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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

[ETSI EN 301 908-1 V13.1.1\(2019-11\)](#)–IMT cellular networks;Harmonised Standard for access to radio spectrum;Part 1: Introduction and common requirements

[ETSI EN 301 908-13 V13.1.1 \(2019-11\)](#)–IMT cellular networks;Harmonised Standard for access to radio spectrum;Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)

[ETSI TS 136 521-1 V16.6.0 \(2020-12\)](#)–LTE;Evolved Universal Terrestrial Radio Access (E-UTRA);User Equipment (UE) conformance specification;Radio transmission and reception;Part 1: Conformance testing (3GPP TS 36.521-1 version 16.6.0 Release 16)

[ETSI TS 136 508 V16.6.0 \(2020-11\)](#)- LTE;Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC);Common test environments for User Equipment (UE) conformance testing (3GPP TS 36.508 version 16.6.0 Release 16)

1.2. Report version information

Revision No.	Date of issue	Description
N/A	2022-09-21	Original

2. TEST DESCRIPTION

Radio Spectrum Matter (RSM) Part of Transmitter			
Test Item	Test require	Result #1	Test Engineer
Radiated emissions (UE)	EN 301 908-1 Section 4.2.2	Pass	Pan Xie
Control and monitoring functions (UE)	EN 301 908-1 Section 4.2.4	Pass ^{*1}	N/A
Transmitter Maximum Output Power	EN 301 908-13 Section 4.2.2	Pass ^{*2}	N/A
Transmitter Spectrum emission mask	EN 301 908-13 Section 4.2.3	Pass ^{*2}	N/A
Transmitter Spurious Emissions	EN 301 908-13 Section 4.2.4	Pass ^{*2}	N/A
Transmitter Minimum Output Power	EN 301 908-13 Section 4.2.5	Pass ^{*2}	N/A
Transmitter Adjacent Channel Leakage Power Ratio	EN 301 908-13 Section 4.2.11	Pass ^{*2}	N/A
Radio Spectrum Matter (RSM) Part of Receiver			
Test Item	Test require	Result #1	Test Engineer
Receiver Adjacent Channel Selectivity	EN 301 908-13 Section 4.2.6	Pass ^{*2}	N/A
Receiver Blocking Characteristics	EN 301 908-13 Section 4.2.7	Pass ^{*2}	N/A
Receiver Spurious Response	EN 301 908-13 Section 4.2.8	Pass ^{*2}	N/A
Receiver Intermodulation Characteristics	EN 301 908-13 Section 4.2.9	Pass ^{*2}	N/A
Receiver Spurious Emissions	EN 301 908-13 Section 4.2.10	Pass ^{*2}	N/A
Receiver Reference Sensitivity Level	EN 301 908-13 Section 4.2.12	Pass ^{*2}	N/A

Note:

- 1) #1: The test result does not include measurement uncertainty value
- 2) *1: Refer to the module report which report No. is 64610REM.001A2,
*2: Refer to the module report which report No. is 64610REM.001A1,
- 3) This device has installed the certified modular which model number is nRF9160, so these conducted test data directly reference the modular's data.
- 4) In this device, Cat M only use B1,B3,B8,B20.B28,other bands are shielded by software.

3. SUMMARY

3.1. Client Information

Applicant:	HARDWARIO a.s.
Address:	U Jezu 525/4, 460 01 Liberec, CZECHIA
Manufacturer:	HARDWARIO a.s.
Address:	U Jezu 525/4, 460 01 Liberec, CZECHIA

3.2. Product Description

Main unit information:	
Product Name:	CHESTER
Trade Mark:	-
Model No.:	CHESTER
Listed Model(s):	-
Power supply:	DC 3.6V
Hardware version:	R3.2
Software version:	v1.0.0

3.3. Radio Specification Description

Support LTE type:	<input checked="" type="checkbox"/> Cat M1					
Support Operating Band:	<input checked="" type="checkbox"/> FDD Band 1	<input checked="" type="checkbox"/> FDD Band 3	<input checked="" type="checkbox"/> FDD Band 8	<input checked="" type="checkbox"/> FDD Band 20	<input checked="" type="checkbox"/> FDD Band 28	
Operating Frequency Range:	Please refer to note #2					
Channel bandwidth:	Please refer to note #3					
Maximum RB:	1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
	6	6	6	6	6	6
Uplink Modulation type:	<input checked="" type="checkbox"/> QPSK	<input checked="" type="checkbox"/> 16QAM	<input type="checkbox"/> 64QAM	<input type="checkbox"/> 256QAM		
Downlink Modulation type:	<input checked="" type="checkbox"/> QPSK	<input checked="" type="checkbox"/> 16QAM	<input type="checkbox"/> 64QAM	<input type="checkbox"/> 256QAM		
Power Class:	<input type="checkbox"/> Class 1	<input type="checkbox"/> Class 2	<input checked="" type="checkbox"/> Class 3	<input type="checkbox"/> Class 4		
Antenna type:	PCB antenna					
Antenna gain #4:	3.5 dBi					

Note:

- : means that this feature is supported; : means that this feature is not supported
- #2: Operating frequency range is as follow:

LTE Band	Uplink frequency	Downlink frequency
FDD Band 1	1920 ~ 1980 MHz	2110 ~ 2170 MHz
FDD Band 3	1710 ~ 1785 MHz	1805 ~ 1880 MHz
FDD Band 8	880 ~ 915 MHz	925 ~ 960 MHz
FDD Band 20	832 ~ 862 MHz	791 ~ 821 MHz
FDD Band 28	703 ~ 748 MHz	758 ~ 803 MHz

- #3: Supported channel bandwidth is as follow:

LTE Band	1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
FDD Band 1	-	-	√	√	√	√
FDD Band 3	√	√	√	√	√	√
FDD Band 8	√	√	√	√	-	-
FDD Band 20	-	-	√	√	√	√
FDD Band 28	-	√	√	√	√	√

√: means that this feature is supported; -: means that this feature is not supported

- #4: The antenna gain is provided by the applicant, and the applicant should be responsible for its authenticity, HTW lab has not verified the authenticity of its information

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Connect information:	Tel: 86-755-26715499 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn

4. TEST CONFIGURATION

4.1. Test frequency list

FDD Band 1:	Test Frequency ID	Bandwidth [MHz]	N_{UL}	Frequency of Uplink [MHz]	N_{DL}	Frequency of Downlink [MHz]	
	Low Range	5	18025	1922.5	25	2112.5	
		10	18050	1925	50	2115	
		15	18075	1927.5	75	2117.5	
		20	18100	1930	100	2120	
	Mid Range	5/10/15/20	18300	1950	300	2140	
	High Range	5	18575	1977.5	575	2167.5	
		10	18550	1975	550	2165	
		15	18525	1972.5	525	2162.5	
		20	18500	1970	500	2160	
FDD Band 3	Test Frequency ID	Bandwidth [MHz]	N_{UL}	Frequency of Uplink [MHz]	N_{DL}	Frequency of Downlink [MHz]	
	Low Range	1.4	19207	1710.7	1207	1805.7	
		3	19215	1711.5	1215	1806.5	
		5	19225	1712.5	1225	1807.5	
		10	19250	1715	1250	1810	
		15 ^[1]	19275	1717.5	1275	1812.5	
		20 ^[1]	19300	1720	1300	1815	
	Mid Range	1.4/3/5/10/15 ^[1] /20 ^[1]	19575	1747.5	1575	1842.5	
	High Range	1.4	19943	1784.3	1943	1879.3	
		3	19935	1783.5	1935	1878.5	
		5	19925	1782.5	1925	1877.5	
		10	19900	1780	1900	1875	
		15 ^[1]	19875	1777.5	1875	1872.5	
		20 ^[1]	19850	1775	1850	1870	
	FDD Band 8:	Test Frequency ID	Bandwidth [MHz]	N_{UL}	Frequency of Uplink [MHz]	N_{DL}	Frequency of Downlink [MHz]
		Low Range	1.4	21457	880.7	3457	925.7
			3	21465	881.5	3465	926.5
			5	21475	882.5	3475	927.5
10 ^[1]			21500	885	3500	930	
Mid Range		1.4/3/5/10 ^[1]	21625	897.5	3625	942.5	
High Range		1.4	21793	914.3	3793	959.3	
		3	21785	913.5	3785	958.5	
		5	21775	912.5	3775	957.5	
		10 ^[1]	21750	910	3750	955	
NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.							
FDD Band 20:		Test Frequency ID	Bandwidth [MHz]	N_{UL}	Frequency of Uplink [MHz]	N_{DL}	Frequency of Downlink [MHz]
		Low Range	5	24175	834.5	6175	793.5
			10 ^[1]	24200	837	6200	796
	15 ^[1]		24225	839.5	6225	798.5	
	20 ^[1]		24250	842	6250	801	
	Mid Range	5/10 ^[1] /15 ^[1] /20 ^[1]	24300	847	6300	806	
	High range	5	24425	859.5	6425	818.5	
		10 ^[1]	24400	857	6400	816	
		15 ^[1]	24375	854.5	6375	813.5	
		20 ^[1]	24350	852	6350	811	
	NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.						
	FDD Band 28:	Test Frequency ID	Bandwidth [MHz]	N_{UL}	Frequency of Uplink [MHz]	N_{DL}	Frequency of Downlink [MHz]
Low Range		3	27225	704.5	9225	759.5	
		5	27235	705.5	9235	760.5	
		10 ^[1]	27260	708	9260	763	
		15 ^[1]	27285	710.5	9285	765.5	
		20 ^[1]	27310	713	9310	768	
Mid Range		3	27375	719.5	9375	774.5	
		5	27385	720.5	9385	775.5	
		10 ^[1]	27410	723	9410	778	
		15 ^[1]	27435	725.5	9435	780.5	
20 ^[1,2]		27460	728	9460	783		
High Range		3	27645	746.5	9645	801.5	
		5	27635	745.5	9635	800.5	
		10[1]	27610	743	9610	798	
		15[1]	27585	740.5	9585	795.5	
		20[1]	27560	738	9560	793	
NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.							
NOTE 2: Mid Range for 20 MHz moved due to note 2 in Table 5.6.1-1 of TS 36.101 [27].							
NOTE 3: For CA_18A-28A and CA_1A-18A-28A use test frequencies in Table 4.3.1.1.28-2.							
NOTE 4: For CA_19A-28A and CA_1A-19A-28A use test frequencies in Table 4.3.1.1.28-3.							

4.2. Descriptions of Test mode

The EUT has been tested under typical operating condition.

