

SOUTENANCE FINALE - 18/01/2024

# Projet - NFC

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# Le système NFC, c'est quoi ?



Near-Field Communication

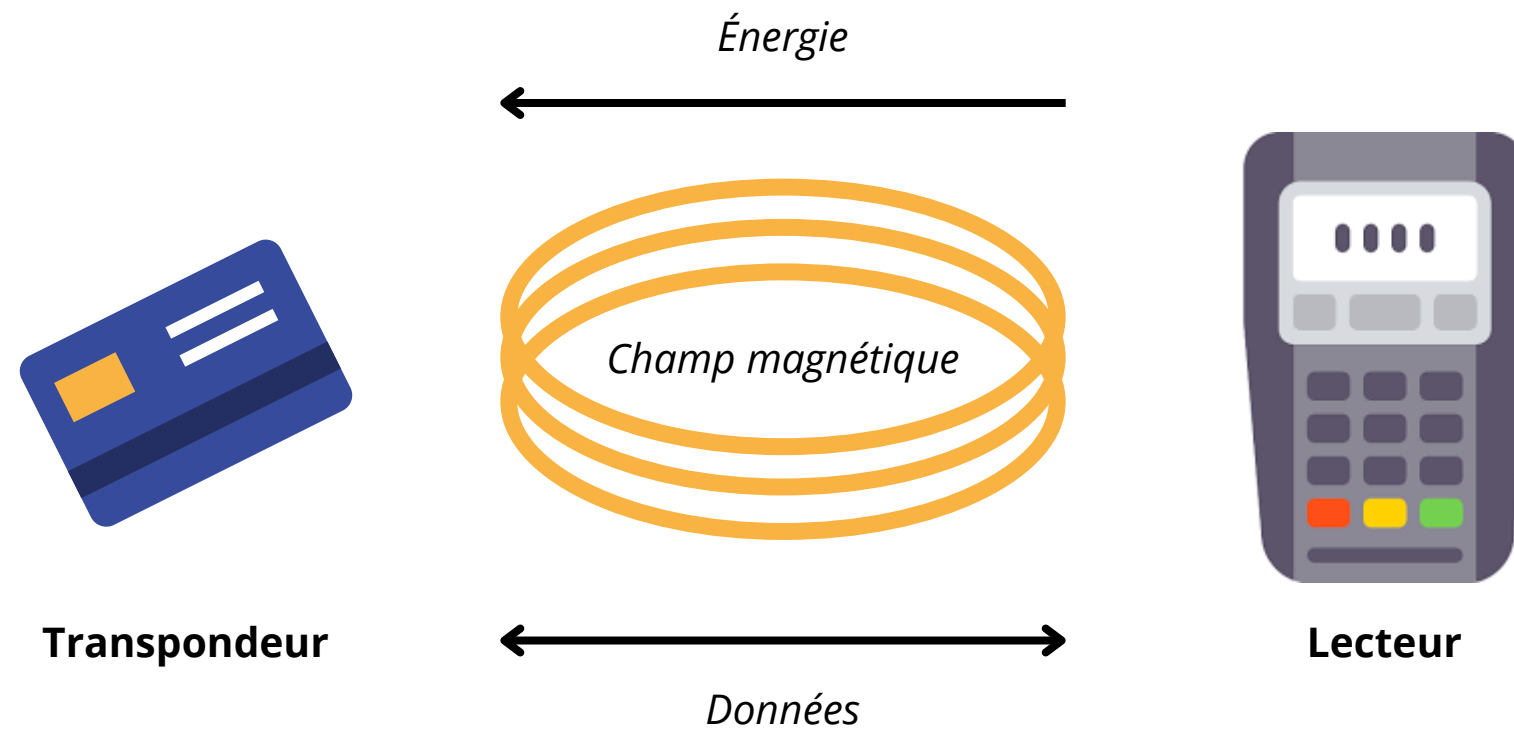
Communication sans contact

Utilisation simple

De nombreux usages

Plusieurs supports

# Le système NFC, comment ça marche ?



Distance : ~ 3cm

Fréquence : 13.56 MHz

Débits : 106, 212,424 ou 848 kbits/s

Plusieurs normes

Le transpondeur utilise l'énergie du lecteur

# GNU Radio, et ça c'est quoi ?



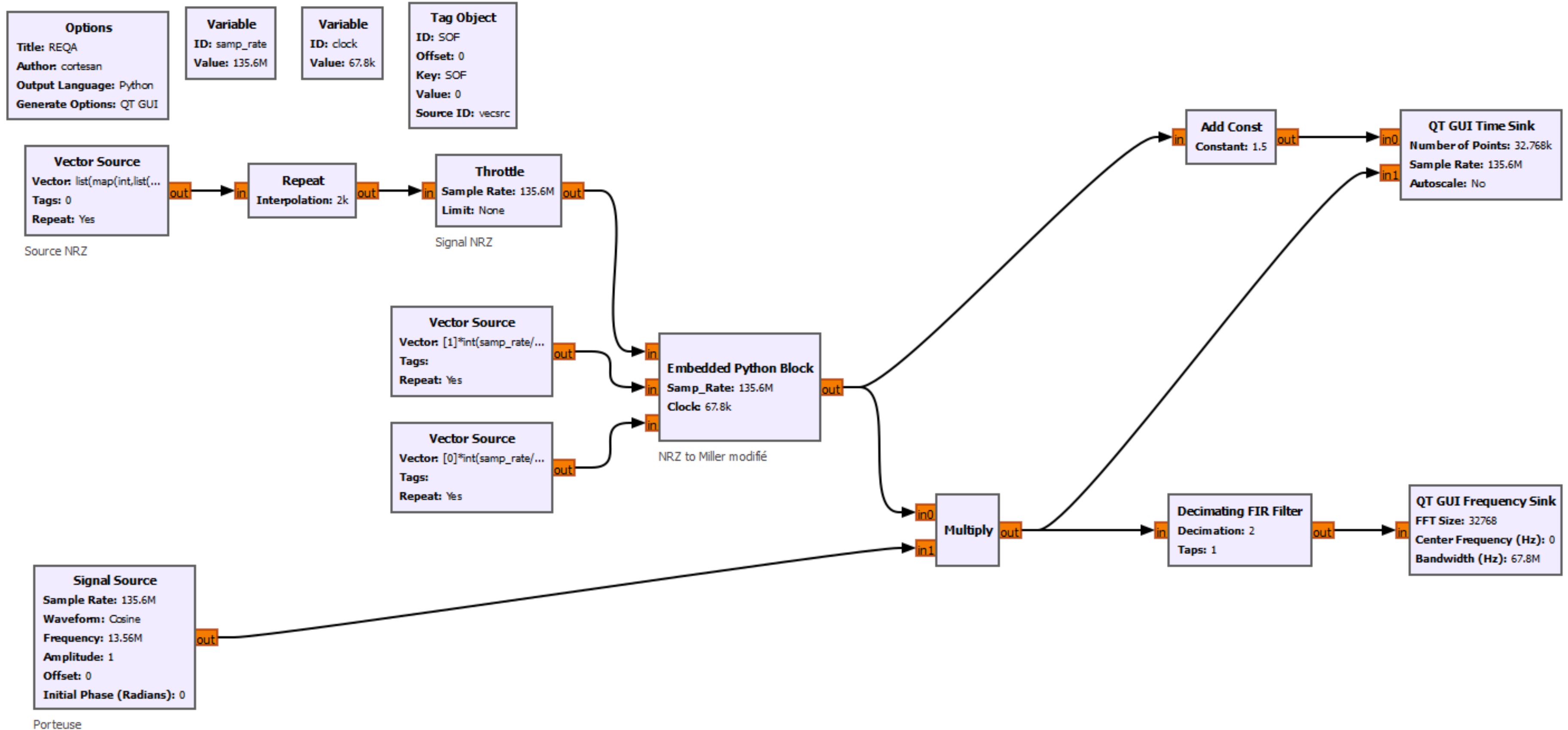
Logiciel open-source

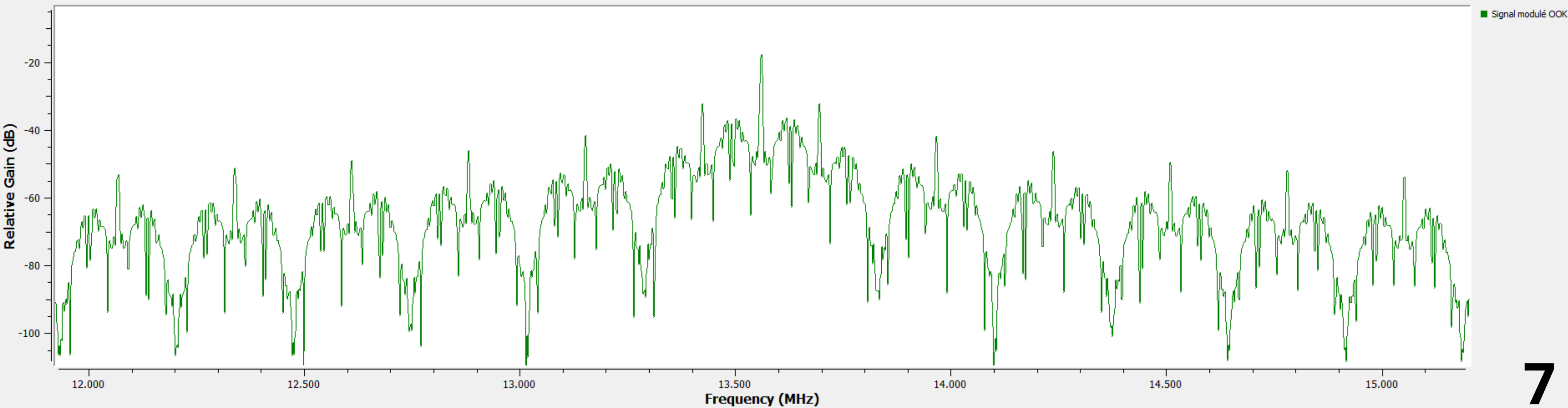
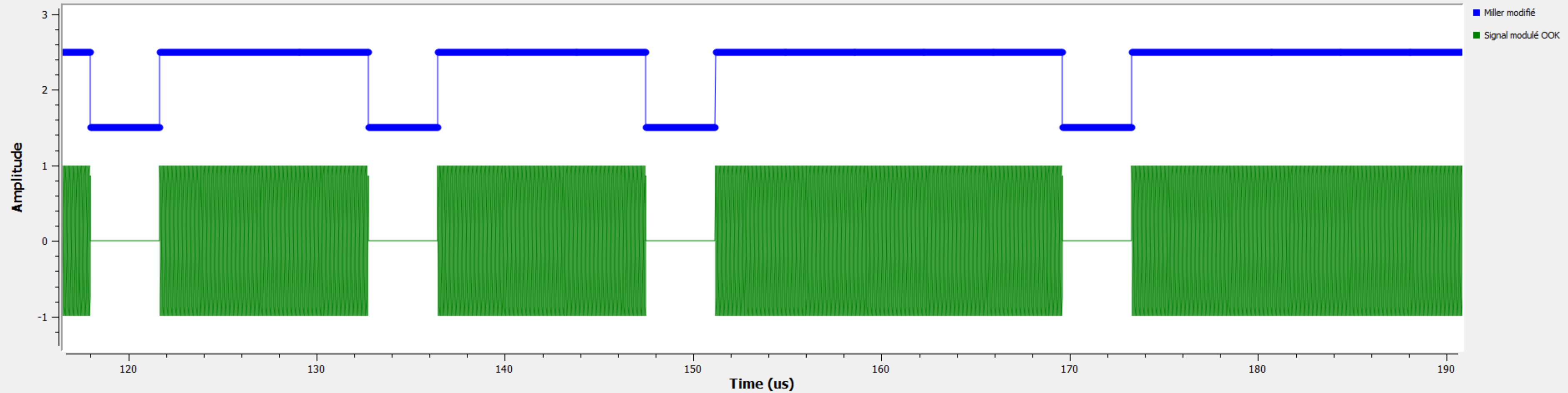
Codé en C++ et Python

