



TEST REPORT

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Report No.:
KR20-SRF0048-A

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1. Client

- Name : HYUNDAI MOBIS CO., LTD.
- Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
- Date of Receipt : 2019-09-20

2. Use of Report : Certification

3. Name of Product and Model : WIDE AVN / ATC31HYAN



4. Manufacturer and Country of Origin : Hyundai Mobis Co., Ltd. / Korea

5. FCC ID : TQ8-ATC31HYAN

6. Date of Test : 2019-10-16 to 2020-02-20

7. Test Standards : FCC Part 2
FCC Part 22 subpart H
FCC Part 24 subpart E
FCC Part 27 subpart C

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Euijung Kim  (Signature)	 Name : Heesu Ahn (Signature)

2020-02-21

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Report revision history

Date	Revision	Page No
2020-02-09	Initial report	-
2020-02-21	Updated	3,9,24,25,26,27

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Note. The report No. KR20-SRF0048 is superseded by the report No. KR20-SRF0048-A.

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1. General information

Client : HYUNDAI MOBIS CO., LTD.
 Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
 Manufacturer : Hyundai Mobis Co., Ltd
 Address : 95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do
 27862 Korea
 Laboratory : KCTL Inc.
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
 Industry Canada Registration No. : 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : WIDE AVN
 Model : ATC31HYAN
 Derivative model : ATC31HCAN, ATC34HCAN
 Frequency range : 779.5 MHz ~ 784.5 MHz (LTE Band 13)
 824.7 MHz ~ 848.3 MHz (LTE Band 5)
 1 710.7 MHz ~ 1 754.3 MHz (LTE Band 4)
 1 850.7 MHz ~ 1 909.3 MHz (LTE Band 2)
 824.7 MHz ~ 848.31 MHz (CDMA BC0)
 1 851.25 MHz ~ 1 908.75 MHz (CDMA BC1)
 Modulation technique : QPSK, 16-QAM (LTE)
 QPSK (CDMA)
 Power source : DC 14.4 V
 Antenna specification : C-PAD Antenna(LTE), Shark Antenna(CDMA)
 Software version : MQ4.USA.0000.V028.001.190821
 Hardware version : MQ4.USA.STD_AVN_G5_WIDE.004.001
 Test device serial No. : N/A
 Operation temperature : -20 °C ~ 70 °C

2.1. Information about derivative model

The difference between basic model and derivative models is:

The derivative models have a different product identification number.

ATC31HCAN (96560 P4710), ATC34HCAN (96560 P4910)

2.2. Frequency/channel operations

This device contains the following capabilities:

LTE Band 13, LTE Band 5, LTE Band 4, LTE Band 2, CDMA 850/1900(BC0, BC1)

LTE Band 13

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
23205	779.5	-	-
23230	782.0	23230	782.0
23255	784.5	-	-

Table 2.2.1. 5M BW

Table 2.2.2. 10M BW

LTE Band 5

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
20407	824.7	20415	825.5	20425	826.5	20450	829.0
20525	836.5	20525	836.5	20525	836.5	20525	836.5
20643	848.3	20635	847.5	20625	846.5	20600	844.0

Table 2.2.3. 1.4M BW

Table 2.2.4. 3M BW

Table 2.2.5. 5M BW

Table 2.2.6. 10M BW

LTE Band 4

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
19957	1 710.7	19965	1 711.5	19975	1 712.5
20175	1 732.5	20175	1 732.5	20175	1 732.5
20393	1 754.3	20385	1 753.5	20375	1 752.5

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
20000	1 715.0	20025	1 717.5	20050	1 720.0
20175	1 732.5	20175	1 732.5	20175	1 732.5
20350	1 750.0	20325	1 747.5	20300	1 745.0

Table 2.2.7 1.4M BW

Table 2.2.8 3M BW

Table 2.2.9. 5M BW

Table 2.2.10. 10M BW

Table 2.2.11. 15M BW

Table 2.2.12. 20M BW

LTE Band 2

Ch.	Frequency (MHz)
18607	1 850.7
18900	1 880.0
19193	1 909.3

Table 2.2.13 1.4M BW

Ch.	Frequency (MHz)
18615	1 851.5
18900	1 880.0
19185	1 908.5

Table 2.2.14 3M BW

Ch.	Frequency (MHz)
18625	1 852.5
18900	1 880.0
19175	1 907.5

Table 2.2.15. 5M BW

Ch.	Frequency (MHz)
18650	1 855.0
18900	1 880.0
19150	1 905.0

Table 2.2.16 10M BW

Ch.	Frequency (MHz)
18675	1 857.5
18900	1 880.0
19125	1 902.5

Table 2.2.17 15M BW

Ch.	Frequency (MHz)
18700	1 860.0
18900	1 880.0
19100	1 900.0

Table 2.2.18 20M BW

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3. Maximum ERP/EIRP power

LTE Band 13

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 13	779.5 ~ 718.4	4M53G7D	20.40	0.110
		4M53W7D	19.61	0.091
	782.0	8M92G7D	20.41	0.110
		8M94W7D	18.24	0.067