Test bandwidth is as follow:

Test Item	FDD B1	FDD B3	FDD B8	FDD B20	FDD B28
Radiated emissions (UE)	5MHz 20MHz	1.4MHz 5MHz 20MHz	1.4MHz 5MHz 10MHz	5MHz 20MHz	3MHz 5MHz 20MHz

4.3. Support unit used in test configuration and system

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?				
✓ No				
Item	Equipment	Trade Name	Model No.	Other
1				
2				

4.4. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Conditon	V _N =Nominal Voltage	DC 3.60V
	T _N =Normal Temperature	25 °C
Extreme Conditon	V _L =Lower Voltage	DC 3.24V
	T _L =Lower Temperature	-20 °C
	V _H =Higher Voltage	DC 3.96V
	T _H =Higher Temperature	40 °C

4.5. Statement of the measurement uncertainty

Test Items	Measurement Uncertainty
Radio frequency	<1GHz: 0.022ppm >1GHz: 0.64ppm
Conducted output power	0.65 dB
Conducted spurious emission	0.65 dB
Radiated spurious emission	<1GHz: 2.85dB >1GHz: 3.66dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.6. Equipments used during the test

● Radiated Spurious Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2018/09/27	2023/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2022/08/25	2023/08/24
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/04/06	2024/04/05
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2020/04/27	2023/04/26
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0123	VULB9163	538	2021/04/06	2024/04/05
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2021/11/05	2022/11/04
●	Broadband Preamplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2022/02/28	2023/02/27
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0119-05	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	EMI Test Software	Audix	N/A	E3	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. ETSI EN301908-1 Requirement

5.1.1. Radiated emissions (UE)

LIMIT

ETSI EN 301 908-1 Sub-clause 4.2.2.2

The frequency boundary and reference bandwidths for the detailed transitions of the limits between the requirements for out-of-band emissions and spurious emissions are based on ITU-R Recommendations SM.329-10 [3] and SM.1539-1 [4].

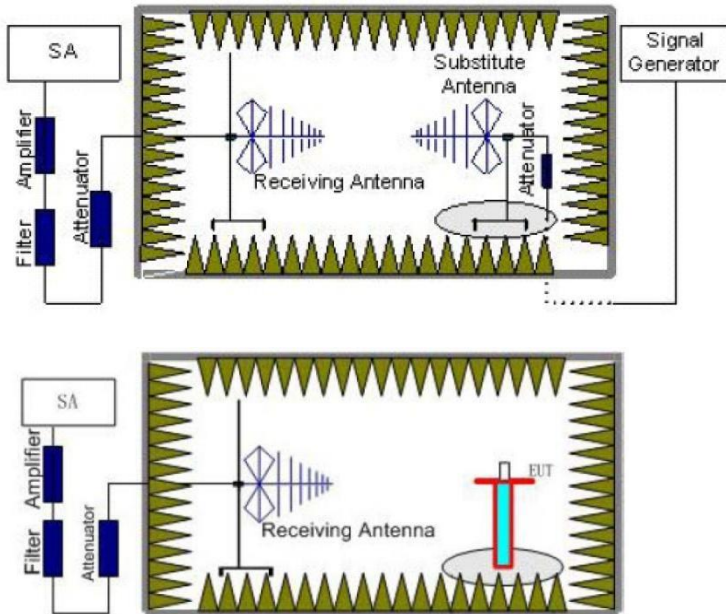
The requirements shown in table 4.2.2.2-1 are only applicable for frequencies in the spurious domain.

Table 4.2.2.2-1: Radiated spurious emissions requirements (UE)

Frequency	Minimum requirement (e.r.p./ reference bandwidth idle mode)	Minimum requirement (e.r.p./ reference bandwidth traffic mode)	Applicability
$30 \text{ MHz} \leq f < 1 \text{ 000 MHz}$	-57 dBm/100 kHz	-36 dBm/100 kHz	All
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-47 dBm/1 MHz	-30 dBm/1 MHz	All
$f_c - 2,5 \times 5 \text{ MHz} < f < f_c + 2,5 \times 5 \text{ MHz}$		Not defined	UTRA FDD, UTRA TDD, 3,84 Mcps option, cdma2000, spreading rate 3
$f_c - 2,5 \times BW_{\text{Channel}} \text{ MHz} < f < f_c + 2,5 \times BW_{\text{Channel}} \text{ MHz}$		Not defined	E-UTRA FDD, E-UTRA TDD, Mobile WiMAX, UMB
$f_c - 2,5 \times 10 \text{ MHz} < f < f_c + 2,5 \times 10 \text{ MHz}$		Not defined	UTRA TDD, 7,68 Mcps option
$f_c - 4 \text{ MHz} < f < f_c + 4 \text{ MHz}$		Not defined	UTRA TDD, 1,28 Mcps option cdma2000, spreading rate 1
$f_c - 500 \text{ kHz} < f < f_c + 500 \text{ kHz}$		Not defined	UWC 136, 200 kHz option
$f_c - 250 \text{ kHz} < f < f_c + 250 \text{ kHz}$		Not defined	UWC 136, 30 kHz option

NOTE: f_c is the UE transmit centre frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The test conditions.

Normal condition Extreme conditions

2. Please refer to ETSI EN301908-1 Sub-clause 5.3.1 for the measurement method.

TEST MODE:

