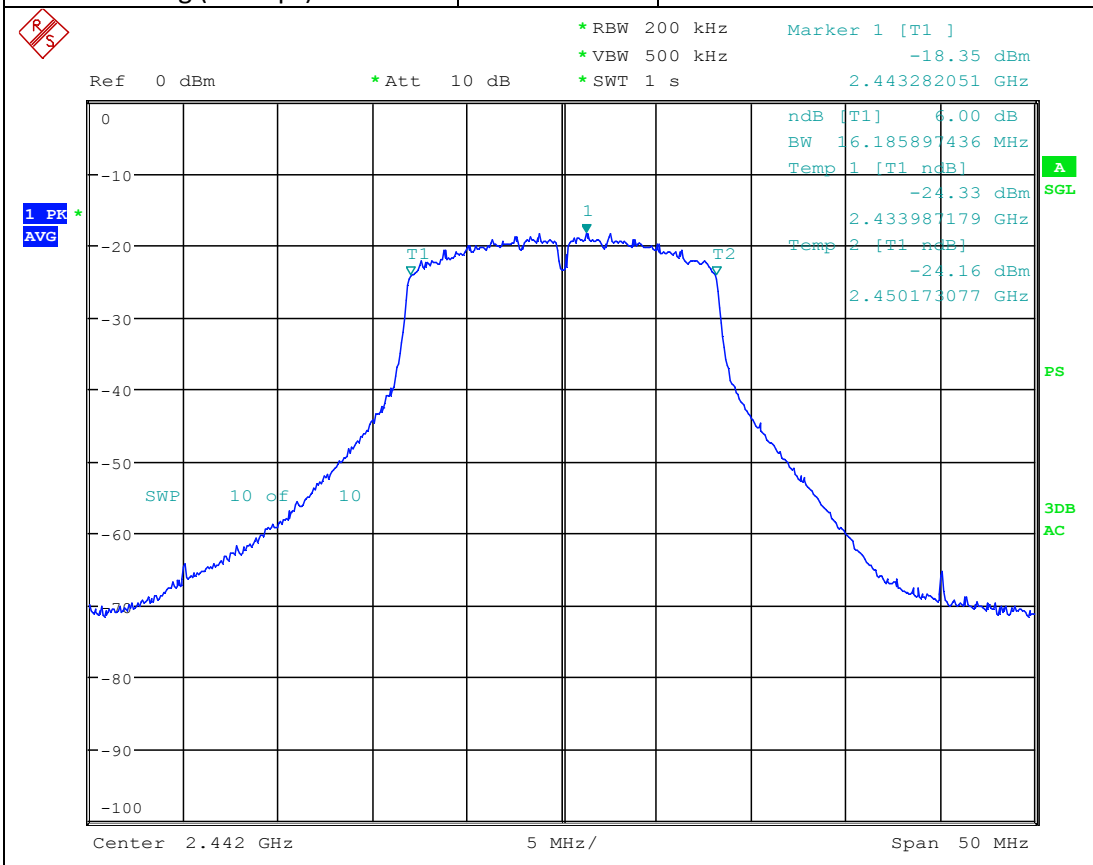
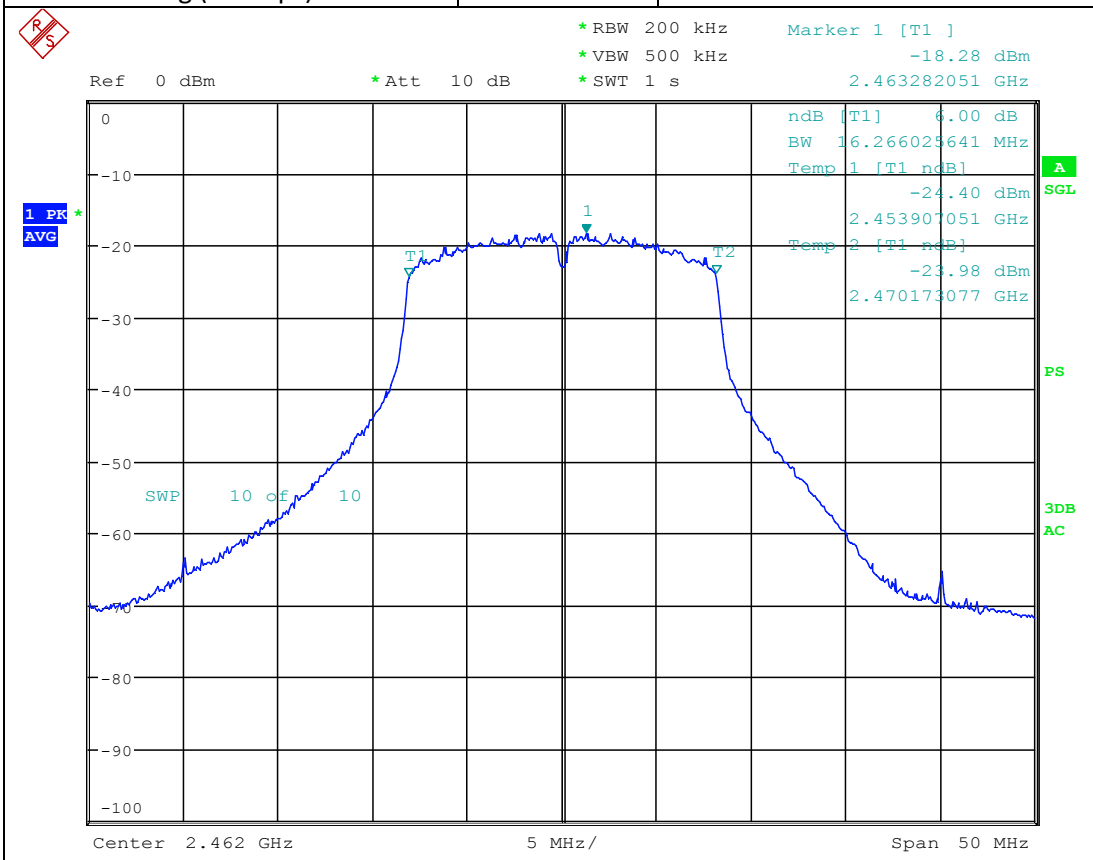
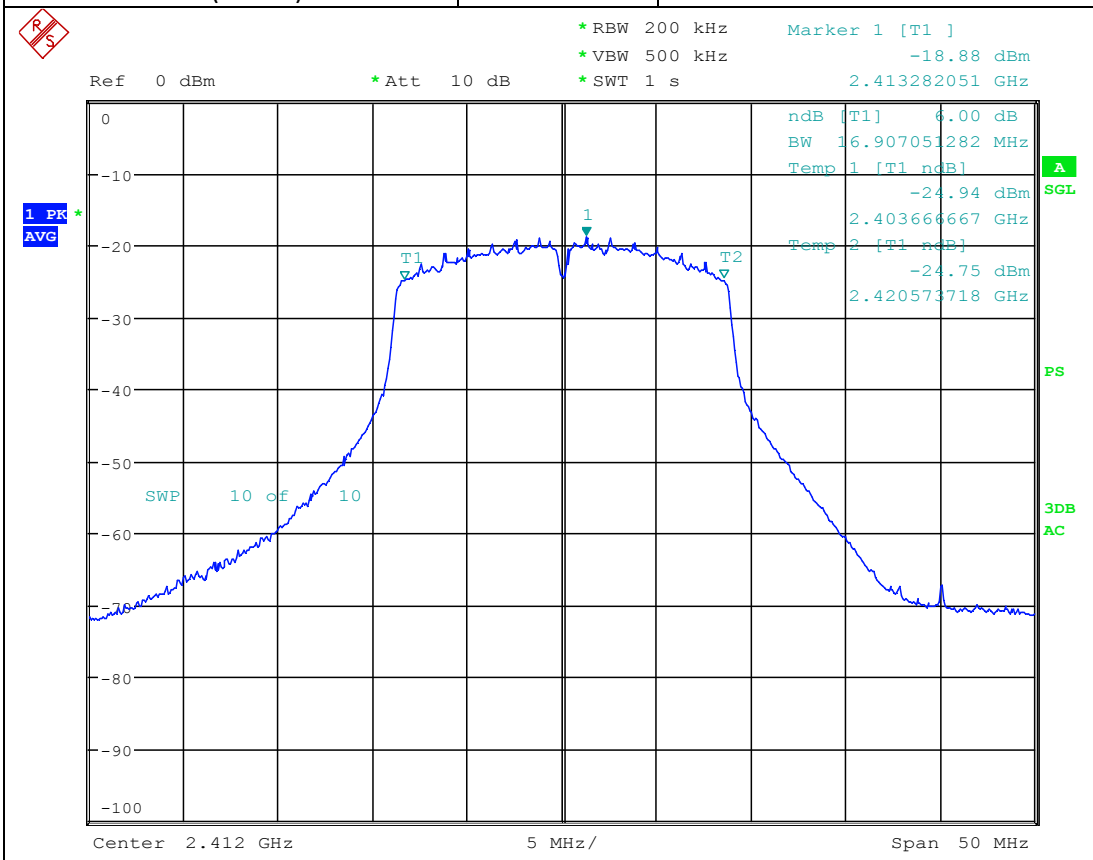
Modulation	Channel	6dB Channel Bandwidth (MHz)
11g (54Mbps)	07	16.186



