

Annex 1: Measurement diagrams 23-1-0078001T001a-A1

Number of pages:	39	Date of Report:	2023-Nov-20
Testing company:	cetecom advanced GmbH Untertuerkheimer Str. 6-10 66117 Saarbruecken GERMANY	Applicant:	Eliko Tehnoloogia Arenduskeskus OÜ
Product: Model:	Positioning device ELIKO ANCHOR		
FCC ID: Contains FCC ID:	2AF2I-ANCHOR 2AC7Z-ESPWROOM32D	IC: Contains IC:	27124-ANCHOR 21098-ESPWROOM32D
Testing has been carried out in accordance with:	FCC Regulations Title 47 CFR, Chapter I, Subchapter A, Part 15 Subpart C Intentional Radiators § 15.203 Antenna requirement § 15.205 Restricted bands of operation. § 15.209 Radiated emission limits; general requirements Subpart F Ultra-Wideband Operation § 15.517 Technical requirements for indoor UWB systems § 15.521 Technical requirements applicable to all UWB devices ISED-Regulations Radio Standards Specifications RSS-Gen, Issue 5 General Requirements for Compliance of Radio Apparatus RSS-220, Issue 1 + Amendment 1 (July 2018) Devices Using Ultra-Wideband (UWB) Technology		

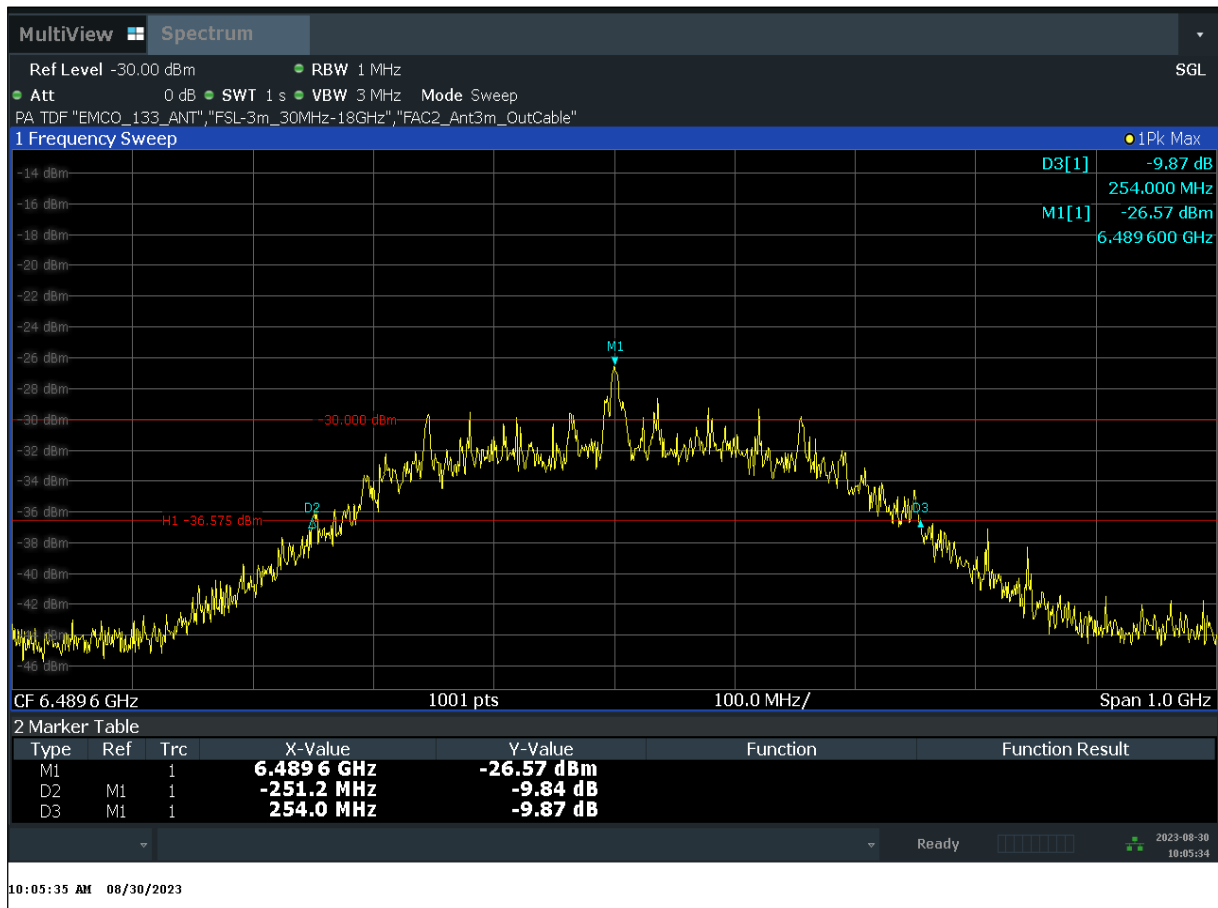
1	Measurement diagrams.....	3
1.1	10dB bandwidth	3
1.1.1	Op.Mode 1 (0xC4, A3).....	3
1.1.2	Op.Mode 2 (A1)	4
1.1.3	Op.Mode 3 (A2)	5
1.2	Max. PSD In-Band	6
1.3	Peak power (RBW=50MHz)	7
1.4	Spurious emission accord. FCC 15.209 / RSS-Gen	9
1.4.1	Frequency range: 9kHz to 30MHz.....	9
1.4.2	Frequency range: 30MHz to 1GHz	11
1.5	Spurious emissions accord. §15.517.....	13
1.5.1	Range: 960MHz to 3.1GHz	13
1.5.2	Requirements for RSS-220: 3.1GHz to 4.75GHz.....	17
1.5.3	Range: 3.1GHz to 10.6GHz	21
1.5.4	Range: 10.6 to 12.4GHz.....	23
1.5.5	Range: 12.4GHz to 18GHz	25
1.5.6	Range: 18GHz to 33GHz	27
1.5.7	Range: 33GHz to 40GHz	29
1.5.8	Spurious emissions in GPS1 band (lower GPS band).....	31
1.5.9	Spurious emissions in GPS2 band (higherGPS band).....	33
1.6	Timing tests	35
1.6.1	Communication to Tag (AE3)	35
1.6.2	No communication with Tag (AE3)	38

1 Measurement diagrams

1.1 10dB bandwidth

1.1.1 Op.Mode 1 (0xC4, A3)

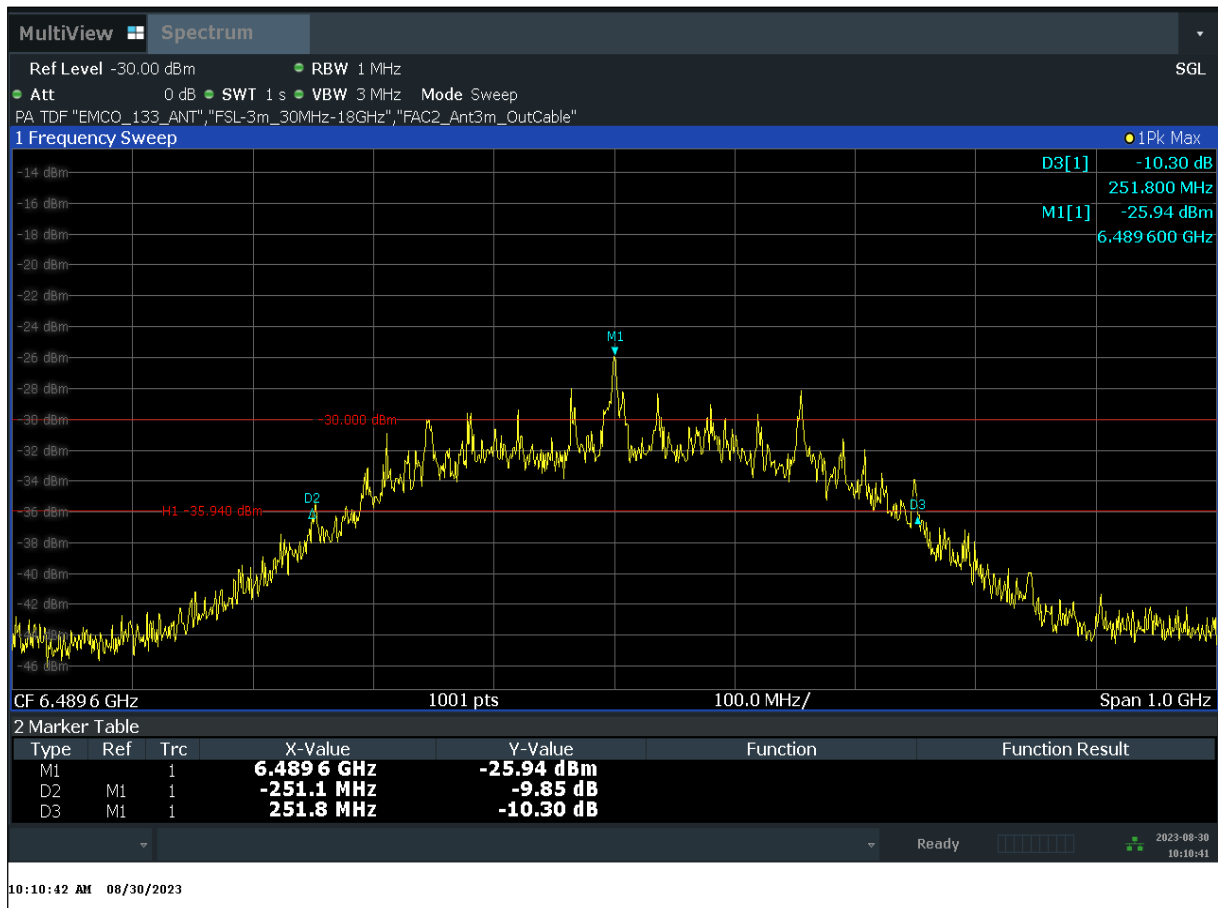
TID010a_10dB_BW_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7
3_AntH



BW=505.2MHz with packet size 73 and 850kbit

1.1.2 Op.Mode 2 (A1)

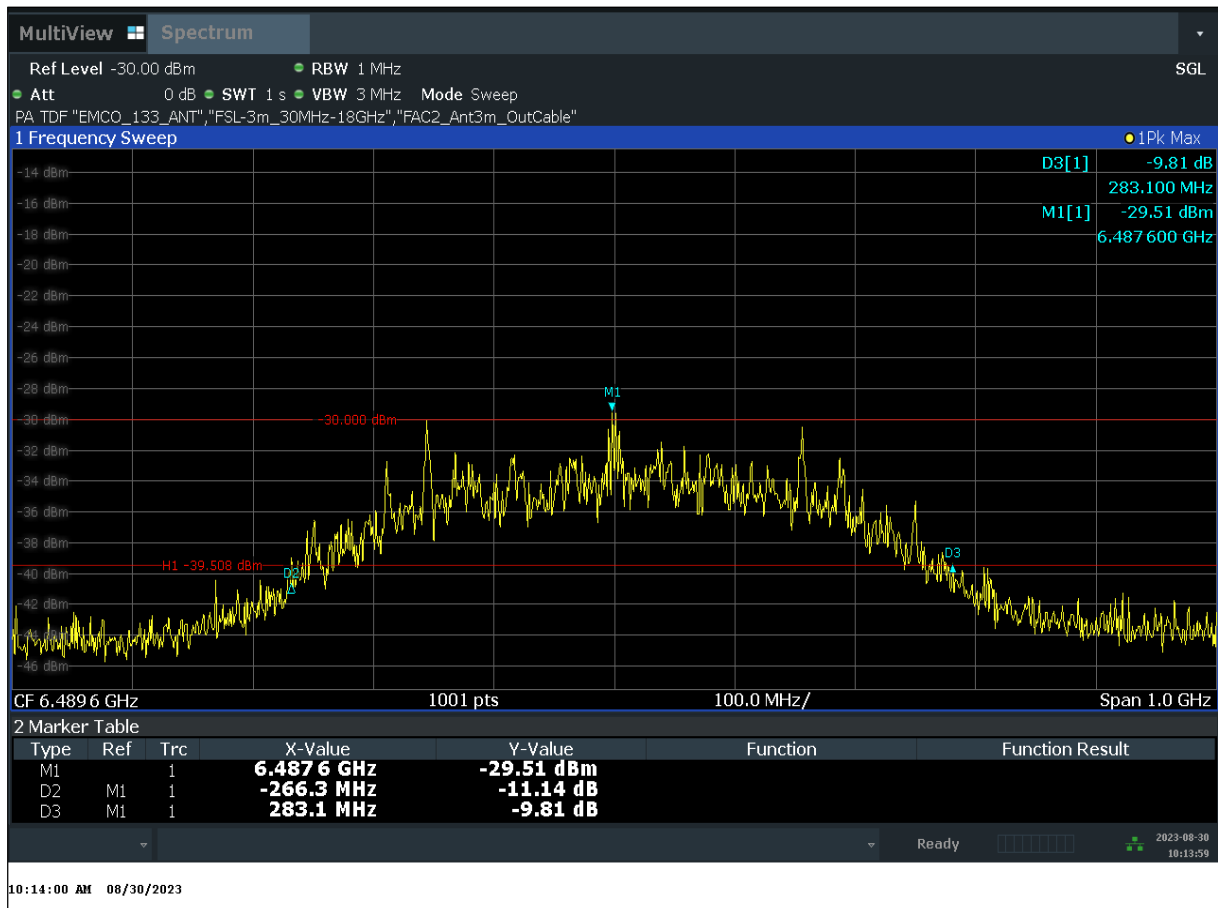
TID011a_10dB_BW_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet5
 6_AntH



BW=502.9 MHz with packet size 56 and 850kbit

1.1.3 Op.Mode 3 (A2)

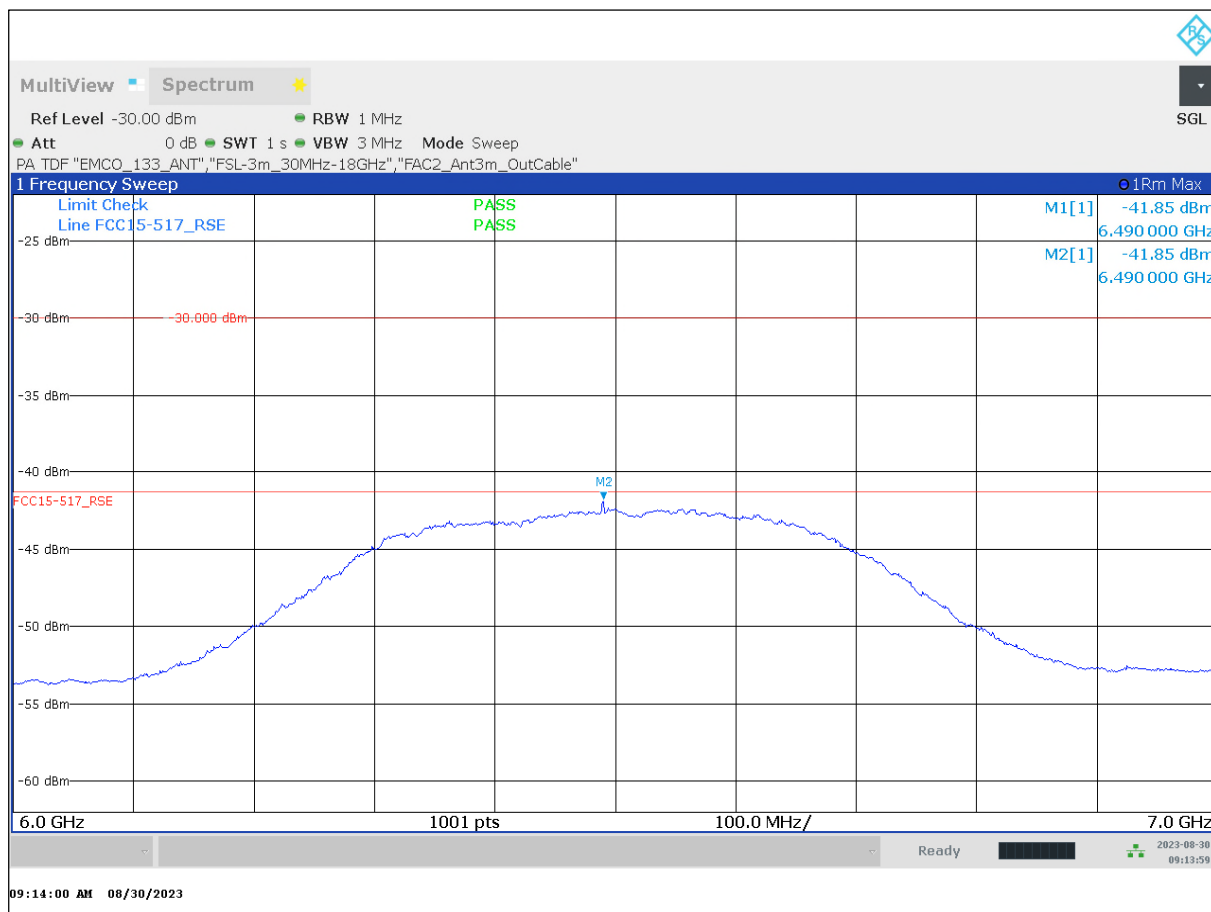
TID012a_10dB_BW_Ch5_PWR_0xC4C4C4C4_DataRate_6_8MBit_PRF64MHz_128Sym_Packet 56_AntH