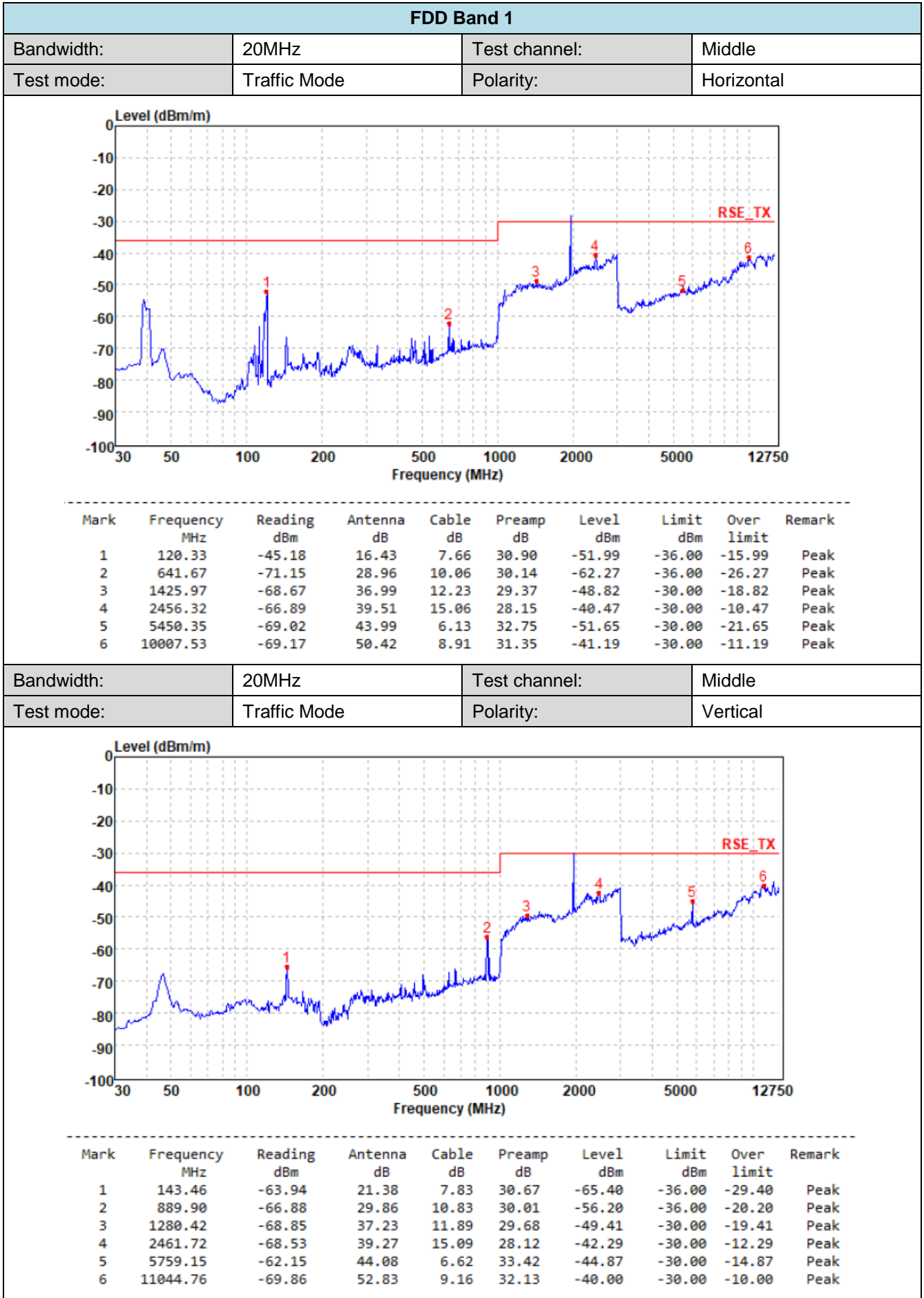
ETSI EN301908-1 Sub-clause 5.3.1

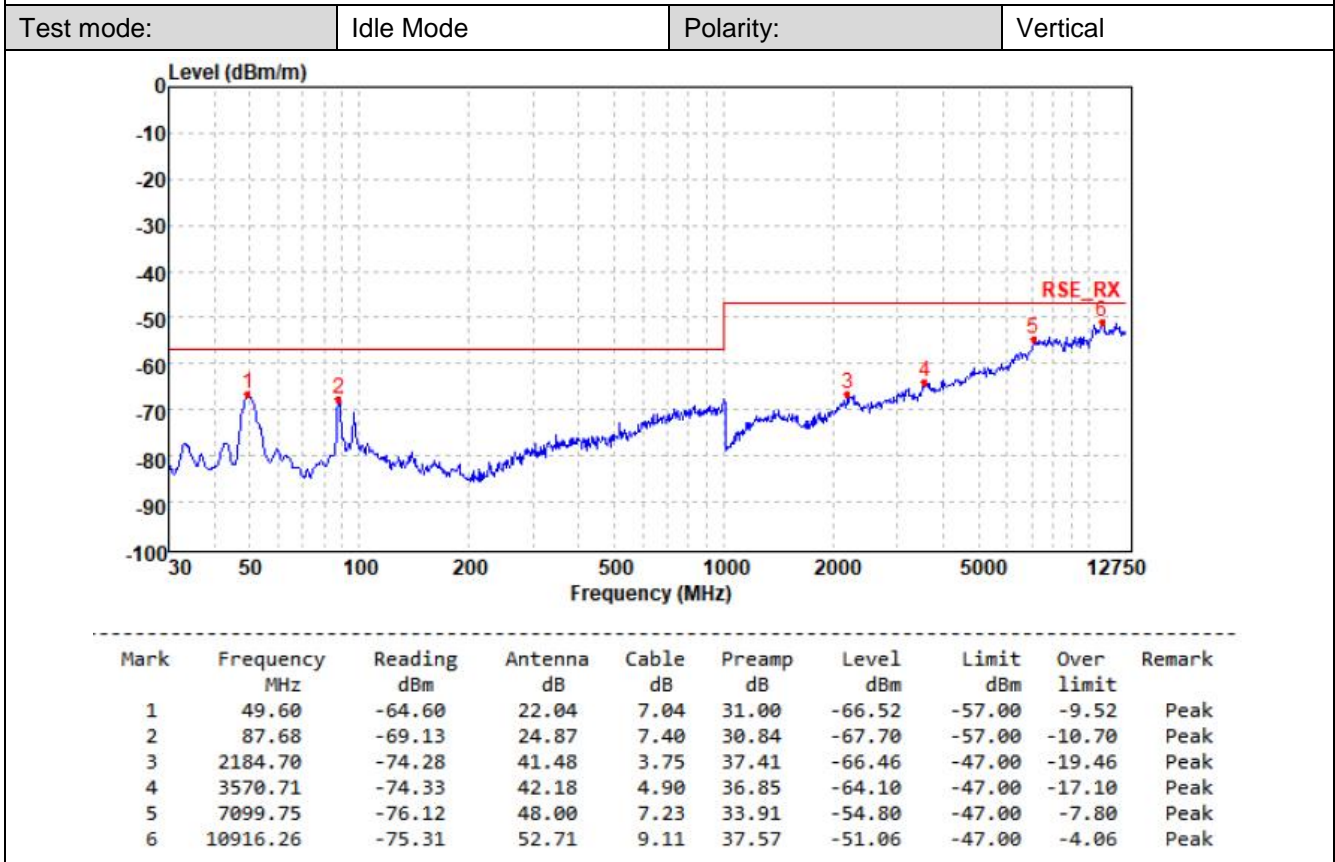
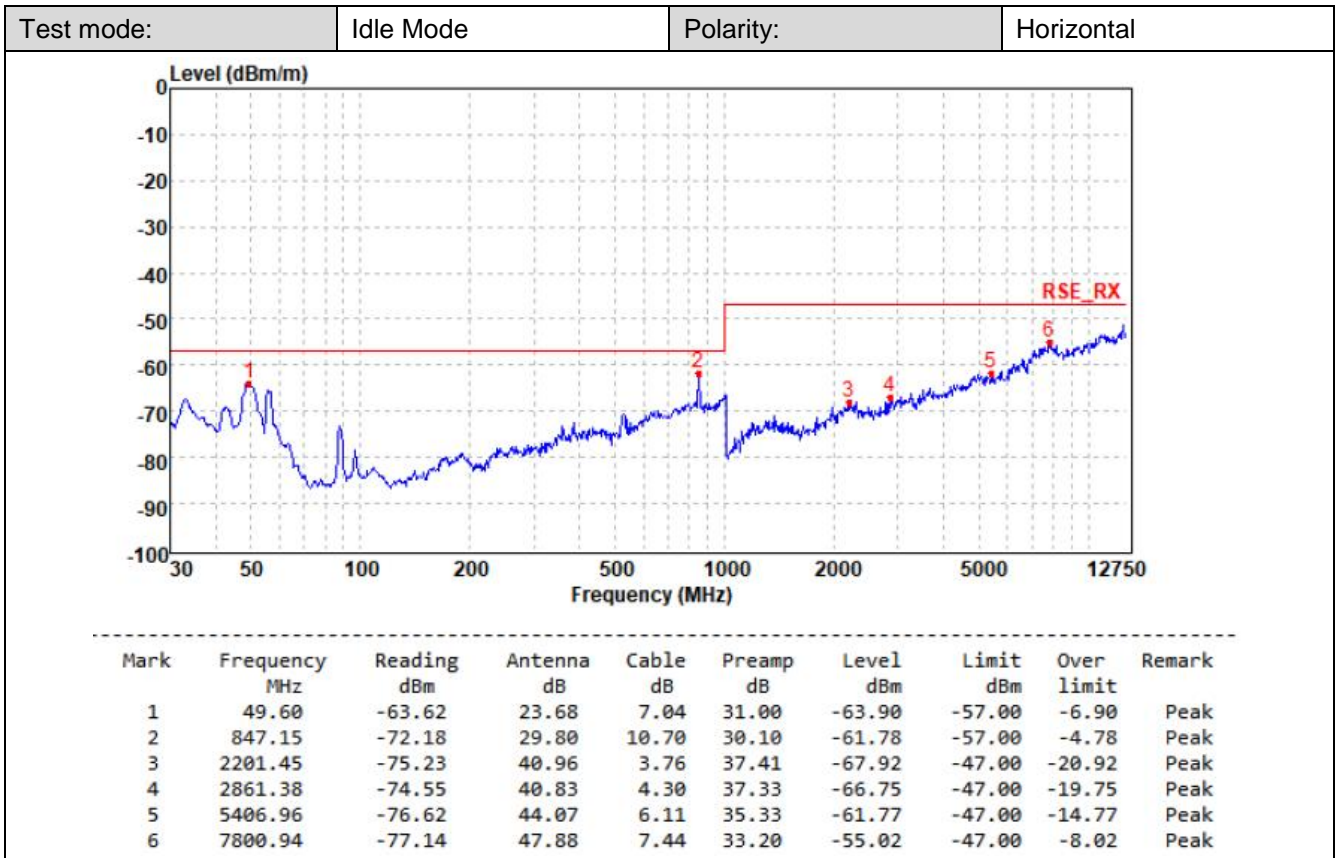
Traffic mode, Idle mode

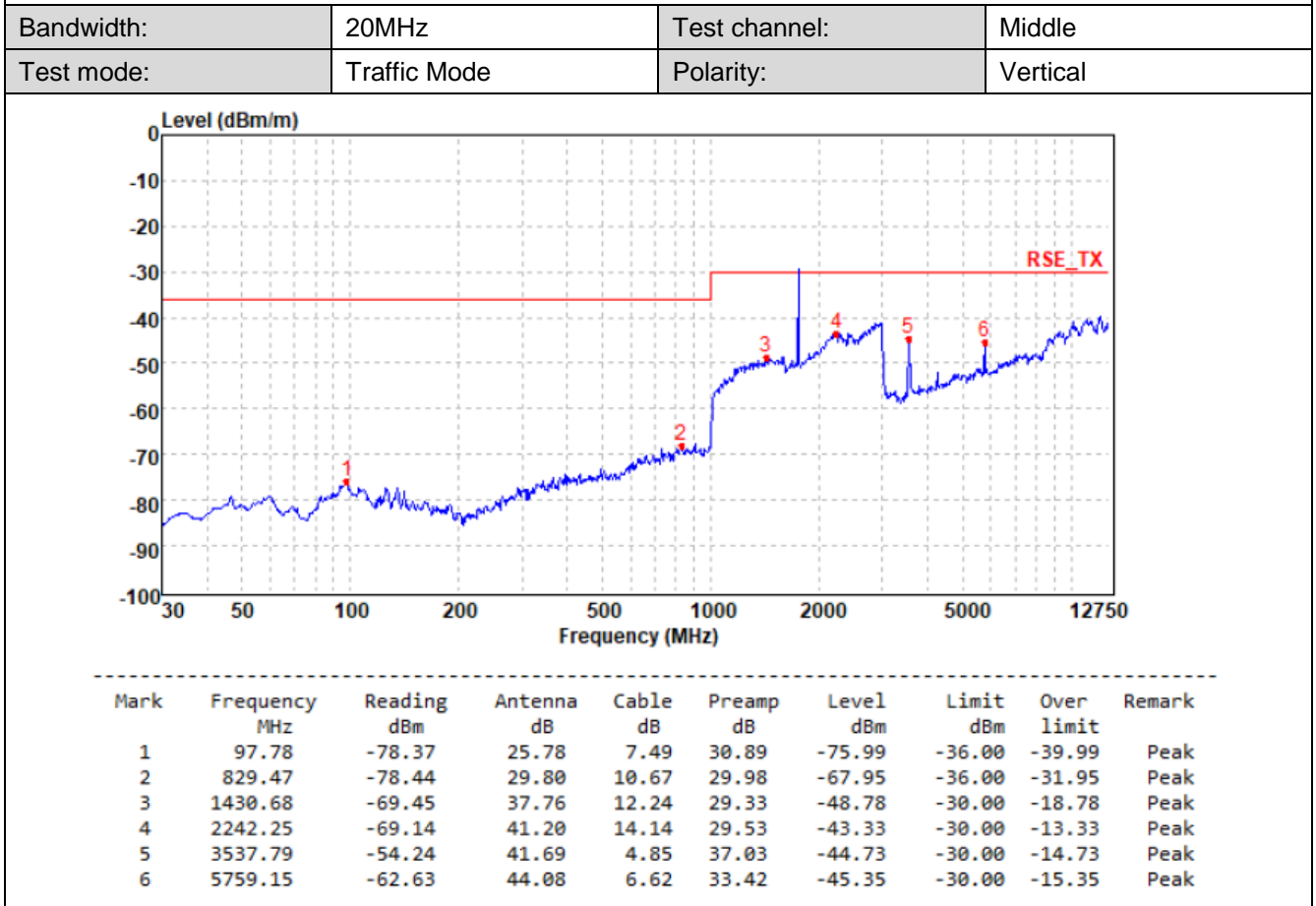
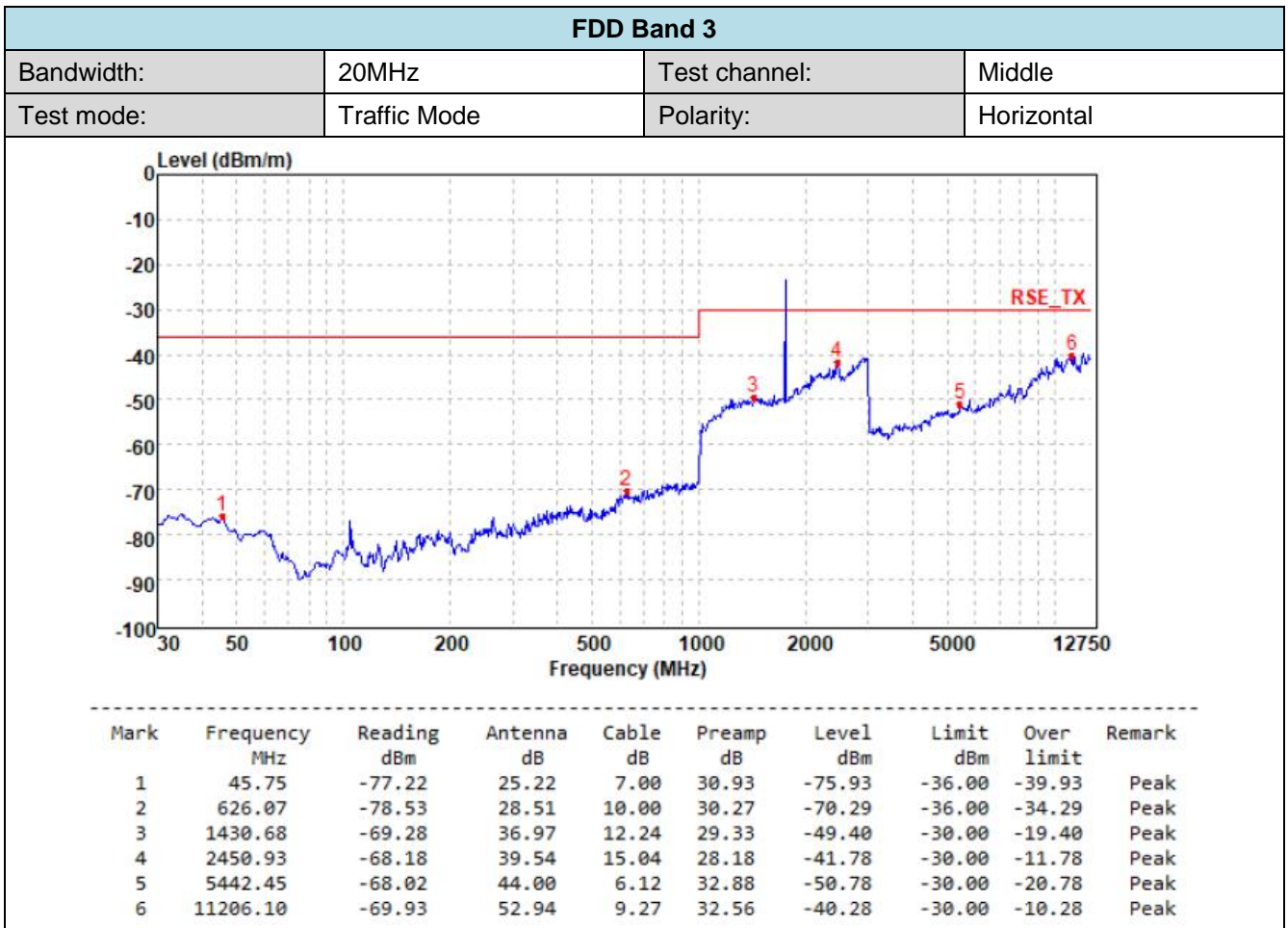
TEST RESULTS

