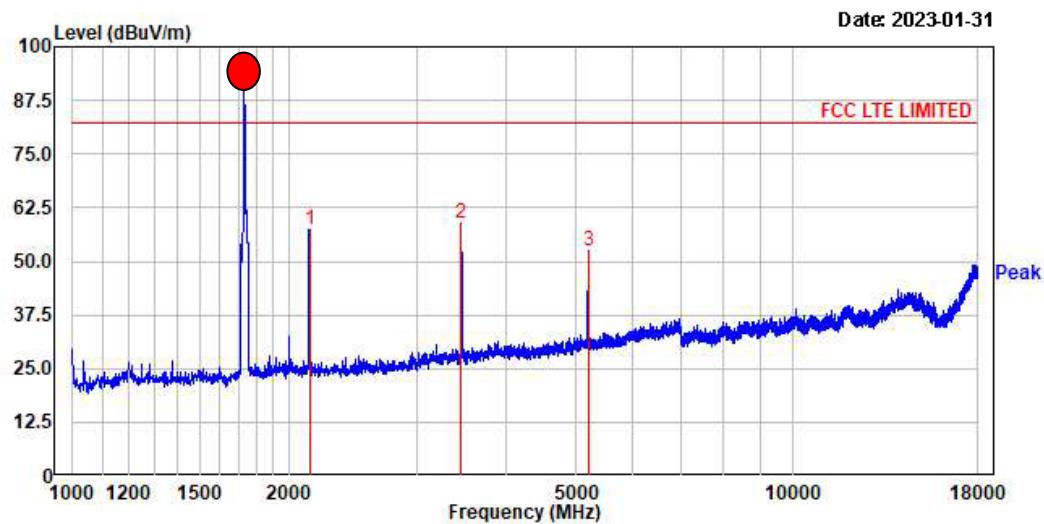


No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
		PK	AV	PK	AV	PK	AV	PK	AV	cm	deg		
	MHz	dBµV	dBµV	dB	dBµV	dBµV	dBµV	dBµV	dB	dB			
1.	277.47	48.89	-----	-10.54	38.35	-----	82.23	-----	43.88	-----	100	3	horizontal
2.	654.80	44.48	-----	-1.98	42.50	-----	82.23	-----	39.73	-----	120	360	horizontal
3.	672.02	42.96	-----	-1.74	41.22	-----	82.23	-----	41.01	-----	140	360	horizontal