Pour l'implémentation de radio logicielle et de traitement de signaux

- Notre utilisation :
- GNU Radio Companion
  - Pour de la simulation
  - Comprendre les systèmes NFC

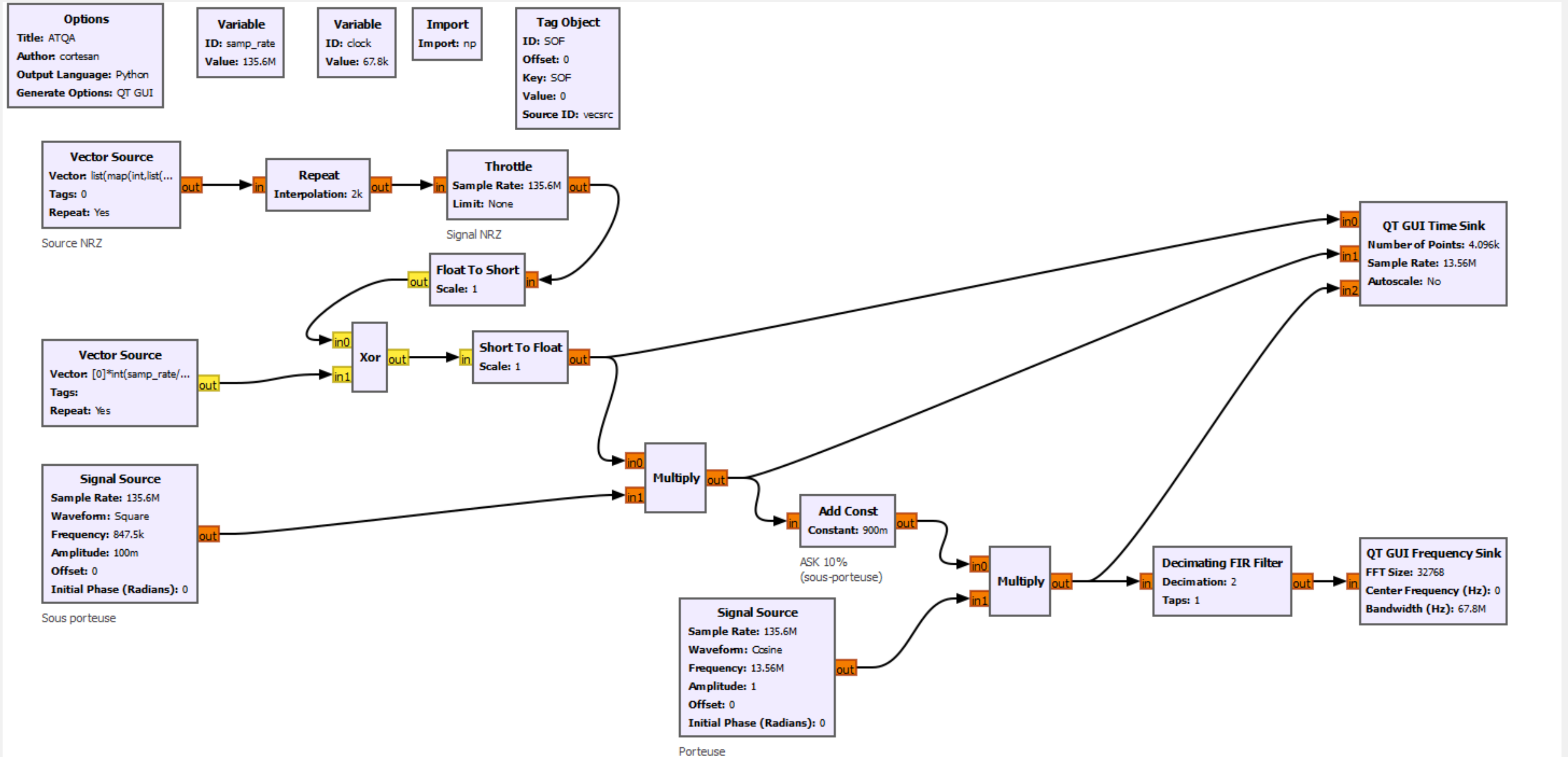
# Diagrammes : Trame REQA



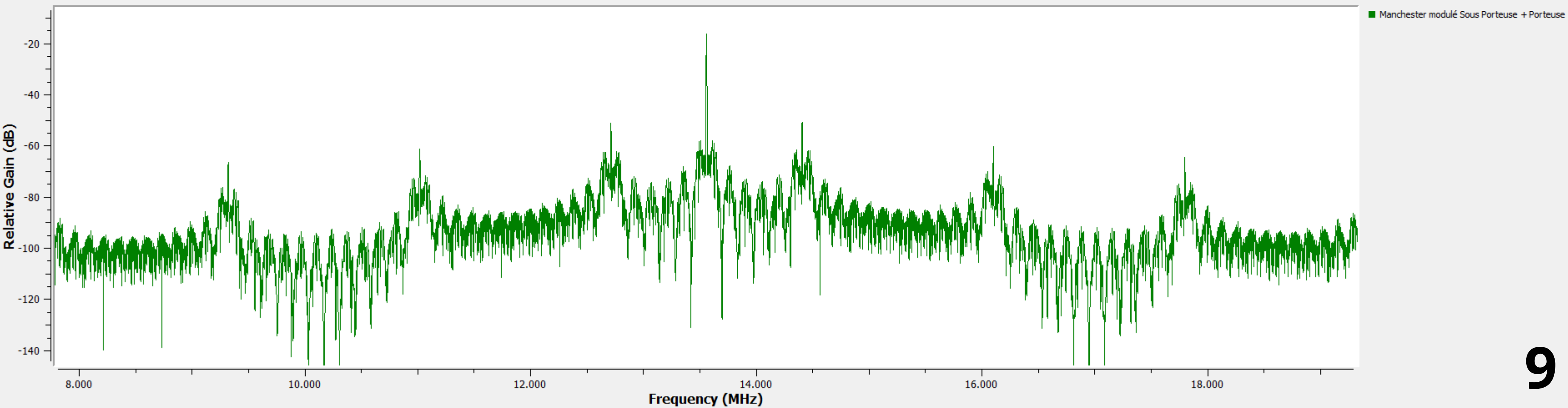
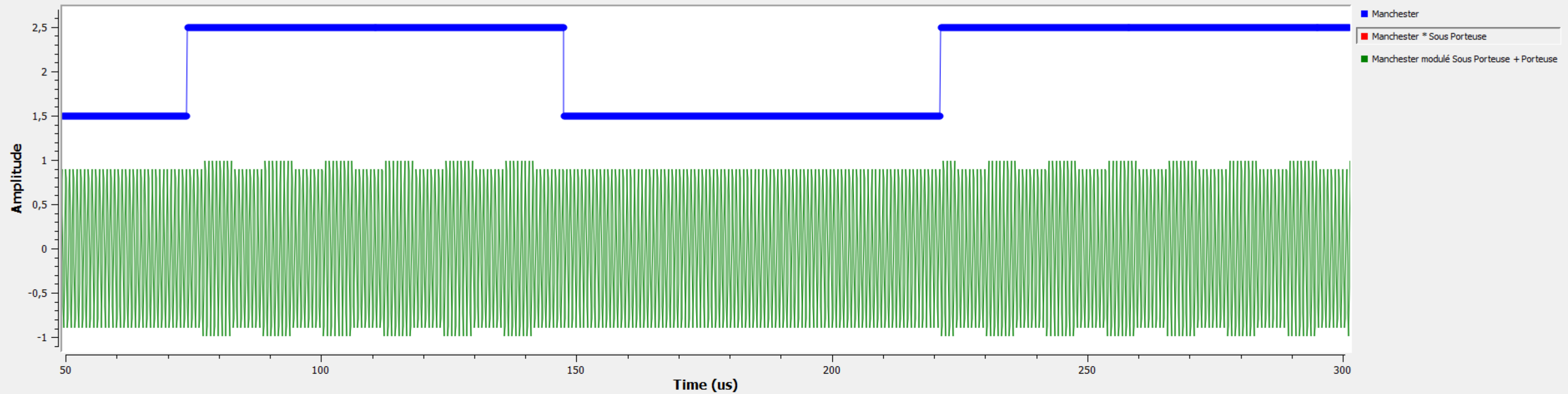