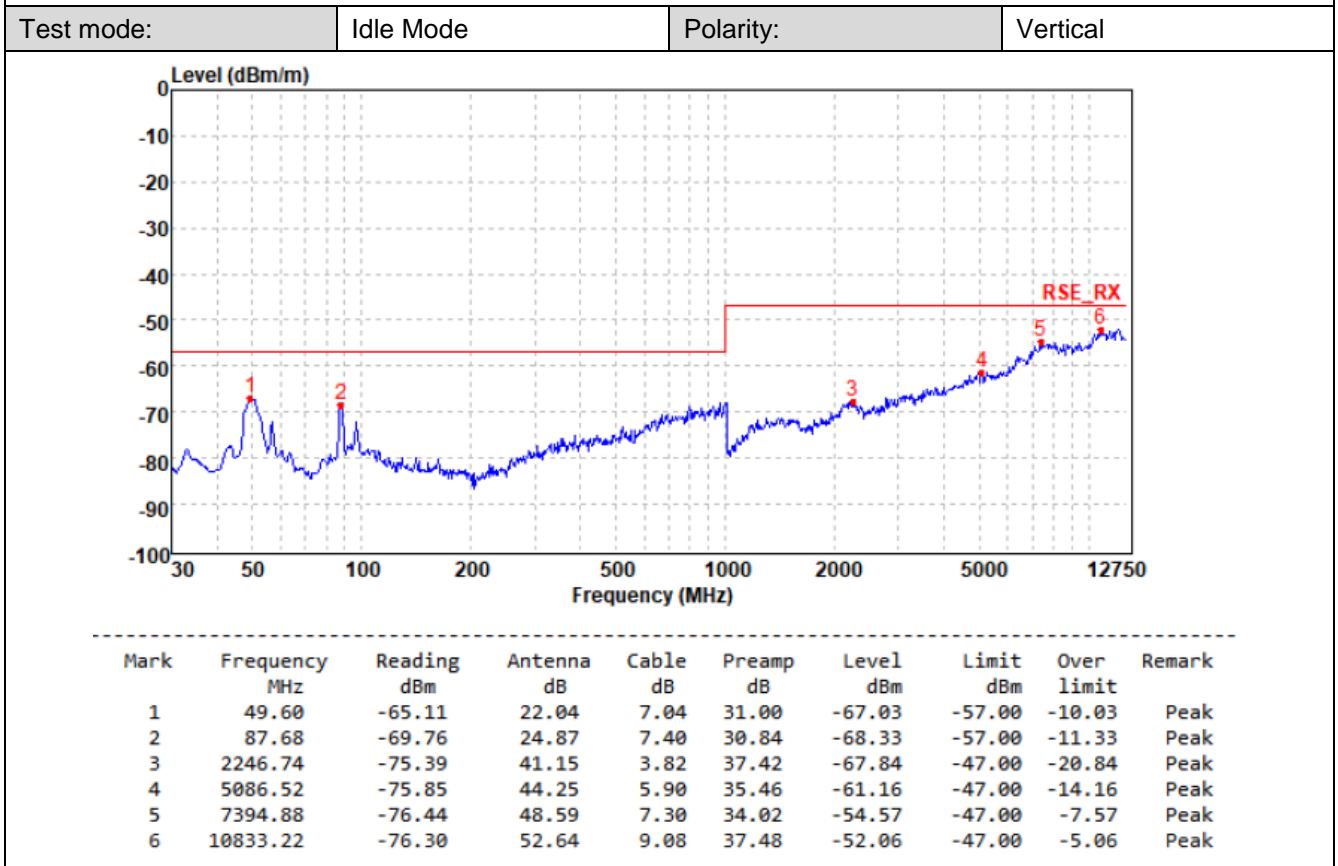
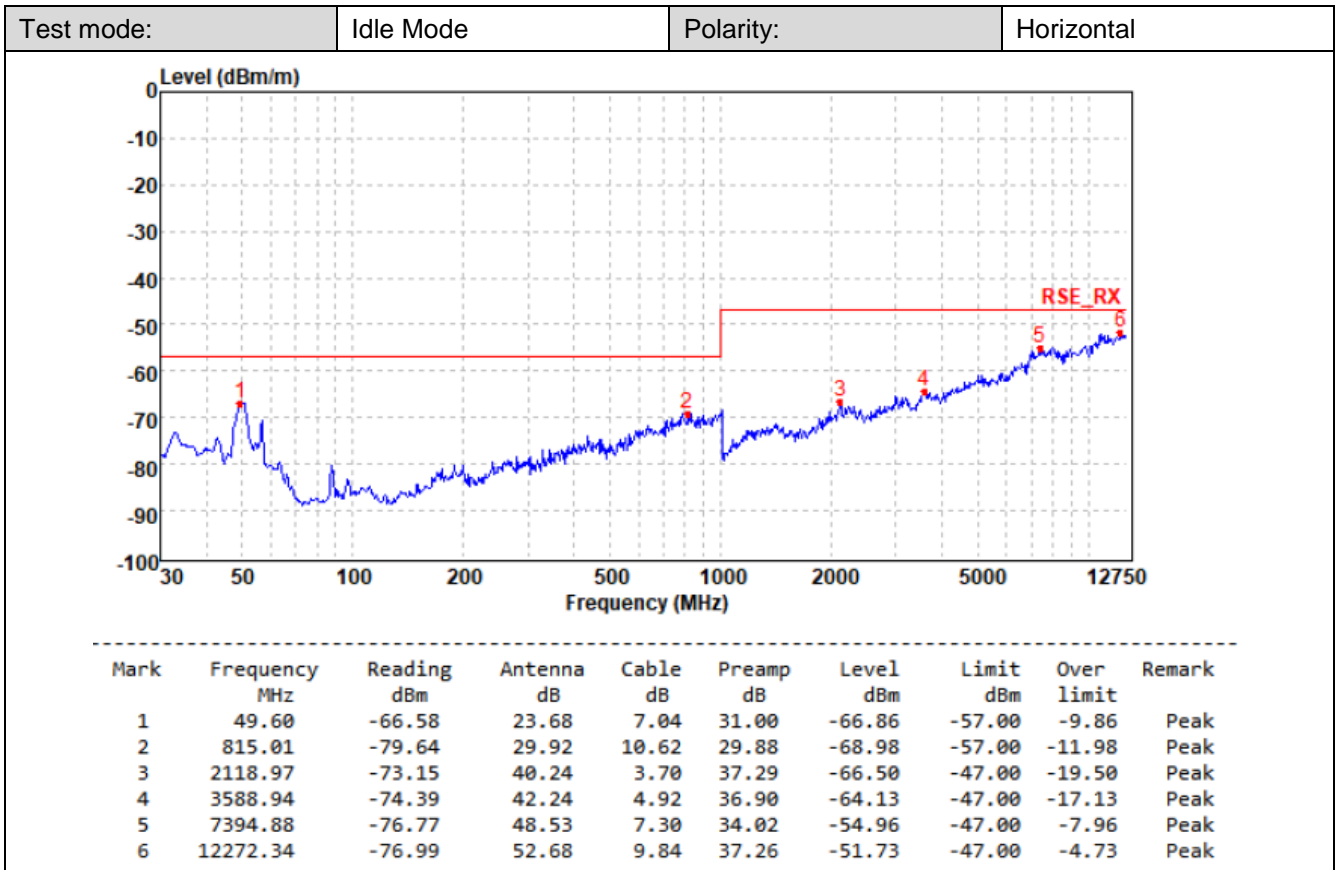
Passed Not Applicable