BW=549.2MHz with packet size 56 and 6.8Mbit

1.2 Max. PSD In-Band

TID007a_PSD_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_An
tH

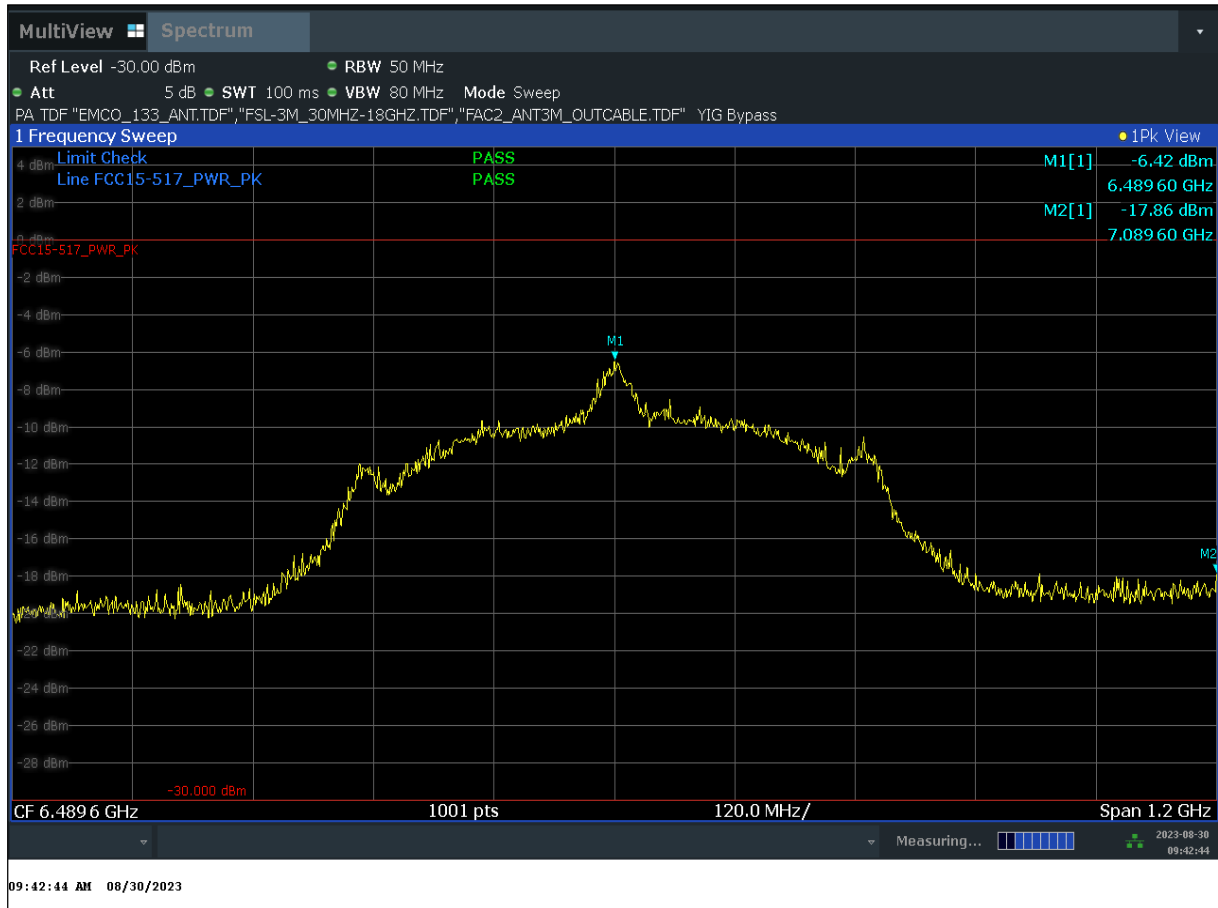


Max. Value: -41.85dBm

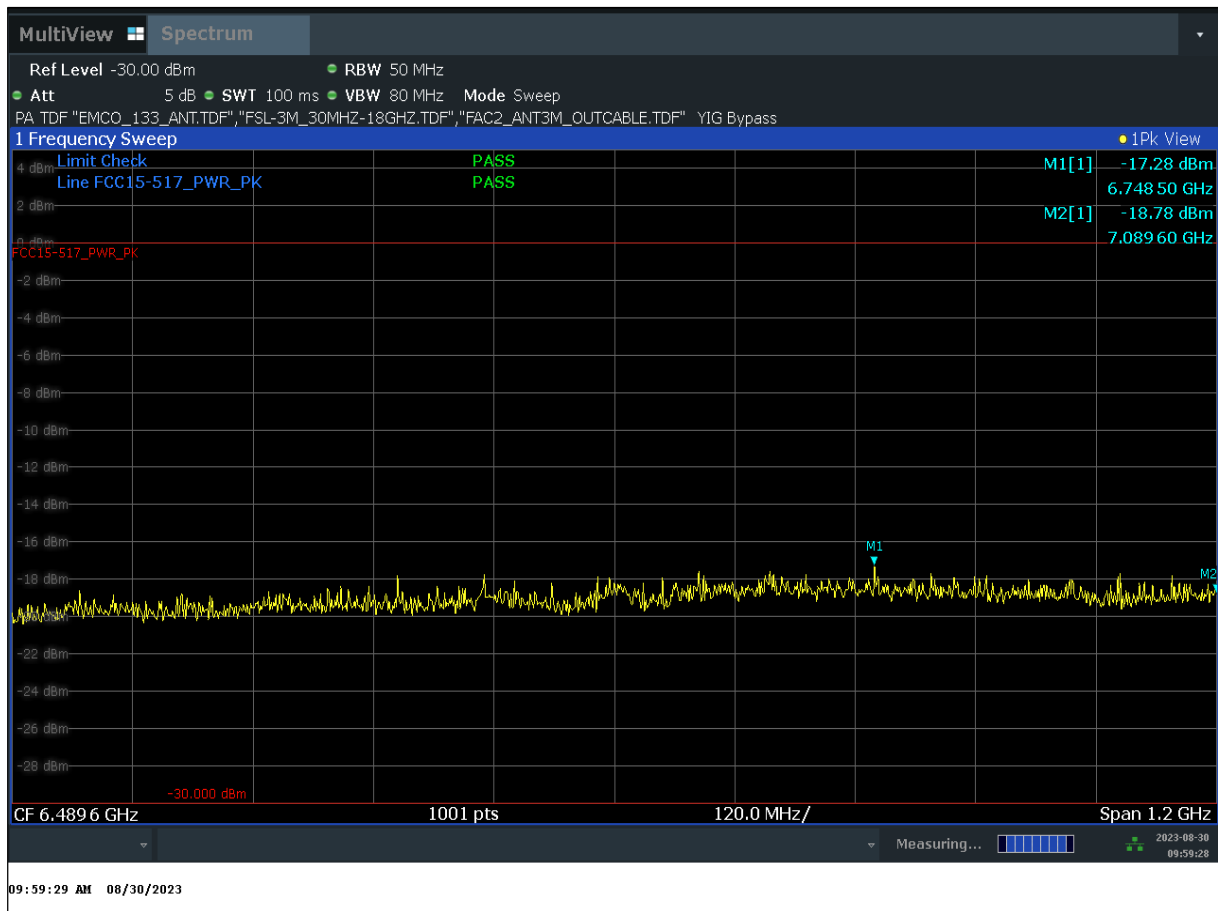
Max. Packet size tested = 73 (Worst-Case test mode: max. TX-on time during 1ms)

1.3 Peak power (RBW=50MHz)

TID009a_PeakPWR_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7
3_AntH



TID009b_PeakPWR_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7 3__AntV



1.4 Spurious emission accord. FCC 15.209 / RSS-Gen

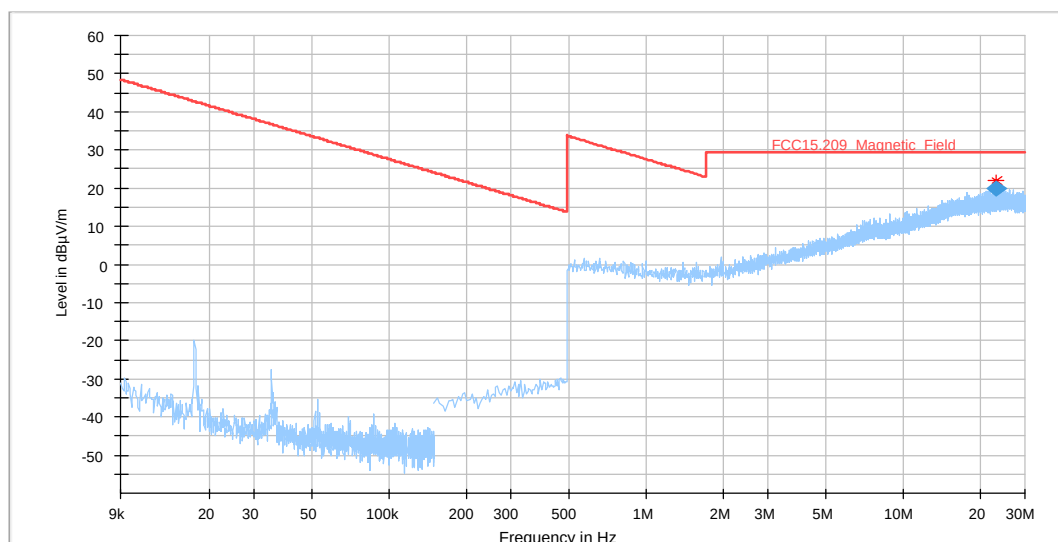
1.4.1 Frequency range: 9kHz to 30MHz

2.01_MgFeld_Ant_standing

Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.50.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	Lor
Operating Mode:	TX-on, UWB channel 5, power 0xC4C4C4C4
Power during tests:	48V DC over PoE
Comment 1:	Channel 5 UWB
Comment 2:	Antenna standing
Environmental Conditions:	T=22.5deg, Humidity: 56%rH
EUT Setup:	S06 (Anchor) + PoE Adapter + Notebook + Cable Ethernet
Verdict:	Passed

Full Spectrum



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
23.118000	19.97	29.54	9.57	9.000	V	194.0	1.8	09:29:33 - 06.09.2023

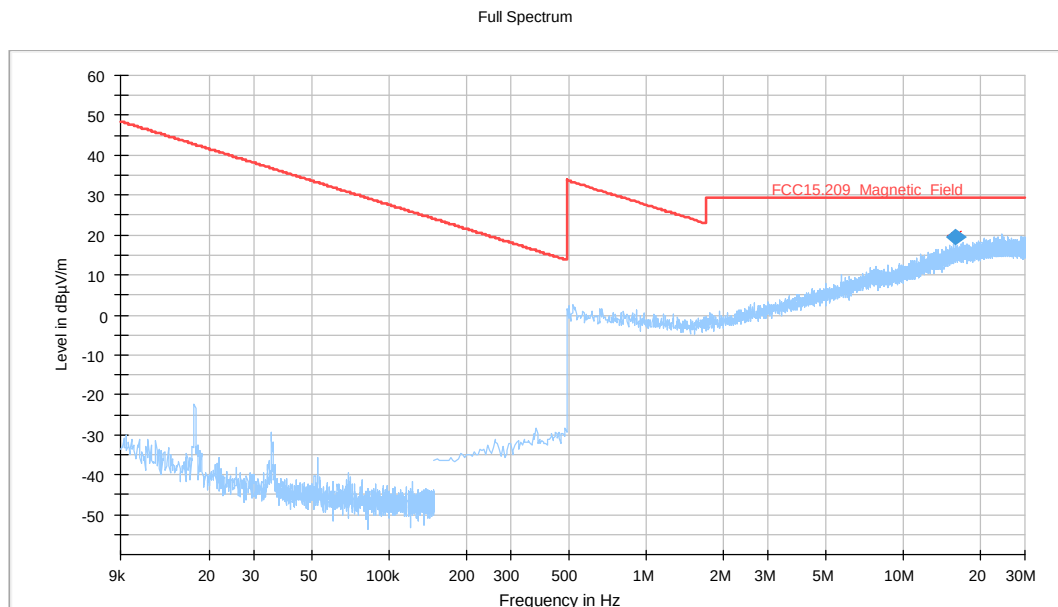
2.02_MgFeld_Ant_laying

Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.50.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	Lor
Operating Mode:	TX-on, UWB channel 5, power 0xC4C4C4C4
Power during tests:	48V DC over PoE
Comment 1:	Channel 5 UWB
Comment 2:	Antenna laying
Environmental Conditions:	T=22.5deg, Humidity: 56%rH
EUT Setup:	S06 (Anchor) + PoE Adapter + Notebook + Cable Ethernet
Verdict:	Passed

EUT Information

PMT number:	23-1-00293S02_C01
Power:	24 V DC



Final Result

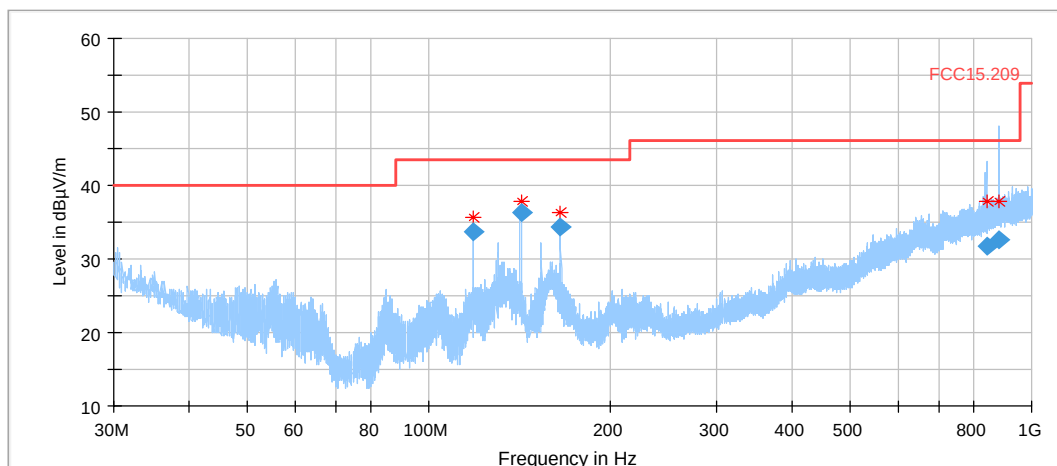
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
16.090000	19.65	29.54	9.89	9.000	H	48.0	0.4	09:58:55 - 06.09.2023