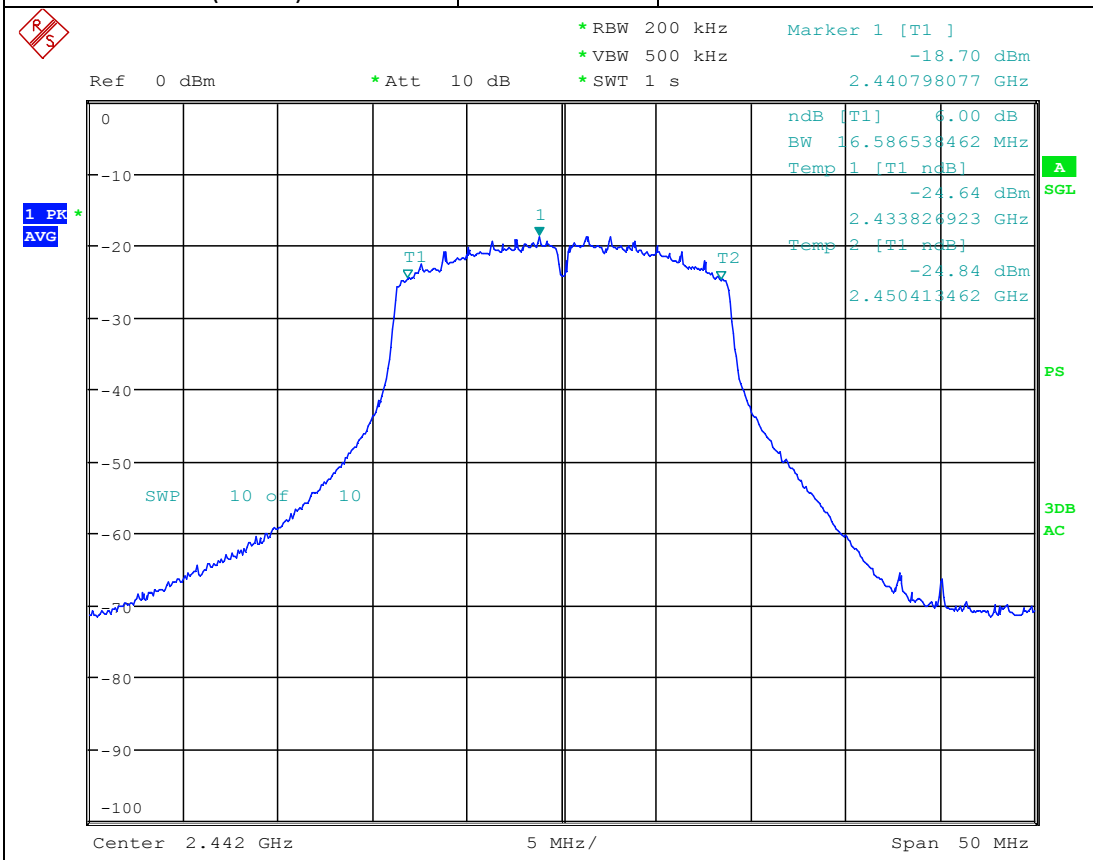
Modulation	Channel	6dB Channel Bandwidth (MHz)
11g (54Mbps)	11	16.266



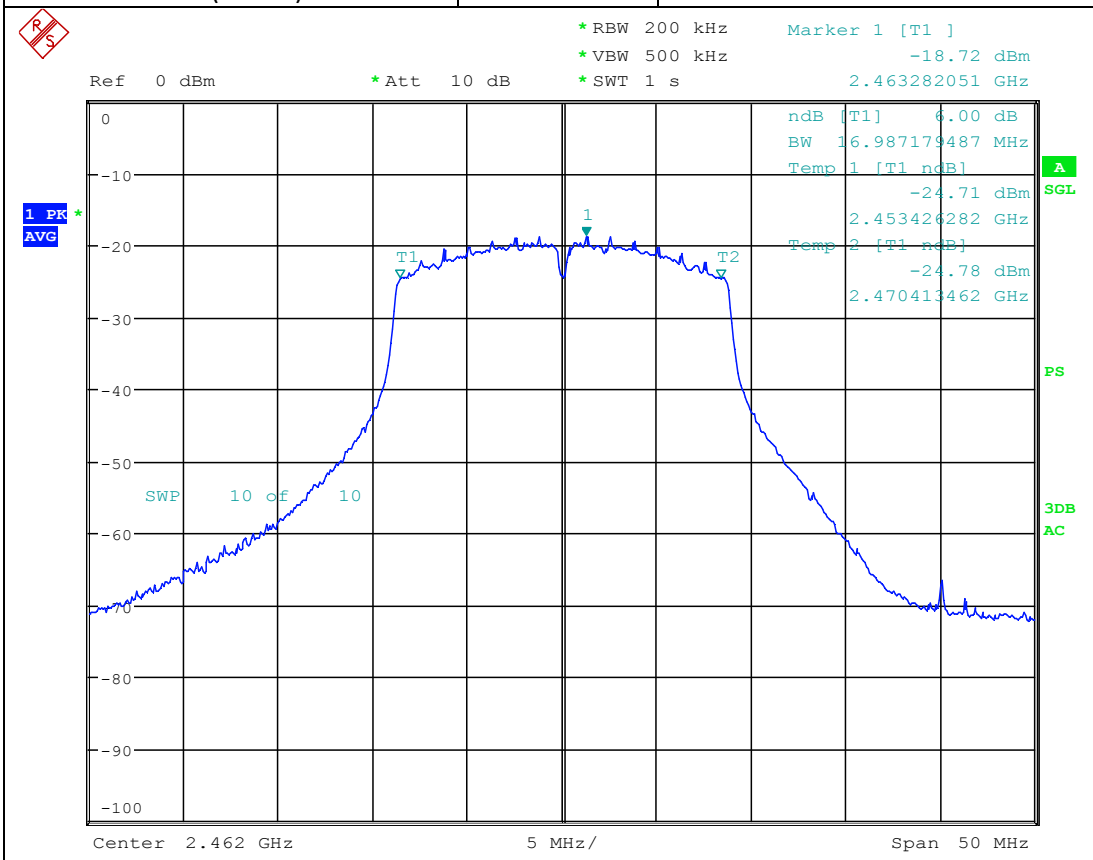
Modulation	Channel	6dB Channel Bandwidth (MHz)
11n (MCS 7)	01	16.907



Modulation	Channel	6dB Channel Bandwidth (MHz)
11n (MCS 7)	07	16.587



Modulation	Channel	6dB Channel Bandwidth (MHz)
11n (MCS 7)	11	16.987



Comments: None.
Test Unit: 001
Test Setup: A (Conducted)
Tested by: D. Jamieson
Test Date/s: 17th February 2017
Test Status: **PASS**