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

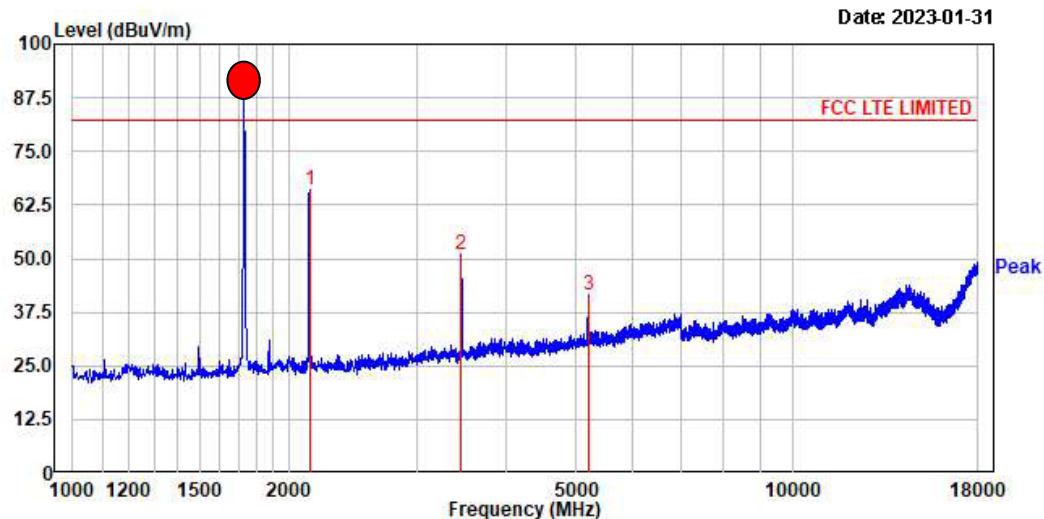


Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



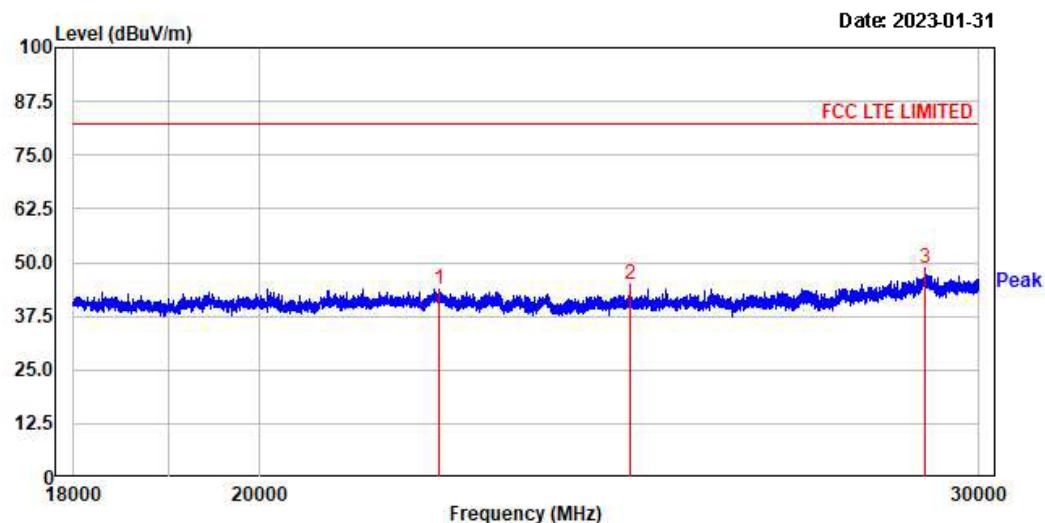
No.	Freq	RD		C.F		Result		Result		Limit		Margin		Margin	Height	Angle	Polarity
		MHz	PK	RD	PK	AV	PK	AV	PK	AV	PK	AV	PK	AV			
1.	2132.63	62.84	-----	-4.65	57.39	-----	82.23	-----	24.84	-----	100	0	horizontal				
2.	3462.88	58.49	-----	0.34	58.83	-----	82.23	-----	23.40	-----	100	0	horizontal				
3.	5196.88	47.46	-----	5.12	52.58	-----	82.23	-----	29.65	-----	100	0	horizontal				

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



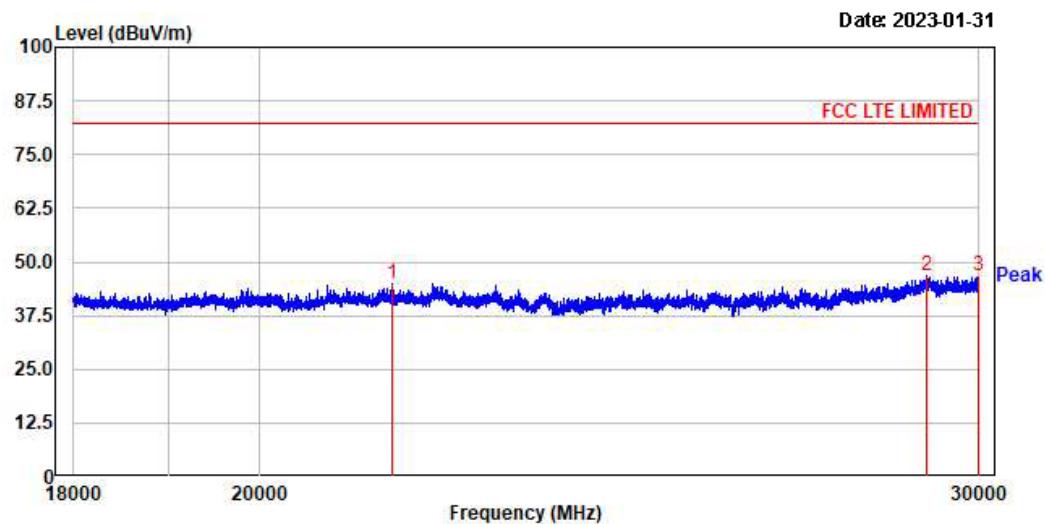
No.	Freq	RD		C.F		Result		Result		Limit		Margin		Margin	Height	Angle	Polarity
		MHz	PK	RD	PK	AV	PK	AV	PK	AV	PK	AV	PK	AV			
1.	2132.63	70.50	-----	-4.65	65.85	-----	82.23	-----	16.38	-----	100	78	vertical				
2.	3467.13	50.49	-----	0.34	50.83	-----	82.23	-----	31.40	-----	100	360	vertical				
3.	5196.88	36.40	-----	5.12	41.52	-----	82.23	-----	40.71	-----	100	360	vertical				