1.4.2 Frequency range: 30MHz to 1GHz

3.01_Efield_EUT_laying

Common Information

Test Description:	Radiated field strength emission in 3m distance
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 57%rH; Temperature: 22.8°C
Operator Name:	Lor
EUT:	S06 + Ethernet Cable + PoE Adapter + Notebook (off)
Operating Mode:	TX
Power supply:	48V DC
Comment:	Ch5 UWB
Verdict:	Passed



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)
118.270000	33.66	43.50	9.84	120.000	105.0	V	90.0	7.3	0.0	1.0
141.930000	36.37	43.50	7.13	120.000	119.0	V	354.0	8.0	0.0	1.1
165.550000	34.36	43.50	9.14	120.000	105.0	V	353.0	9.5	0.0	1.3
840.750000	31.84	46.00	14.16	120.000	302.0	V	218.0	26.3	0.0	3.2
882.110000	32.64	46.00	13.36	120.000	287.0	V	185.0	27.0	0.0	3.5

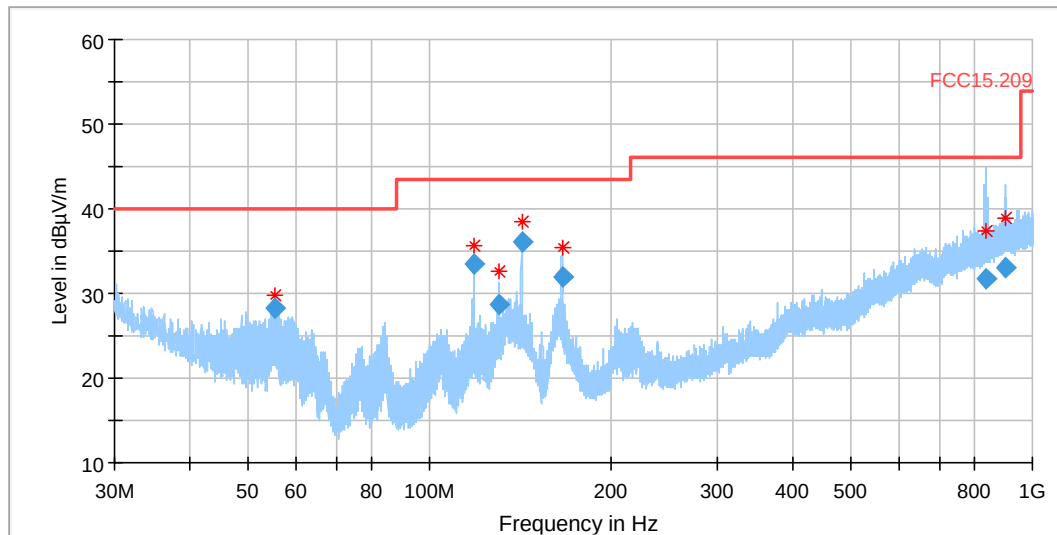
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
118.270000	6.3	26.4	10:54:29 - 06.09.2023
141.930000	6.9	28.4	10:44:48 - 06.09.2023
165.550000	8.2	24.8	10:49:24 - 06.09.2023
840.750000	23.1	5.5	11:04:16 - 06.09.2023
882.110000	23.5	5.7	10:59:14 - 06.09.2023

3.02_Efield_EUT_standing

Common Information

Test Description:	Radiated field strength emission in 3m distance
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 57%rH; Temperature: 22.8°C
Operator Name:	Lor
EUT:	S06 + Ethernet Cable + PoE Adapter + Notebook (off)
Operating Mode:	UWB Ch5, Continuous Mode, Packet Size 73
Power supply:	48V DC
Comment:	Ch5 UWB
Verdict:	Passed



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)
55.470000	28.15	40.00	11.85	120.000	112.0	V	346.0	10.0	0.0	0.7
118.270000	33.52	43.50	9.98	120.000	105.0	V	84.0	7.3	0.0	1.0
130.150000	28.59	43.50	14.91	120.000	105.0	V	115.0	8.5	0.0	1.0
141.950000	36.03	43.50	7.47	120.000	111.0	V	131.0	8.0	0.0	1.1
165.710000	32.02	43.50	11.48	120.000	105.0	V	352.0	9.5	0.0	1.3
836.010000	31.78	46.00	14.22	120.000	360.0	V	63.0	26.2	0.0	3.2
902.370000	33.12	46.00	12.88	120.000	112.0	H	71.0	27.4	0.0	3.5

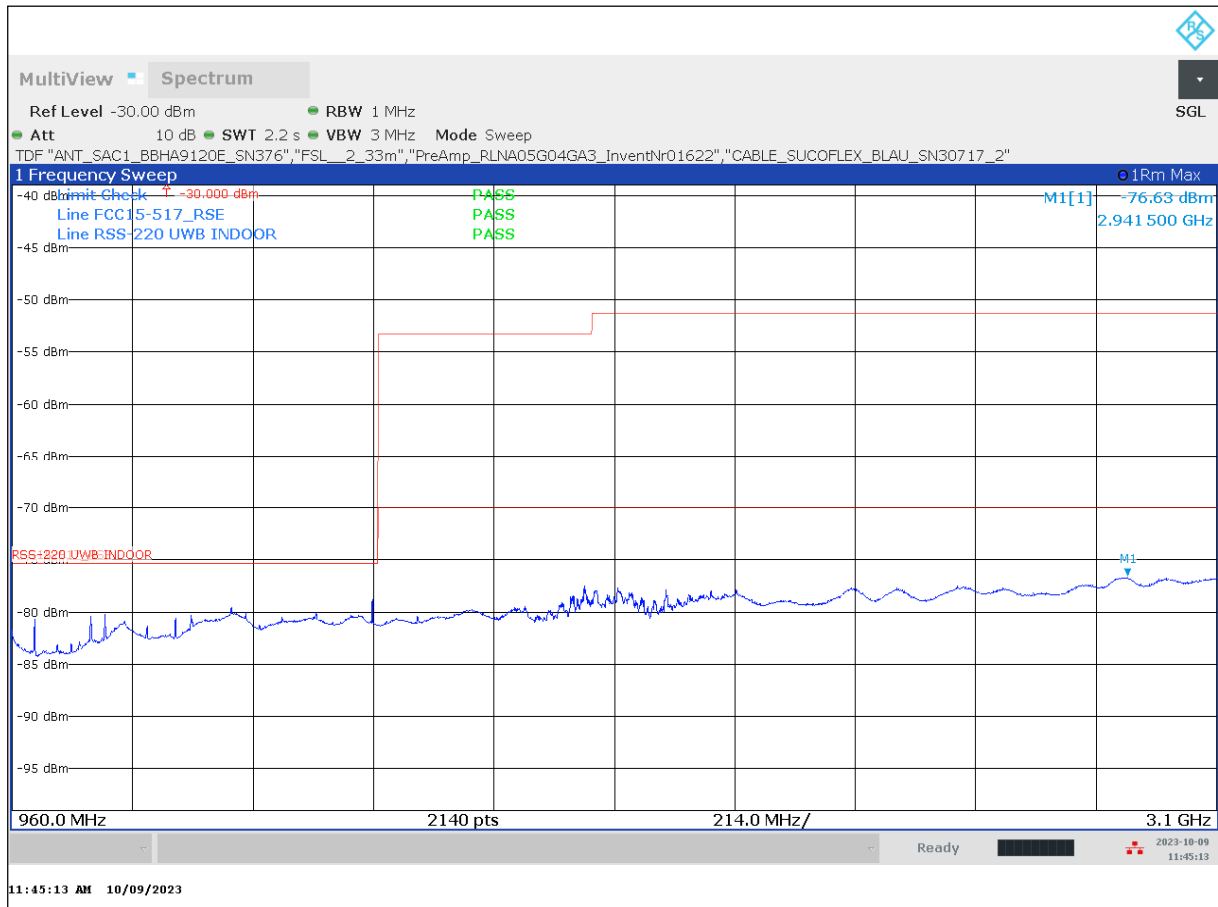
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
55.470000	9.3	18.2	12:35:59 - 06.09.2023
118.270000	6.3	26.2	12:16:19 - 06.09.2023
130.150000	7.5	20.1	12:21:08 - 06.09.2023
141.950000	6.9	28.0	12:25:52 - 06.09.2023
165.710000	8.2	22.5	12:11:11 - 06.09.2023
836.010000	23.0	5.6	12:30:33 - 06.09.2023
902.370000	23.9	5.8	12:06:53 - 06.09.2023

1.5 Spurious emissions accord. §15.517

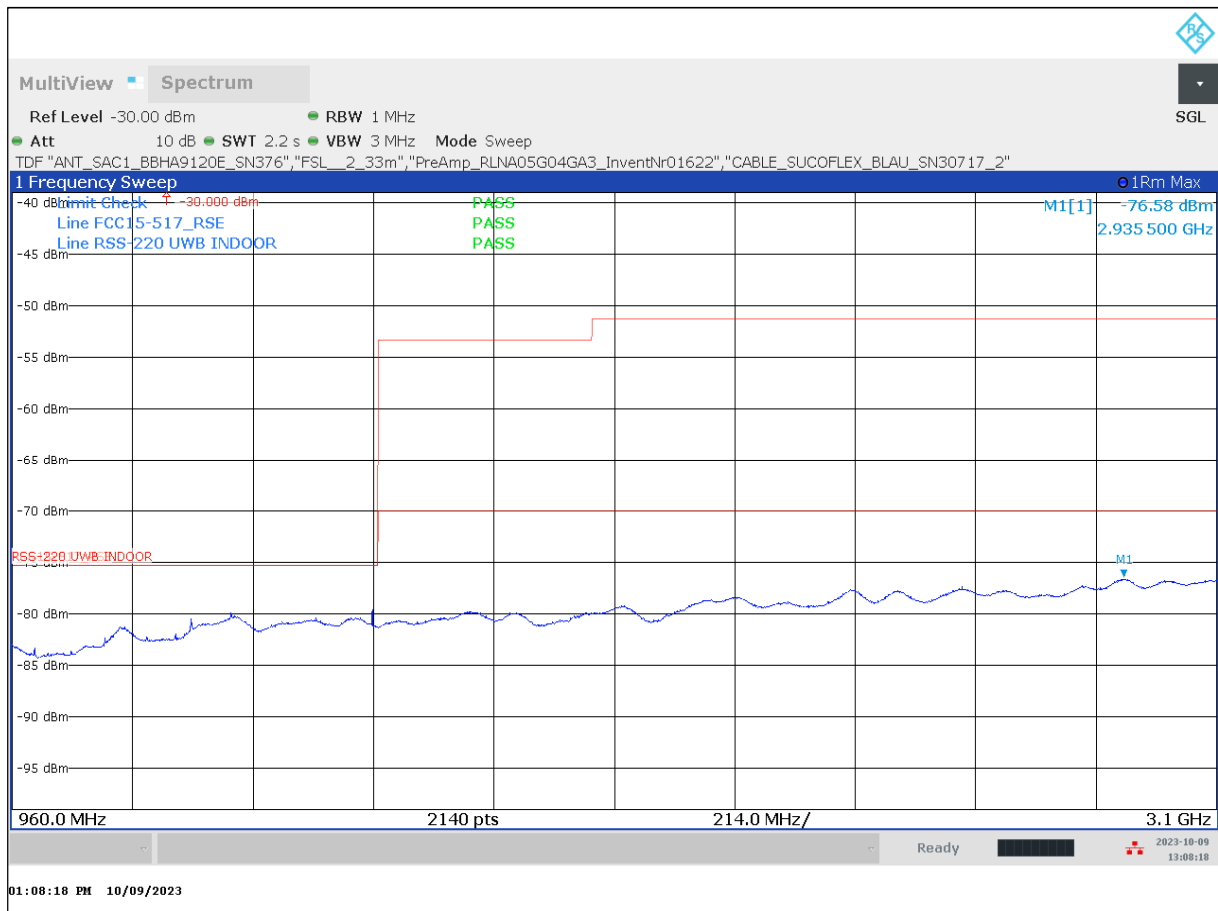
1.5.1 Range: 960MHz to 3.1GHz

TID020a_RSE_TX_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_
EUT_laying_AntH

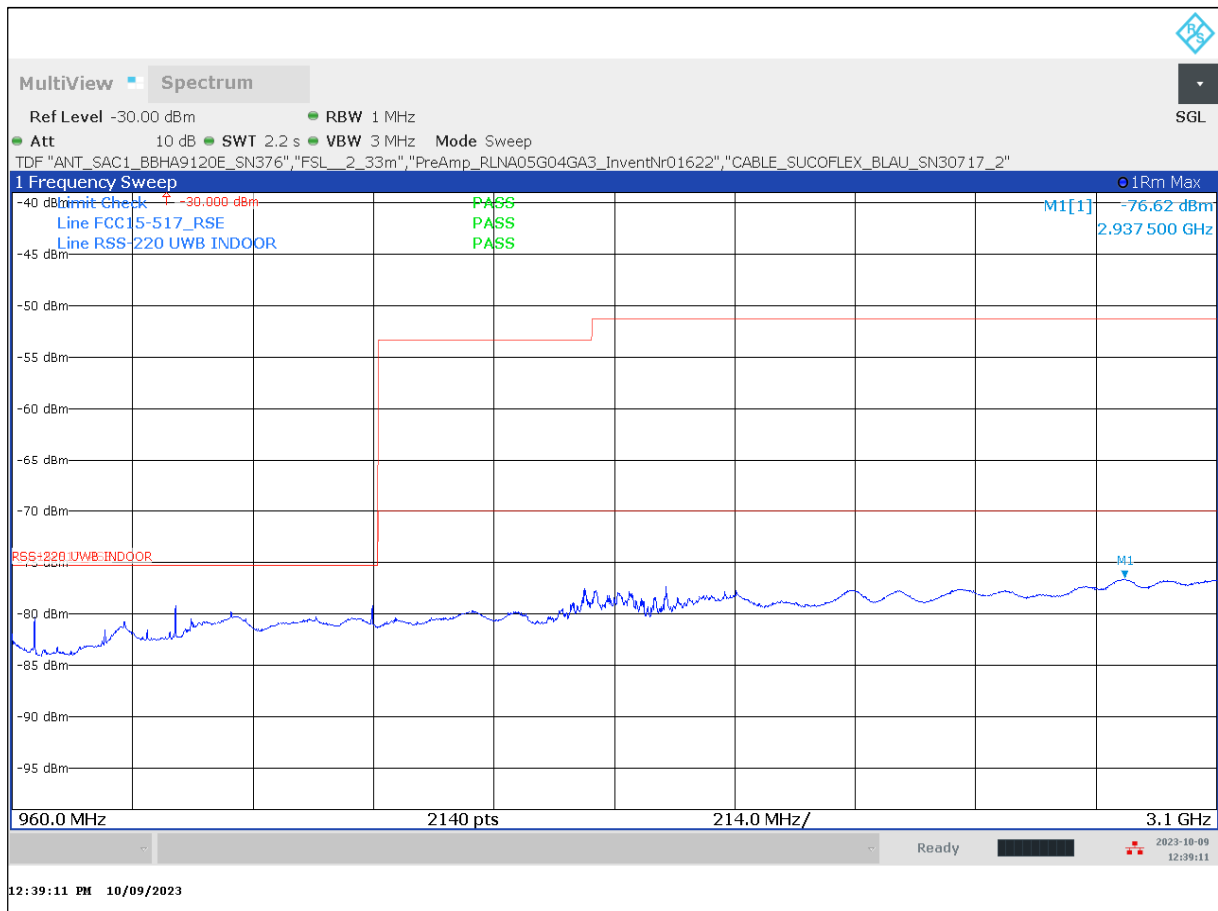


TID020a_RSE_TX_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_EUT_standing_Anth