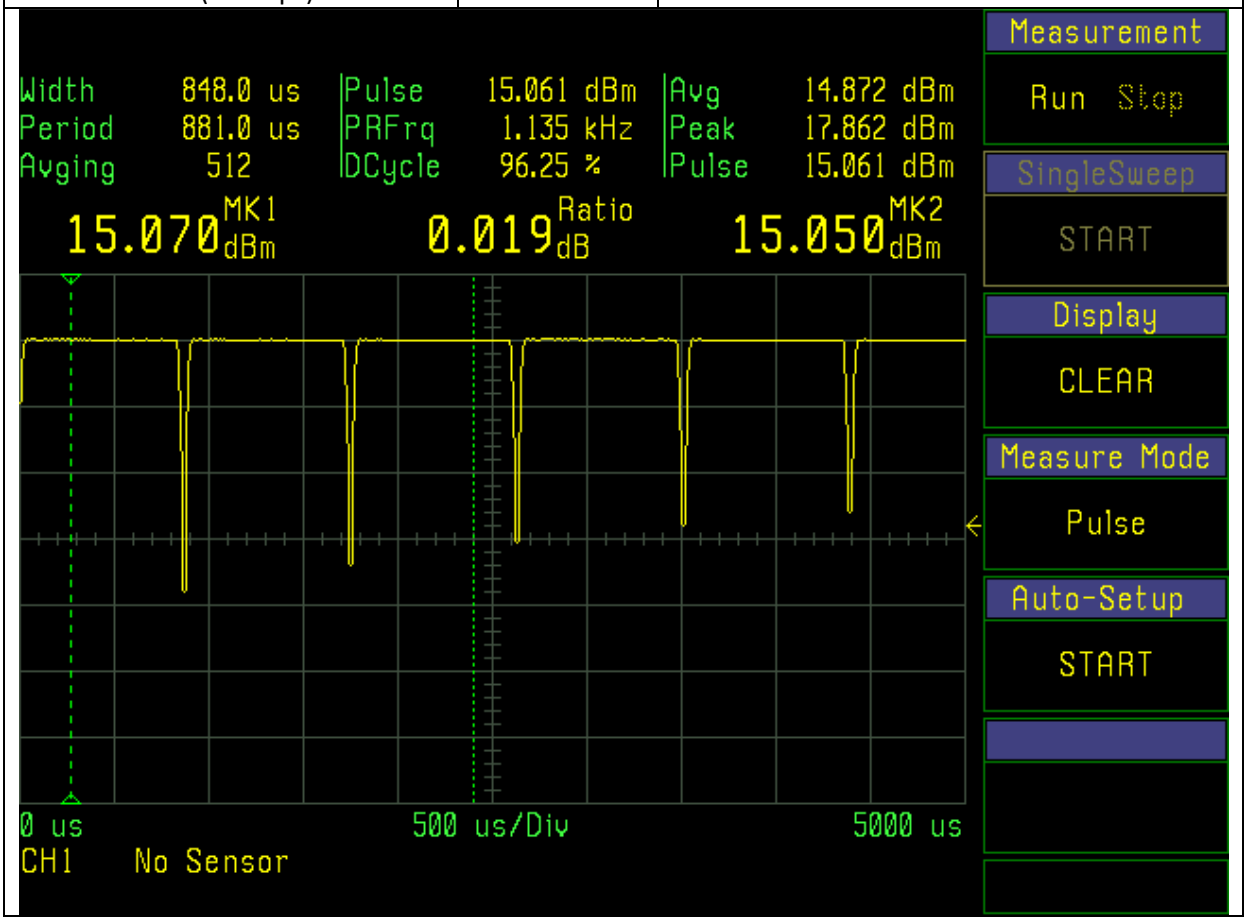
6.7 Peak Output Power

6.7.1 Peak Output Power – Results Summary

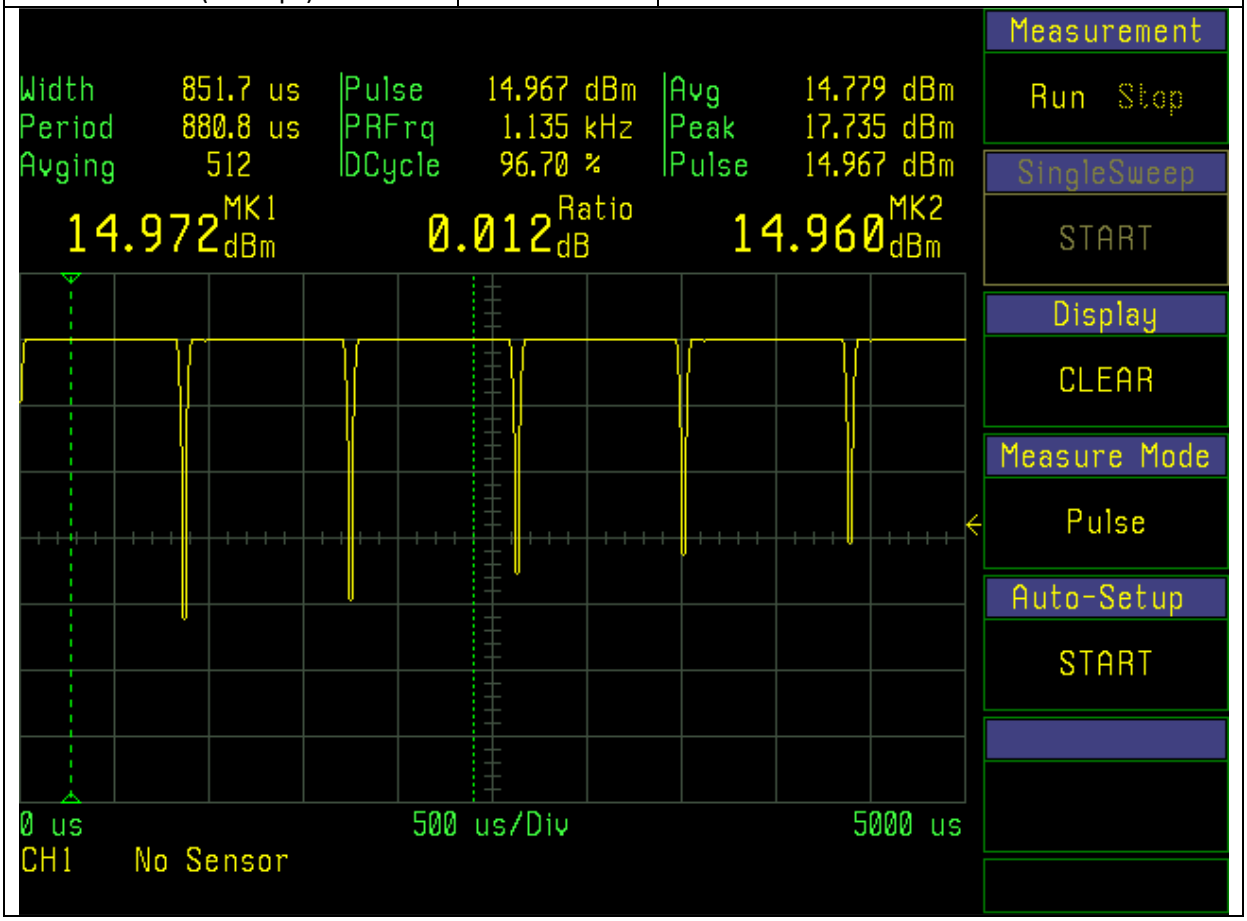
Type	Chan.	Measured Power (dBm)	Measured Power (mW)	Tx Duty cycle	Peak Power (mW)	Limit (mW)	Result
11b (11Mbps)	1	15.06	32.06269325	0.9625	33.31	1000	Pass
	7	14.97	31.40508694	0.9670	32.48	1000	Pass
	11	15.16	32.80952931	0.9580	34.25	1000	Pass
11g (54Mbps)	1	13.19	20.84490883	0.8820	23.63	1000	Pass
	7	13.41	21.92804935	0.8856	24.76	1000	Pass
	11	13.45	22.1309471	0.8749	25.30	1000	Pass
11n (MCS 7)	1	12.62	18.28100216	0.8734	20.93	1000	Pass
	7	12.74	18.79316817	0.8749	21.48	1000	Pass
	11	12.85	19.27524913	0.8664	22.25	1000	Pass
BT (1MB/s)	1	7.433	5.53732482	0.3064	18.07	1000	Pass
	40	7.868	6.120684589	0.3064	19.98	1000	Pass
	79	7.146	5.183224264	0.3065	16.91	1000	Pass
BT (2MB/s)	1	4.221	2.643017264	0.3118	8.48	1000	Pass
	40	4.219	2.64180039	0.3118	8.47	1000	Pass
	79	4.019	2.522899786	0.3118	8.09	1000	Pass
BT (3MB/s)	1	4.211	2.636938493	0.3118	8.46	1000	Pass
	40	4.193	2.626031916	0.3120	8.42	1000	Pass
	79	3.977	2.498618781	0.3118	8.01	1000	Pass