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



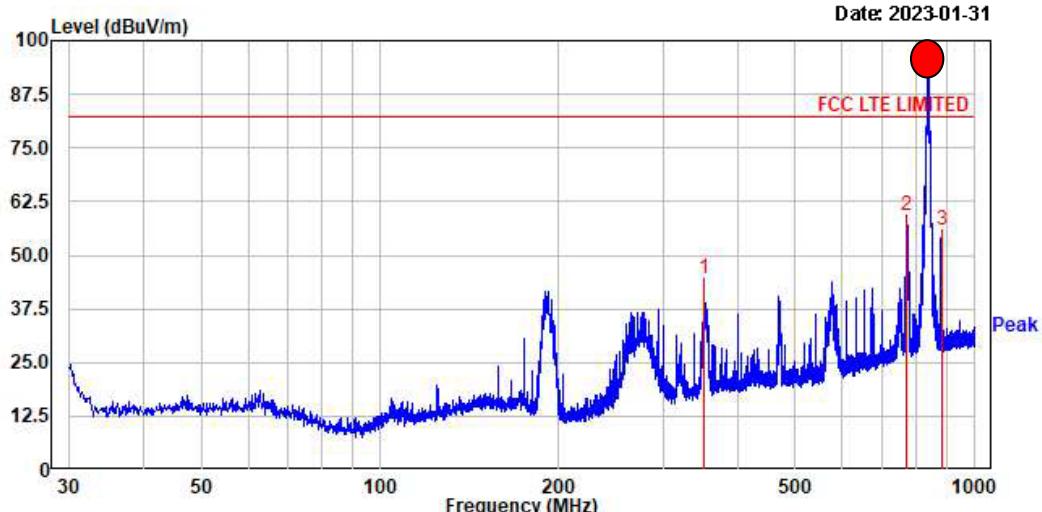
No.	Freq	RD	RD	C.F	Result		Limit		Margin		Margin	Height	Angle	Polarity
					PK	AV	PK	AV	PK	AV				
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB	cm	deg		
1.	22122.00	27.97	-----	15.96	43.93	-----	82.23	-----	38.30	-----	100	360	horizontal	
2.	24643.50	27.49	-----	17.37	44.86	-----	82.23	-----	37.37	-----	100	12	horizontal	
3.	29103.00	25.40	-----	23.11	48.51	-----	82.23	-----	33.72	-----	100	314	horizontal	