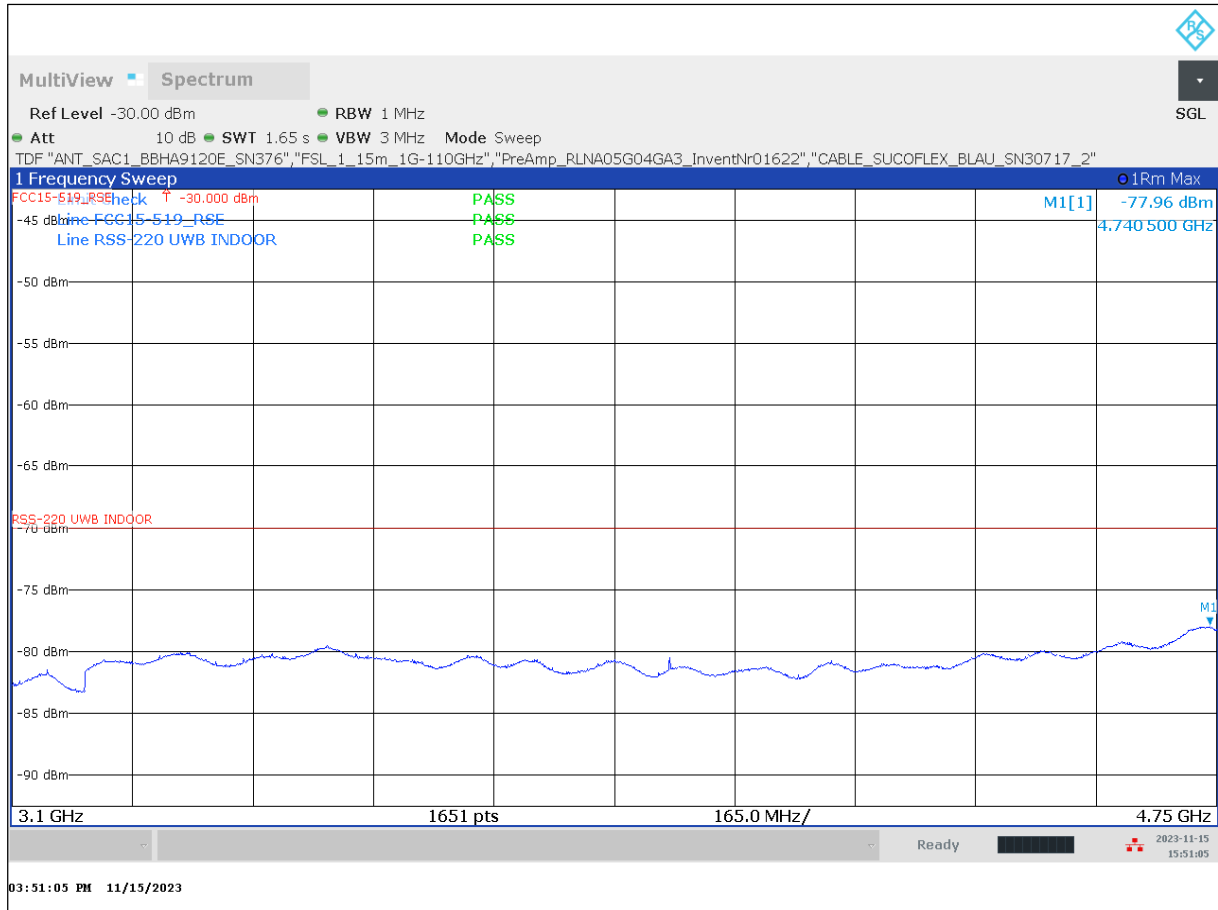
TID020b_RSE_TX_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_EUT_laying_AntV


TID020b_RSE_TX_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_EUT_standing_AntV