# Diagrammes : Trame ATQA

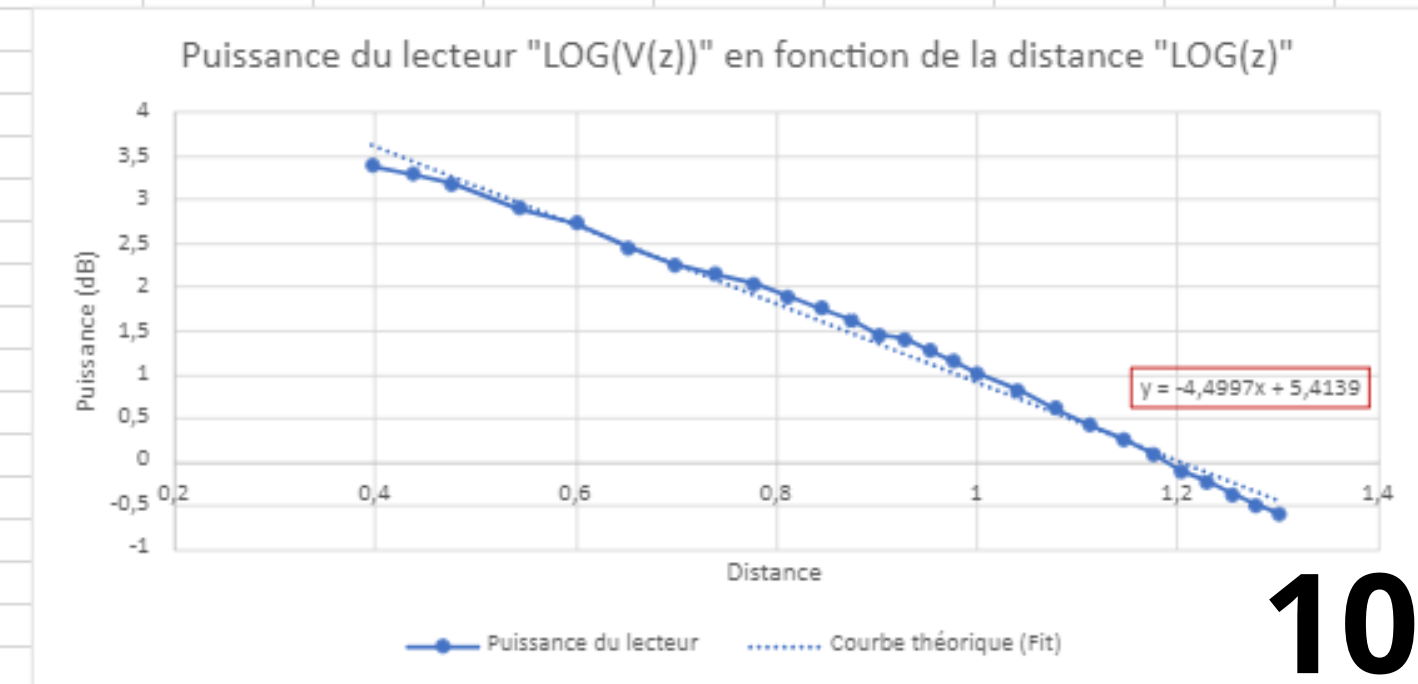
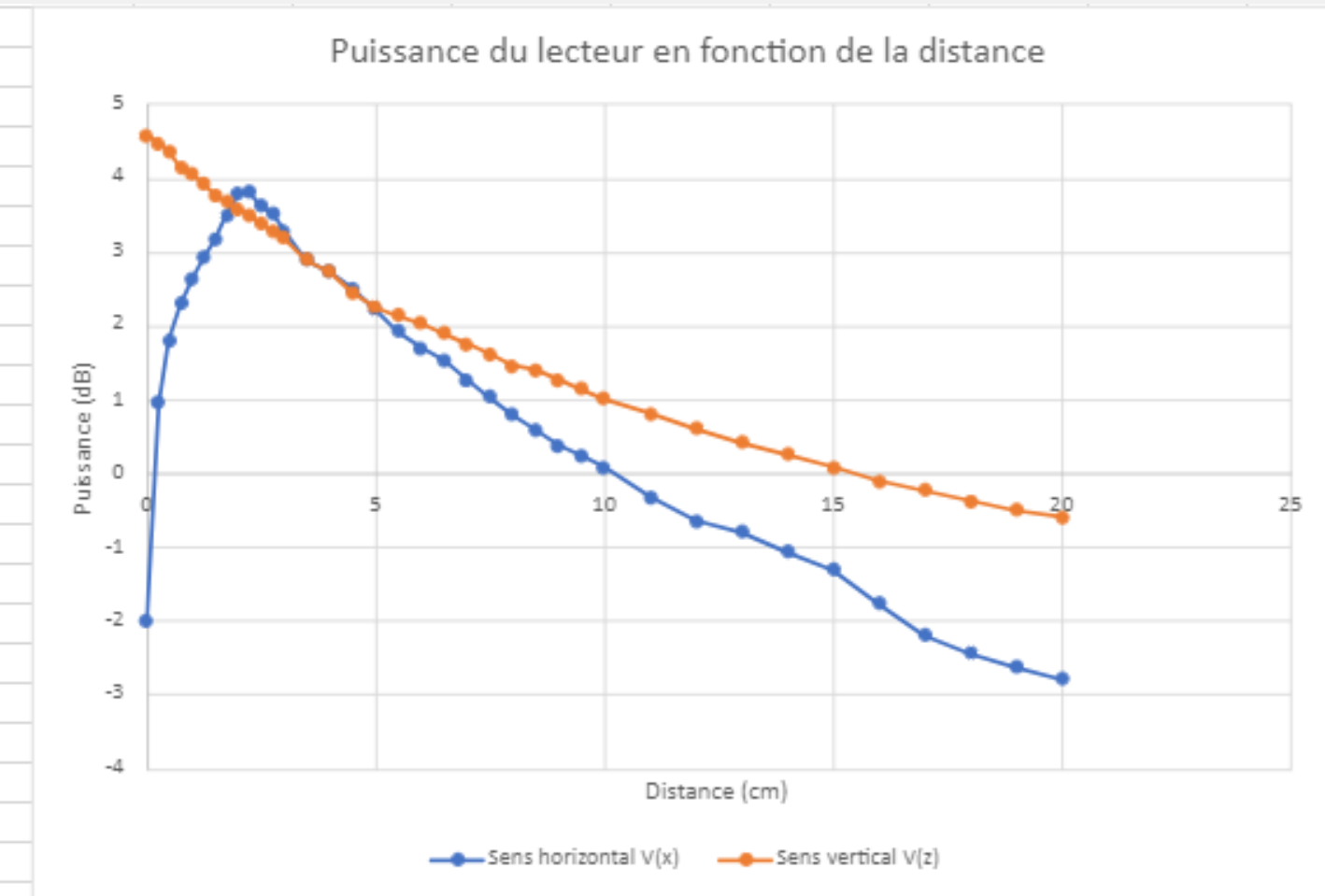