6.7.2 Peak Output Power – Result Plots

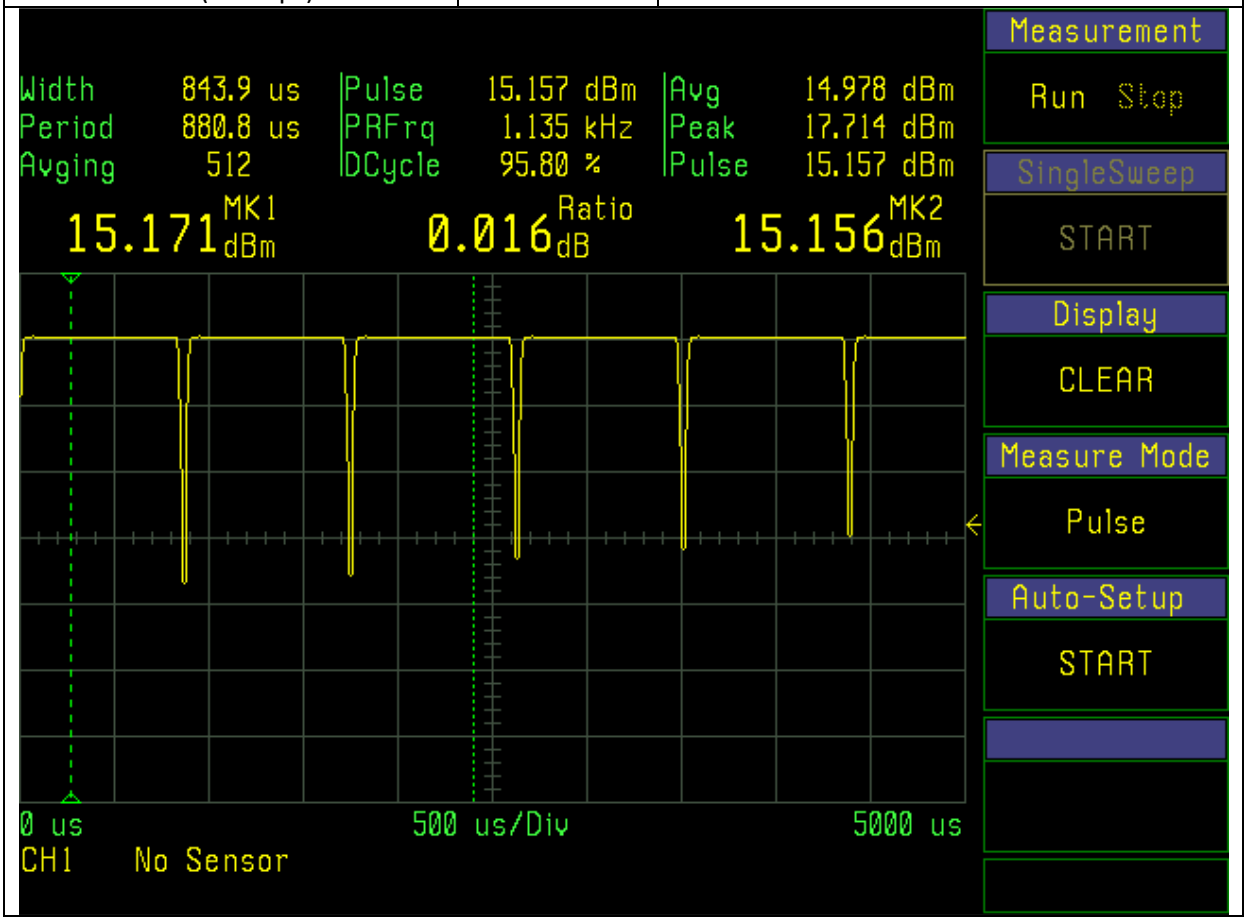
Modulation	Channel	Peak Output Power (dBm)
11b (11Mbps)	01	15.06



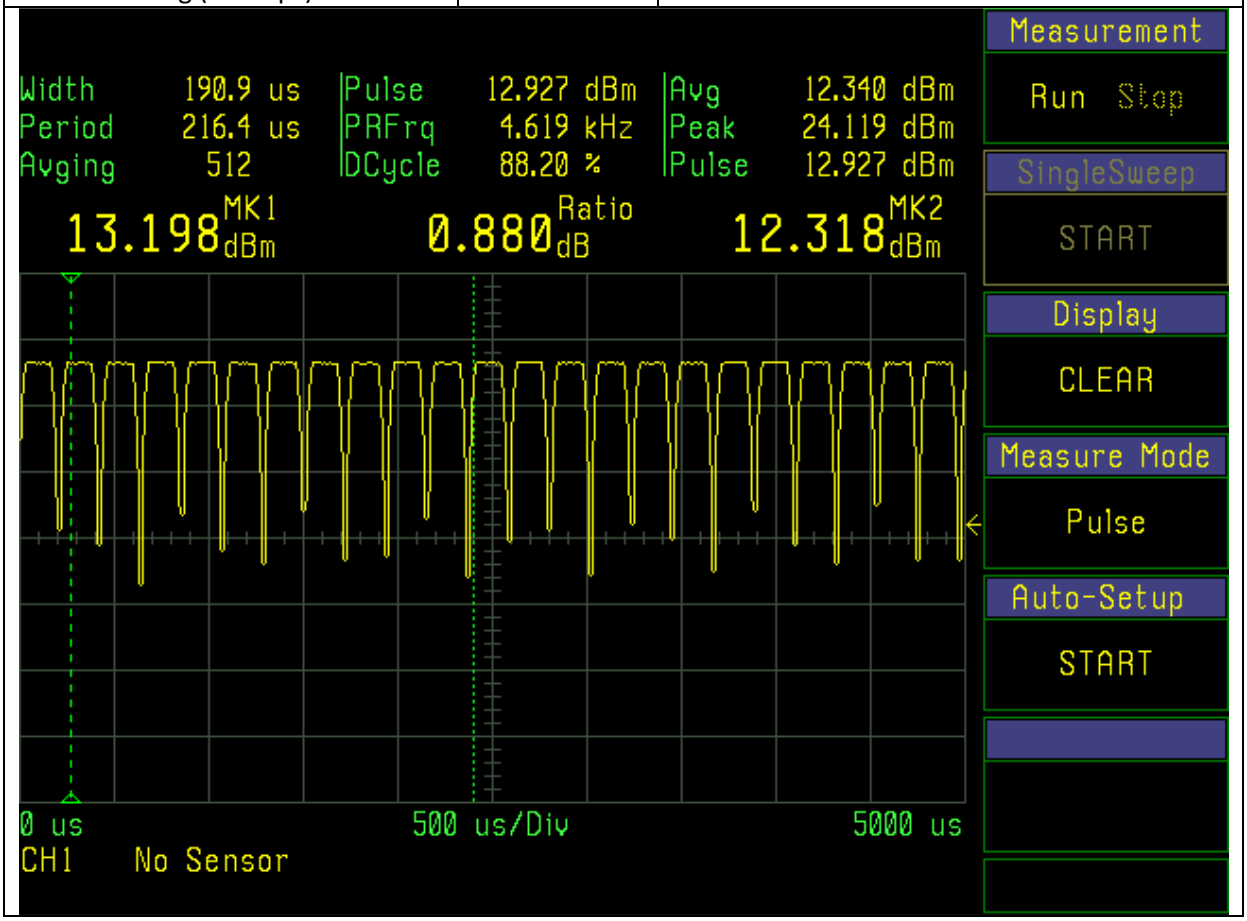
Modulation	Channel	Peak Output Power (dBm)
11b (11Mbps)	07	14.97