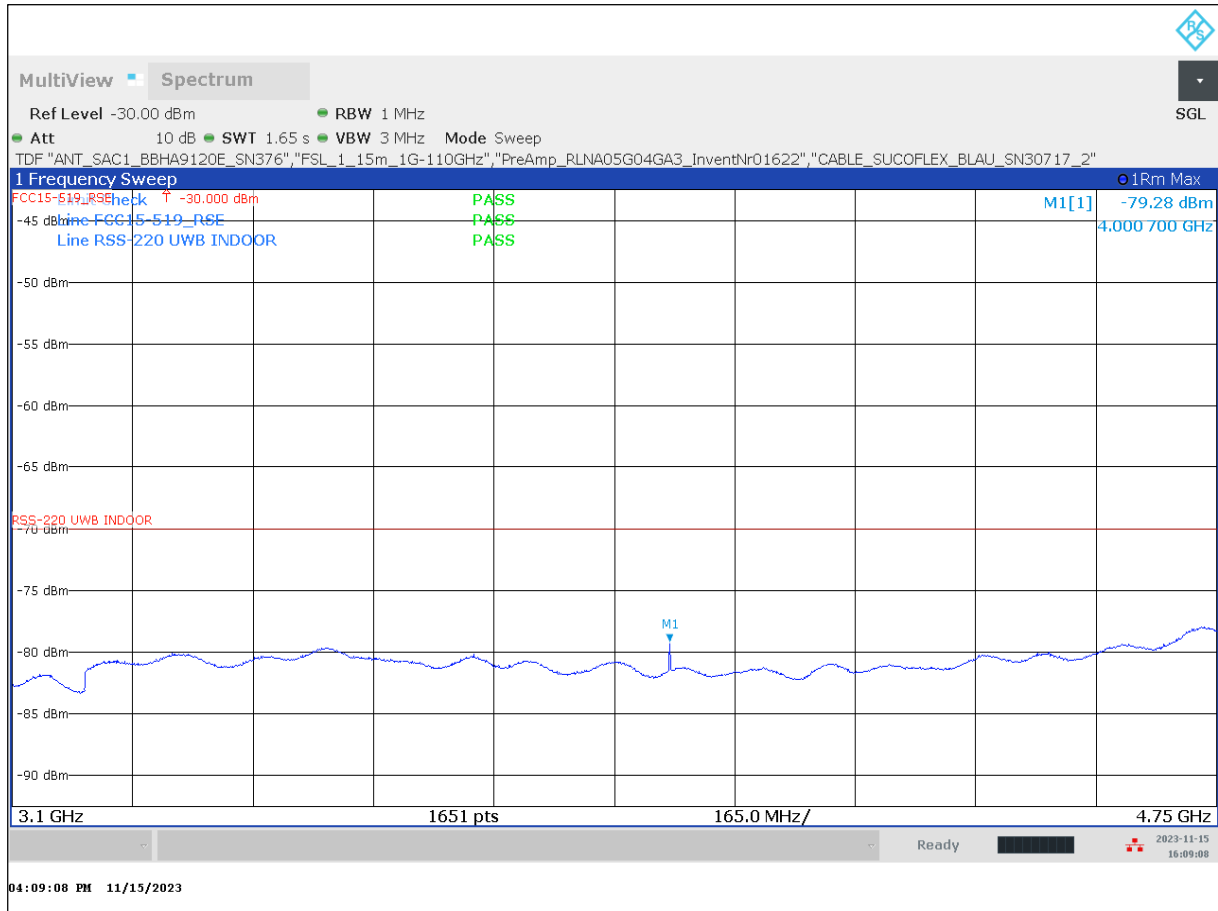


1.5.2 Requirements for RSS-220: 3.1GHz to 4.75GHz

TID021a_02__TX_RSE_EUT_laying__Anth



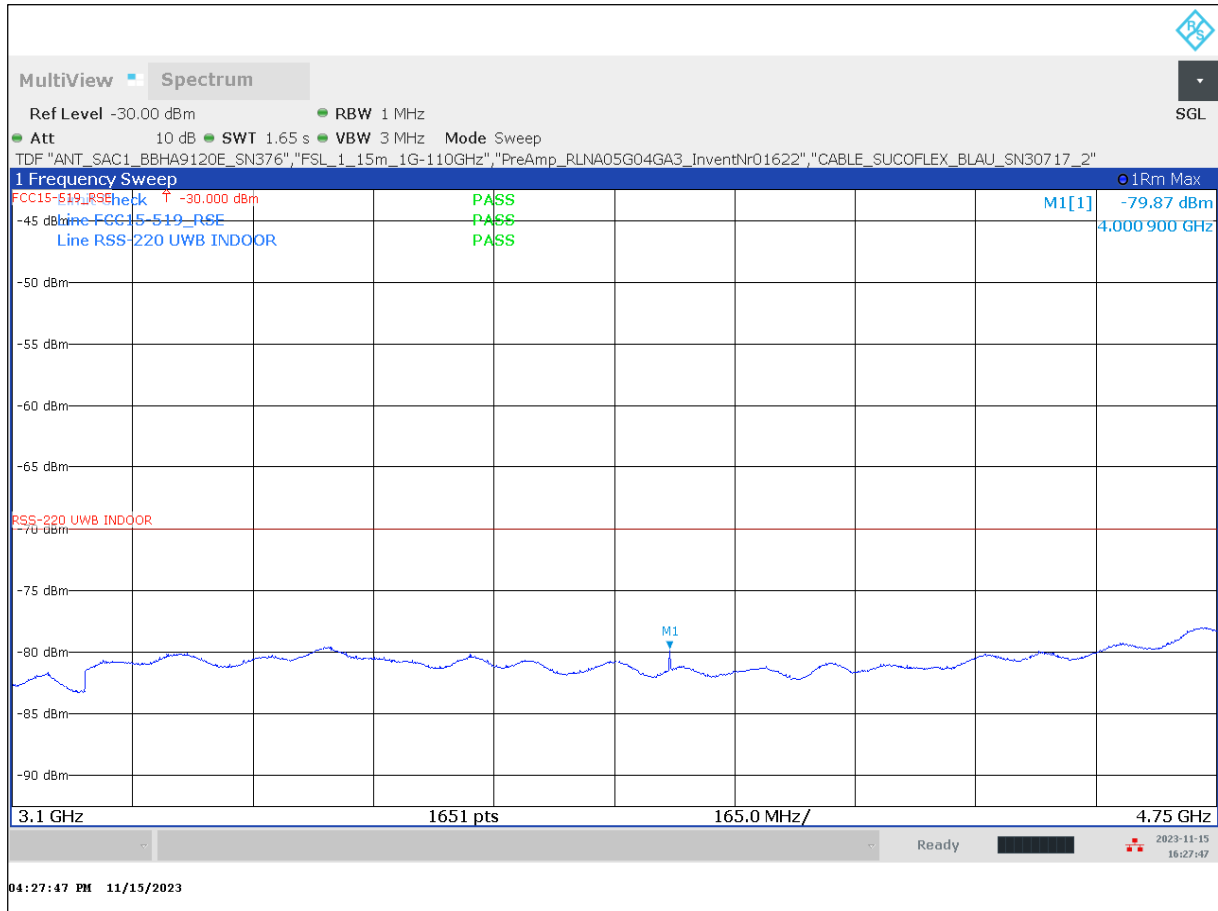
TID021a_03__TX_RSE_EUT_standing__Anth



TID021b_01__TX_RSE_EUT_laying__AntV

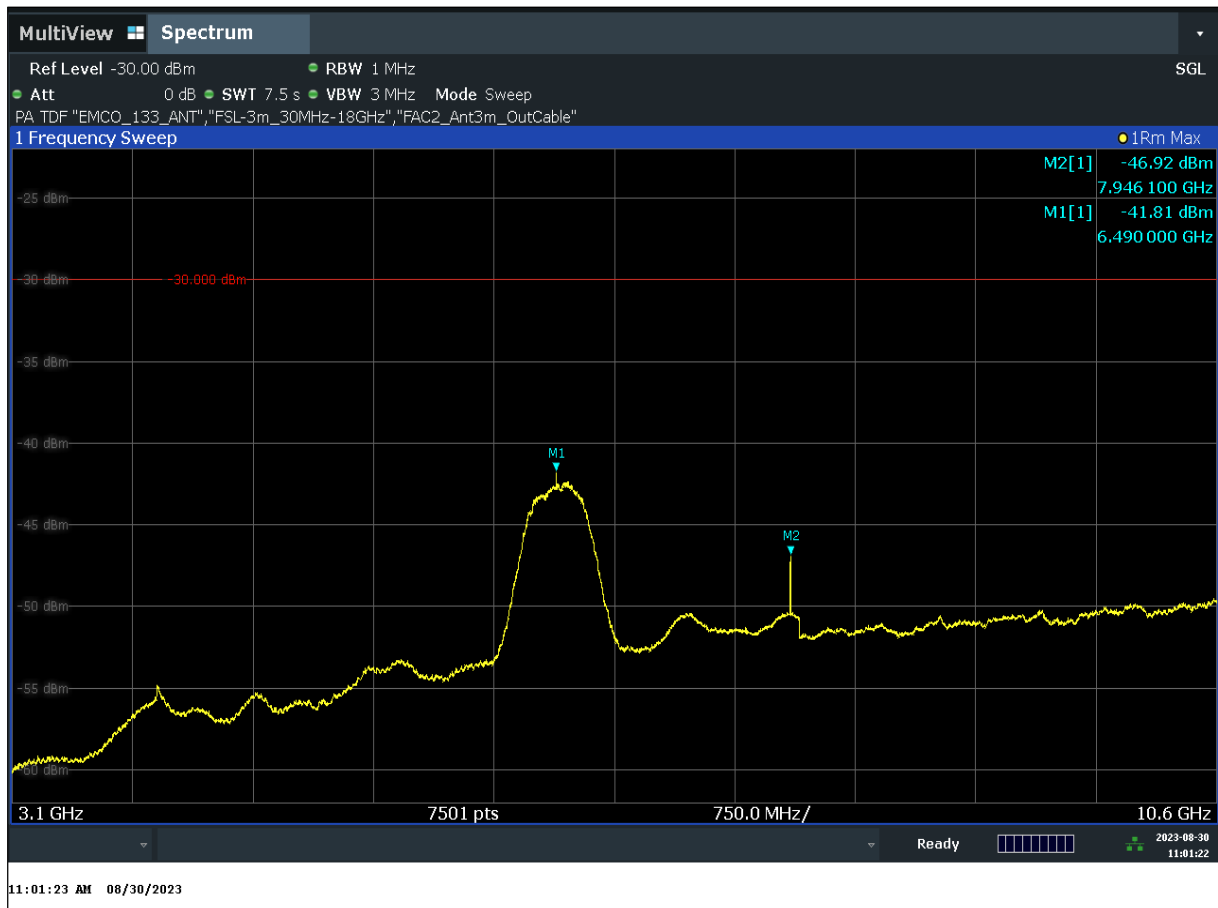


TID021b_04__TX_RSE_EUT_standing__AntV



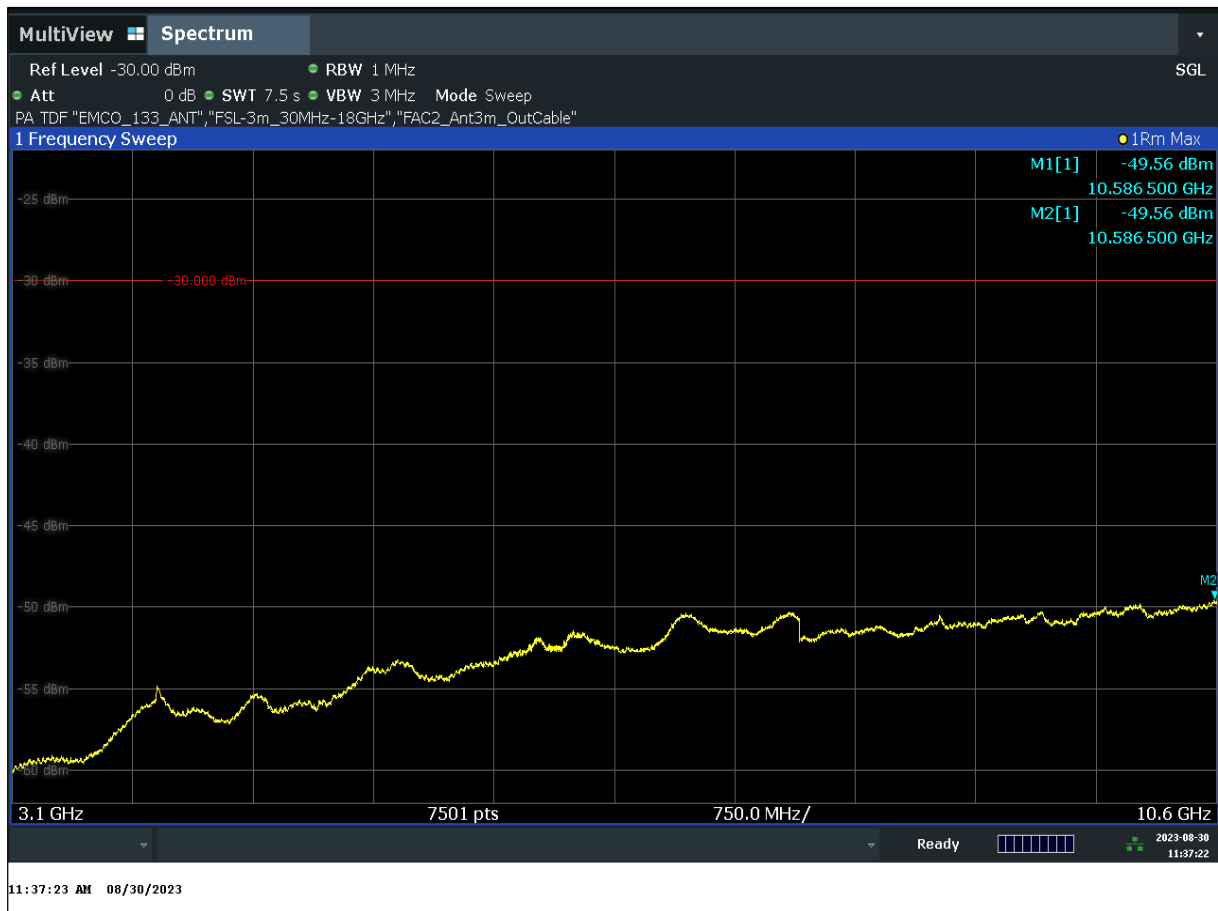
1.5.3 Range: 3.1GHz to 10.6GHz

TID013a_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
H



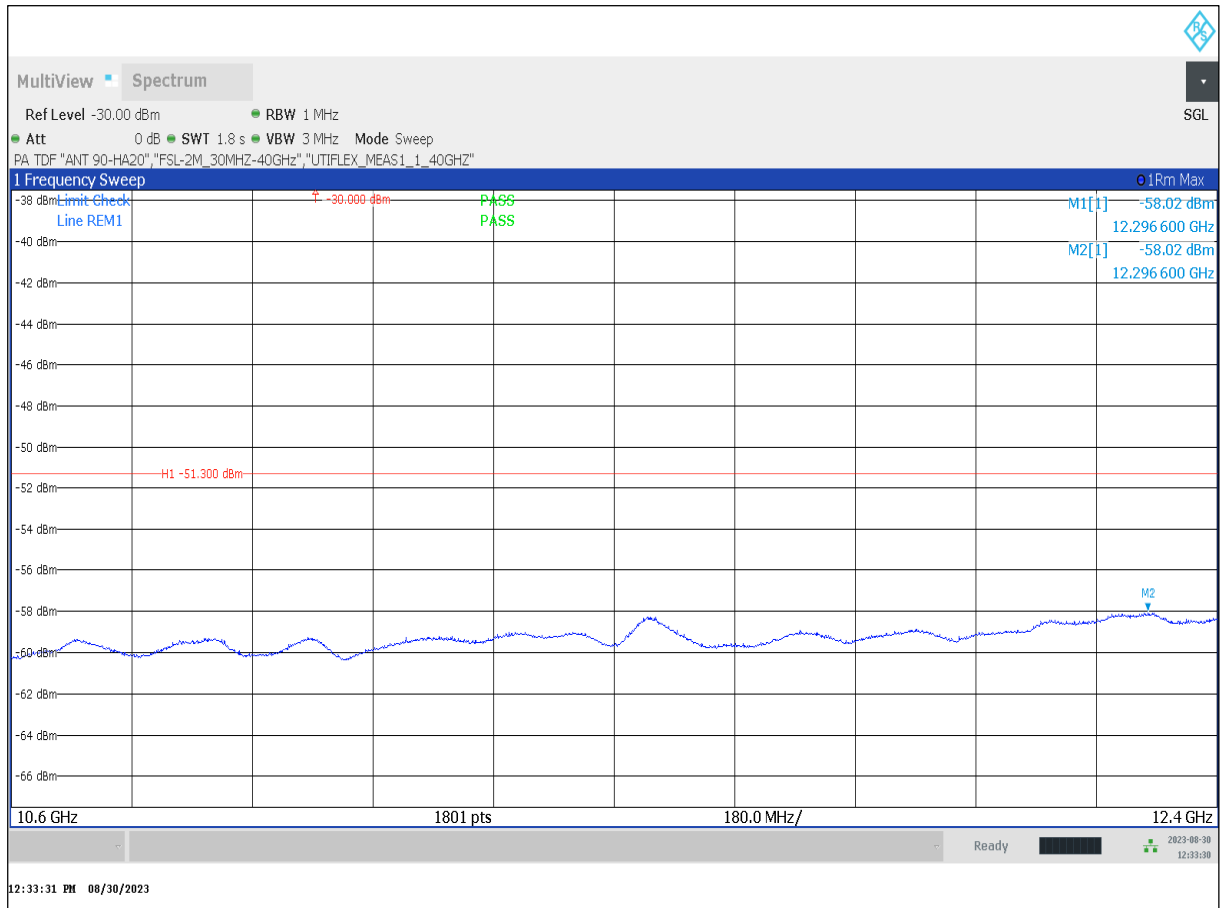
Max Value: -41.81dBm

TID013b_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
V

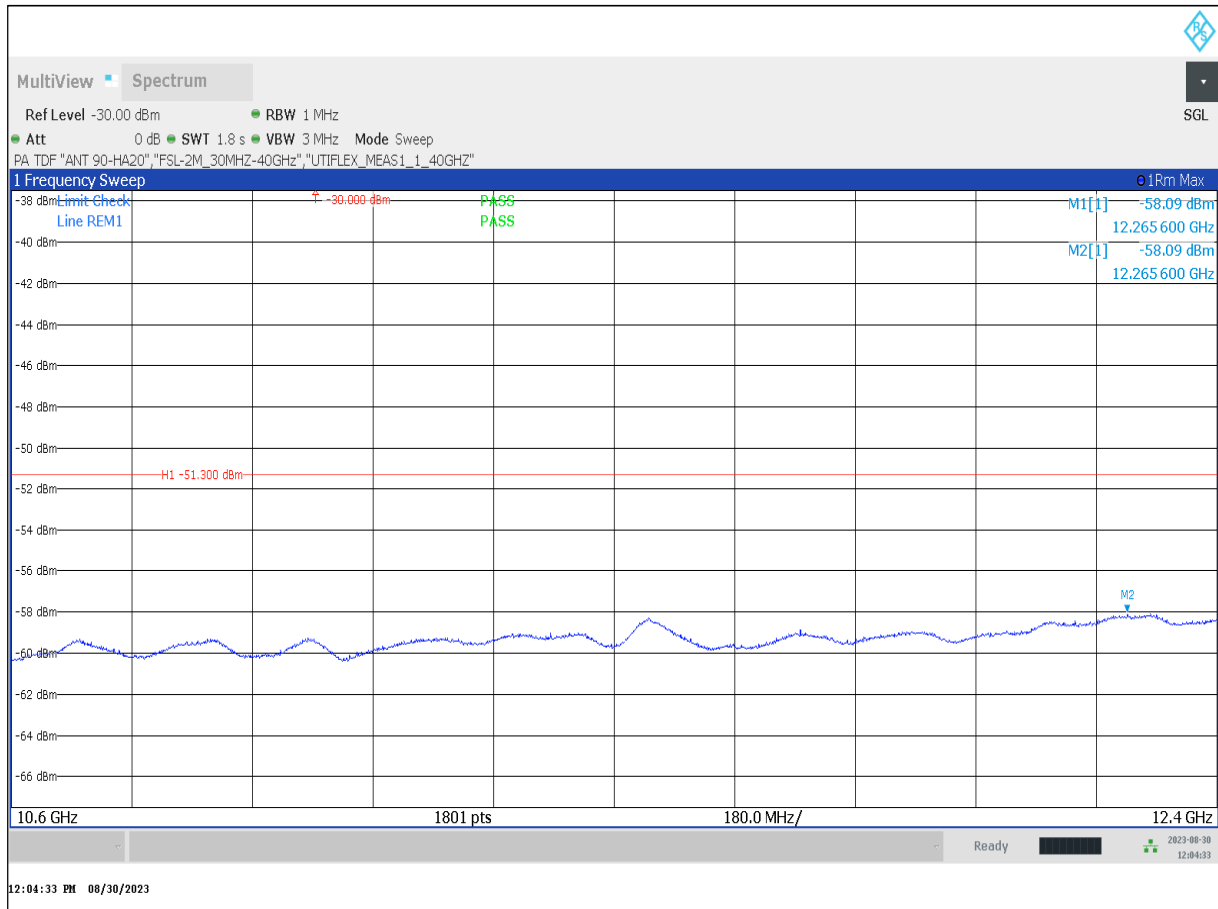


1.5.4 Range: 10.6 to 12.4GHz

TID014a_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
H