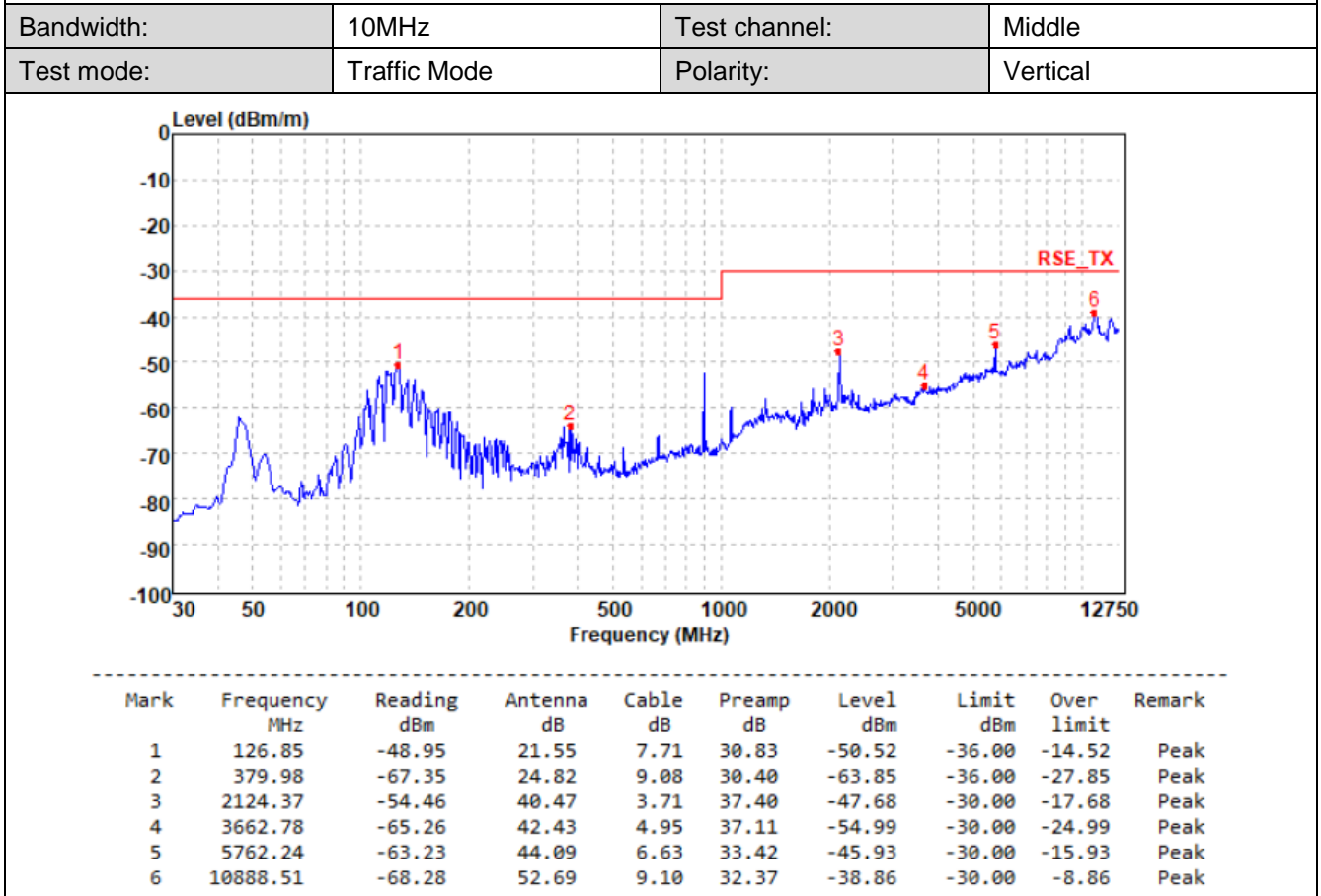
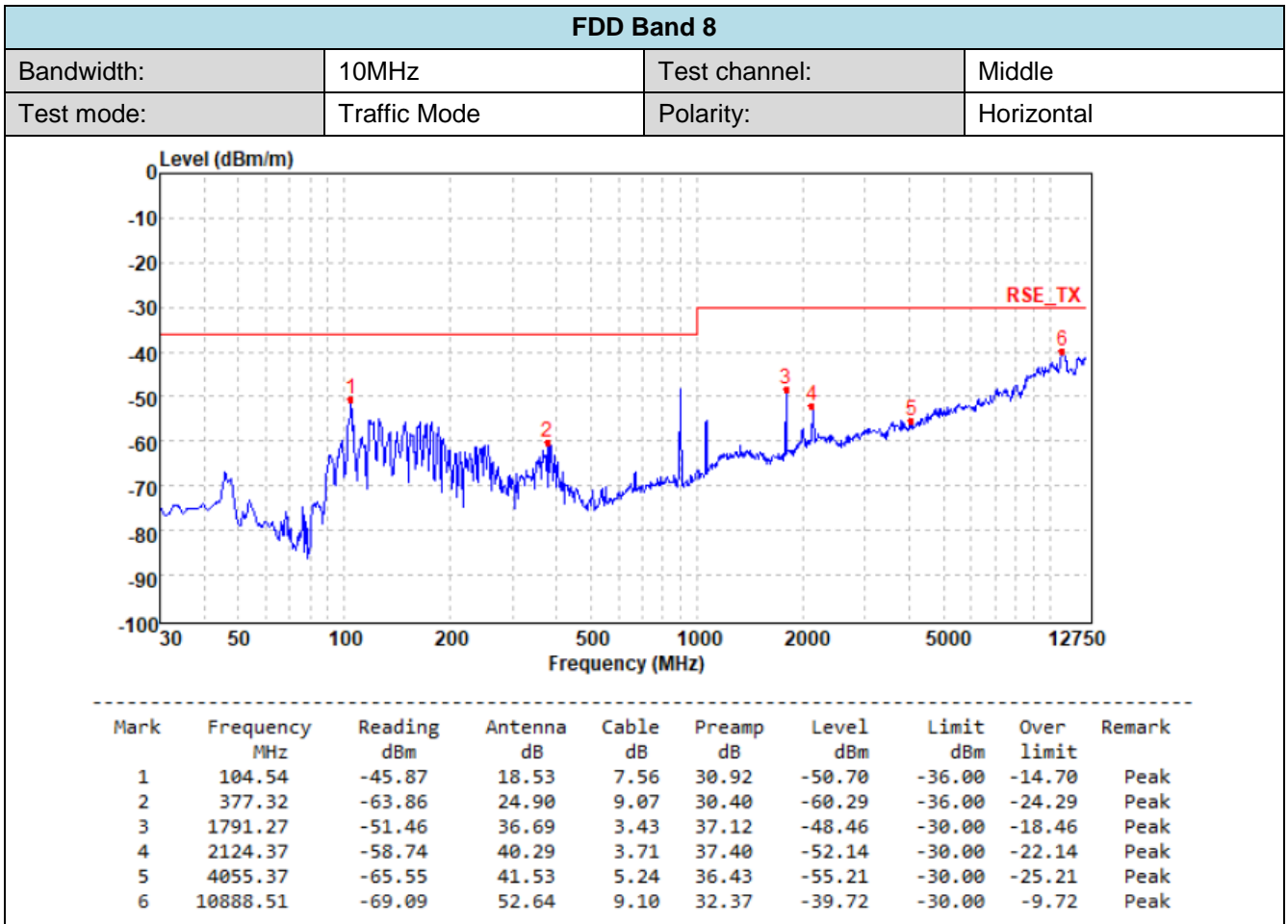
Note: Pre-scan all kinds of bandwidth and channel, but only show the worst test data on the report.



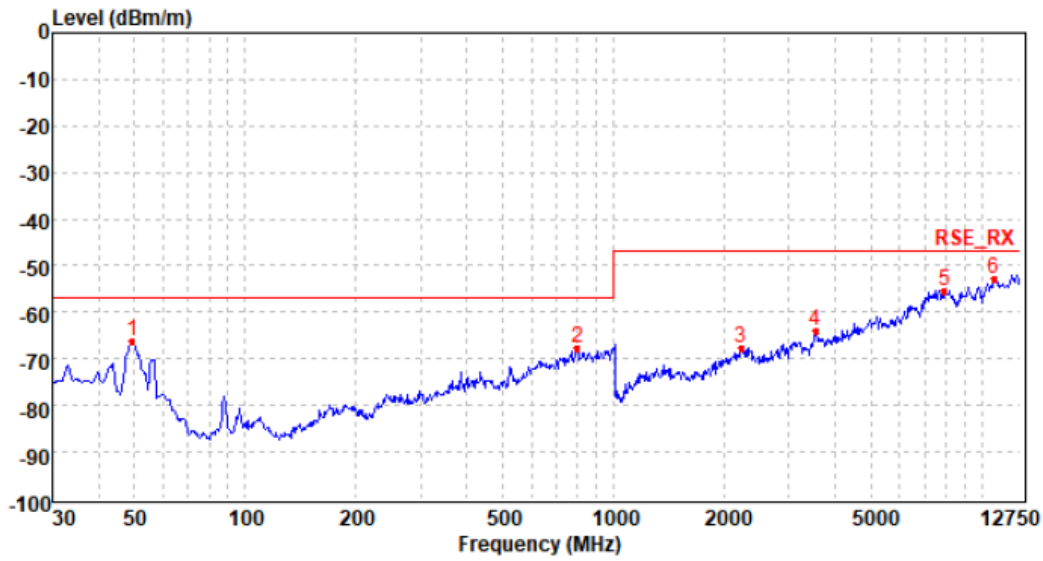






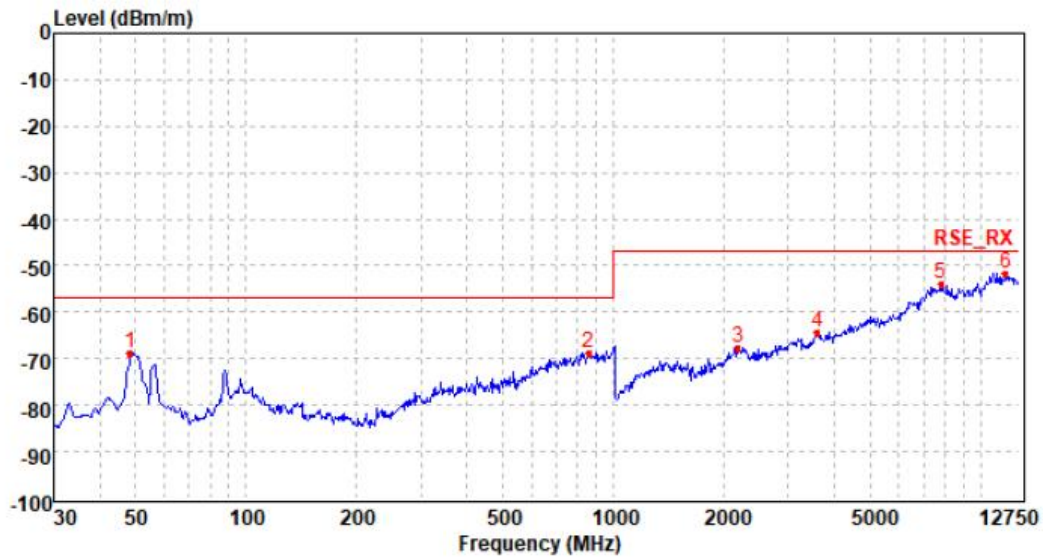


Test mode:	Idle Mode	Polarity:	Horizontal
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Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	49.60	-65.98	23.68	7.04	31.00	-66.26	-57.00	-9.26	Peak
2	797.99	-78.29	29.85	10.55	29.95	-67.84	-57.00	-10.84	Peak
3	2229.65	-74.78	40.79	3.80	37.41	-67.60	-47.00	-20.60	Peak
4	3552.58	-73.92	41.74	4.87	36.80	-64.11	-47.00	-17.11	Peak
5	7921.00	-77.52	48.03	7.55	33.33	-55.27	-47.00	-8.27	Peak
6	10833.22	-76.92	52.51	9.08	37.48	-52.81	-47.00	-5.81	Peak