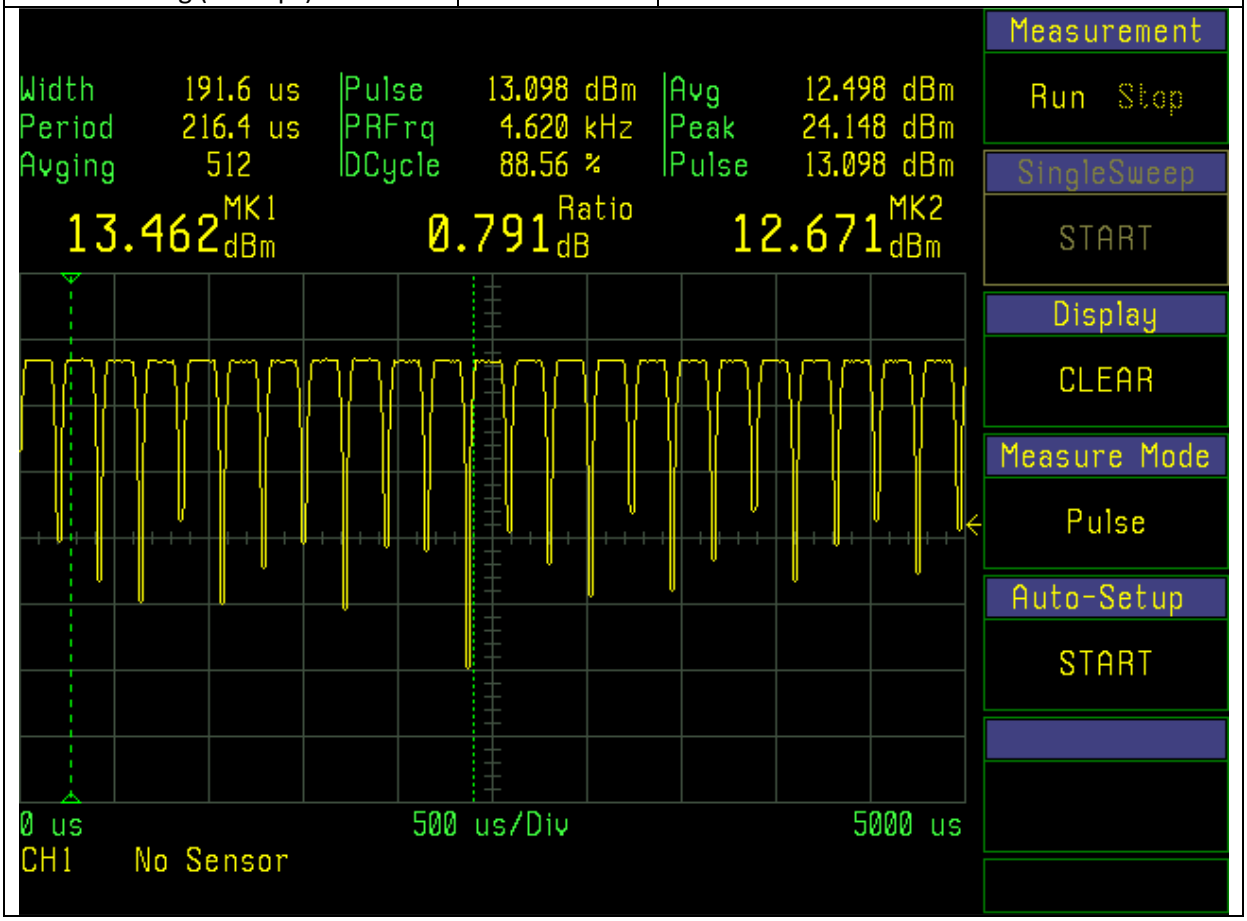
Modulation	Channel	Peak Output Power (dBm)
11b (11Mbps)	11	15.16



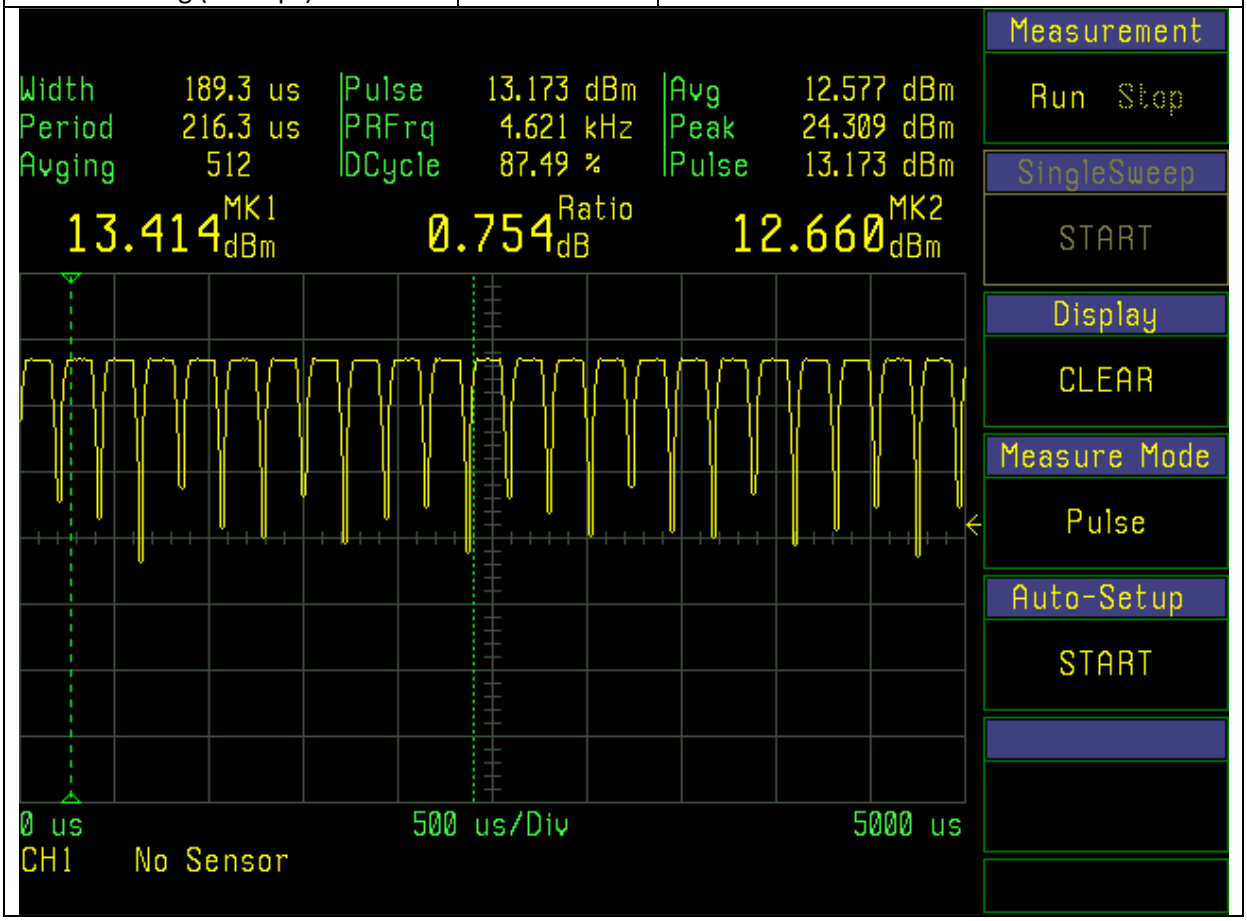
Modulation	Channel	Peak Output Power (dBm)
11g (54Mbps)	01	13.19