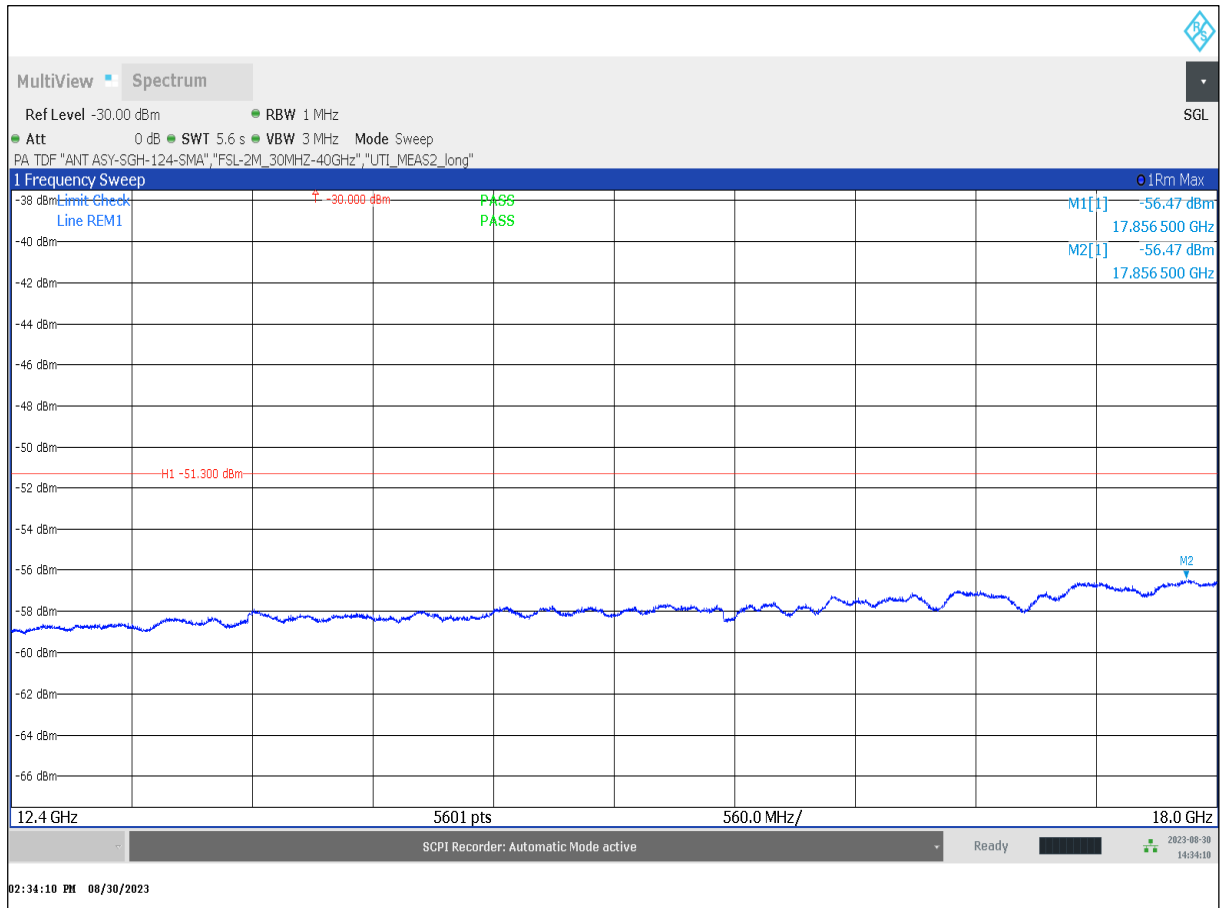


TID014b_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
V

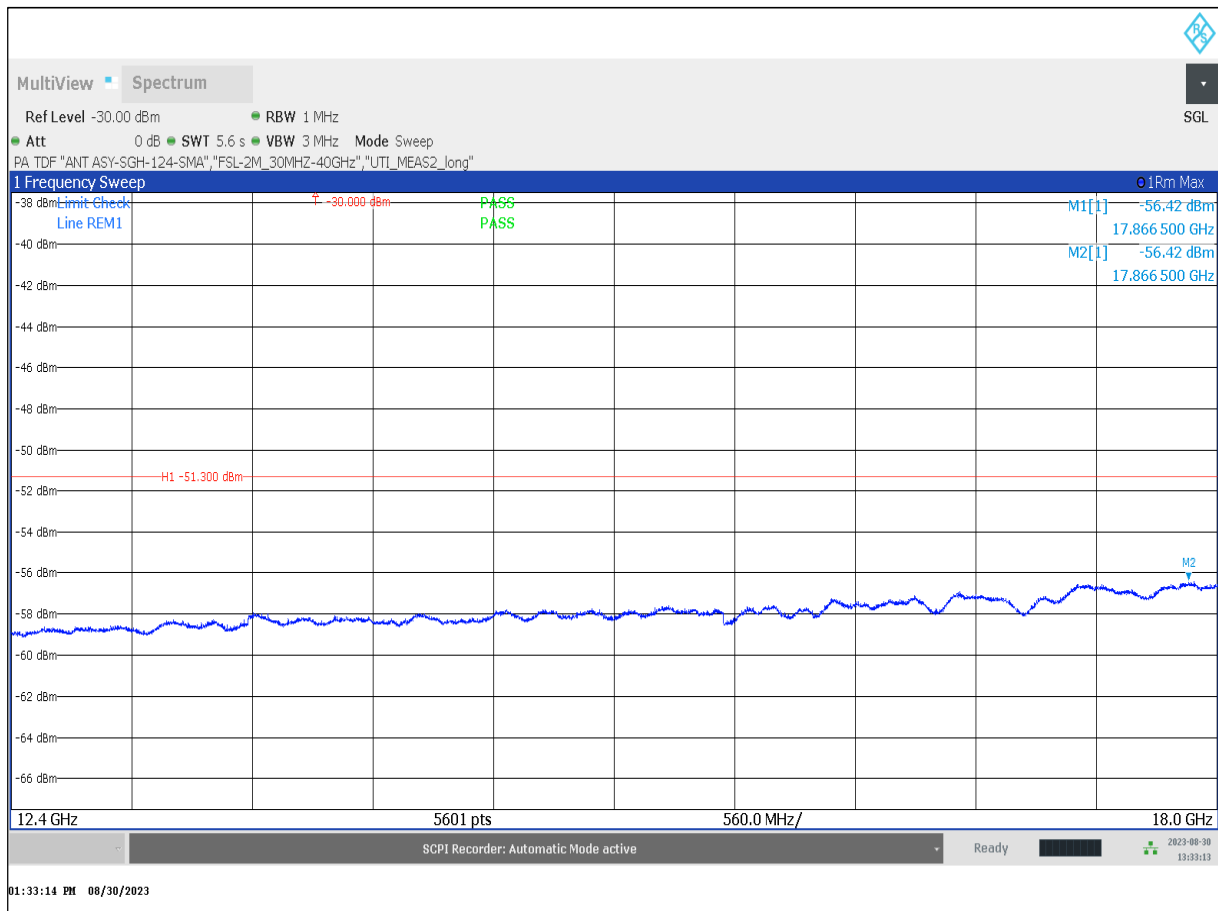


1.5.5 Range: 12.4GHz to 18GHz

TID015a_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
H

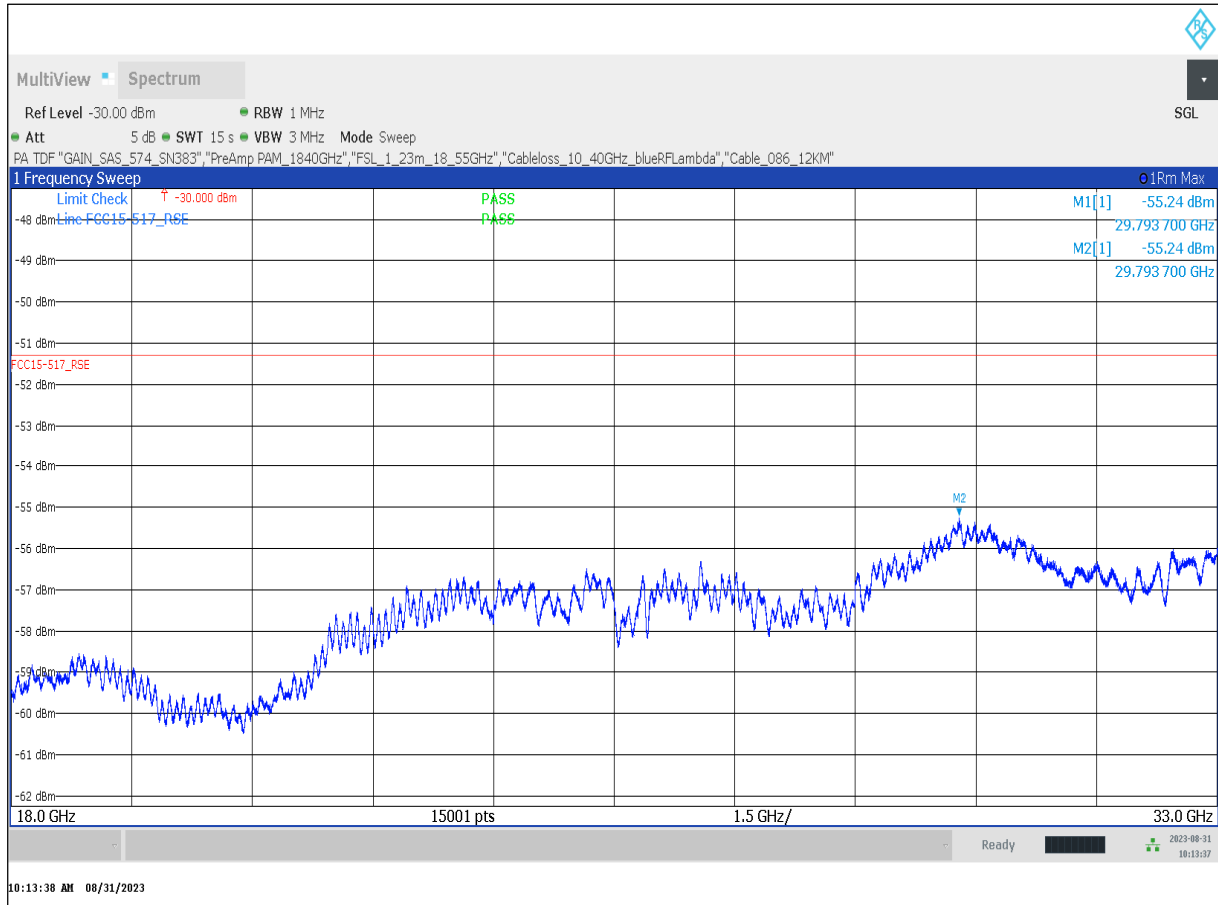


TID015b_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_Ant
V

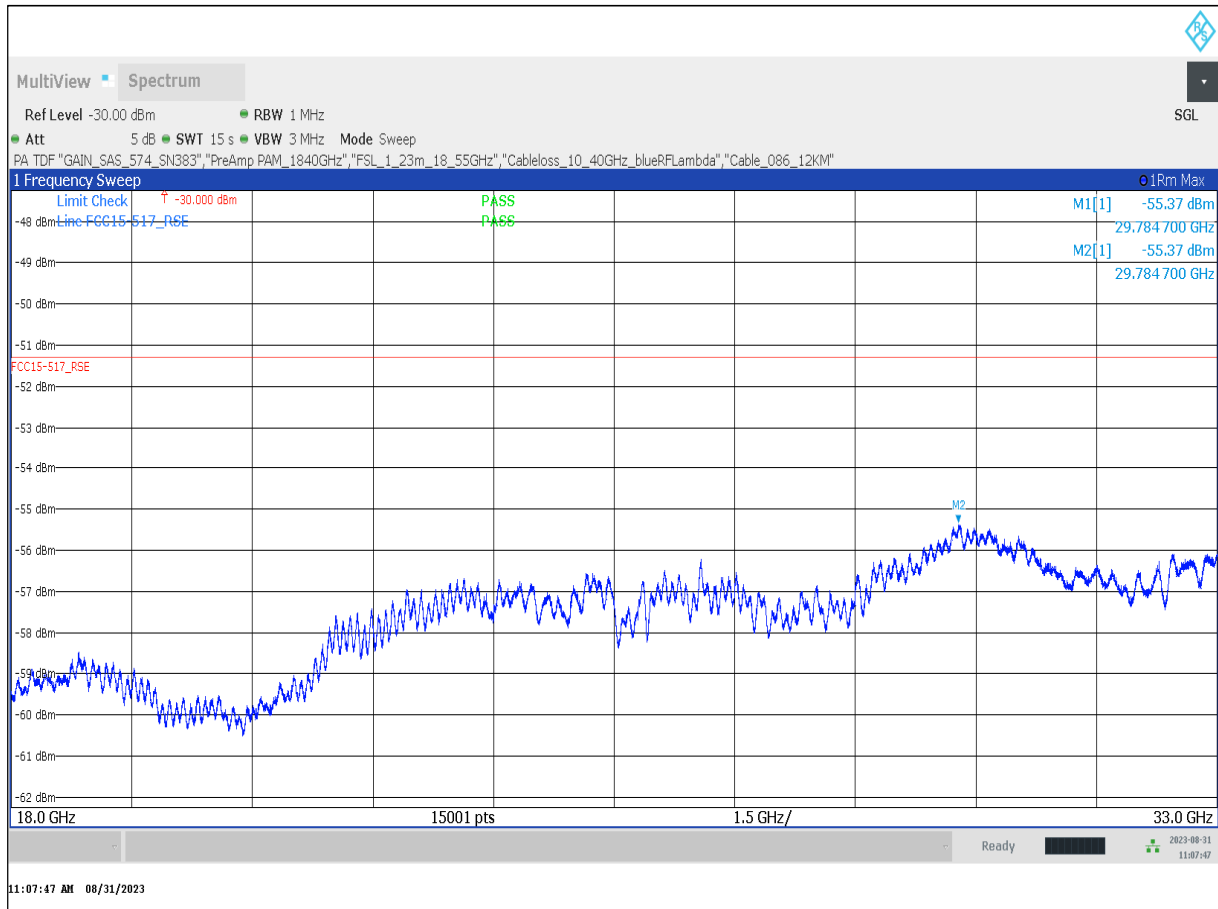


1.5.6 Range: 18GHz to 33GHz

TID018a_01_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_AntH

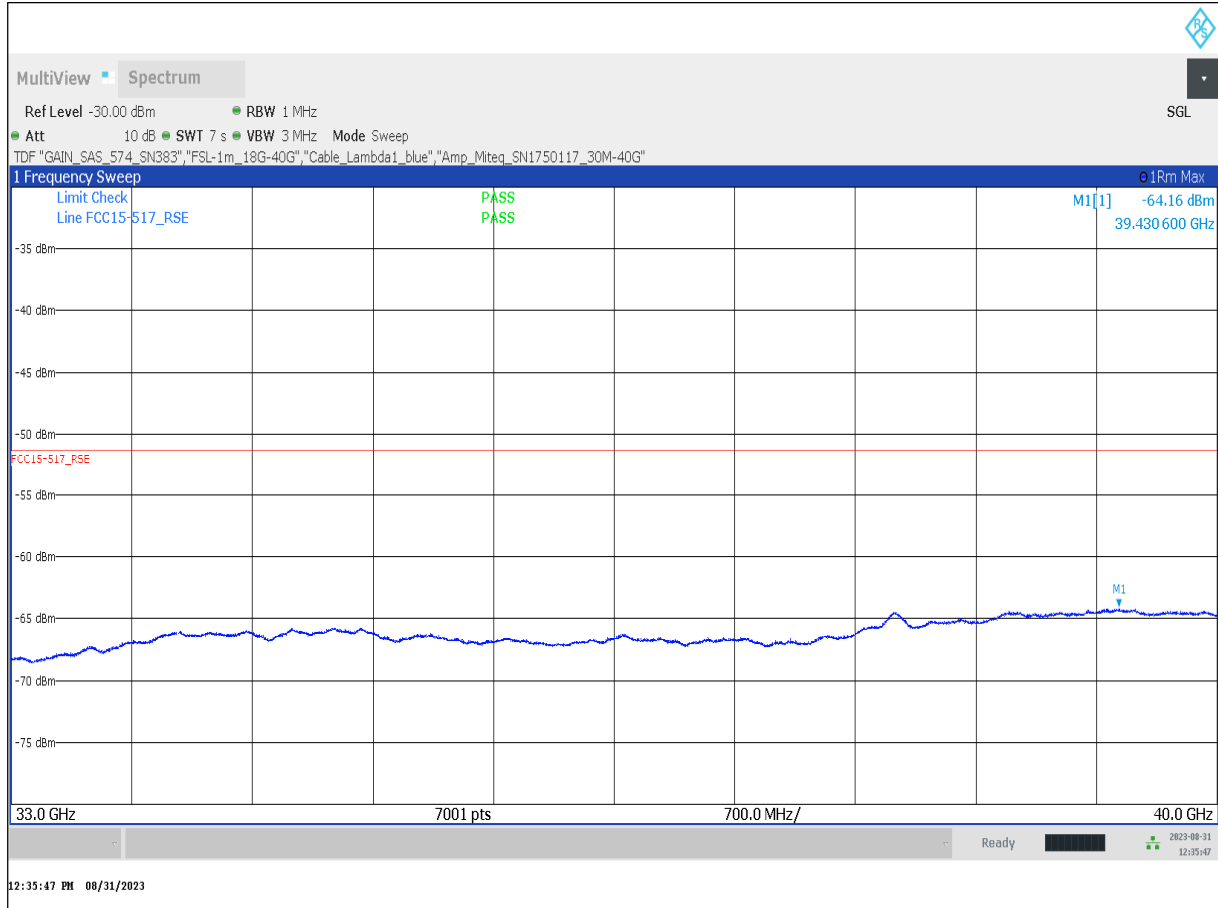


TID018b_01_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_AntV

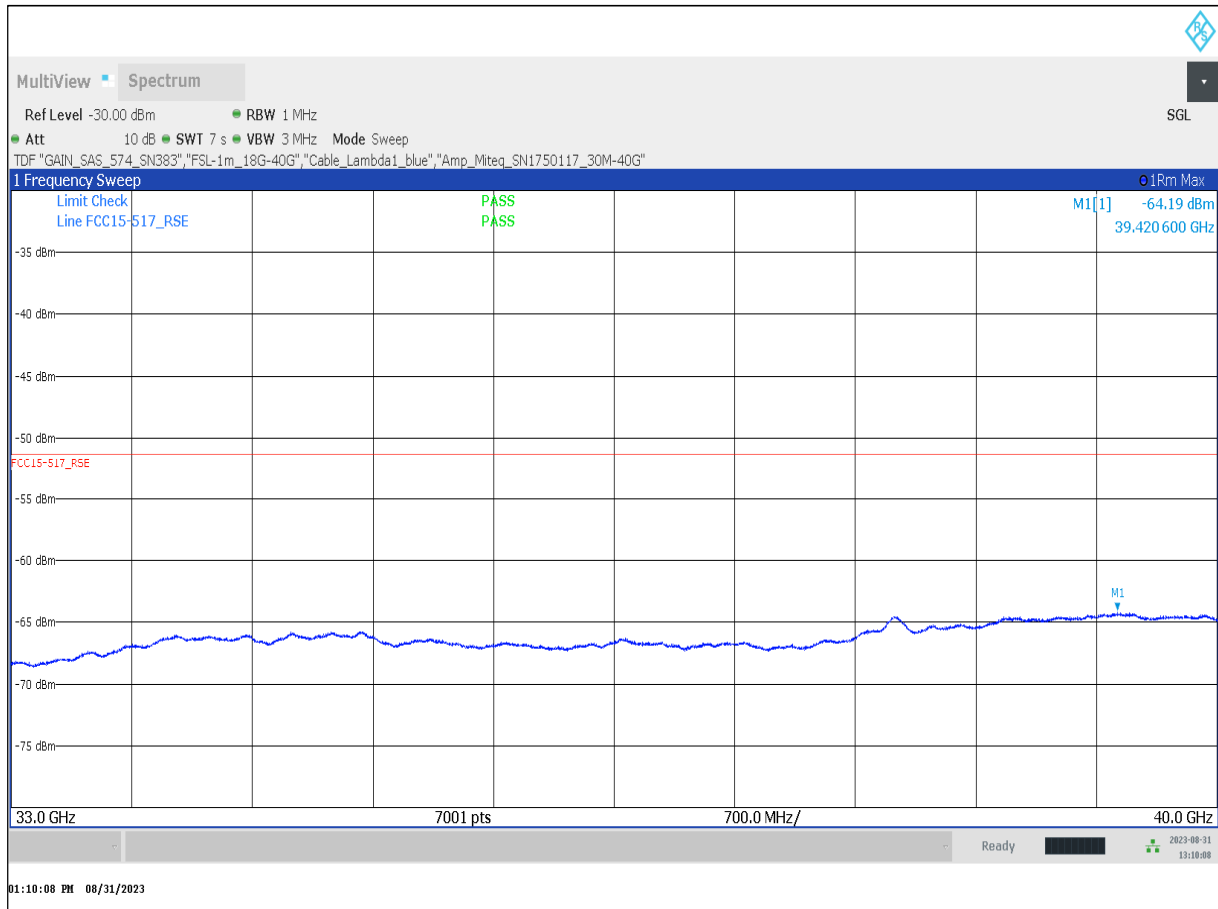


1.5.7 Range: 33GHz to 40GHz

TID019a_01_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_AntH