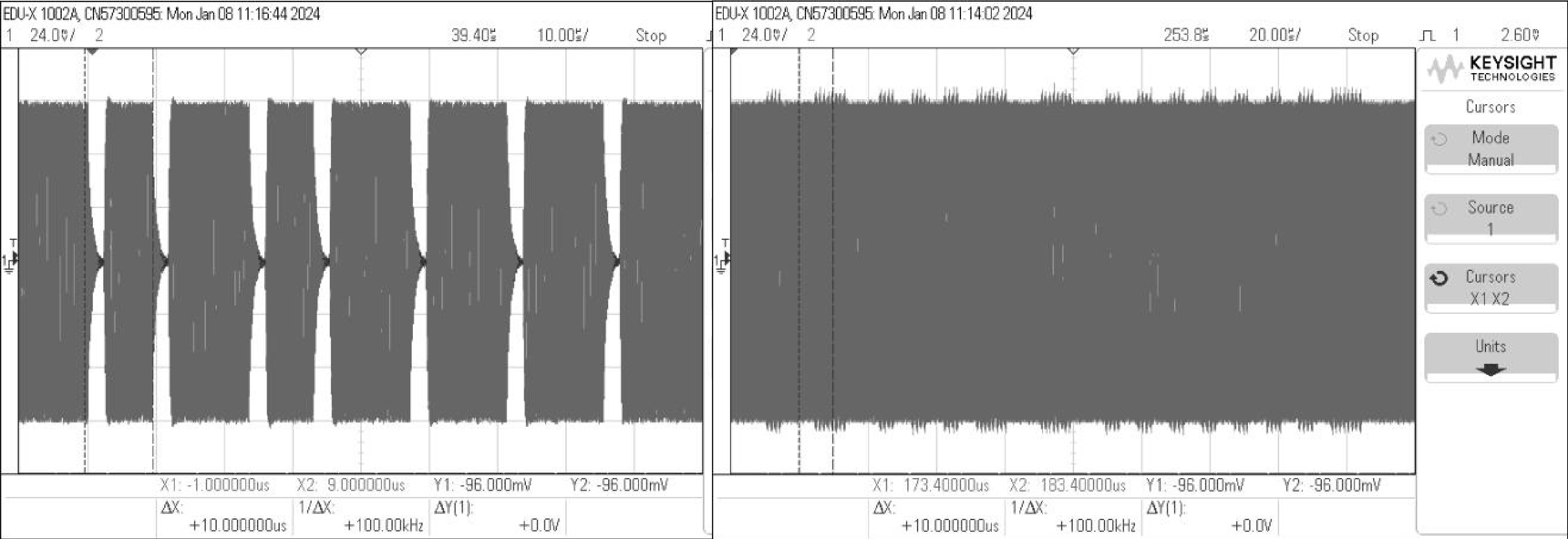


# Mesures : Puissance / Distance

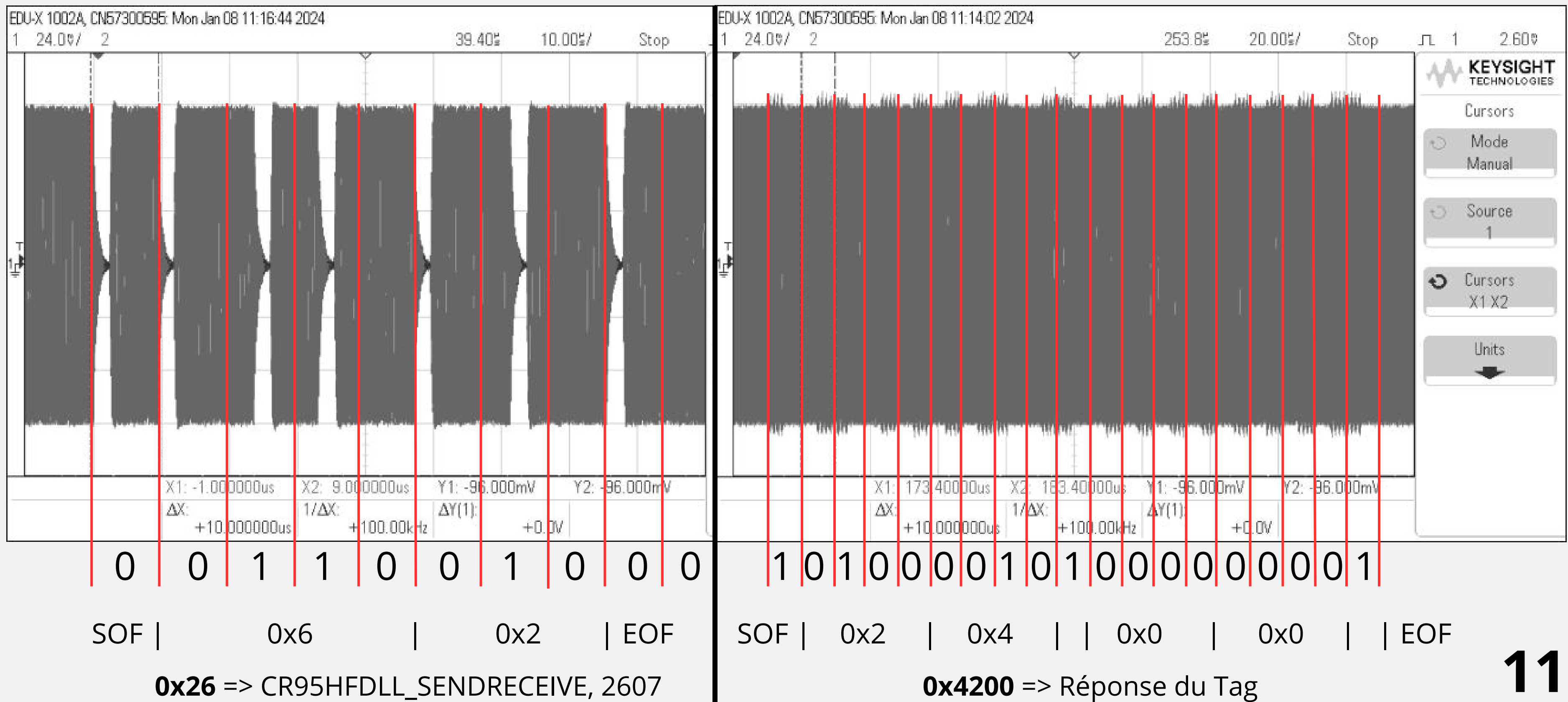
LOG10 Distance	Distance (cm)	Tension peak à peak (mV)		Tension efficace (mV)		Puissance (dB)	
		Sens horizontal V(x)	Sens vertical V(z)	Sens horizontal V(x)	Sens vertical V(z)	Sens horizontal V(x)	Sens vertical V(z)
	0	1	1950	0,707106781	1378,858223	-2	4,580069223
-0,602059991	0,25	30	1710	21,21320344	1209,152596	0,954242509	4,465992221
-0,301029996	0,5	80	1510	56,56854249	1067,73124	1,806179974	4,357953895
-0,124938737	0,75	140	1170	98,99494937	827,314934	2,292256071	4,136371723
0	1	207	1060	146,3711037	749,5331881	2,631940691	4,050611731
0,096910013	1,25	290	900	205,0609665	636,3961031	2,924795996	3,908485019
0,176091259	1,5	380	770	268,7005769	544,4722215	3,159567193	3,77298145
0,243038049	1,75	560	690	395,9797975	487,903679	3,496376054	3,677698181
0,301029996	2	780	610	551,5432893	431,3351365	3,784189205	3,57065967
0,352182518	2,25	800	560	565,6854249	395,9797975	3,806179974	3,496376054
0,397940009	2,5	640	490	452,54834	346,4823228	3,612359948	3,38039216
0,439332694	2,75	580	440	410,1219331	311,1269837	3,526855987	3,286905353
0,477121255	3	440	390	311,1269837	275,7716447	3,286905353	3,182129214
0,544068044	3,5	280	280	197,9898987	197,9898987	2,894316063	2,894316063
0,602059991	4	230	230	162,6345597	162,6345597	2,723455672	2,723455672
0,653212514	4,5	177	167	125,1579003	118,0868325	2,495946533	2,445432942
0,698970004	5	129	133	91,21677477	94,0452019	2,221179421	2,247703282
0,740362689	5,5	92	117	65,05382387	82,7314934	1,927575655	2,136371723
0,77815125	6	70	103	49,49747468	72,83199846	1,69019608	2,025674449
0,812913357	6,5	58	88	41,01219331	62,22539674	1,526855987	1,888965344
0,84509804	7	43	75	30,40559159	53,03300859	1,266936911	1,750122527
0,875061263	7,5	33	64	23,33452378	45,254834	1,03702788	1,612359948
0,903089987	8	25	53	17,67766953	37,4766594	0,795880017	1,448551739
0,929418926	8,5	19,7	50	13,93000359	35,35533906	0,588932452	1,397940009
0,954242509	9	15,3	43	10,81873375	30,40559159	0,369382862	1,266936911
0,977723605	9,5	13,1	37	9,263098834	26,1629509	0,234542591	1,136403448
1	10	10,9	32	7,707463915	22,627417	0,074852996	1,010299957
1,041392685	11	6,9	25,3	4,87903679	17,88980156	-0,322301819	0,806241042
1,079181246	12	4,7	20	3,323401872	14,14213562	-0,655804284	0,602059991
1,113943352	13	4	16,1	2,828427125	11,38441918	-0,795880017	0,413651752
1,146128036	14	2,9	13,3	2,050609665	9,40452019	-1,075204004	0,247703282
1,176091259	15	2,2	10,9	1,555634919	7,707463915	-1,315154638	0,074852996
1,204119983	16	1,3	8,8	0,919238816	6,222539674	-1,772113295	-0,111034656
1,230448921	17	0,8	7,6	0,565685425	5,374011537	-2,193820026	-0,238372815
1,255272505	18	0,6	6,4	0,424264069	4,5254834	-2,443697499	-0,387640052
1,278753601	19	0,48	5,6	0,339411255	3,959797975	-2,637517525	-0,503623946
1,301029996	20	0,4	5	0,282842712	3,535533906	-2,795880017	-0,602059991