LTE Band 5

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 5	824.7 ~ 848.3	1M10G7D	19.44	0.088
		1M10W7D	18.23	0.067
	825.5 ~ 847.5	2M71G7D	19.00	0.079
		2M71W7D	17.67	0.058
	826.5 ~ 846.5	4M53G7D	18.82	0.076
		4M53W7D	17.85	0.061
	829.0 ~ 844.0	8M94G7D	18.88	0.077
		8M94W7D	17.86	0.061

LTE Band 4

Mode	Tx frequency (MHz)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
LTE Band 4	1 710.7 ~ 1 754.3	1M10G7D	20.45	0.111
		1M10W7D	19.78	0.095
	1 711.5 ~ 1 753.5	2M71G7D	20.36	0.109
		2M71W7D	19.14	0.082
	1 712.5 ~ 1 752.5	4M53G7D	20.25	0.106
		4M53W7D	19.74	0.094
	1 715.0 ~ 1 750.0	8M97G7D	20.22	0.105
		8M94W7D	19.60	0.091
	1 717.5 ~ 1 747.5	13M5G7D	20.58	0.114
		13M5W7D	19.82	0.096
	1 720.0 ~ 1 745.0	17M9G7D	20.34	0.108
		17M9W7D	19.78	0.095

LTE Band 2

Mode	Tx frequency (MHz)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
LTE Band 2	1 850.7 ~ 1 909.3	1M10G7D	19.09	0.081
		1M10W7D	18.18	0.066
	1 851.5 ~ 1 908.5	2M71G7D	19.36	0.086
		2M72W7D	18.71	0.074
	1 852.5 ~ 1 907.5	4M52G7D	19.12	0.082
		4M54W7D	18.02	0.063
	1 855.0 ~ 1 905.0	8M94G7D	19.36	0.086
		8M94W7D	18.17	0.066
	1 857.5 ~ 1 902.5	13M5G7D	19.37	0.086
		13M5W7D	18.29	0.067
	1 860.0 ~ 1 900.0	17M9G7D	19.32	0.086
		17M9W7D	18.83	0.076

4. Summary of tests

FCC Part Section(s)	Parameter	Test results
2.1046 22.913(a)(5) 24.232(c) 27.50(c),(d) ,(h)(2)	Conducted Output Power	N/T ^(note1)
2.1049	Occupied Bandwidth & 26 dB Bandwidth	N/T ^(note1)
2.1051 22.917(a) 24.238(a) 27.53(c)(2) ,(h)(1)	Band Edge Emissions at Antenna Terminal	N/T ^(note1)
	Spurious Emissions at Antenna Terminal	N/T ^(note1)
22.913(d) 24.232(d) 27.50(d)(5)	Peak to Average Power Ratio	N/T ^(note1)
2.1055 22.355 24.235 27.54	Frequency stability	N/T ^(note1)
22.913(a)(5) 24.232(c) 27.50(b)(10) ,(d)(4)	Effective Radiated Power & Equivalent Isotropic Radiated Power	Pass
22.917(a) 24.238(a) 27.53(c)(2), ,(h)(1)	Radiated Spurious Emissions	Pass

Notes: (N/T: Not Tested, N/A: Not Applicable)

1. This test item was not performed by the request of manufacturer. Please refer to original test report no. F690501/RF-RTL011907-1 issued on Nov. 09, 2017 by SGS Korea Co., Ltd. (Gunpo Laboratory)
2. All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations and paging service configurations in the test data.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
4. The test procedure(s) in this report were performed in accordance as following.
 - ◆ ANSI C63.26-2015
 - ◆ ANSI/TIA-603-E-2016
 - ◆ KDB 971168 D01 v03r01

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty(±)	
Radiated spurious emissions	9 kHz ~ 30 MHz	2.28 dB
	30 MHz ~ 1 GHz	3.68 dB
	Above 1 GHz	5.72 dB