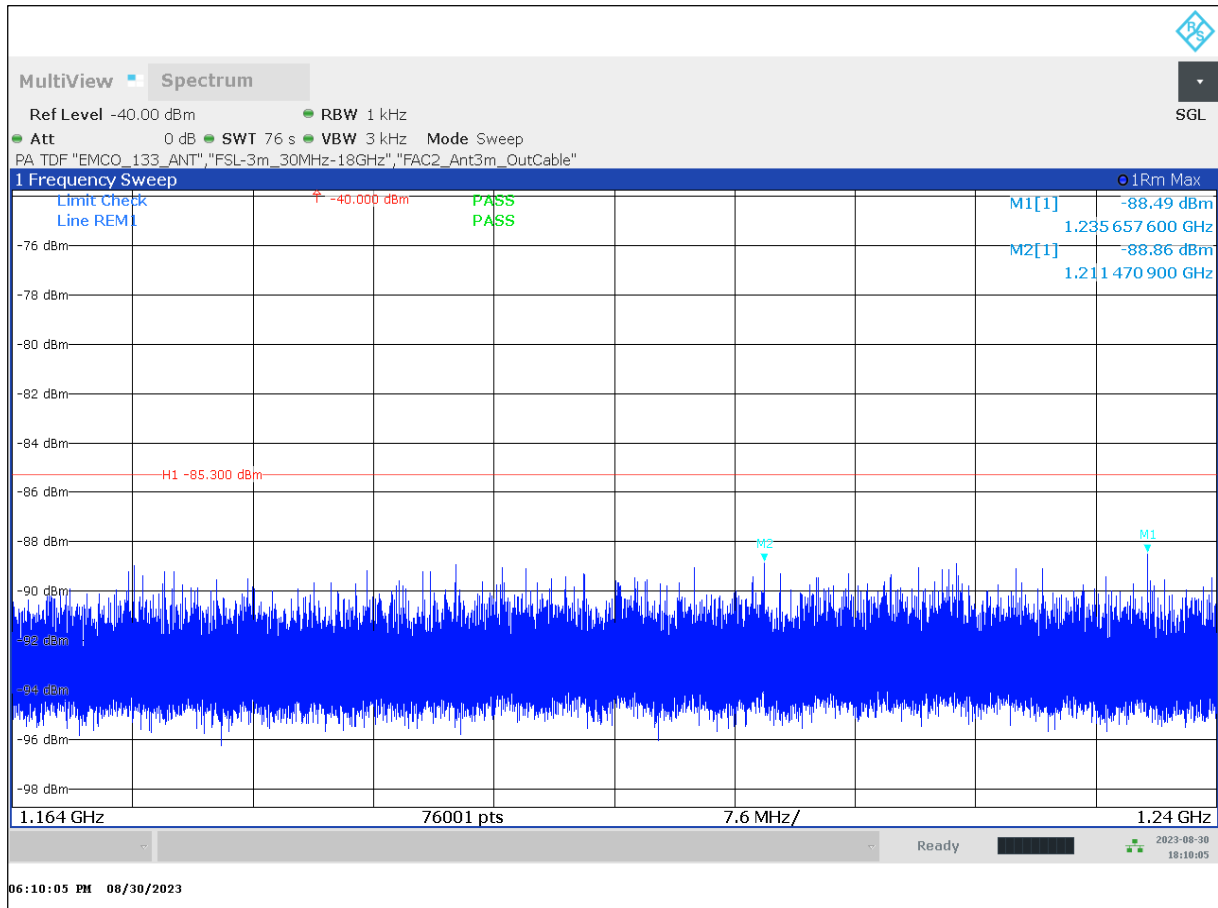


TID019b_01_RSE_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet73_
AntV

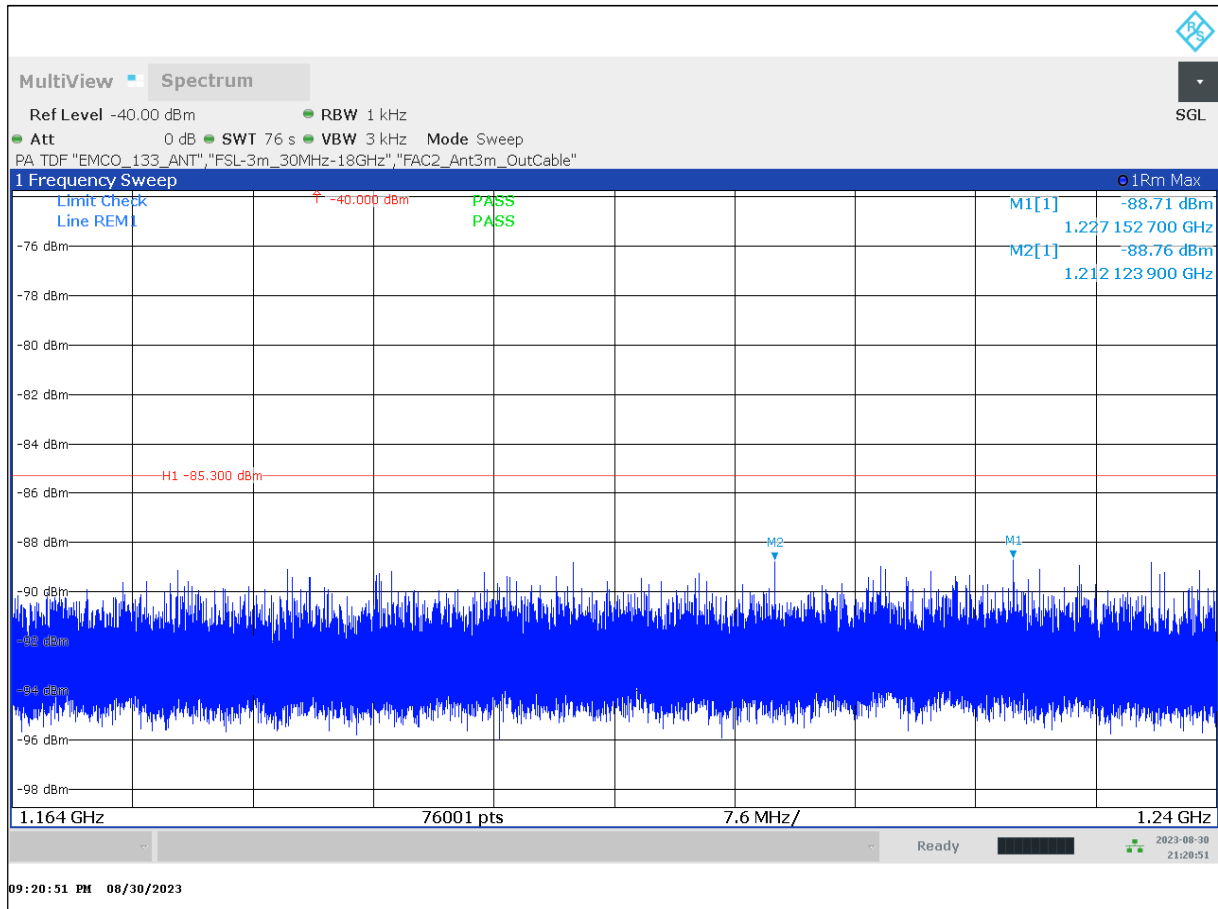


1.5.8 Spurious emissions in GPS1 band (lower GPS band)

TID016a_RSE_GPS1_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7_3_AntH

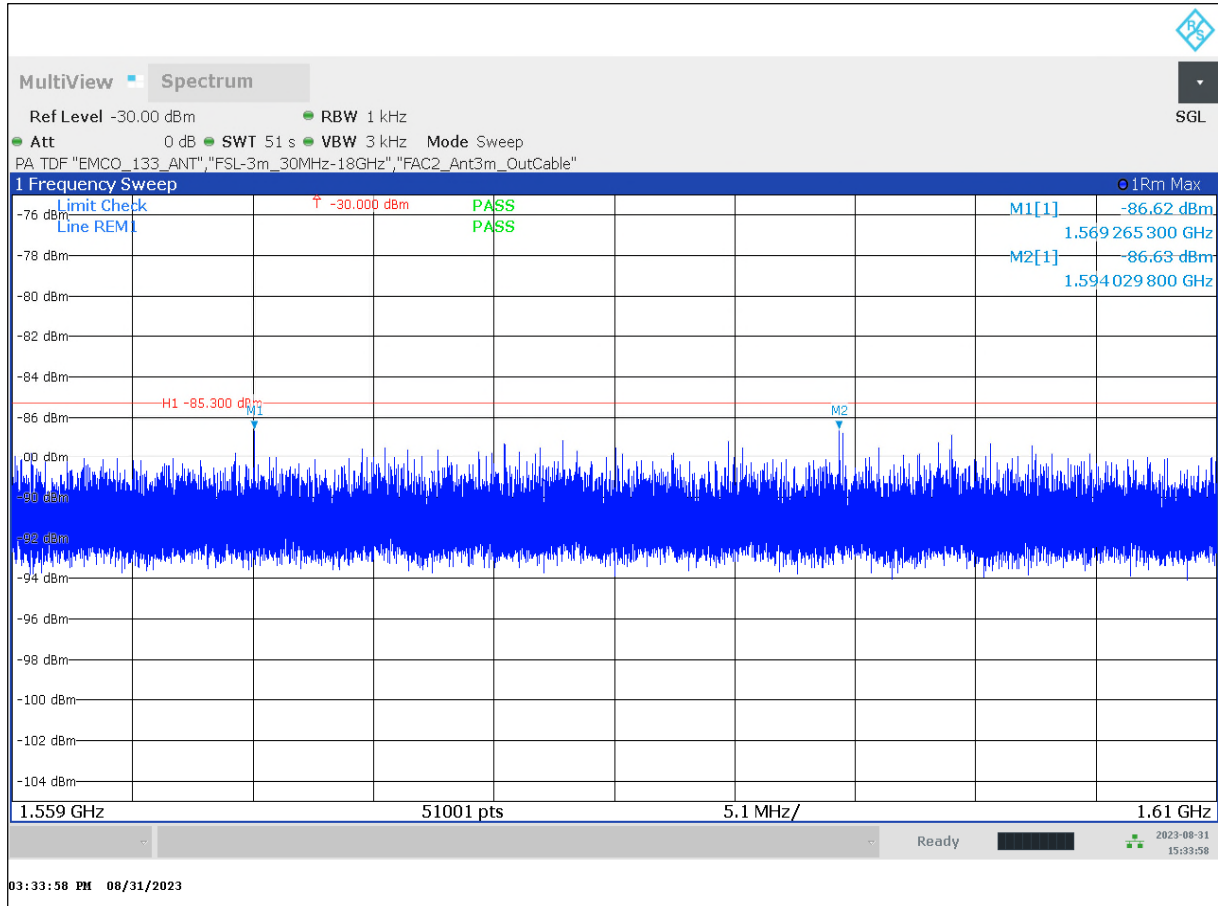


TID016b_RSE_GPS1_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7
3_AntV

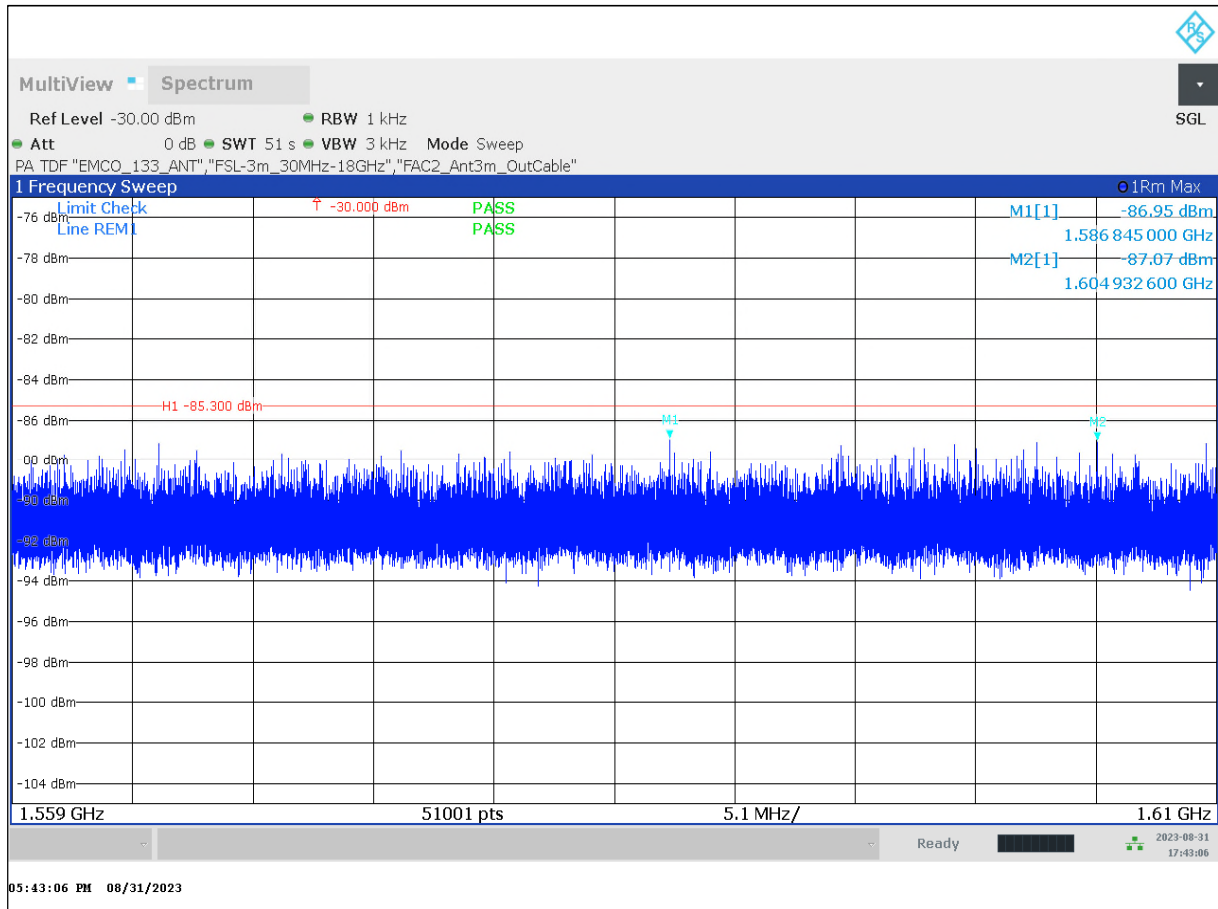


1.5.9 Spurious emissions in GPS2 band (higherGPS band)

TID017a_RSE_GPS2_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7
3_AntH



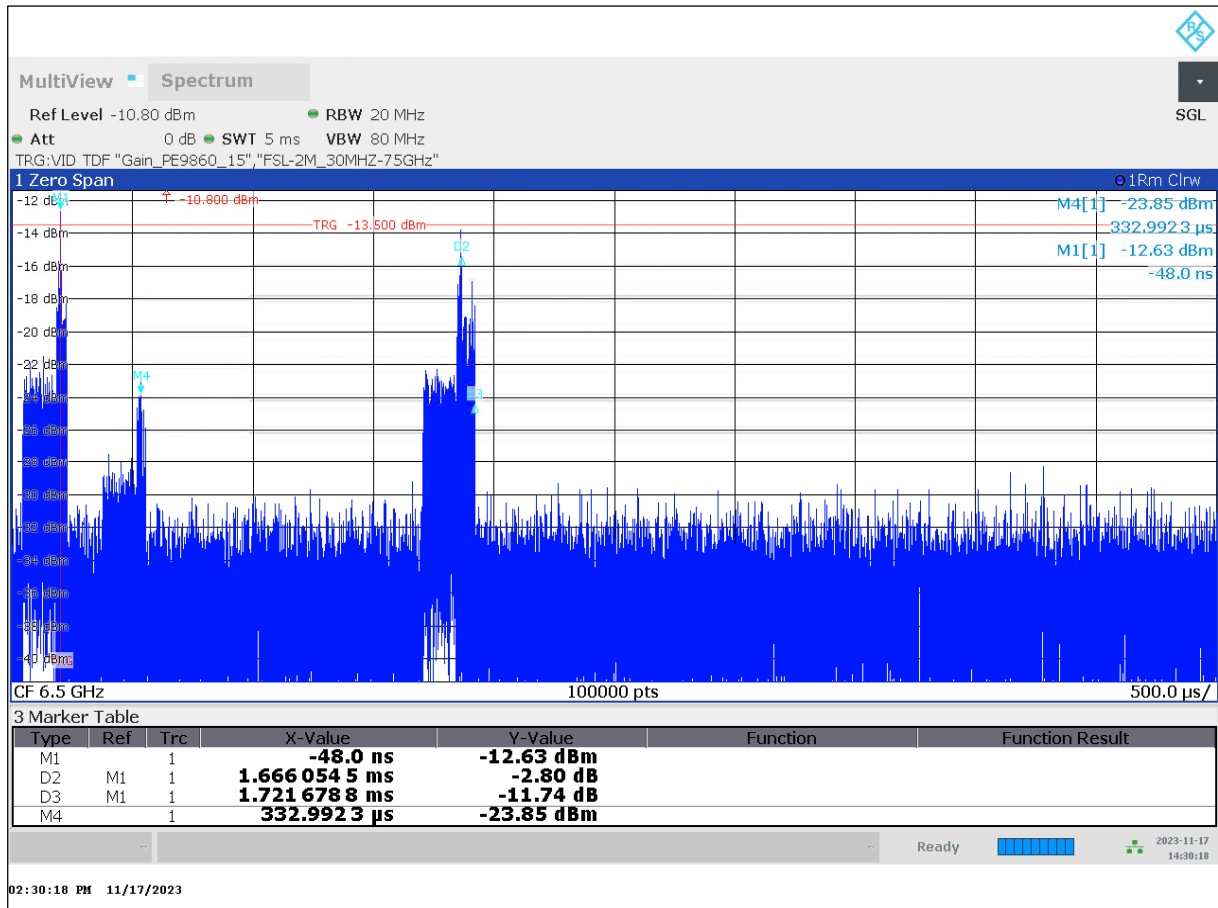
TID017b_RSE_GPS2_Ch5_PWR_0xC4C4C4C4_DataRate_850kBit_PRF64MHz_256Sym_Packet7 3_AntV