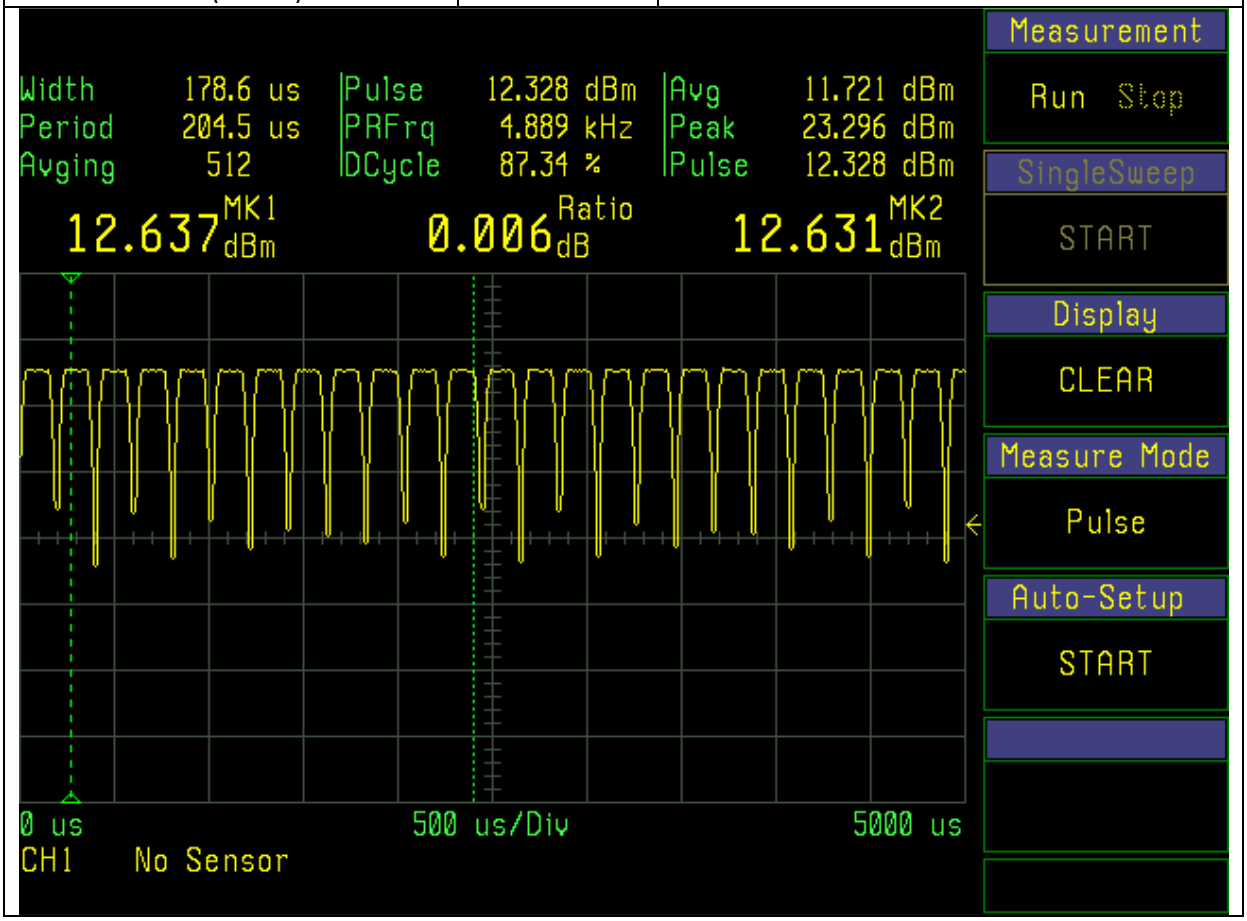
Modulation	Channel	Peak Output Power (dBm)
11g (54Mbps)	07	13.41



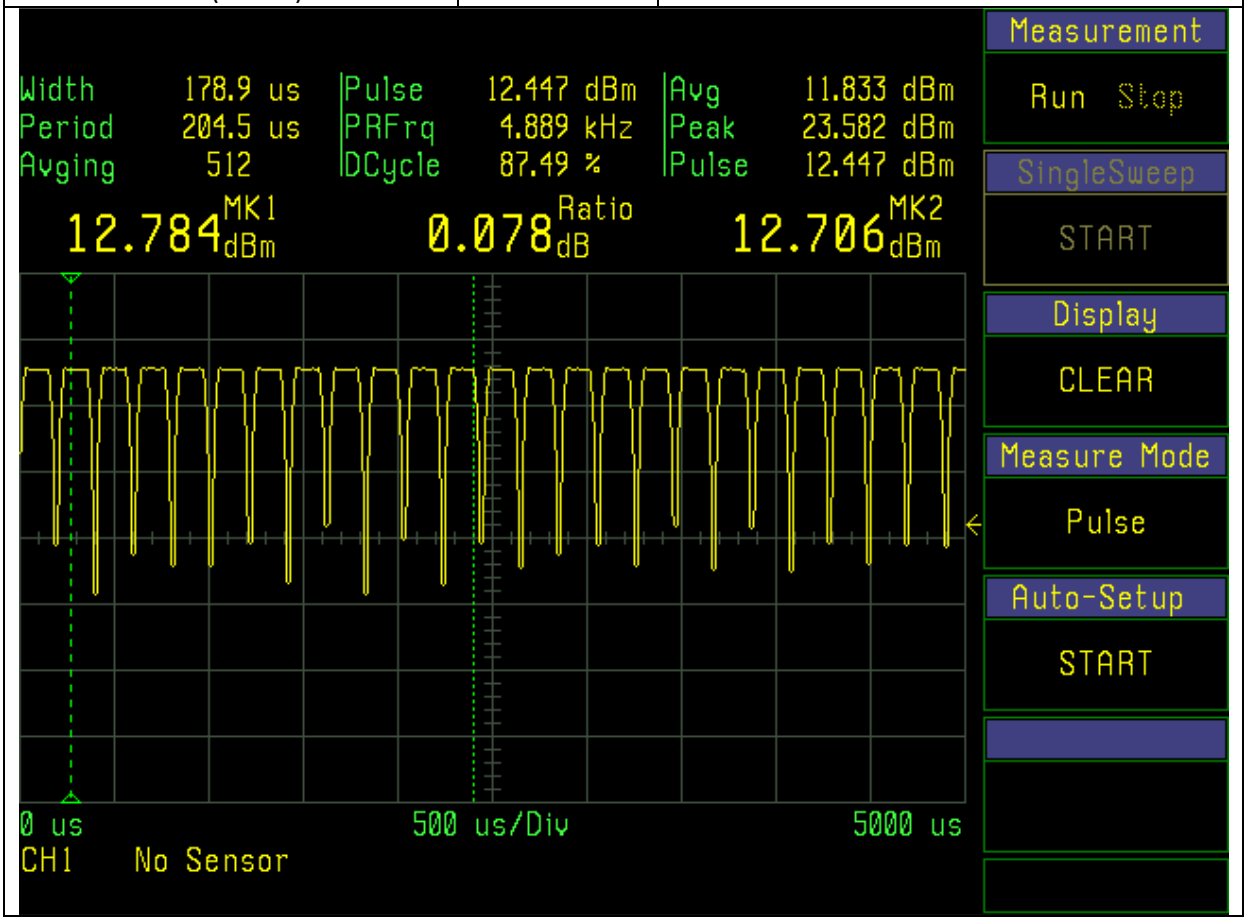
Modulation	Channel	Peak Output Power (dBm)
11g (54Mbps)	11	13.45



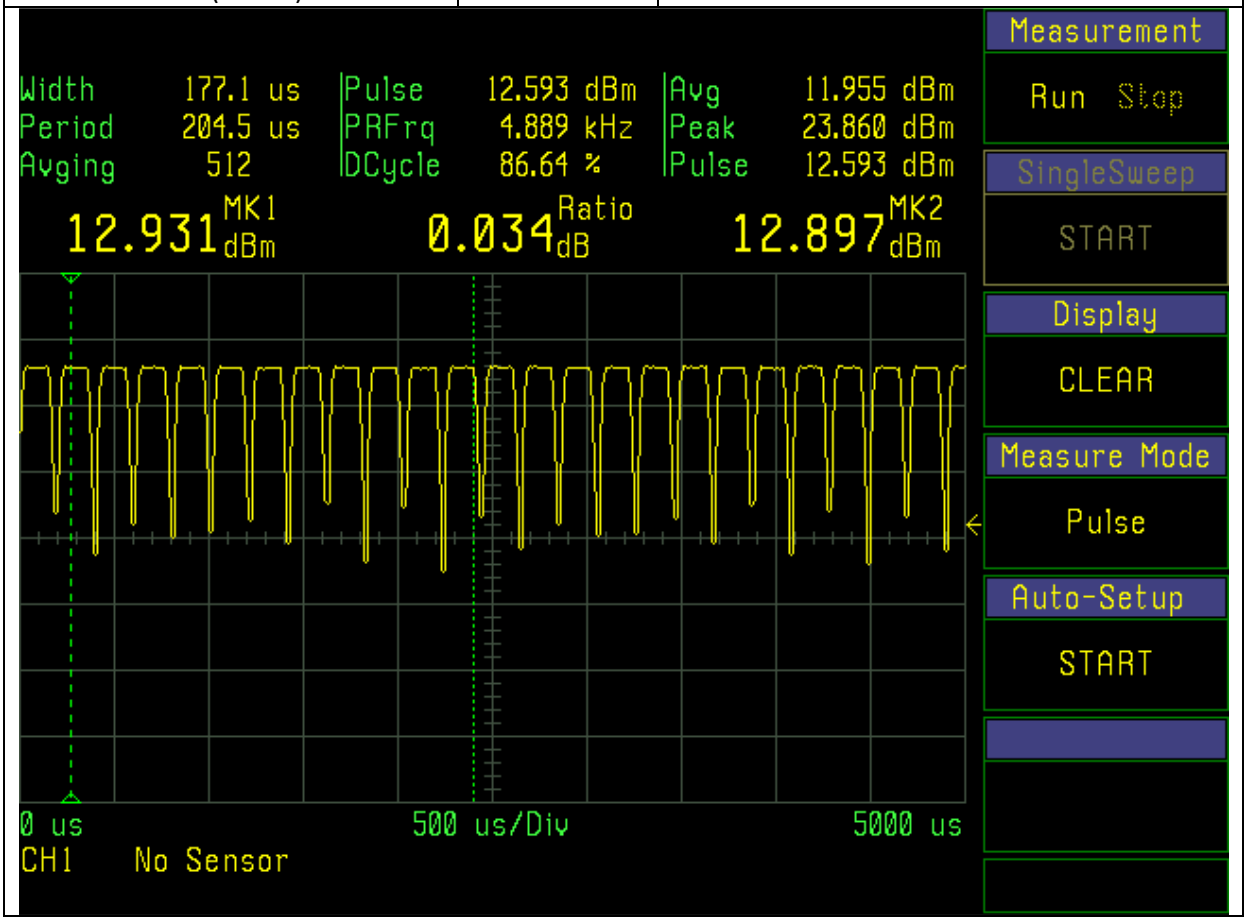
Modulation	Channel	Peak Output Power (dBm)
11n (MCS 7)	01	12.62