# Mesures : ISO 14443-A

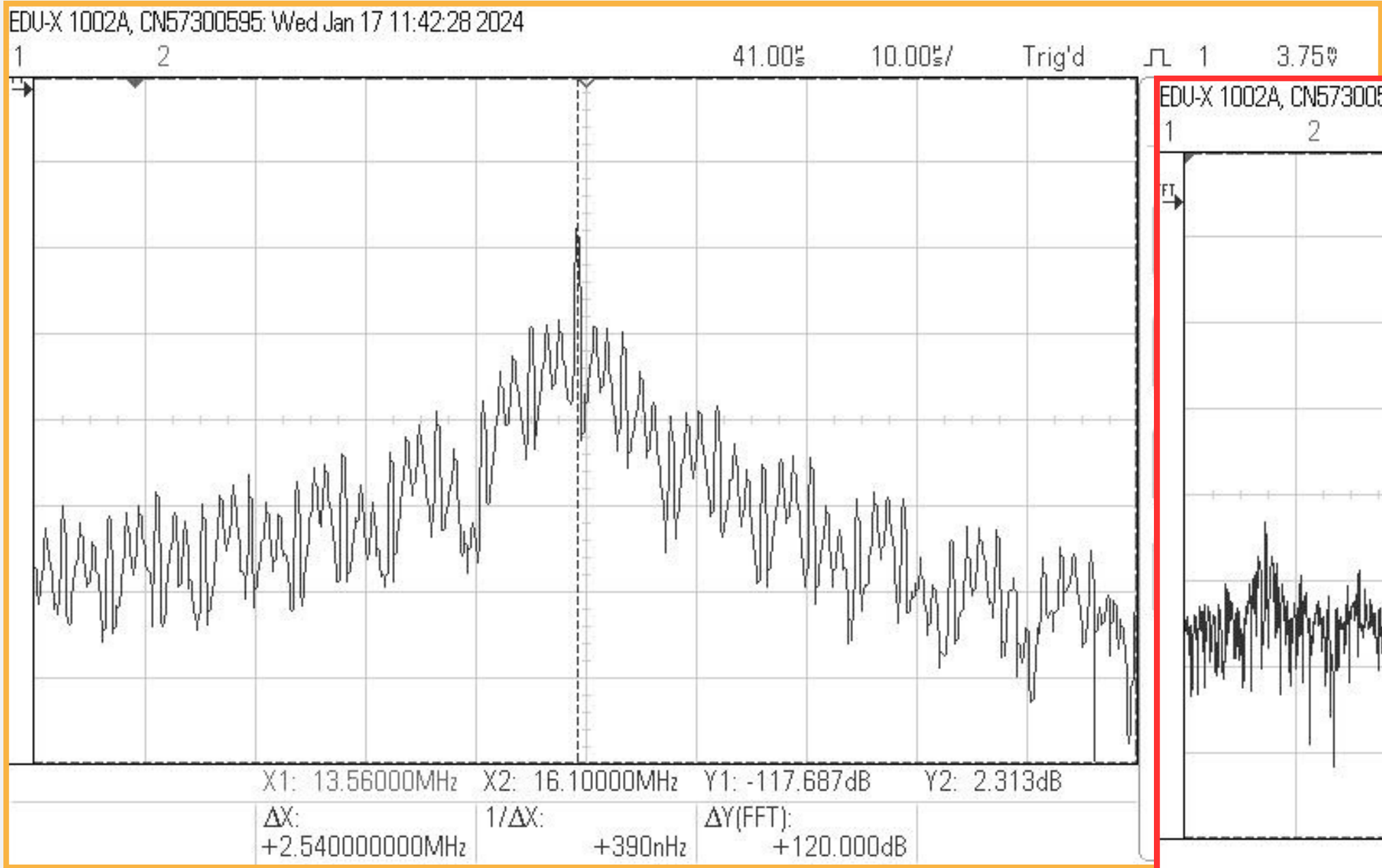


# Mesures : ISO 14443-A

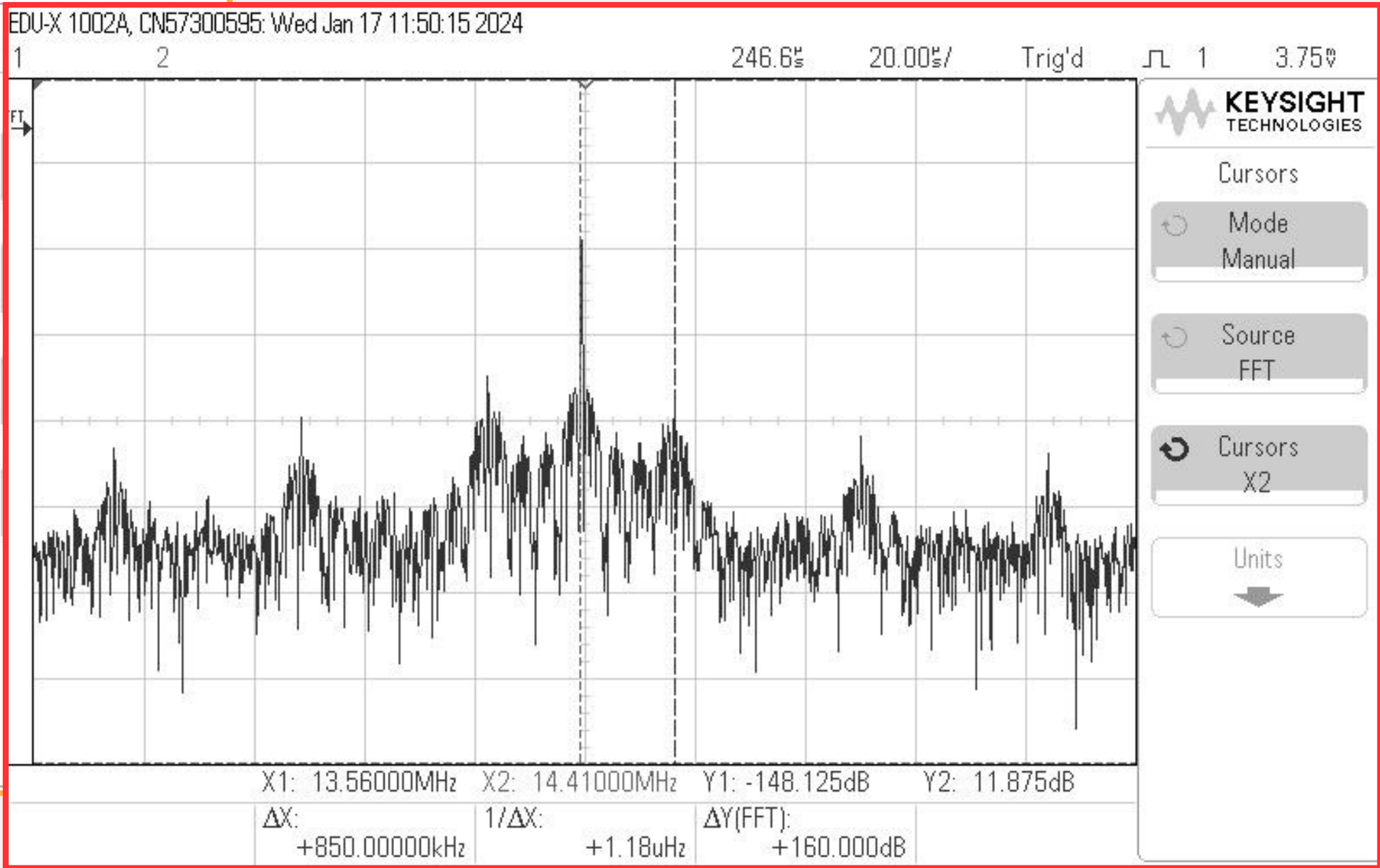




# Mesures : ISO 14443-A

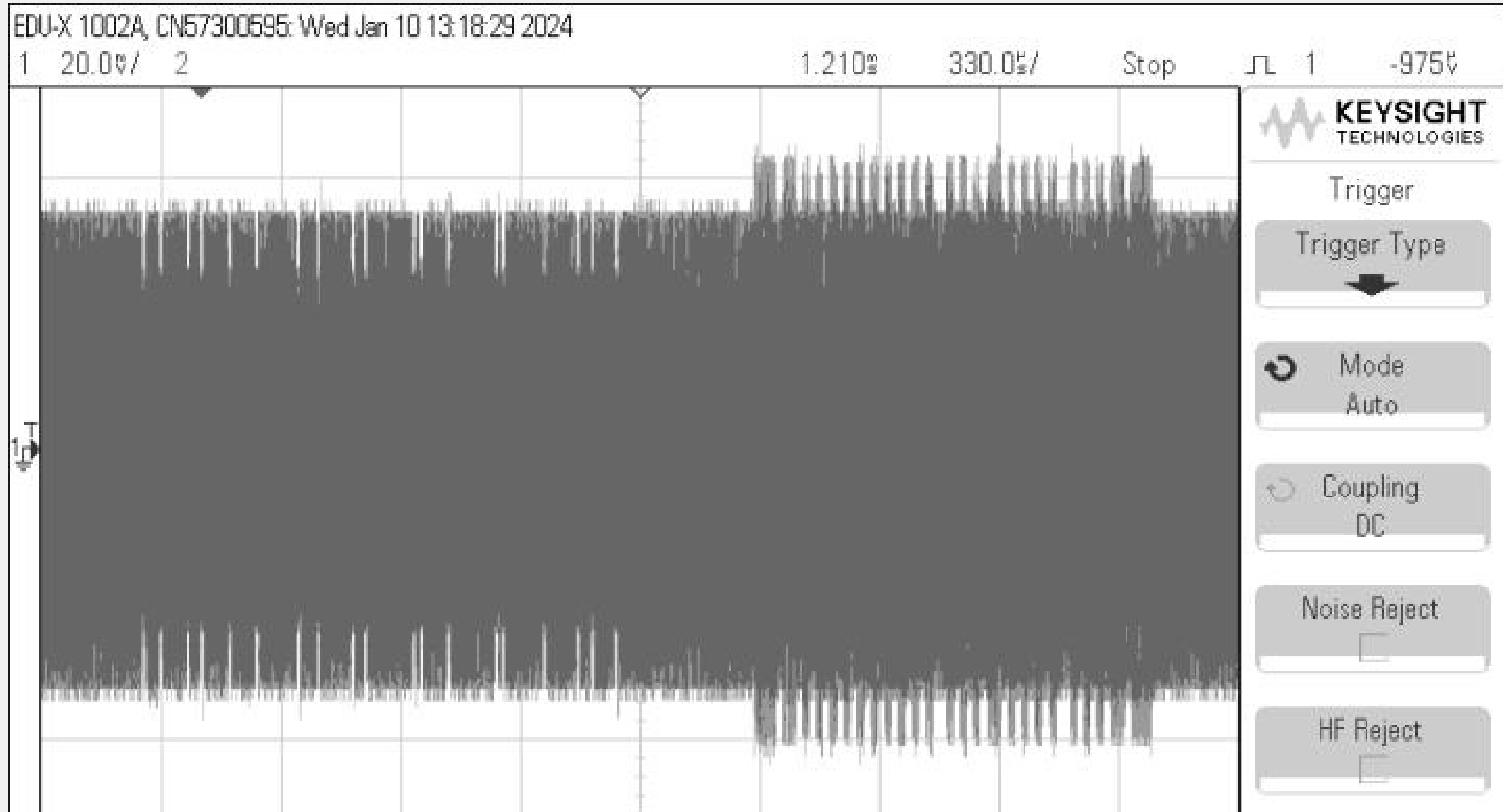