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



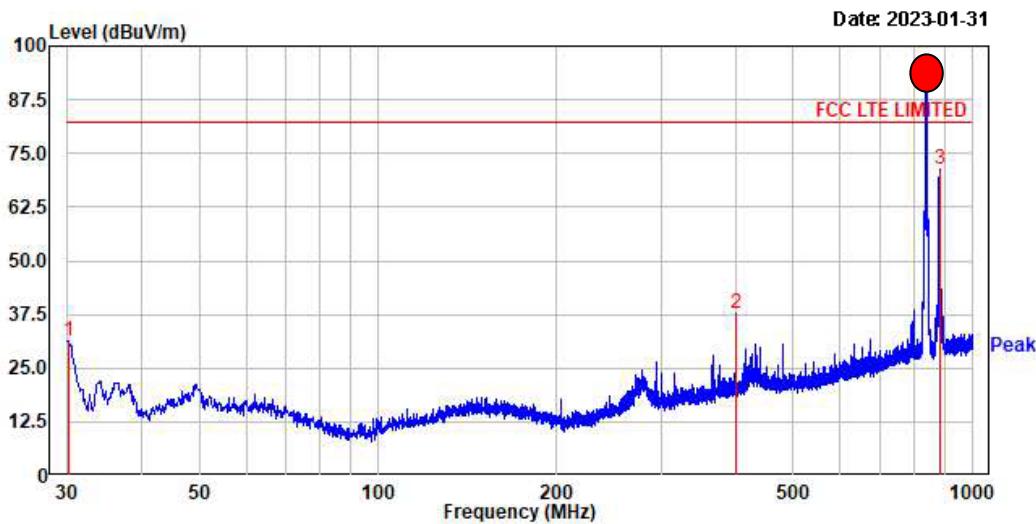
No.	Freq	RD	RD	C.F	Result		Limit		Margin		Margin	Height	Angle	Polarity
					PK	AV	PK	AV	PK	AV				
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB	dB	cm	deg		
1.	21552.00	28.94	-----	15.98	44.92	-----	82.23	-----	37.31	-----	100	286	vertical	
2.	29148.00	23.92	-----	22.73	46.65	-----	82.23	-----	35.58	-----	100	239	vertical	
3.	30000.00	24.04	-----	22.89	46.93	-----	82.23	-----	35.30	-----	100	360	vertical	

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

Radiated Emissions – LTE Band 5

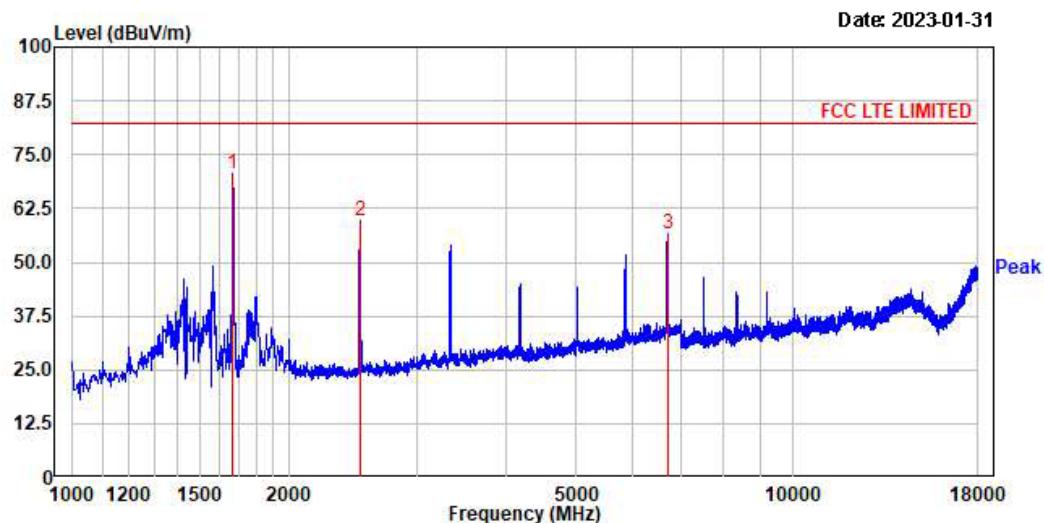
No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
1.	350.10	52.94	-----	-8.60	44.34	-----	82.23	-----	37.89	-----	100	83	horizontal
2.	767.69	58.28	-----	0.88	59.16	-----	82.23	-----	23.87	-----	100	83	horizontal
3.	882.99	53.30	-----	2.45	55.75	-----	82.23	-----	26.48	-----	400	169	horizontal