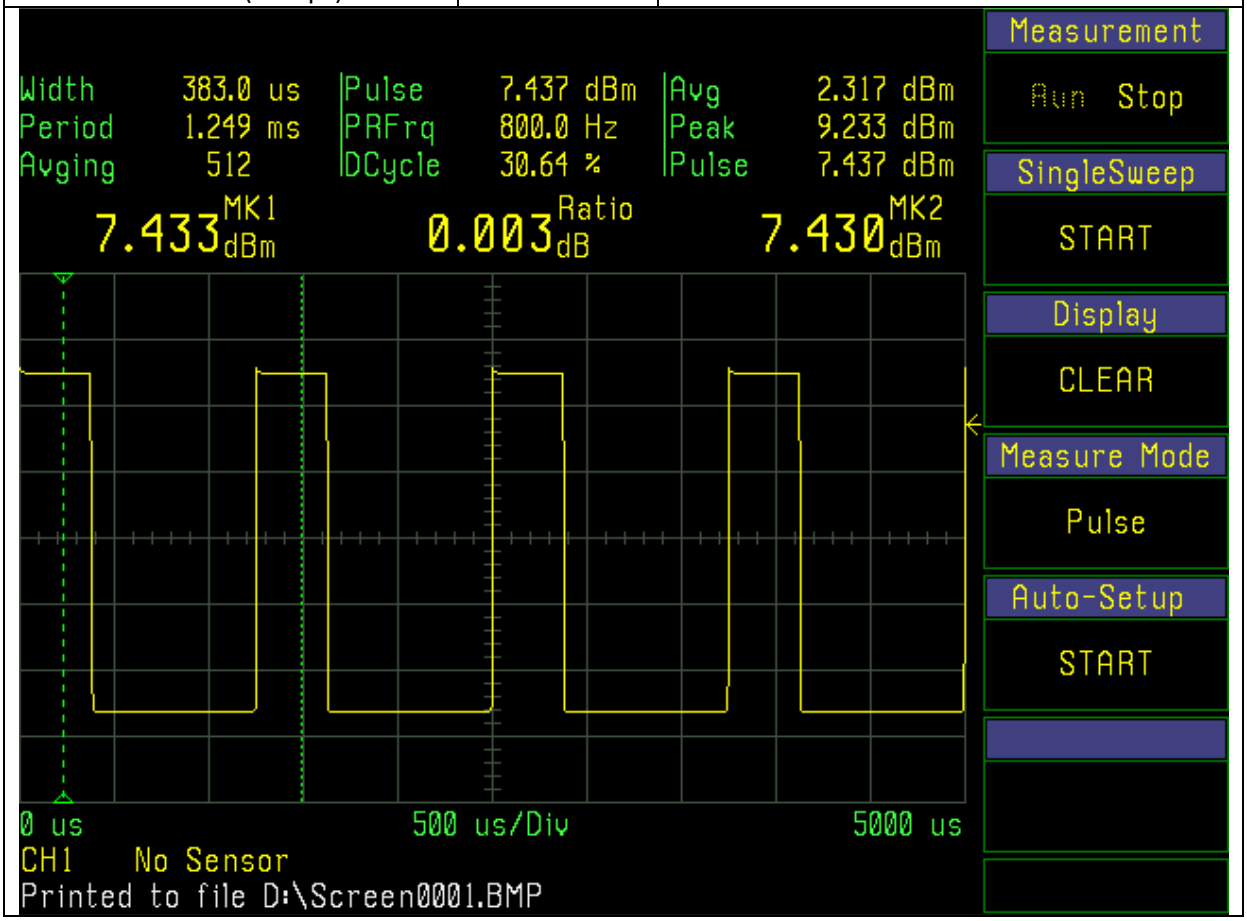
Modulation	Channel	Peak Output Power (dBm)
11n (MCS 7)	07	12.74



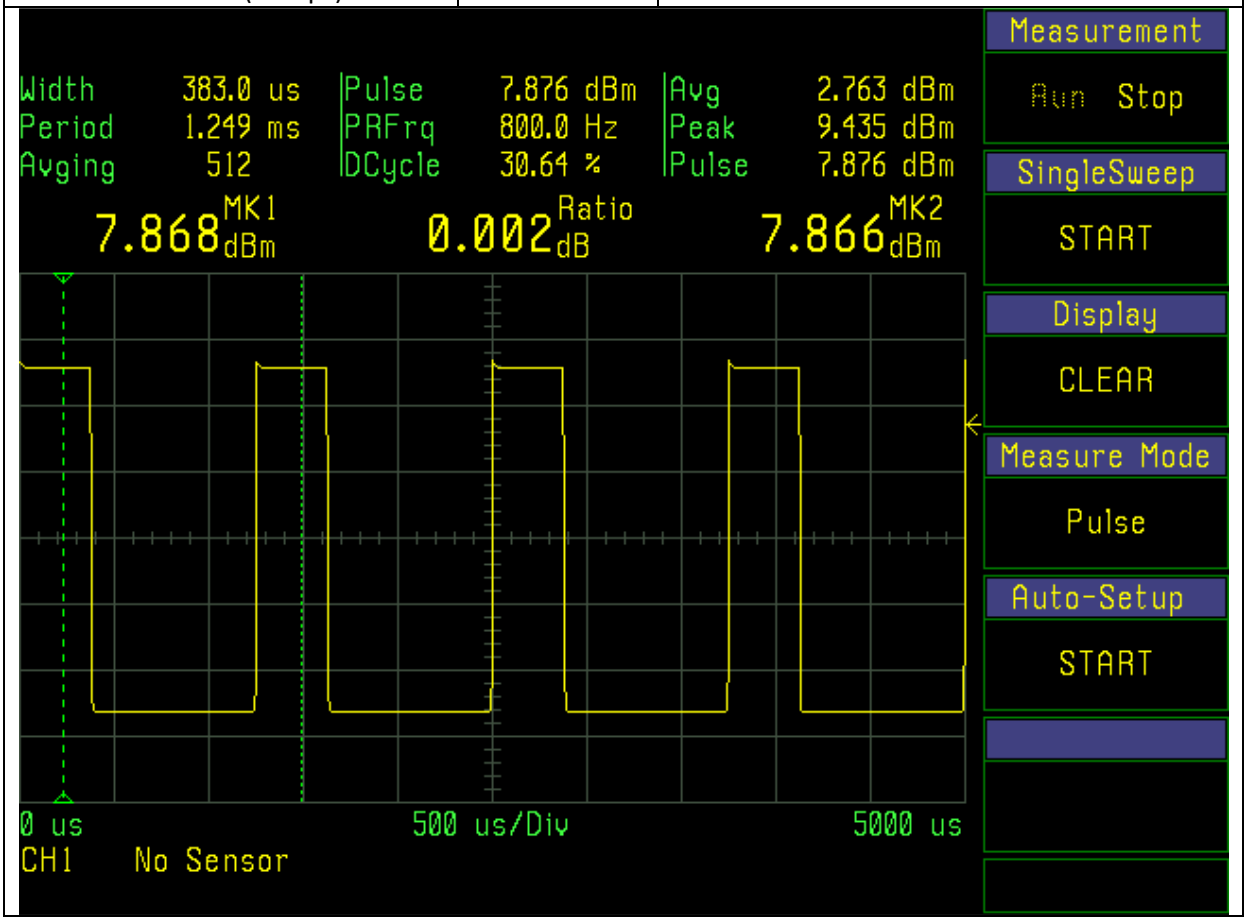
Modulation	Channel	Peak Output Power (dBm)
11n (MCS 7)	11	12.85