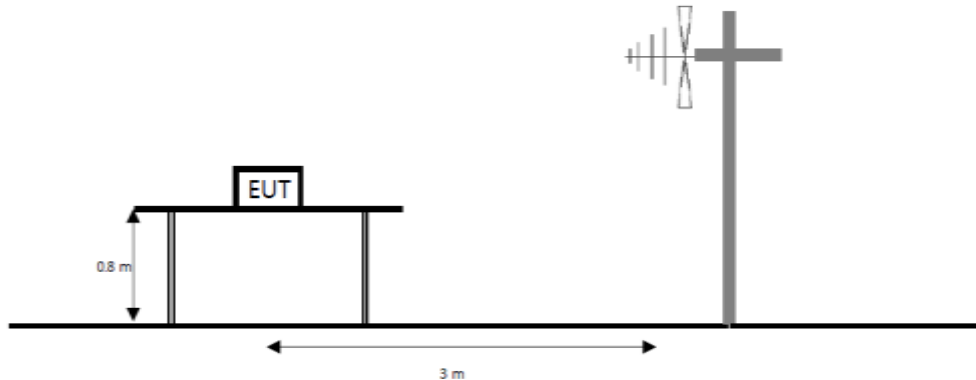
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6. Test results

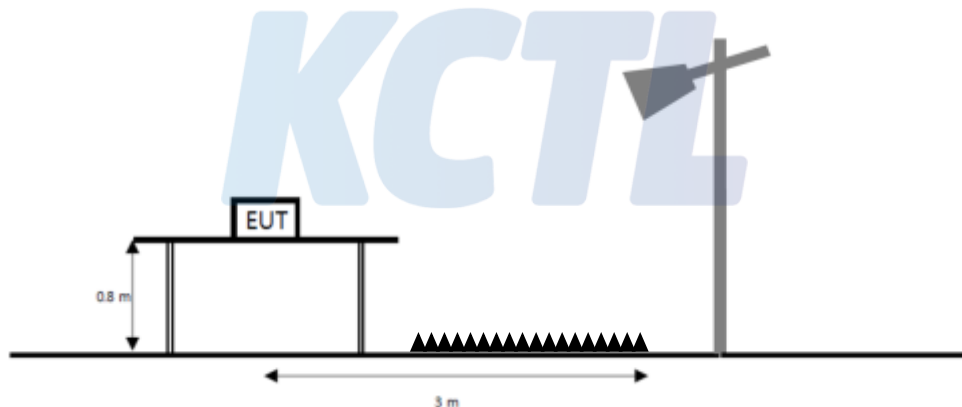
6.1. Radiated Power (ERP/EIRP)

Test setup

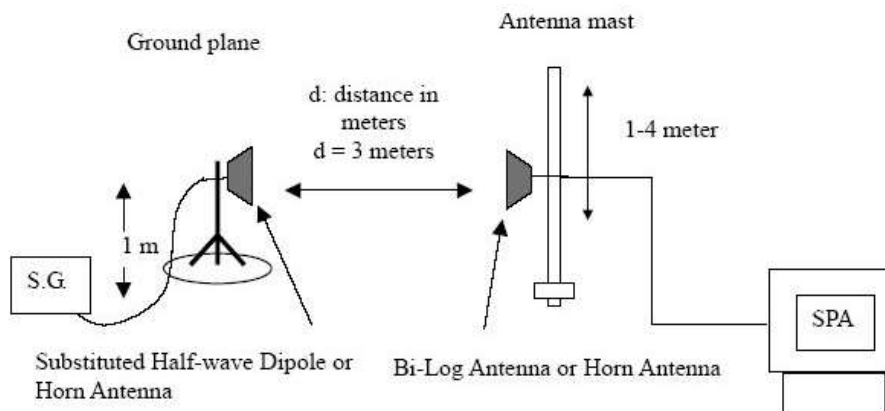
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.913(a)(5), the ERP of transmitters in the cellular radiotelephone service must not exceed the limits in this section. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to §24.232(c) mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to § 27.50(b)(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

According to § 27.50(d)(4) fixed, mobile, and portable (hand-held) stations operating in the 1710~1755 MHz band and mobile and portable stations operating in the 1695~1710 MHz and 1755~1780 MHz bands are 1 watt EIRP.

Test procedure

971168 D01 v03r01 - Section 5.2.2

ANSI 63.26-2015 – Section 5.2.4.4.1

ANSI/TIA-603-E-2016 - Section 2.2.17

Test settings

- 1) RBW = 1 % to 5 % of the OBW.
- 2) VBW $\geq 3 \times$ RBW.
- 3) SPAN = 2 \times to 3 \times the OBW.
- 4) Number of measurement points in sweep $\geq 2 \times$ span / RBW.
- 5) Sweep time :
 - 1) Auto couple, or
 - 2) $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$ for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
- 6) Detector = RMS
- 7) If the EUT can be configured to transmit continuously, then set the trigger to free run.
- 8) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full-power transmissions).
- 9) Trace mode = trace averaging (RMS) over 100 sweeps.
- 10) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
- 11) Allow trace to fully stabilize.