**REQA**

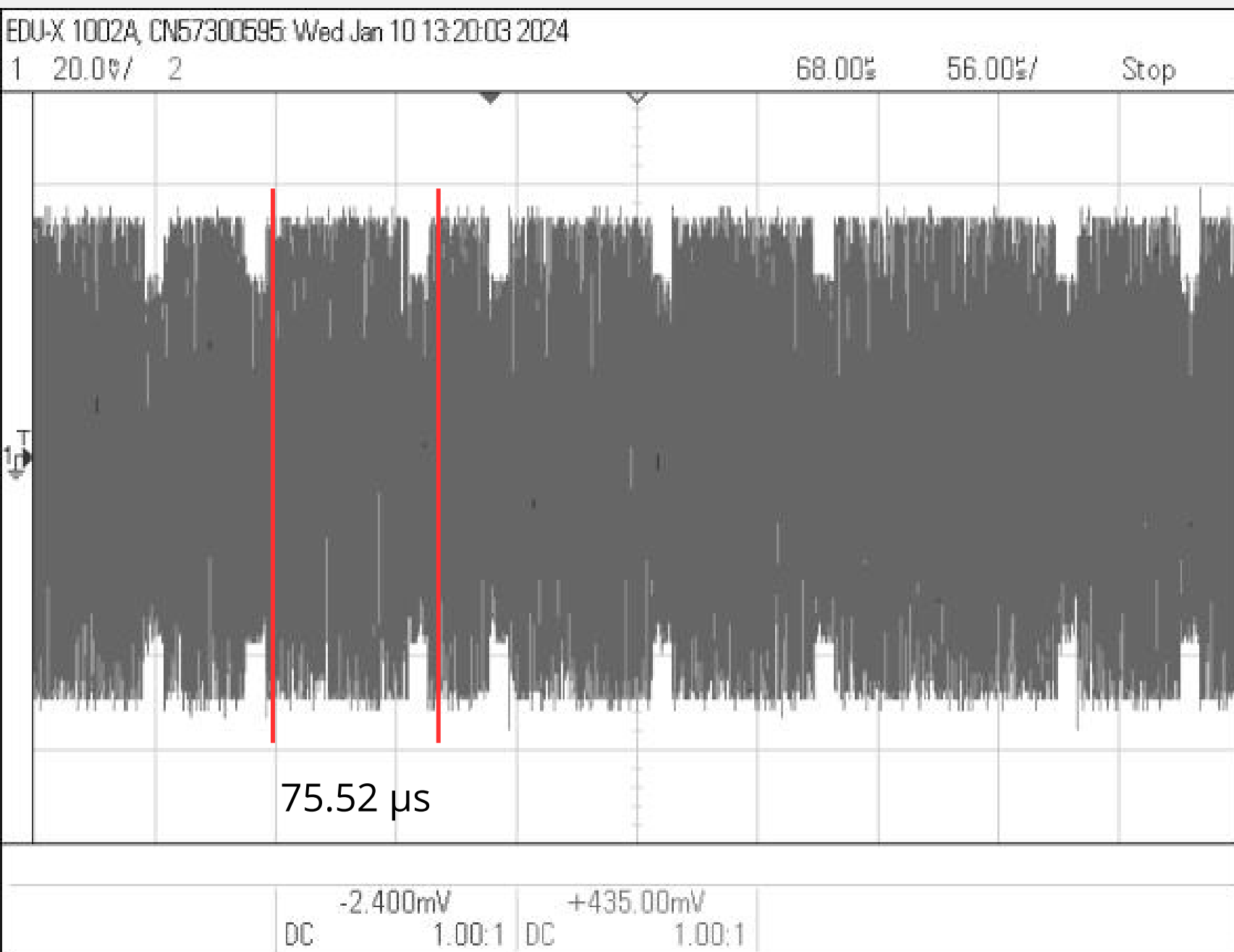


**ATQA**

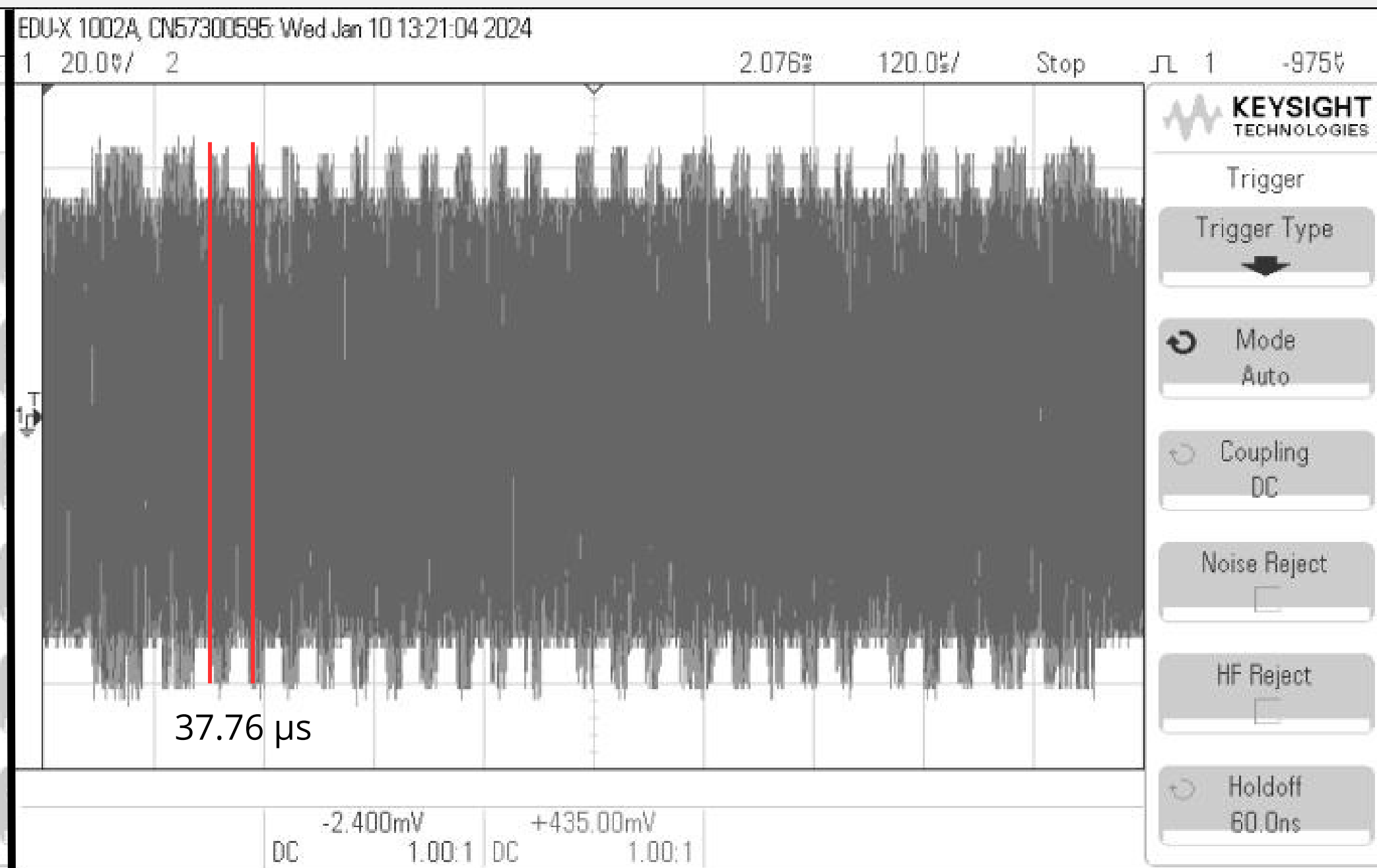
# Mesures : ISO 15693



# Mesures : ISO 15693



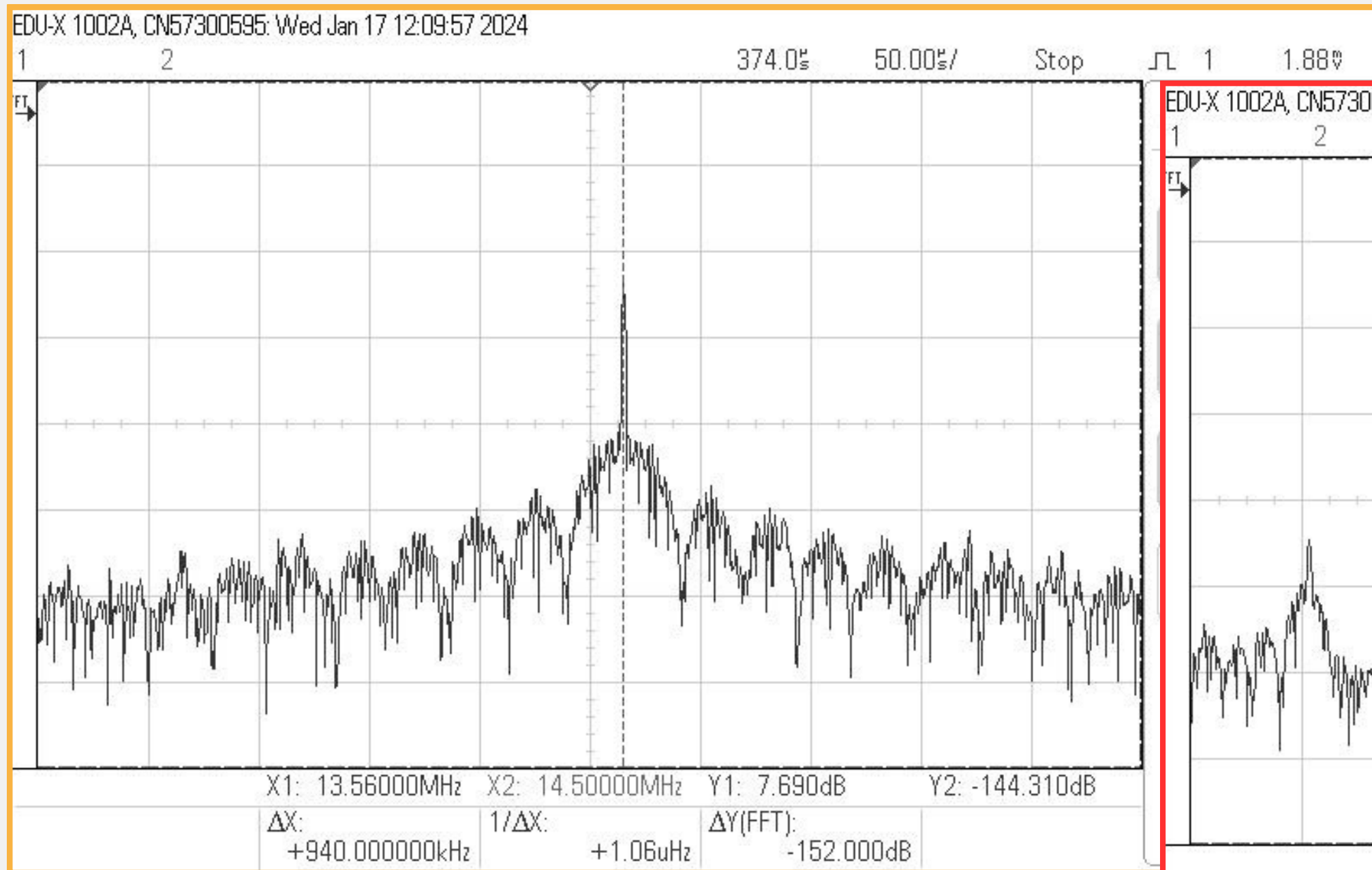
SOF 1000 0000 1001 1000 1100 0011 0010 1101 EOF