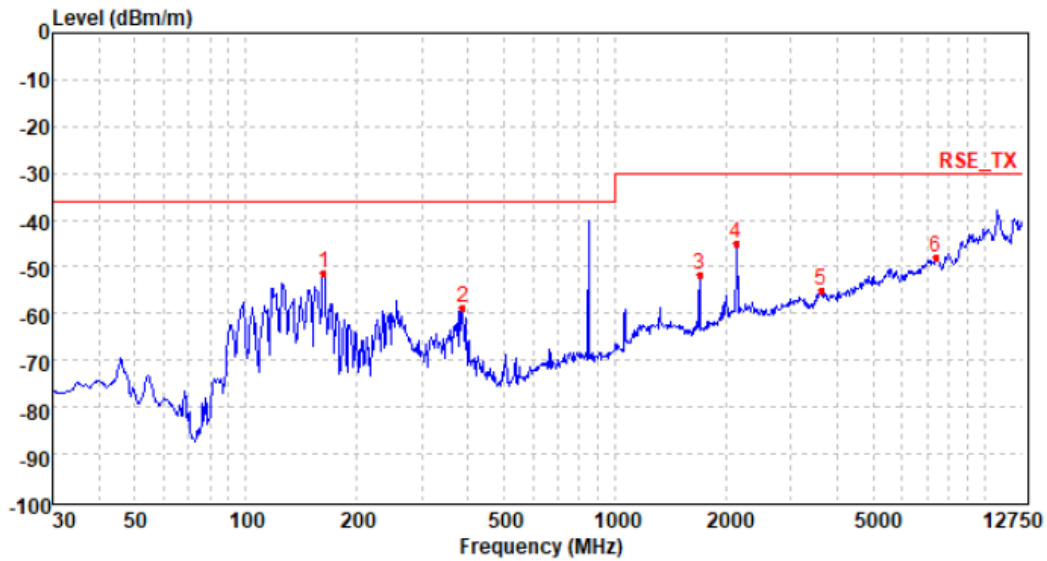
Test mode:	Idle Mode	Polarity:	Vertical
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Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	48.57	-66.64	21.94	7.03	30.98	-68.65	-57.00	-11.65	Peak
2	856.14	-79.04	29.88	10.73	30.16	-68.59	-57.00	-11.59	Peak
3	2184.70	-75.38	41.48	3.75	37.41	-67.56	-47.00	-20.56	Peak
4	3598.09	-75.06	42.59	4.94	36.93	-64.46	-47.00	-17.46	Peak
5	7820.82	-76.49	48.46	7.46	33.23	-53.80	-47.00	-6.80	Peak
6	11752.60	-77.07	53.08	9.56	37.40	-51.83	-47.00	-4.83	Peak

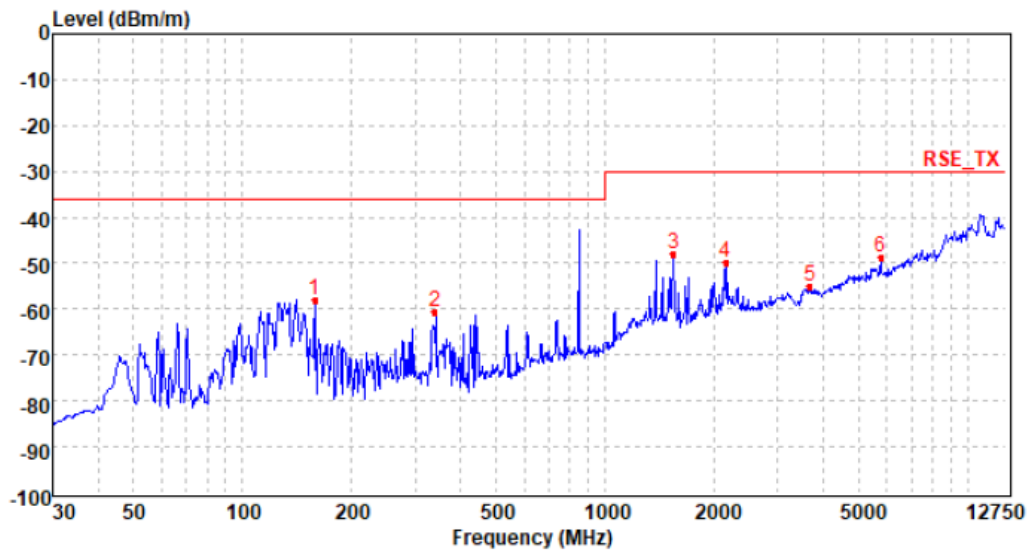
FDD Band 20

Bandwidth:	20MHz	Test channel:	Middle
Test mode:	Traffic Mode	Polarity:	Horizontal

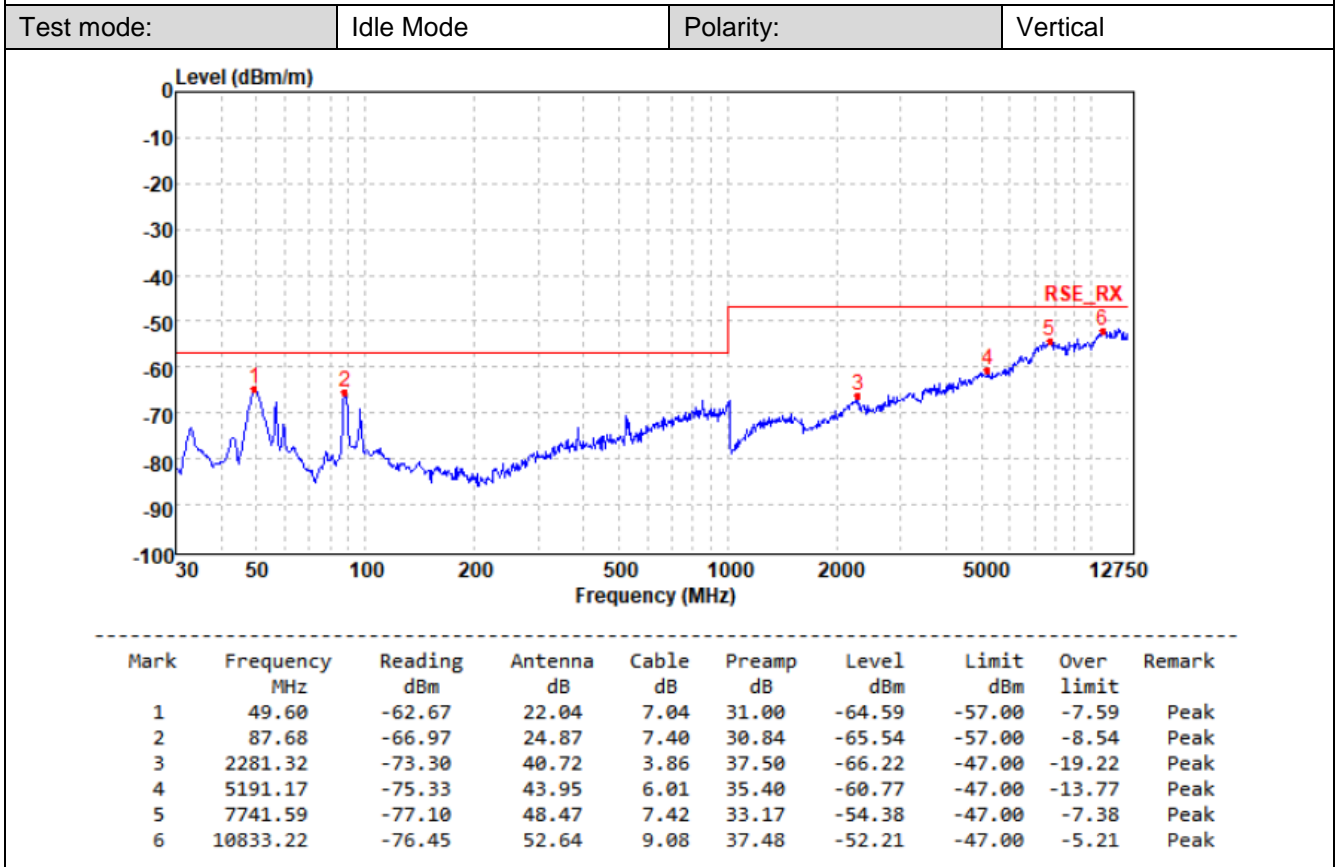
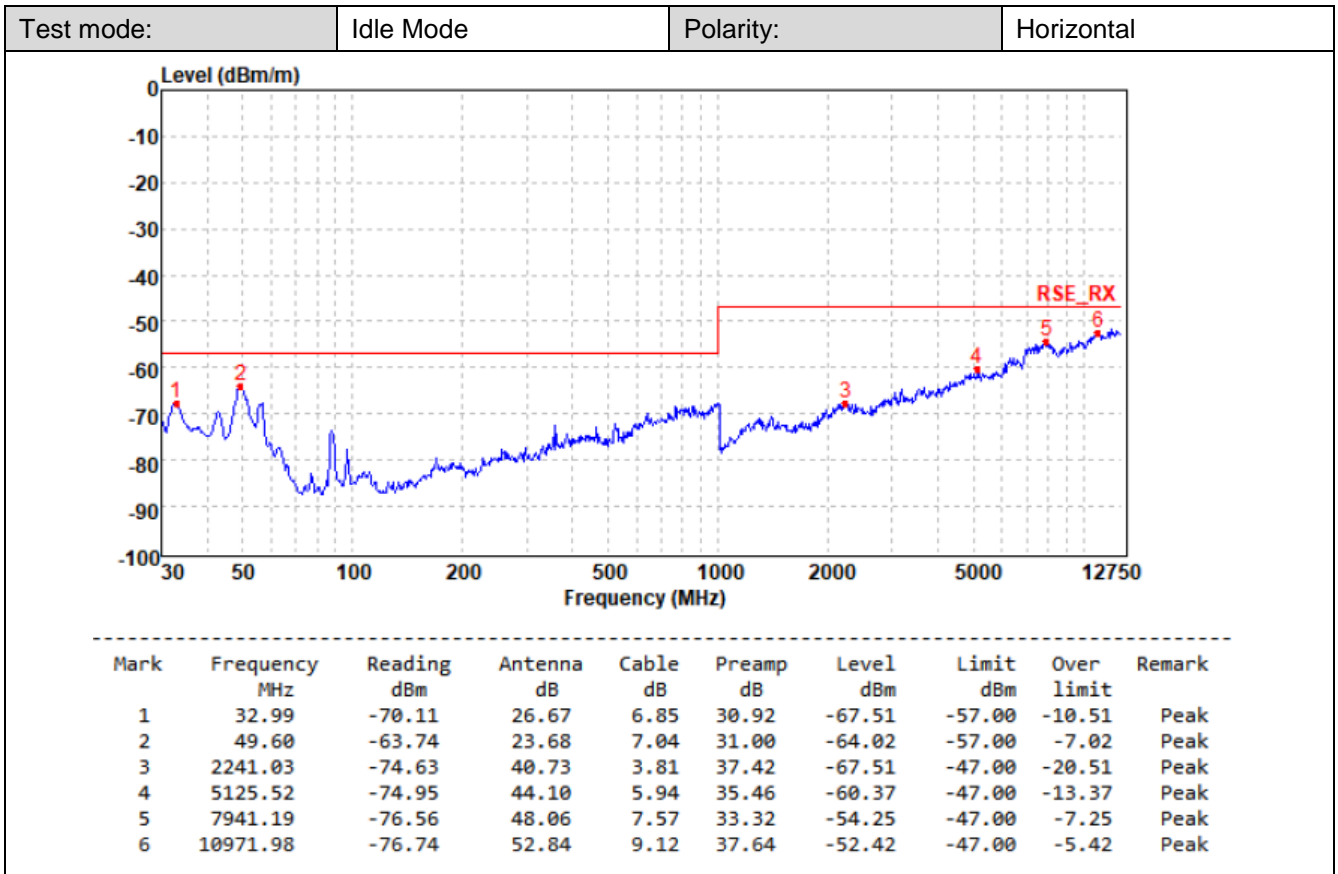