Notes:

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 GHz below) or horn antenna (1 GHz above) connected to a signal generator.
The power is calculated by the following formula;
$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{Cable loss (dB)} + \text{Antenna gain (dB)}$$

Note. Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

Test results

Test mode: LTE Band 13

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	779.5	H	0.00	3.59	23.99	20.40	0.110
		782.0	H	0.10	3.62	23.91	20.39	0.109
		784.5	H	0.10	3.62	23.67	20.15	0.104
	16QAM	779.5	H	0.00	3.59	23.20	19.61	0.091
		782.0	H	0.10	3.62	23.02	19.50	0.089
		784.5	H	0.10	6.62	25.44	18.92	0.078
10 M	QPSK	782.0	H	0.10	3.62	23.93	20.41	0.110
	16QAM	782.0	H	0.10	3.62	21.76	18.24	0.067

Note.

1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

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Test mode: LTE Band 5

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	824.70	H	-0.60	3.69	23.73	19.44	0.088
		836.50	H	-0.50	3.72	22.27	18.05	0.064
		848.30	H	-0.50	3.74	22.08	17.84	0.061
	16QAM	824.70	H	-0.60	3.69	22.52	18.23	0.067
		836.50	H	-0.50	3.72	20.57	16.35	0.043
		848.30	H	-0.50	3.74	21.33	17.09	0.051
3 M	QPSK	825.50	H	-0.60	3.70	23.30	19.00	0.079
		836.50	H	-0.50	3.72	22.05	17.83	0.061
		847.50	H	-0.50	3.74	22.03	17.79	0.060
	16QAM	825.50	H	-0.60	3.70	21.97	17.67	0.058
		836.50	H	-0.50	3.72	20.90	16.68	0.047
		847.50	H	-0.50	3.74	20.90	16.66	0.046
5 M	QPSK	826.50	H	-0.60	3.71	23.13	18.82	0.076
		836.50	H	-0.50	3.72	21.91	17.69	0.059
		846.50	H	-0.50	3.73	22.23	18.00	0.063
	16QAM	826.50	H	-0.60	3.71	22.16	17.85	0.061
		836.50	H	-0.50	3.72	20.68	16.46	0.044
		846.50	H	-0.50	3.73	21.96	17.73	0.059
10 M	QPSK	829.00	H	-0.60	3.71	23.19	18.88	0.077
		836.50	H	-0.50	3.72	22.17	17.95	0.062
		844.00	H	-0.50	3.73	22.59	18.36	0.069
	16QAM	829.00	H	-0.60	3.71	22.17	17.86	0.061
		836.50	H	-0.50	3.72	21.33	17.11	0.051
		844.00	H	-0.50	3.73	21.16	16.93	0.049

Note.

1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 4

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 710.7	V	6.35	5.48	19.58	20.45	0.111
		1 732.5	V	6.32	5.52	19.26	20.06	0.101
		1 754.3	V	6.29	5.56	19.37	20.10	0.102
	16QAM	1 710.7	V	6.35	5.48	18.91	19.78	0.095
		1 732.5	V	6.32	5.52	18.07	18.87	0.077
		1 754.3	V	6.29	5.56	18.21	18.94	0.078
3 M	QPSK	1 711.5	V	6.35	5.48	19.49	20.36	0.109
		1 732.5	V	6.32	5.52	19.20	20.00	0.100
		1 753.5	V	6.30	5.56	19.07	19.81	0.096
	16QAM	1 711.5	V	6.35	5.48	17.98	18.85	0.077
		1 732.5	V	6.32	5.52	18.34	19.14	0.082
		1 753.5	V	6.30	5.56	18.21	18.95	0.079
5 M	QPSK	1 712.5	V	6.35	5.49	19.40	20.25	0.106
		1 732.5	V	6.32	5.52	19.12	19.92	0.098
		1 752.5	V	6.30	5.55	19.04	19.79	0.095
	16QAM	1 712.5	V	6.35	5.49	18.89	19.74	0.094
		1 732.5	V	6.32	5.52	18.35	19.15	0.082
		1 752.5	V	6.30	5.55	18.29	19.04	0.080
10 M	QPSK	1 715.0	V	6.34	5.50	19.38	20.22	0.105
		1 732.5	V	6.32	5.52	18.99	19.79	0.095
		1 750.0	V	6.30	5.54	19.05	19.81	0.096
	16QAM	1 715.0	V	6.34	5.50	18.76	19.60	0.091
		1 732.5	V	6.32	5.52	18.32	19.12	0.082
		1 750.0	V	6.30	5.54	18.17	18.93	0.078
15 M	QPSK	1 717.5	V	6.34	5.49	19.73	20.58	0.114
		1 732.5	V	6.32	5.52	19.04	19.84	0.096
		1 747.5	V	6.30	5.54	18.85	19.61	0.091
	16QAM	1 717.5	V	6.34	5.49	18.97	19.82	0.096
		1 732.5	V	6.32	5.52	18.24	19.04	0.080
		1 747.5	V	6.30	5.54	18.12	18.88	0.077
20 M	QPSK	1 720.0	V	6.34	5.50	19.50	20.34	0.108
		1 732.5	V	6.32	5.52	18.99	19.79	0.095
		1 745.0	V	6.31	5.56	18.93	19.68	0.093
	16QAM	1 720.0	V	6.34	5.50	18.94	19.78	0.095
		1 732.5	V	6.32	5.52	17.76	18.56	0.072
		1 745.0	V	6.31	5.56	18.36	19.11	0.081

Note.