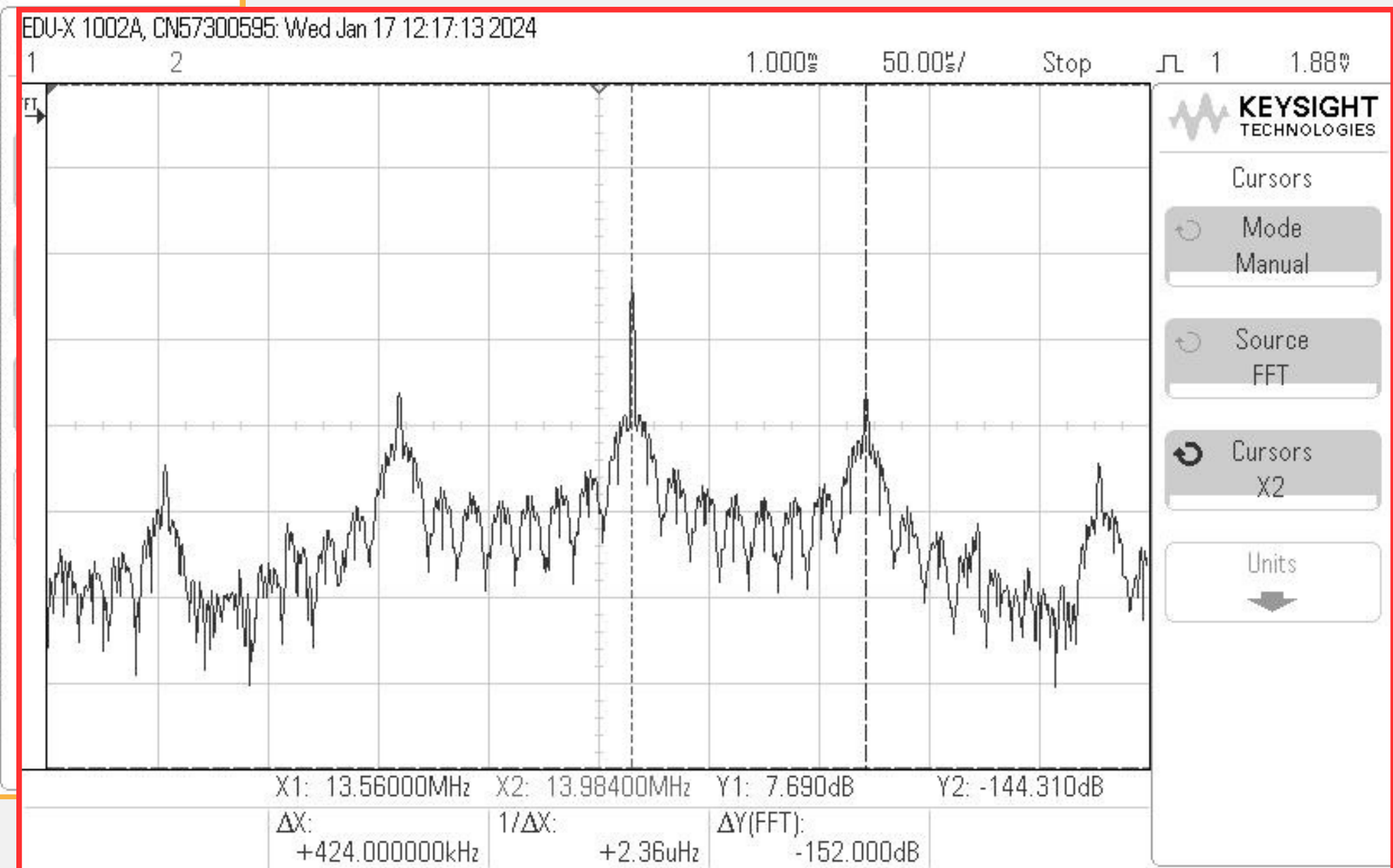
SOF 0000 0000 0001 1110 0000 1111 EOF



# Mesures : ISO 15693

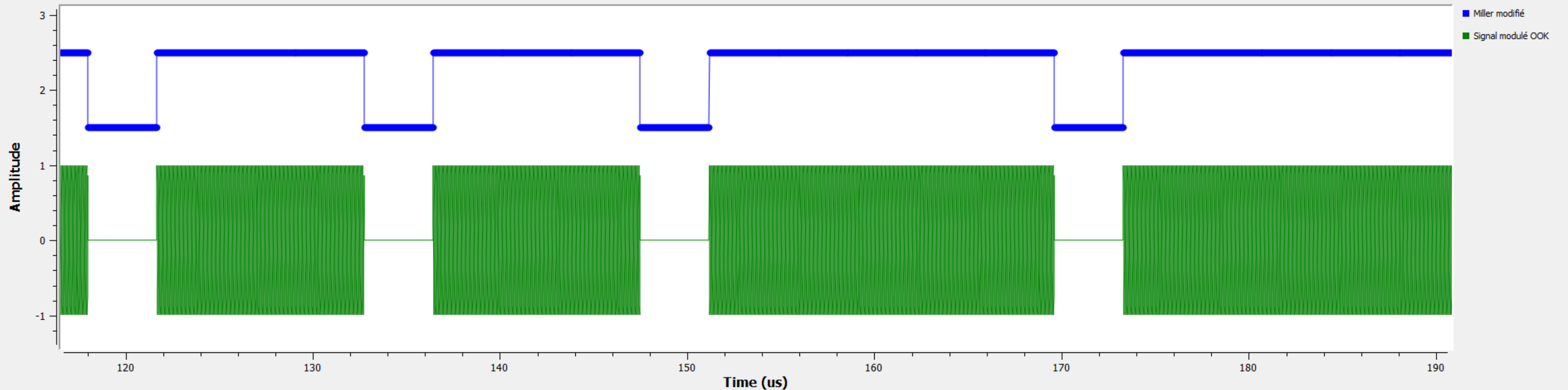
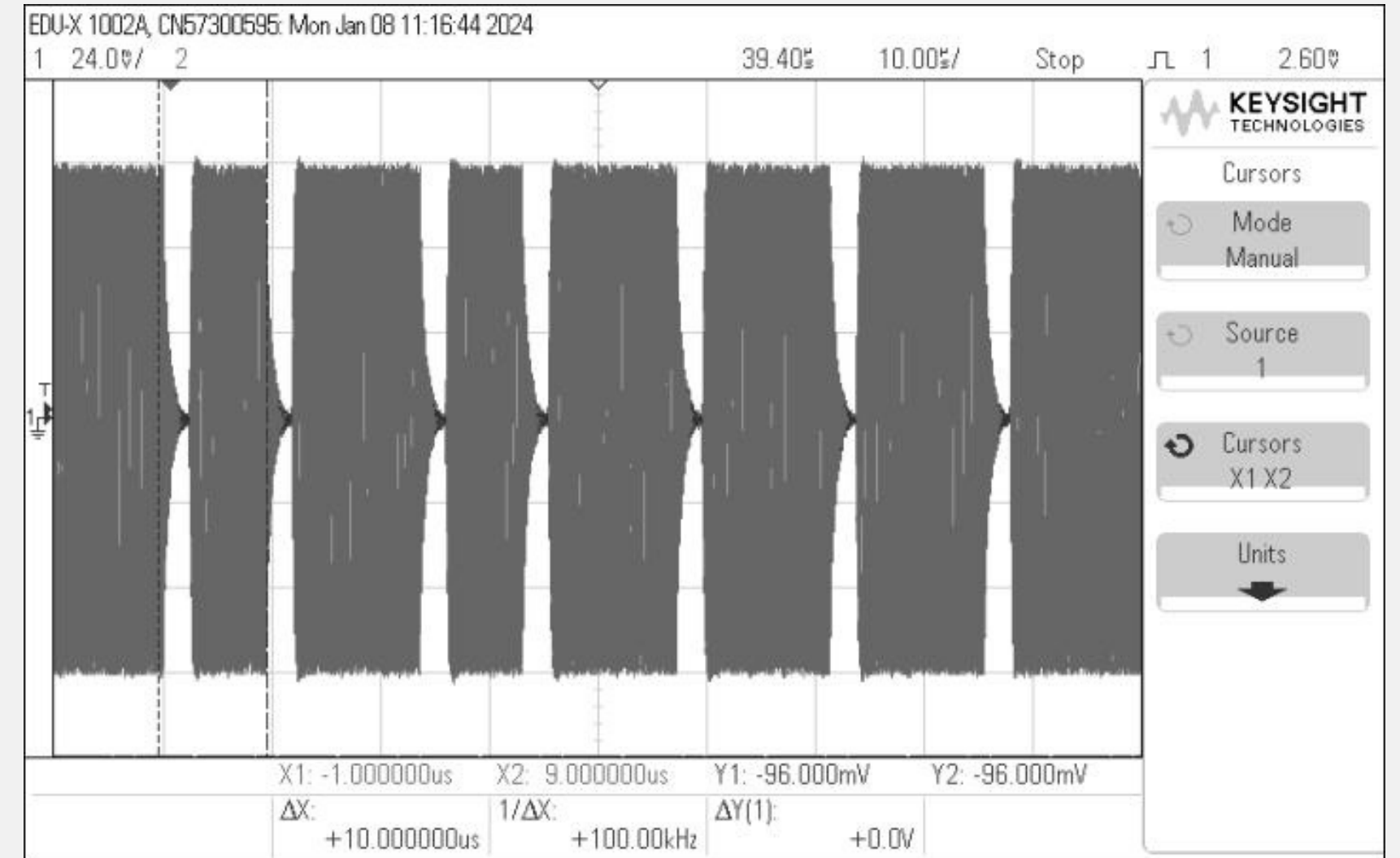


REQA

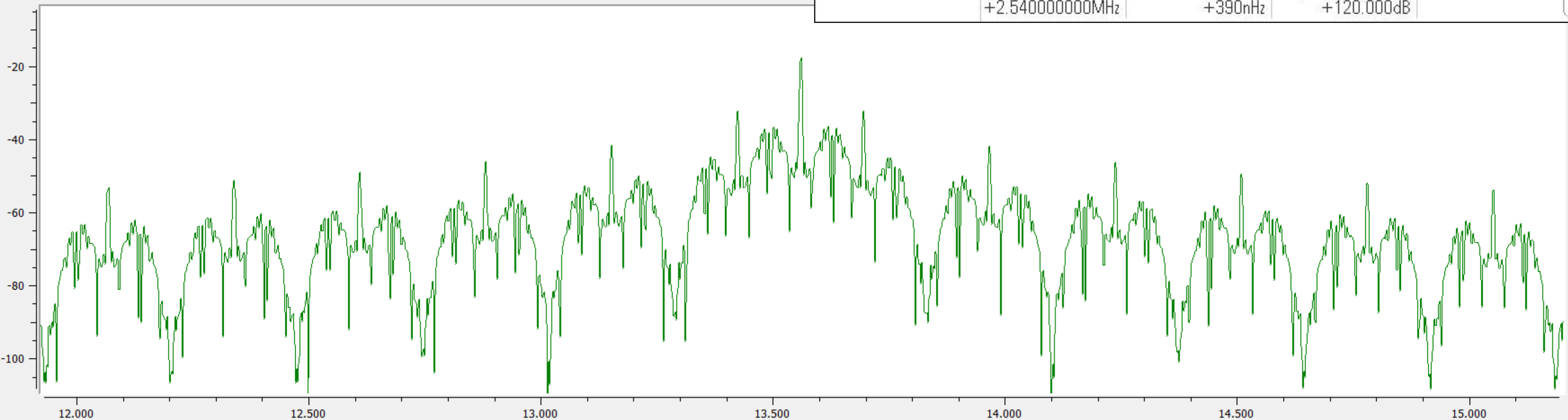
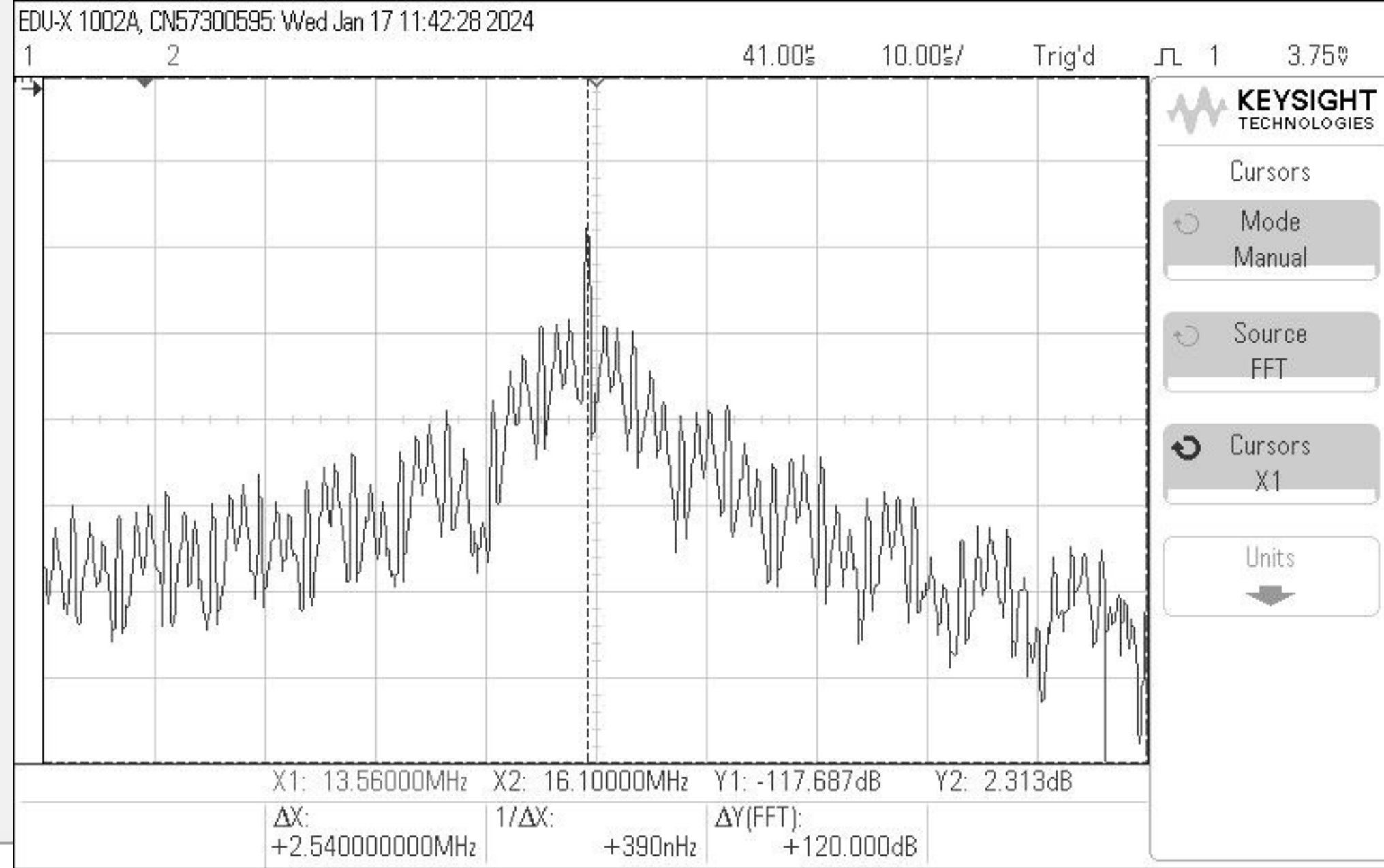