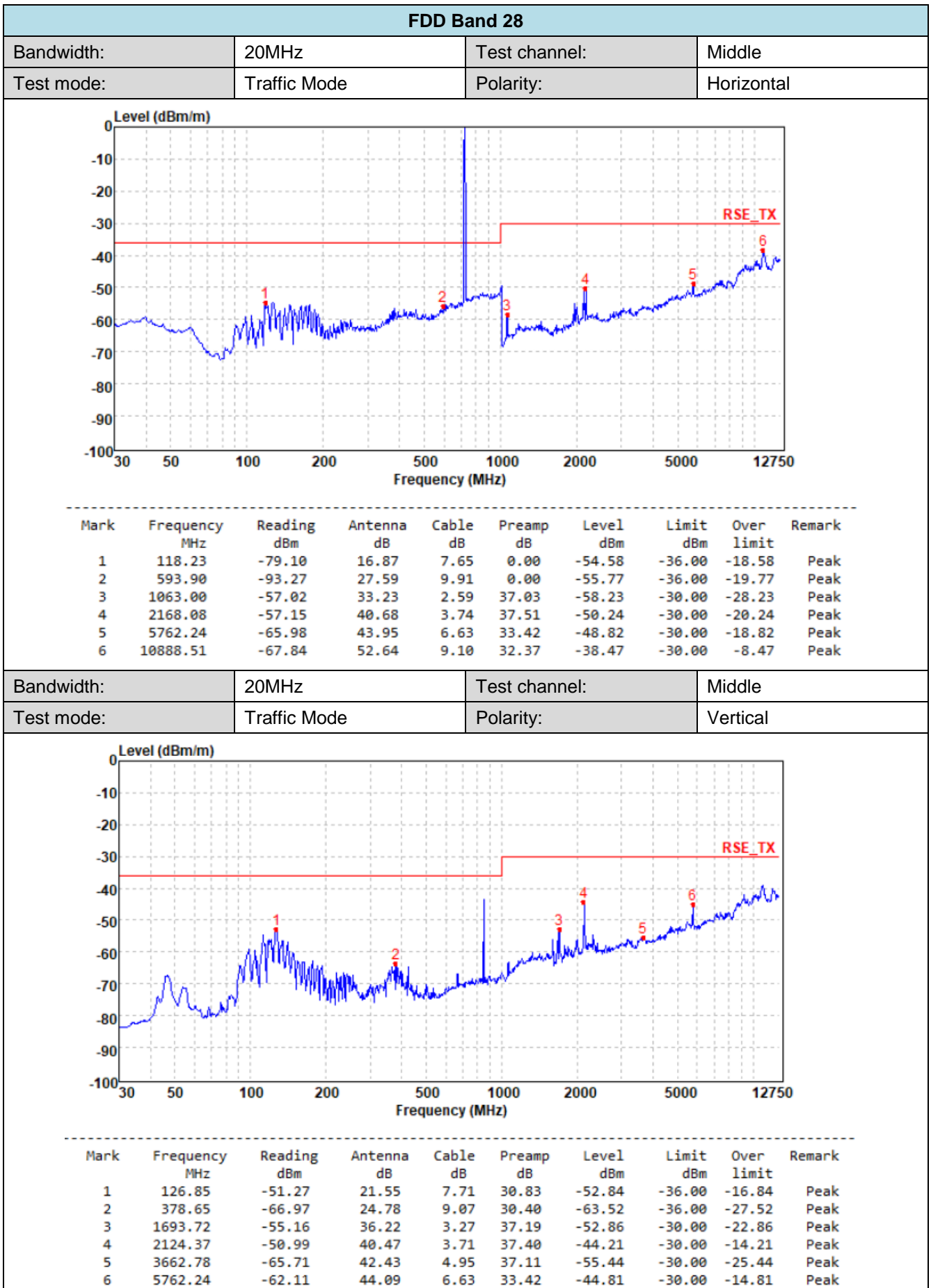
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	162.82	-48.34	19.82	7.96	30.61	-51.17	-36.00	-15.17	Peak
2	388.08	-62.46	25.17	9.12	30.43	-58.60	-36.00	-22.60	Peak
3	1693.72	-53.93	36.33	3.27	37.19	-51.52	-30.00	-21.52	Peak
4	2129.79	-51.61	40.34	3.71	37.41	-44.97	-30.00	-14.97	Peak
5	3625.67	-65.40	42.36	4.94	37.02	-55.12	-30.00	-25.12	Peak
6	7413.73	-70.08	48.49	7.31	33.84	-48.12	-30.00	-18.12	Peak

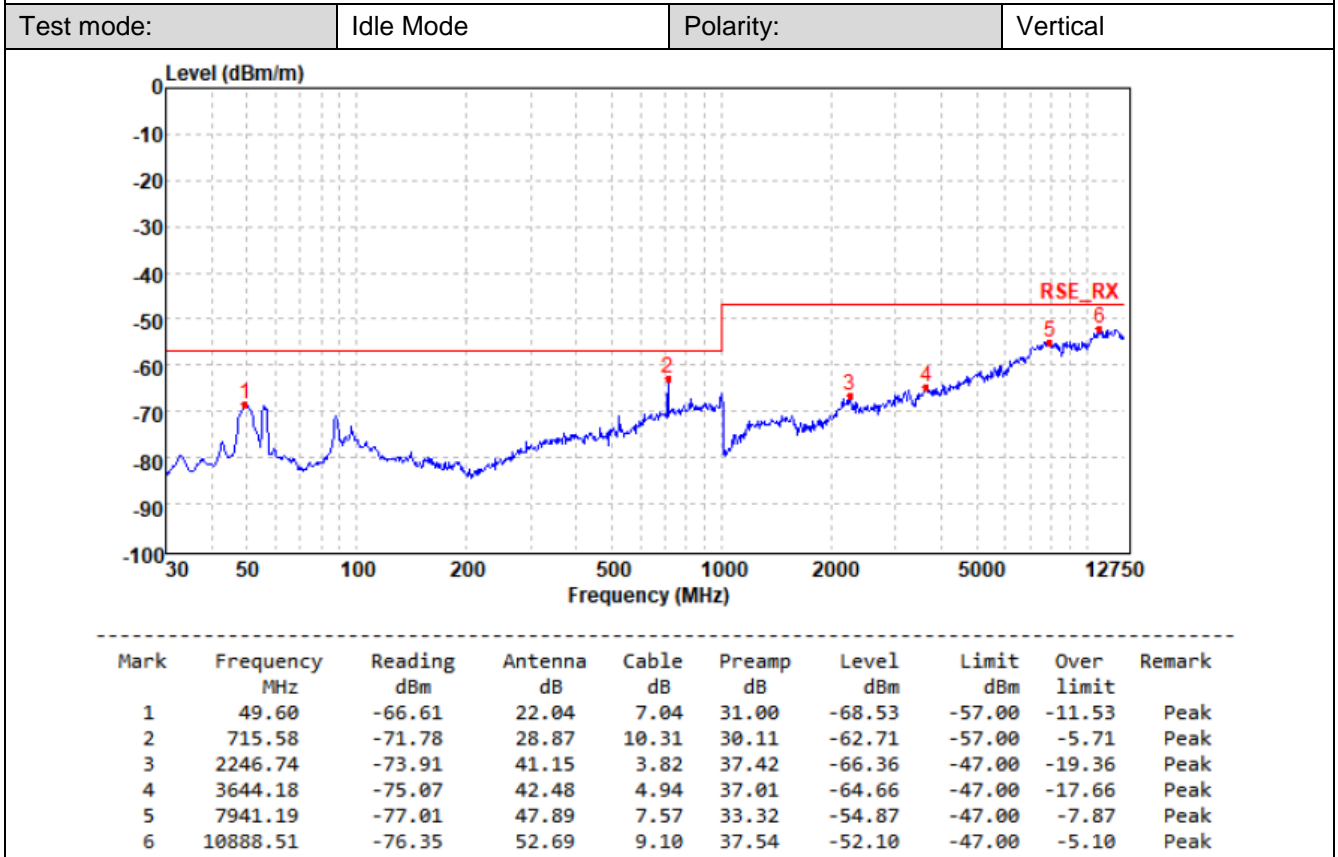
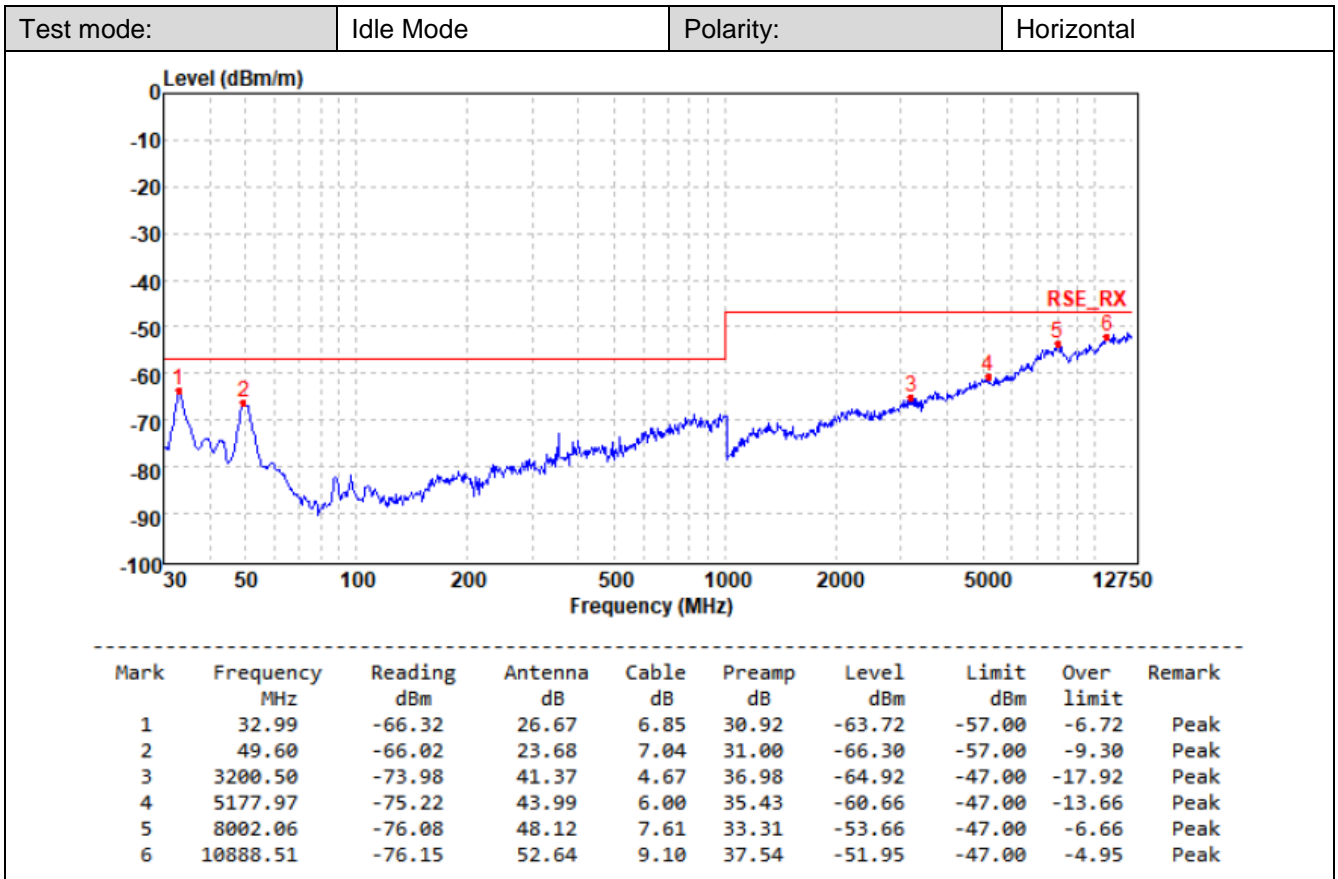
Bandwidth:	20MHz	Test channel:	Middle
Test mode:	Traffic Mode	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	158.30	-56.20	21.01	7.93	30.62	-57.88	-36.00	-21.88	Peak
2	340.73	-64.00	24.79	8.91	30.38	-60.68	-36.00	-24.68	Peak
3	1545.41	-52.05	37.76	3.16	36.93	-48.06	-30.00	-18.06	Peak
4	2157.07	-57.04	41.02	3.73	37.48	-49.77	-30.00	-19.77	Peak
5	3672.11	-65.36	42.40	4.95	37.12	-55.13	-30.00	-25.13	Peak
6	5762.24	-65.81	44.09	6.63	33.42	-48.51	-30.00	-18.51	Peak