1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 2

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 850.7	V	6.18	5.74	17.29	17.73	0.059
		1 880.0	V	6.14	5.78	18.63	18.99	0.079
		1 909.3	V	6.11	5.81	18.79	19.09	0.081
	16QAM	1 850.7	V	6.18	5.74	16.39	16.83	0.048
		1 880.0	V	6.14	5.78	17.82	18.18	0.066
		1 909.3	V	6.11	5.81	17.86	18.16	0.065
3 M	QPSK	1 851.5	V	6.18	5.74	17.07	17.51	0.056
		1 880.0	V	6.14	5.78	19.00	19.36	0.086
		1 908.5	V	6.11	5.81	18.60	18.90	0.078
	16QAM	1 851.5	V	6.18	5.74	15.80	16.24	0.042
		1 880.0	V	6.14	5.78	18.35	18.71	0.074
		1 908.5	V	6.11	5.81	17.87	18.17	0.066
5 M	QPSK	1 852.5	V	6.18	5.74	17.19	17.63	0.058
		1 880.0	V	6.14	5.78	18.51	18.87	0.077
		1 907.5	V	6.11	5.80	18.81	19.12	0.082
	16QAM	1 852.5	V	6.18	5.74	16.59	17.03	0.050
		1 880.0	V	6.14	5.78	17.66	18.02	0.063
		1 907.5	V	6.11	5.80	17.28	17.59	0.057
10 M	QPSK	1 855.0	V	6.17	5.75	17.77	18.19	0.066
		1 880.0	V	6.14	5.78	19.00	19.36	0.086
		1 905.0	V	6.11	5.79	18.29	18.61	0.073
	16QAM	1 855.0	V	6.17	5.75	17.39	17.81	0.060
		1 880.0	V	6.14	5.78	17.81	18.17	0.066
		1 905.0	V	6.11	5.79	17.52	17.84	0.061
15 M	QPSK	1 857.5	V	6.17	5.75	17.90	18.32	0.068
		1 880.0	V	6.14	5.78	19.01	19.37	0.086
		1 902.5	V	6.12	5.79	18.64	18.97	0.079
	16QAM	1 857.5	V	6.17	5.75	17.56	17.98	0.063
		1 880.0	V	6.14	5.78	17.93	18.29	0.067
		1 902.5	V	6.12	5.79	17.20	17.53	0.057
20 M	QPSK	1 860.0	V	6.17	5.75	17.94	18.36	0.069
		1 880.0	V	6.14	5.78	18.76	19.12	0.082
		1 900.0	V	6.12	5.79	18.99	19.32	0.086
	16QAM	1 860.0	V	6.17	5.75	16.87	17.29	0.054
		1 880.0	V	6.14	5.78	18.08	18.44	0.070
		1 900.0	V	6.12	5.79	18.50	18.83	0.076

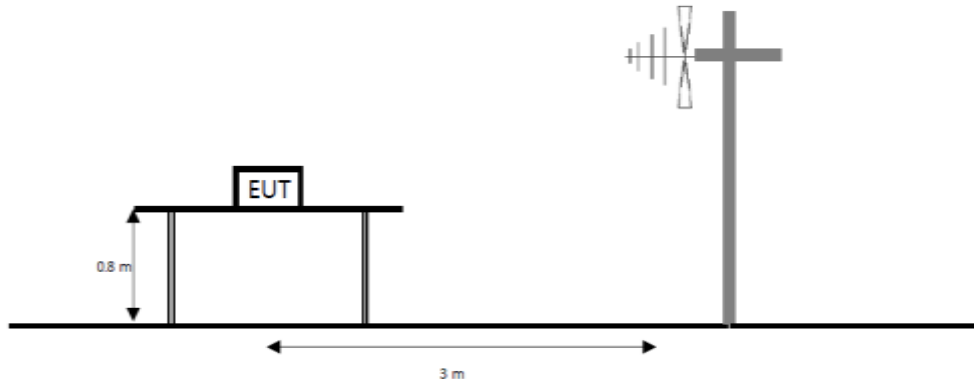
Note.