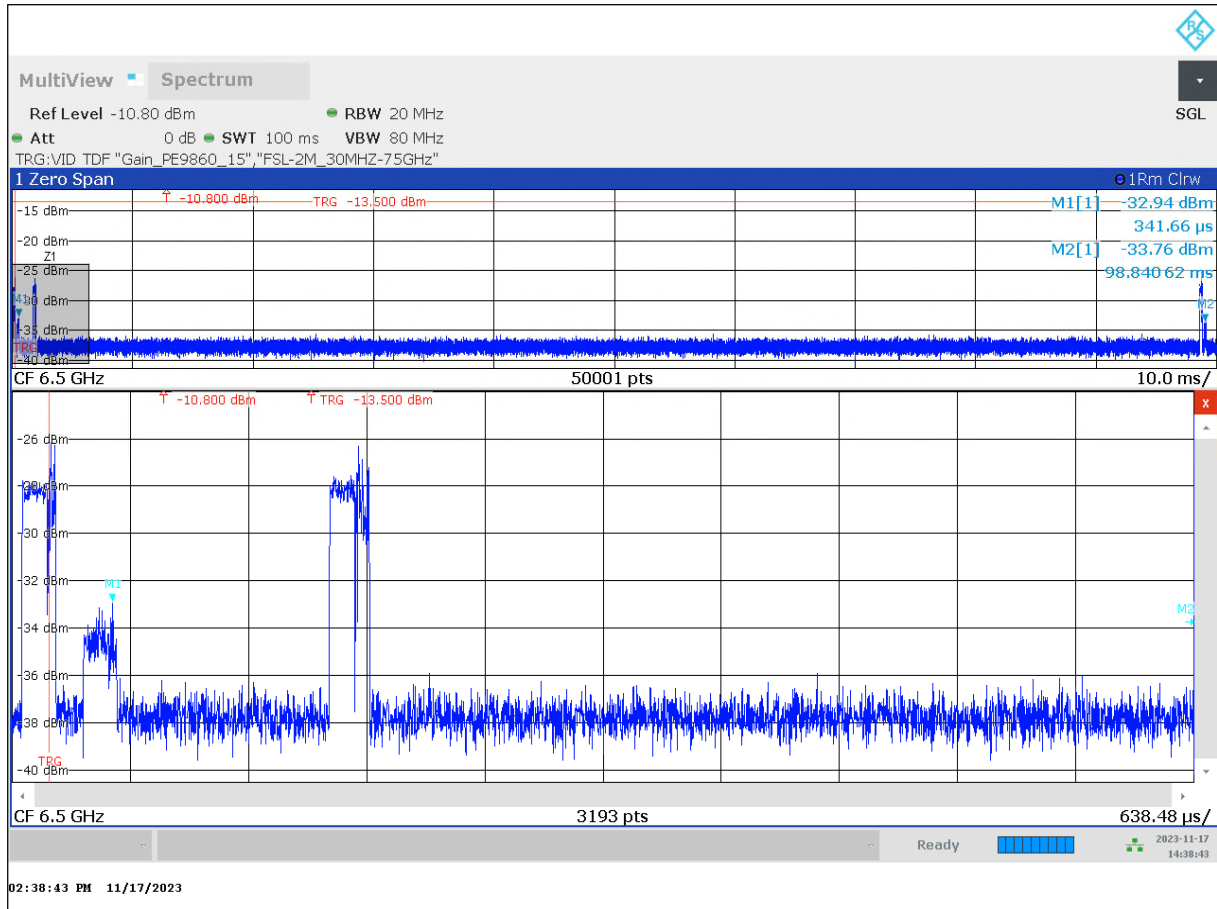
1.6 Timing tests

1.6.1 Communication to Tag (AE3)

TID022_01_Anchor_Communication_to_Tag_

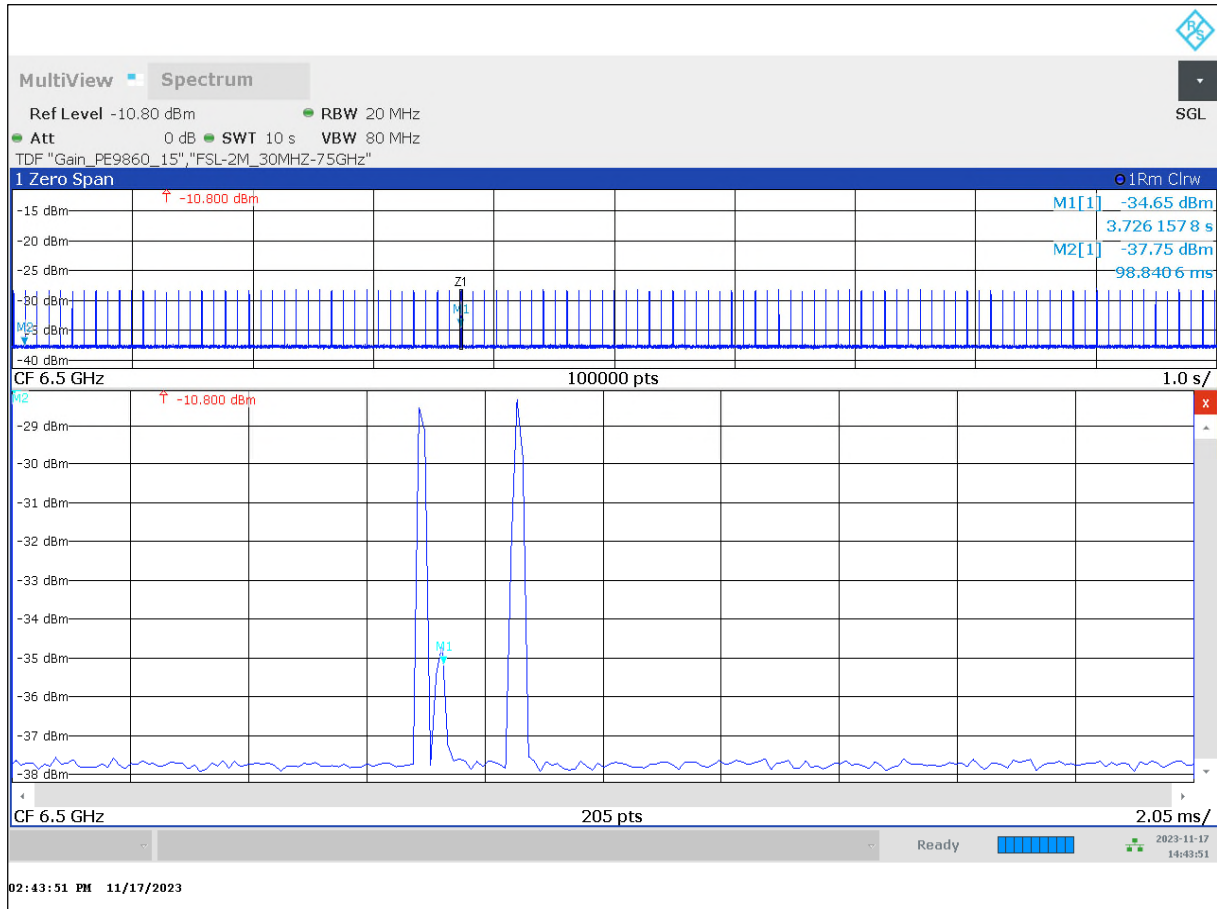


M4 at 332.9923us after trigger point, shows EUT emission, left and right side higher value emissions belongs to tag.

TID022_02_Anchor_Communication_to_Tag_1sec


Two consecutive emission of main EUT shown by marker M1 and M2 (upper split screen)

TID022_03_Anchor_Communication_to_Tag_10sec



Continuous communication, shown for a period of 10 seconds.

Low split screen shows emission (Marker M1) from the main EUT between two emissions of the tag.

1.6.2 No communication with Tag (AE3)

TID022_04_Anchor_stop_communication_to_Tag_10sec

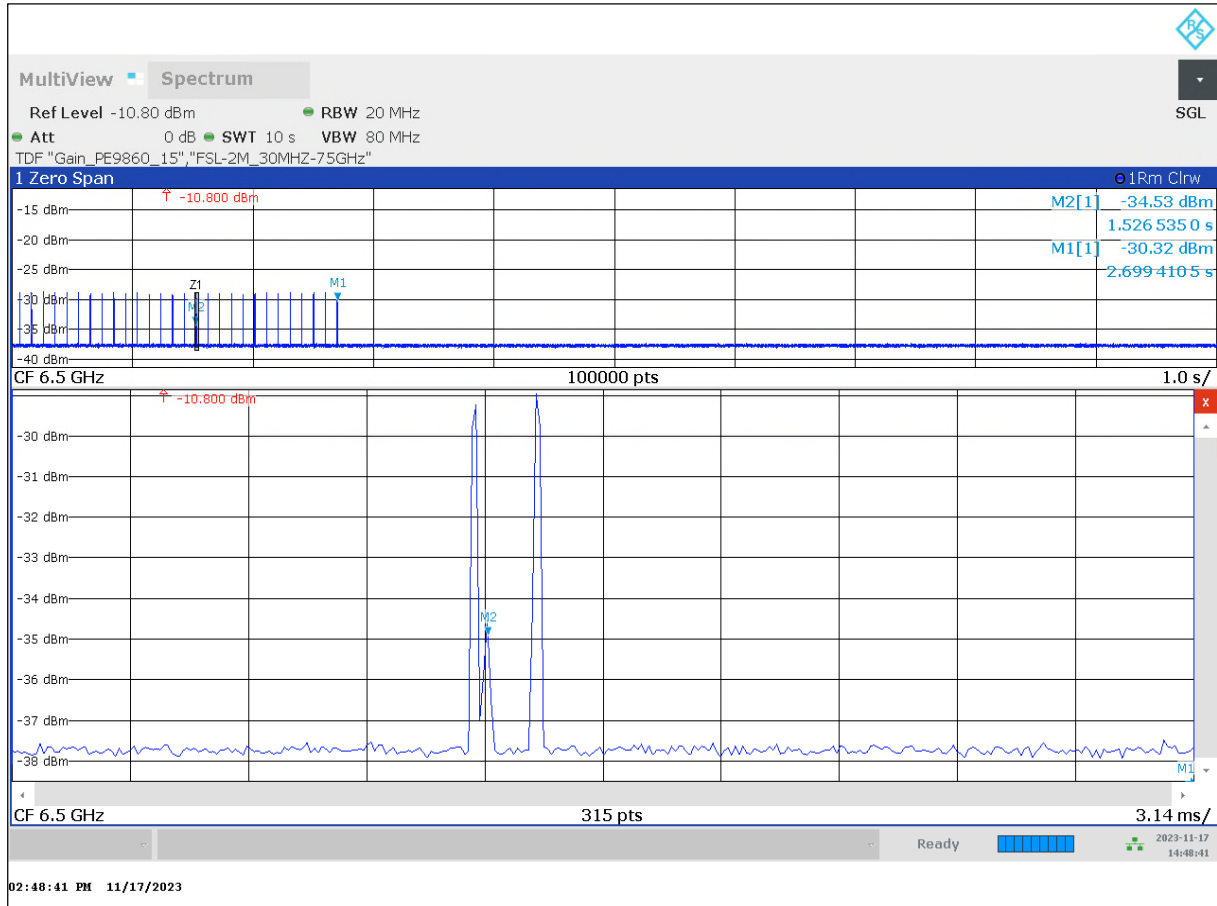
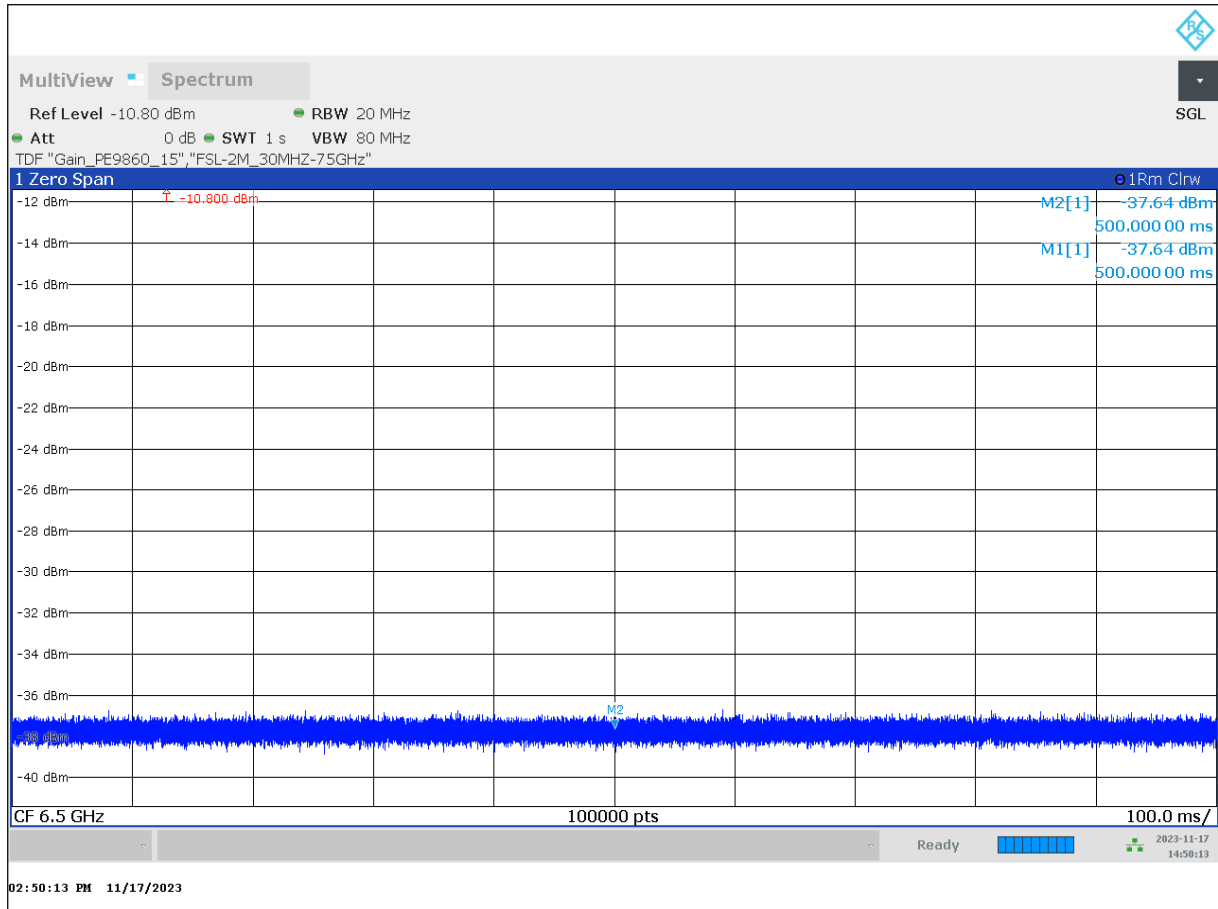


Diagram shows disconnection of Tag. Marker M2 shows emission of the main EUT and silence period after the disconnection from Tag. Tag was switched off at marker Time M1.

TID022_05_Anchor_stop_communication_to_Tag_1sec



No emission from main EUT.

End Of Annex 1