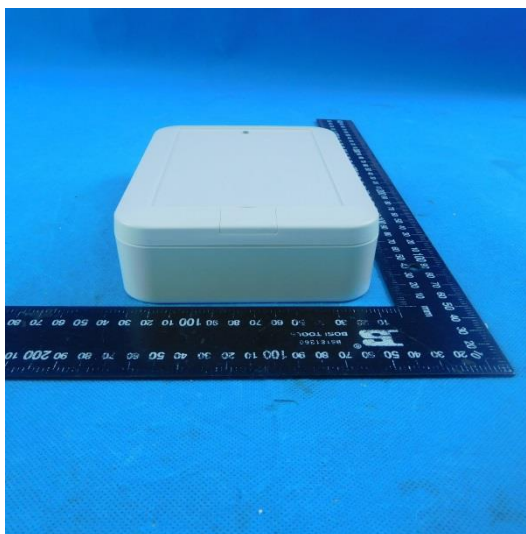
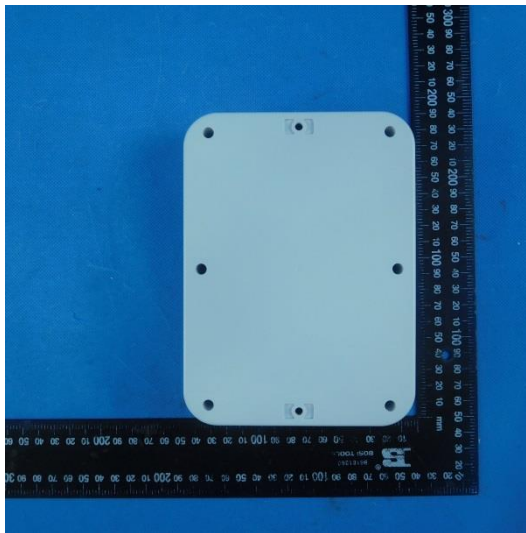


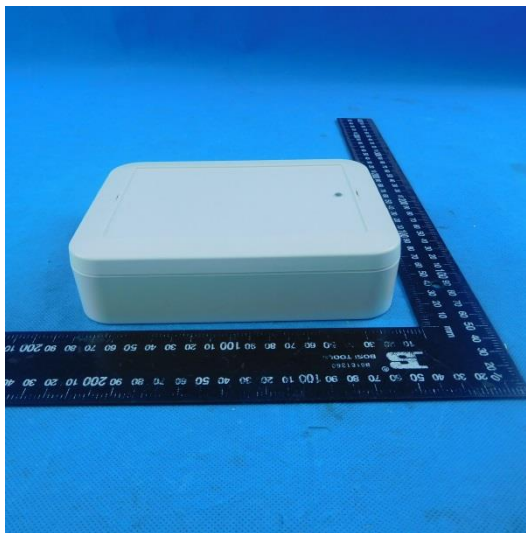
6. TEST SETUP PHOTOS OF THE EUT



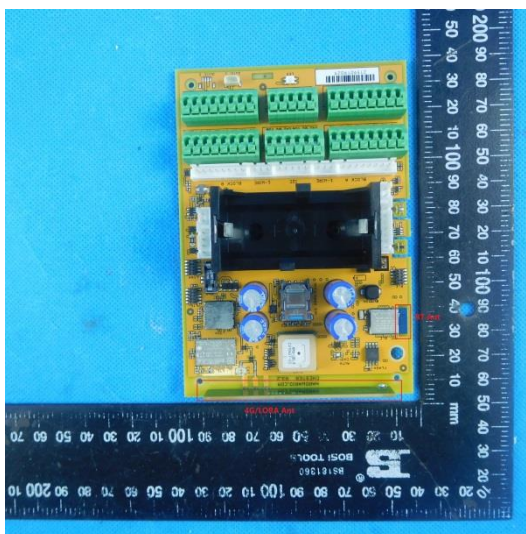
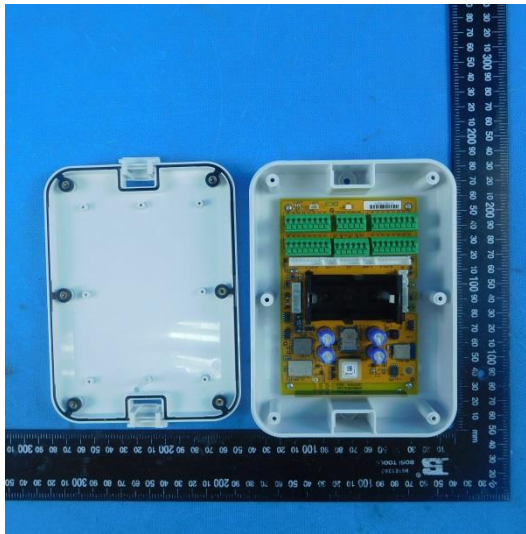
7. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

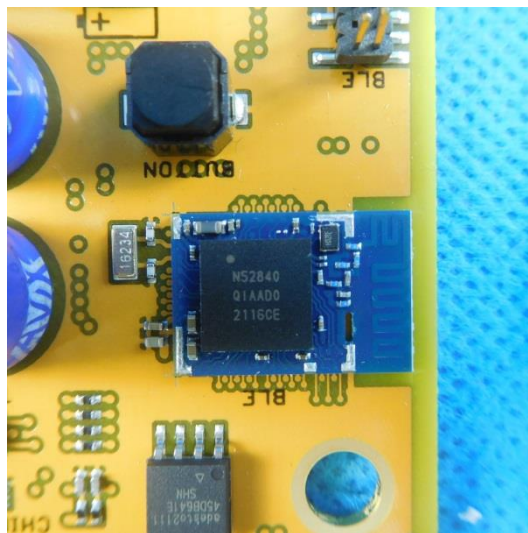
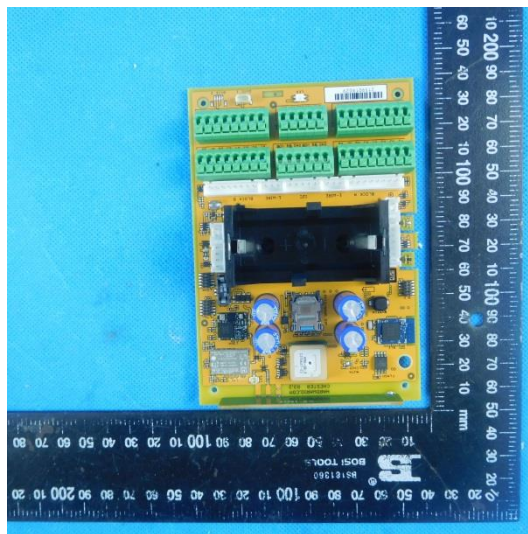
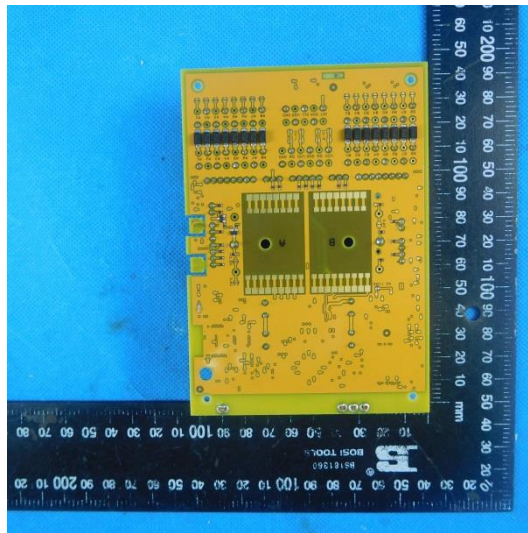
EXTERNAL PHOTOS OF THE EUT

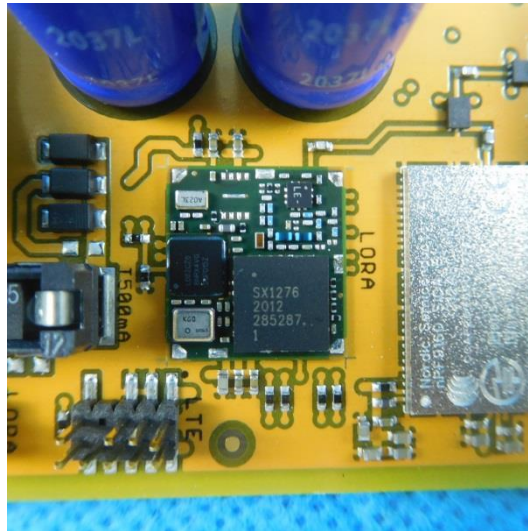




INTERNAL PHOTOS OF THE EUT







-----End of Report-----