1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

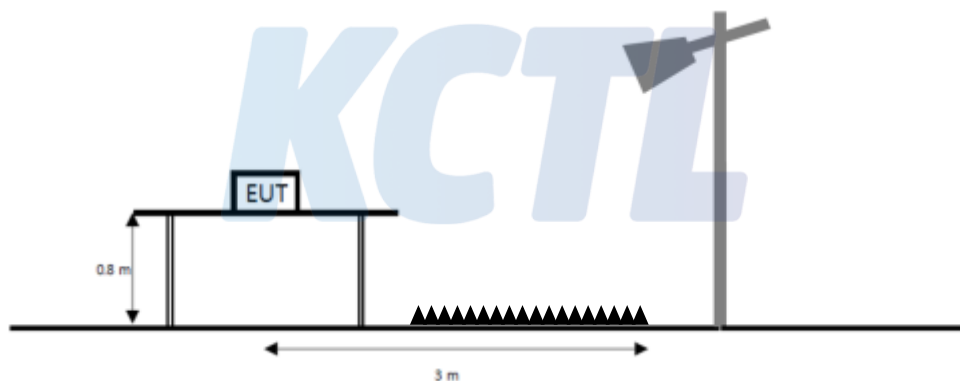
6.2. Radiated Spurious Emissions

Test setup

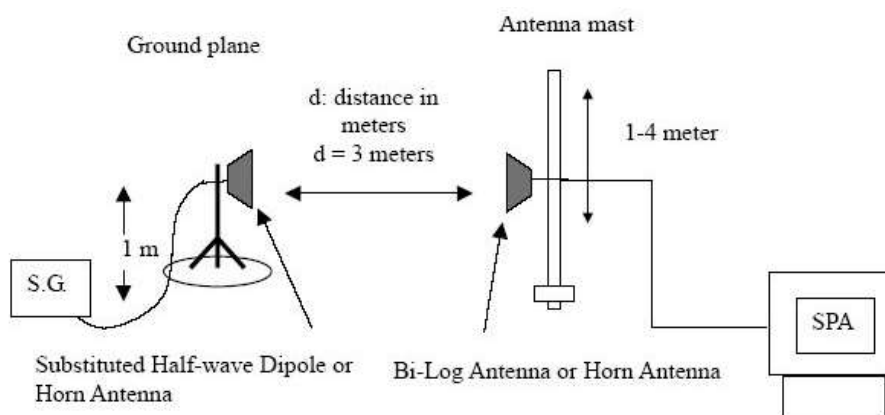
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.917(a), §24.238(a) the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P_{\text{[Watts]}})$ dB.

According to §27.53(g) on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB

According to §27.53(h) the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log(P_{\text{[Watts]}})$ dB.

Test procedure

971168 D01 v03r01 - Section 5.8

ANSI 63.26-2015 – Section 5.5

ANSI/TIA-603-E-2016 - Section 2.2.12

Test settings

- 1) RBW = 1 kHz for below 1 GHz and 1 MHz for above 1 GHz.
- 2) VBW $\geq 3 \times$ RBW.
- 3) Detector = RMS
- 4) Trace mode = Max hold
- 5) Sweep time = Auto couple
- 6) Number of sweep points $\geq 2 \times \text{span} / \text{RBW}$
- 7) Allow trace to fully stabilize.

Notes:

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 GHz below) or horn antenna (1 GHz above) connected to a signal generator.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

Test results (Above 1 000 MHz)

Test mode : LTE Band 13

Frequency(MHz) : 782.0

Channel : 23230

Bandwidth(MHz) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 564.04	V	6.52	5.22	-47.30	-46.00	-13.00	33.00
	2 346.58	H	6.00	6.46	-60.64	-61.10	-13.00	48.10
	2 384.59	V	6.00	6.51	-53.49	-54.00	-13.00	41.00
	3 128.13	V	6.98	7.46	-58.92	-59.40	-13.00	46.40
	3 412.15	V	7.61	7.80	-54.01	-54.20	-13.00	41.20

Note.

1. Limit Calculation(dBm)= 43 + 10log(P_[Watts])

Test mode : LTE Band 13

Frequency(MHz) : 782.0

(1 559 ~ 1 610 MHz)

Channel : 23230

Bandwidth(MHz) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 564.17	V	6.52	5.22	-75.50	-74.20	-50.00	24.20
	1 606.09	V	6.47	5.28	-93.99	-92.80	-50.00	42.80

Note.