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



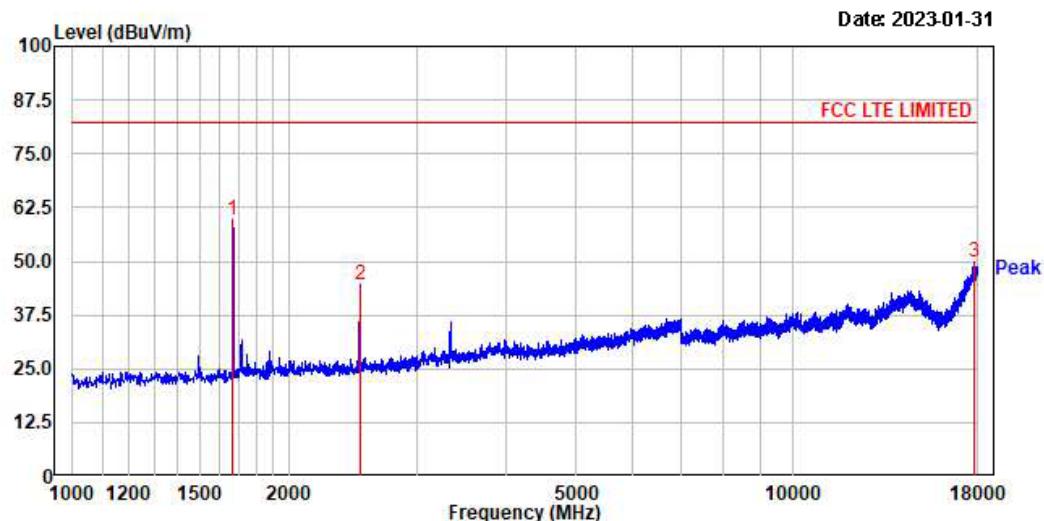
No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
1.	30.24	45.05	-----	-13.57	31.48	-----	82.23	-----	50.75	-----	100	360	vertical
2.	400.86	45.11	-----	-7.33	37.78	-----	82.23	-----	44.45	-----	100	173	vertical
3.	880.93	68.72	-----	2.44	71.16	-----	82.23	-----	11.07	-----	165	360	vertical

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



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
		PK	AV	PK	AV	PK	AV	PK	AV	cm	deg		
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB μ V	dB μ V	dB	dB	deg			
1.	1669.38	78.21	-----	-7.55	70.66	-----	82.23	-----	11.57	-----	100	0	horizontal
2.	2508.75	62.99	-----	-3.36	59.63	-----	82.23	-----	22.68	-----	100	0	horizontal
3.	6692.88	48.70	-----	7.78	56.48	-----	82.23	-----	25.75	-----	100	0	horizontal

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



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
		PK	AV	PK	AV	PK	AV	PK	AV	cm	deg		
MHz	dB μ V	dB μ V	dB	dB μ V	dB μ V	dB μ V	dB μ V	dB	dB	deg			
1.	1671.50	66.95	-----	-7.51	59.44	-----	82.23	-----	22.79	-----	100	0	vertical
2.	2508.75	47.95	-----	-3.36	44.59	-----	82.23	-----	37.64	-----	100	226	vertical
3.	17804.50	24.43	-----	25.33	49.76	-----	82.23	-----	32.47	-----	100	351	vertical

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

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	2023-09-06
2	■	Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2023-03-16
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2023-03-16
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2023-09-06
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2023-09-06
6	■	EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2023-09-06
7	■	RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2023-09-06
8	■	RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2023-03-16
9	■	Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2024-09-10
10	■	DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2024-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2024-03-18
12	■	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2023-03-20
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2023-03-16
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	2023-03-16
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2023-09-06
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2023-09-06
20		Moduleation Analyzer	8901B	3749A05878	HP	1 year	2023-09-06
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	Jin Young Tech	1 year	2023-09-06
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2024-03-18
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2023-03-16
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2023-03-16
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2023-03-16
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2023-03-16
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2023-03-16
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2023-03-16
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2023-03-16
30		Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2023-03-16
31	■	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2 year	2023-09-07