ATQA

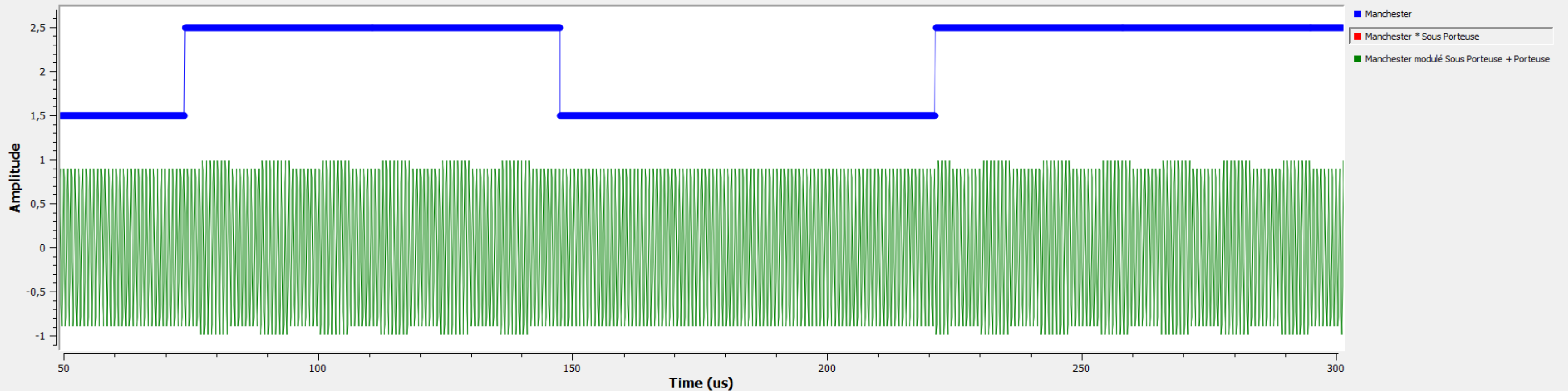
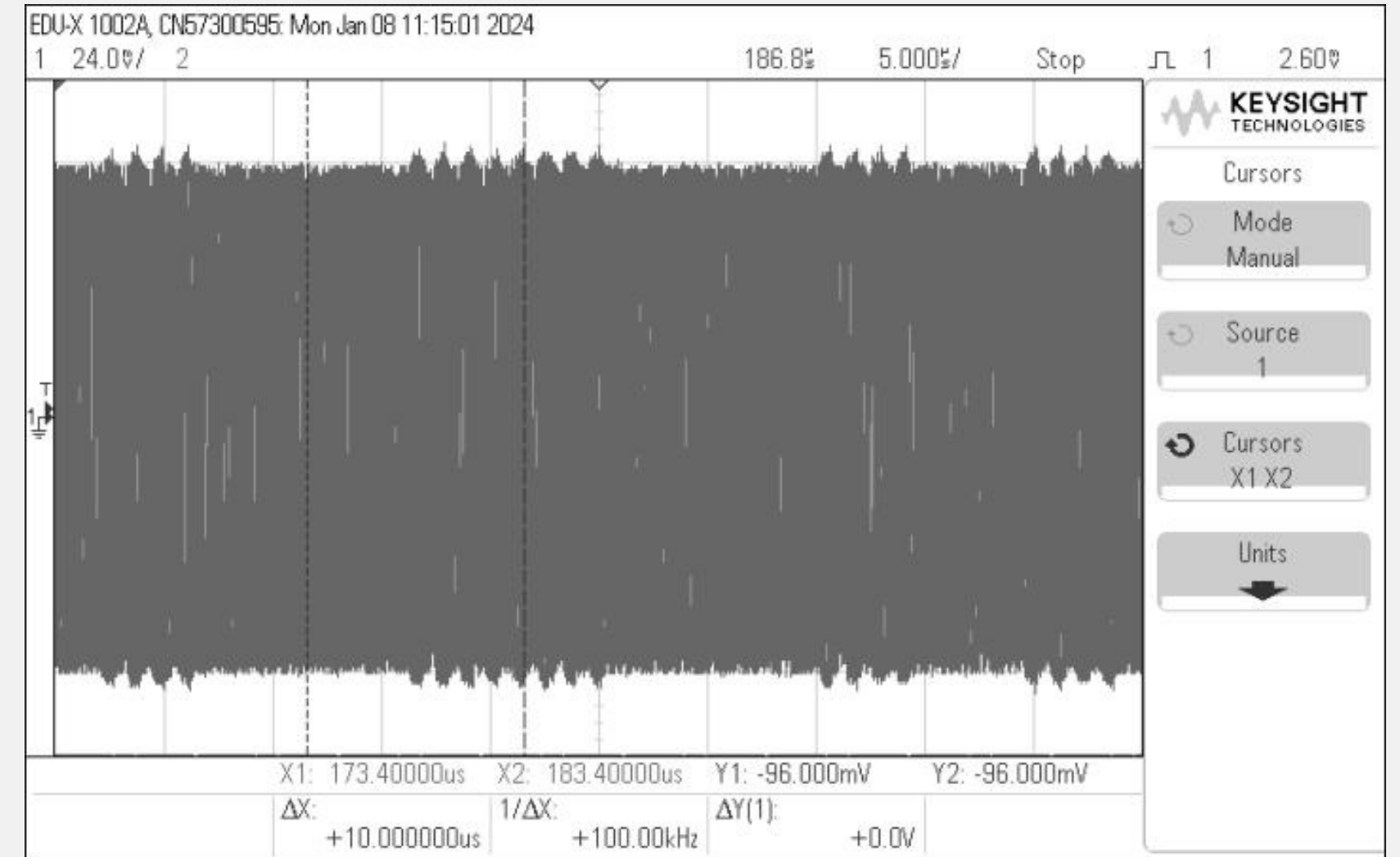
# Comparaison: ISO 14443-A Trame REQA



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# Comparaison: ISO 14443-A Trame ATQA

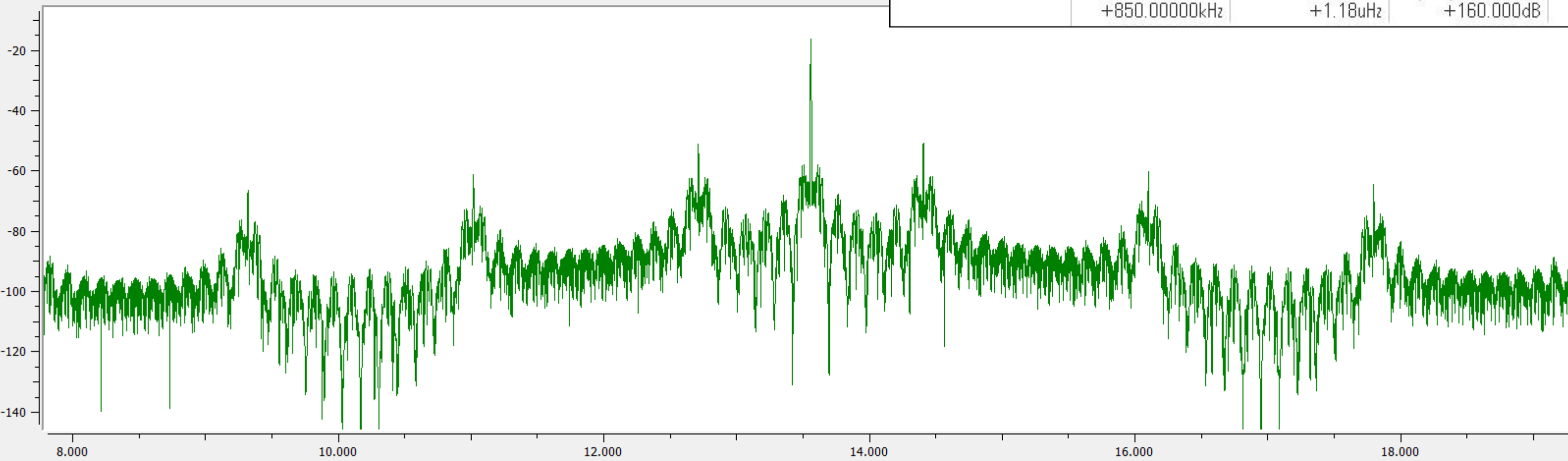
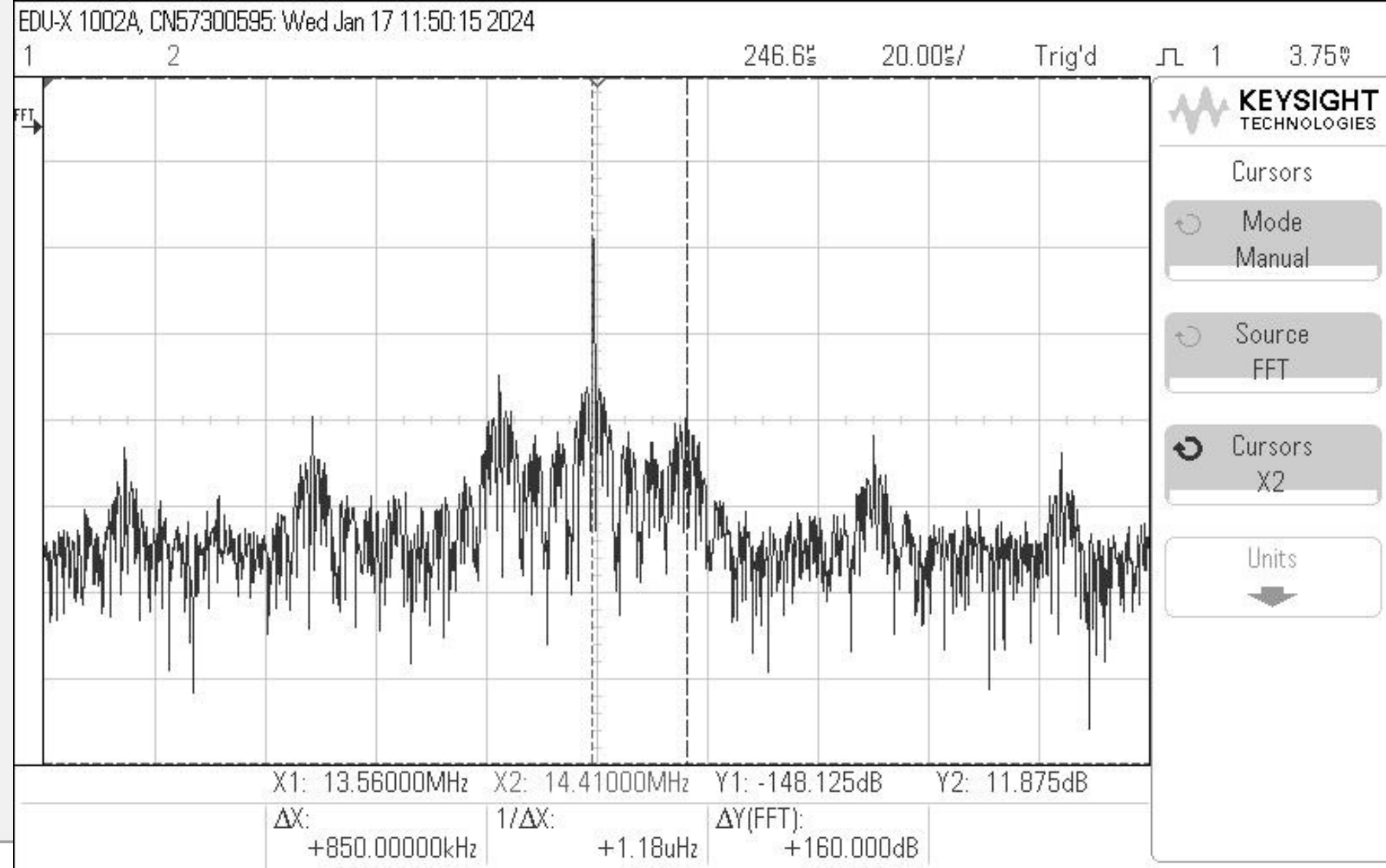




# Comparaison:

## ISO 14443-A

## Trame ATQA



# CONCLUSION

Comprendre le fonctionnement du NFC

Réaliser des communications NFC

Simuler des signaux NFC

Décoder des trames NFC