1. Limit Calculation of wide-band (dBm/MHz) = -70 dBW/MHz (-40 dBm/MHz)

2. Limit Calculation of narrow-band (dBm) = -80 dBW (-50 dBm)

Test mode : LTE Band 5

Frequency(MHz) : 824.7

Channel : 20407

Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 648.54	H	6.42	5.36	-50.56	-49.50	-13.00	36.50
	2 471.09	H	6.00	6.63	-57.27	-57.90	-13.00	44.90
	3 299.14	V	7.36	7.66	-57.60	-57.90	-13.00	44.90
	4 121.70	H	8.72	8.59	-59.43	-59.30	-13.00	46.30

Test mode : LTE Band 5

Frequency(MHz) : 836.5

Channel : 20525

Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 674.04	H	6.42	5.36	-53.46	-52.40	-13.00	39.40
	2 512.59	H	6.00	6.63	-58.37	-59.00	-13.00	46.00
	3 347.65	V	7.36	7.66	-57.80	-58.10	-13.00	45.10
	4 186.70	V	8.72	8.59	-59.93	-59.80	-13.00	46.80

Test mode : LTE Band 5

Frequency(MHz) : 848.3

Channel : 20643

Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 697.04	V	6.36	5.45	-56.71	-55.80	-13.00	42.80
	2 546.60	H	6.07	6.73	-58.14	-58.80	-13.00	45.80
	3 393.15	V	7.56	7.78	-57.58	-57.80	-13.00	44.80
	4 231.20	H	8.83	8.69	-58.74	-58.60	-13.00	45.60

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : LTE Band 4
Frequency(MHz) : 1 717.5
Channel : 20025
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 421.50	V	7.63	7.81	-34.82	-35.00	-13.00	22.00
	5 132.50	H	10.09	9.67	-43.32	-42.90	-13.00	29.90
	6 843.50	V	11.04	11.28	-47.96	-48.20	-13.00	35.20
	8 554.50	V	12.98	12.61	-46.97	-46.60	-13.00	33.60

Test mode : LTE Band 4
Frequency(MHz) : 1 732.5
Channel : 20175
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 465.50	H	7.72	7.87	-27.65	-27.80	-13.00	14.80
	5 198.00	V	10.18	9.73	-35.05	-34.60	-13.00	21.60
	6 930.50	V	11.07	11.40	-40.07	-40.40	-13.00	27.40
	10 015.50	V	12.71	13.70	-49.41	-50.40	-13.00	37.40

Test mode : LTE Band 4
Frequency(MHz) : 1 747.5
Channel : 20325
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 508.00	V	7.81	7.92	-32.29	-32.40	-13.00	19.40
	5 262.50	V	10.27	9.69	-42.28	-41.70	-13.00	28.70
	7 016.50	V	11.13	11.34	-50.49	-50.70	-13.00	37.70
	8 775.00	V	12.89	12.90	-55.89	-55.90	-13.00	42.90

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : LTE Band 2
Frequency(MHz) : 1 857.5
Channel : 18675
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 728.50	V	8.17	8.18	-21.29	-21.30	-13.00	8.30
	5 592.50	H	10.60	10.08	-34.52	-34.00	-13.00	21.00
	7 456.50	V	11.92	11.67	-43.45	-43.20	-13.00	30.20
	9 321.00	H	12.99	13.26	-51.63	-51.90	-13.00	38.90

Test mode : LTE Band 2
Frequency(MHz) : 1 880.0
Channel : 18900
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 773.00	V	8.24	8.25	-24.09	-24.10	-13.00	11.10
	5 660.00	V	10.60	10.20	-42.80	-42.40	-13.00	29.40
	7 546.50	V	12.05	11.85	-43.40	-43.20	-13.00	30.20
	9 437.00	V	13.06	13.33	-53.33	-53.60	-13.00	40.60

Test mode : LTE Band 2
Frequency(MHz) : 1 902.5
Channel : 19125
Bandwidth(MHz) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 791.50	V	8.27	8.27	-31.90	-31.90	-13.00	18.90
	5 687.50	V	10.60	10.22	-38.98	-38.60	-13.00	25.60
	7 583.50	V	12.08	11.87	-46.21	-46.00	-13.00	33.00
	9 475.50	V	13.09	13.35	-55.54	-55.80	-13.00	42.80

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2
+ 2.4G WIFI 802.11g
Frequency(MHz) : 1 880.0 + 2 412
Channel : 18900, 1
Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + OFDM	1 345.09	V	5.11	4.83	-18.38	-18.10	-13.00	5.10
	2 938.99	V	6.61	7.23	-26.59	-27.20	-13.00	14.20
	3 759.00	V	8.21	8.24	-32.88	-32.90	-13.00	19.90
	4 824.50	V	9.62	9.30	-57.62	-57.30	-13.00	44.30
	5 638.50	V	10.60	10.18	-49.32	-48.90	-13.00	35.90
	7 236.00	V	11.52	11.53	-51.60	-51.60	-13.00	38.60

Test mode : Simultaneously
LTE Band 2
+ 5G WIFI 802.11a
Frequency(MHz) : 1 880.0 + 5 745
Channel : 18900, 149
Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + OFDM	1 986.09	V	6.02	5.90	-14.32	-14.20	-13.00	1.20
	3 759.00	V	8.21	8.24	-34.57	-34.60	-13.00	21.60
	5 638.50	V	10.60	10.18	-49.22	-48.80	-13.00	35.80
	11 489.16	V	12.90	14.61	-48.79	-50.50	-13.00	37.50
	17 235.02	V	13.22	1.00	-60.62	-48.40	-13.00	35.40

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2 + BT
Frequency(MHz) : 1 880.0 + 2 441
Channel : 18900, 39
Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + GFSK	1 318.08	H	4.85	4.78	-21.87	-21.80	-13.00	8.80
	3 759.00	V	8.21	8.24	-36.68	-36.70	-13.00	23.70
	4 882.00	V	9.71	9.44	-57.17	-56.90	-13.00	43.90
	5 638.50	V	10.60	10.18	-52.32	-51.90	-13.00	38.90
	7 325.00	V	11.69	11.56	-52.42	-52.30	-13.00	39.30

Test mode : Simultaneously
LTE Band 2 + BT
+ 2.4G WIFI 802.11g
Frequency(MHz) : 1 880.0 + 2 441
+ 2 412
Channel : 18900, 39, 1
Bandwidth(MHz) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + GFSK + OFDM	1 318.08	V	4.85	4.78	-14.97	-14.90	-13.00	1.90
	1 348.59	V	5.15	4.84	-17.81	-17.50	-13.00	4.50
	2 942.99	V	6.62	7.23	-29.19	-29.80	-13.00	16.80
	2 973.99	V	6.66	7.27	-29.60	-30.20	-13.00	17.20
	3 759.00	V	8.21	8.24	-32.98	-33.00	-13.00	20.00
	4 823.50	H	9.62	9.30	-57.22	-56.90	-13.00	43.90
	4 960.50	H	9.84	9.48	-57.16	-56.80	-13.00	43.80
	5 638.50	H	10.60	10.18	-49.32	-48.90	-13.00	35.90
	7 238.00	V	11.53	11.53	-49.60	-49.60	-13.00	36.60
	7 439.00	V	11.89	11.66	-52.33	-52.10	-13.00	39.10

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2 + BT
+ 5G WIFI 802.11a
Frequency(MHz) : 1 880.0 + 2 441
+ 5 320
Channel : 18900, 39, 149
Bandwidth(MHz) : 1.4

Mode	Frequency [MHz]	Pol. [V/H]	Antenna Gain [dBi]	Cable loss [dB]	Substitute Level [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]
QPSK + GFSK + OFDM	1 318.03	V	4.85	4.78	-18.17	-18.10	-13.00	5.10
	1 774.07	V	6.27	5.57	-22.10	-21.40	-13.00	8.40
	1 985.59	V	6.02	5.90	-15.52	-15.40	-13.00	2.40
	3 759.00	V	8.21	8.24	-34.77	-34.80	-13.00	21.80
	4 882.00	H	9.71	9.44	-55.67	-55.40	-13.00	42.40
	5 638.50	H	10.60	10.18	-49.42	-49.00	-13.00	36.00
	11 491.00	V	12.90	14.61	-51.69	-53.40	-13.00	40.40
	17 234.56	V	13.22	1.00	-61.82	-49.60	-13.00	36.60

Note.

1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	19.04.13	20.04.13
Bilog Antenna	Teseq GmbH	CBL 6143A	35039	19.05.21	21.05.21
Horn Antenna	ETS.lindgren	3117	00161083	19.09.18	20.09.18
Horn Antenna	ETS.lindgren	3117	161225	19.05.22	20.05.22
Horn Antenna	Steatite Antennas	QMS-00225	17790	19.08.12	20.08.12
Horn Antenna	ETS.lindgren	3116	00086635	19.05.09	20.05.09
High pass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	20.01.21	21.01.21
High pass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	20.01.21	21.01.21
Attenuator	Weinschel ENGINEERING	10	AJ1239	19.05.14	20.05.14
Attenuator	API Inmet	40AH2W-10	12	19.05.15	20.05.15
Amplifier	SONOMA INSTRUMENT	310N	185799	20.01.21	21.01.21
Amplifier	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2031196	20.02.12	21.02.12
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	19.08.01	20.08.01
Spectrum Analyzer	AGILENT	N9040B	MY57010132	19.07.31	20.07.31
Signal Generator	R&S	SMB100A	176206	20.01.21	21.01.21
Wideband Radio Communication Tester	R & S	CMW500	141780	19.04.18	20.04.18
Antenna Mast	MATURO	EAS 1.5	042/8941211	N/A	N/A
Antenna Mast	MATURO	EAS 1.5	043/8941211	N/A	N/A
Turn Table	MATURO	TT 0.8 PF	041/8941211	N/A	N/A
Cable Assembly	Radiall	R286303620	1649.241	N/A	N/A
Cable Assembly	Radiall	TESTPRO 3	-	N/A	N/A

End of test report