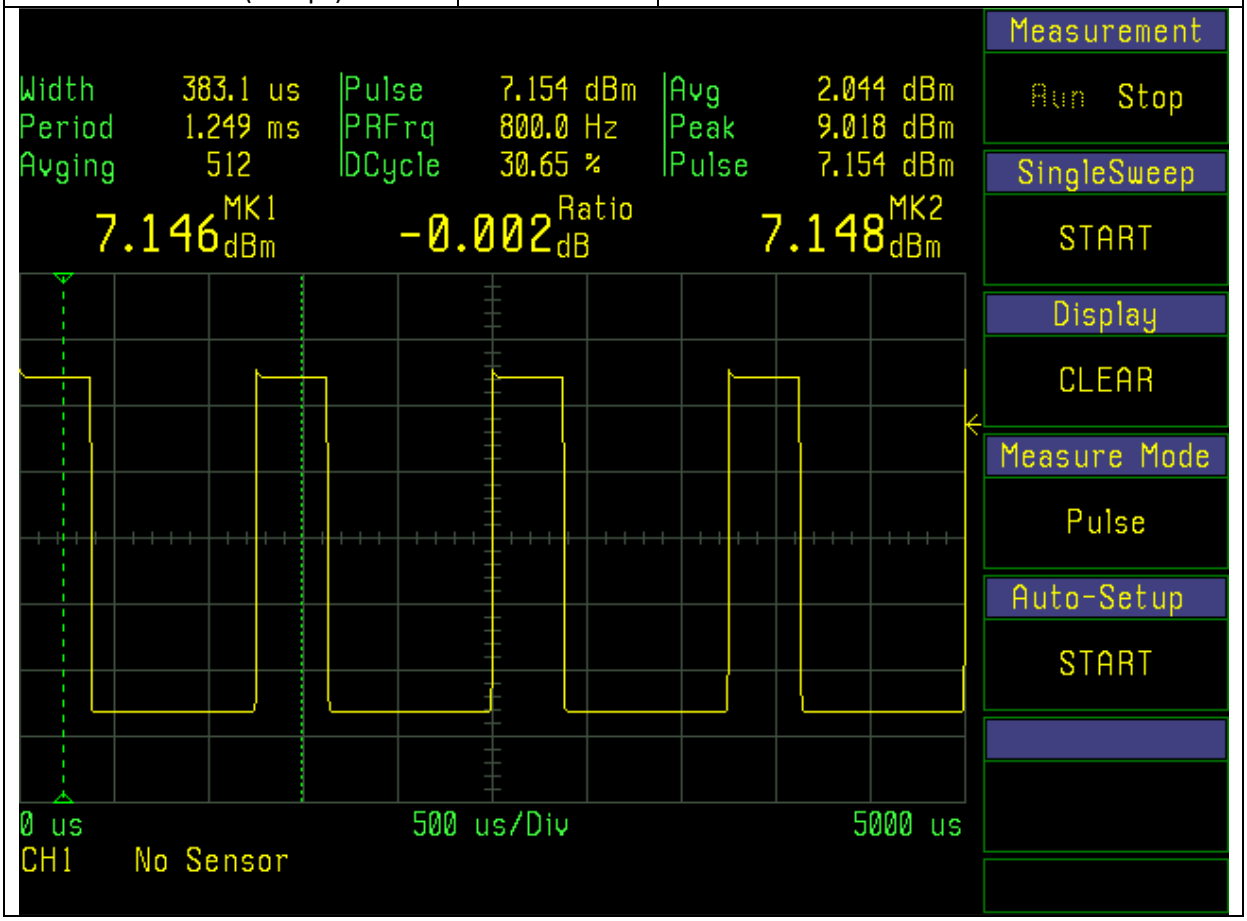
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (1Mbps)	01	7.433



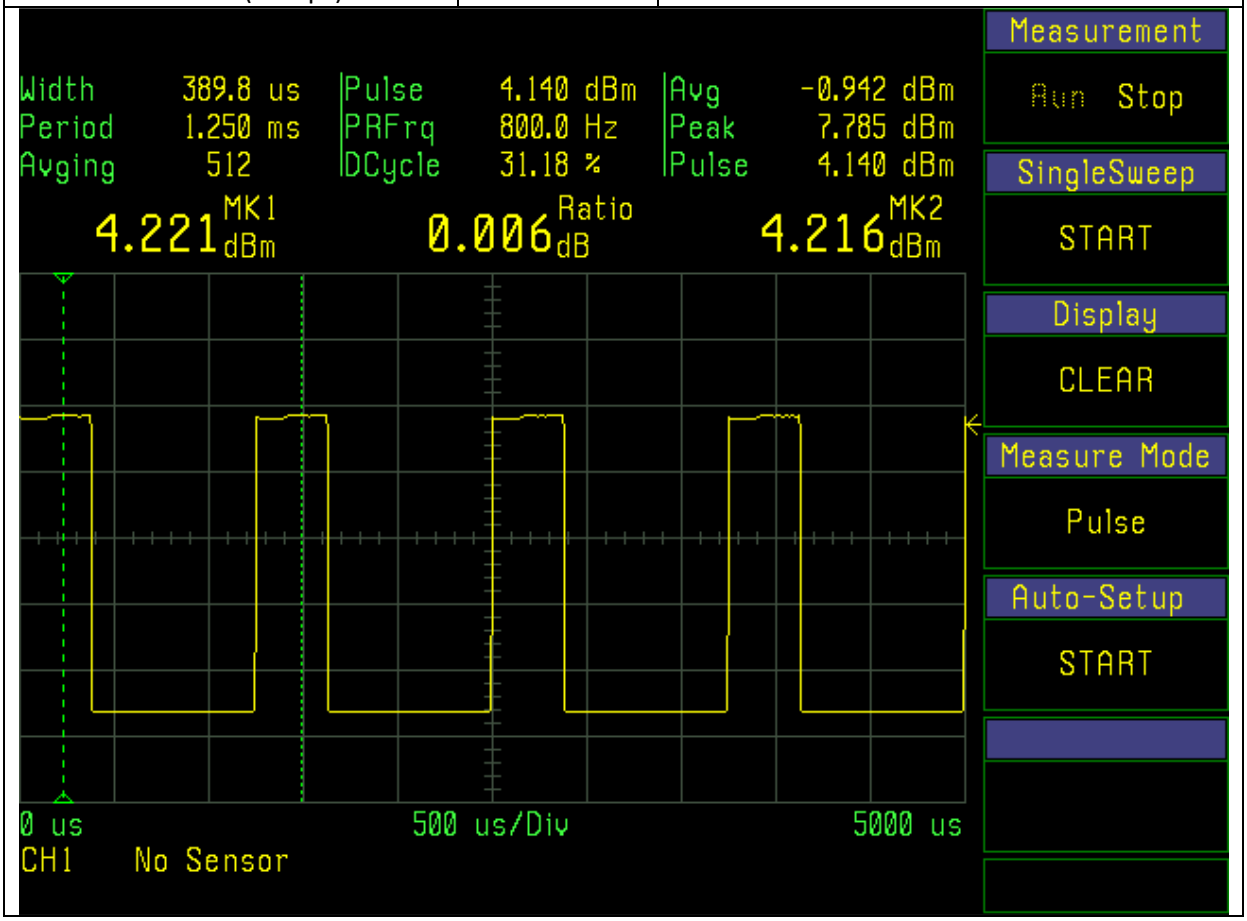
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (1Mbps)	40	7.868



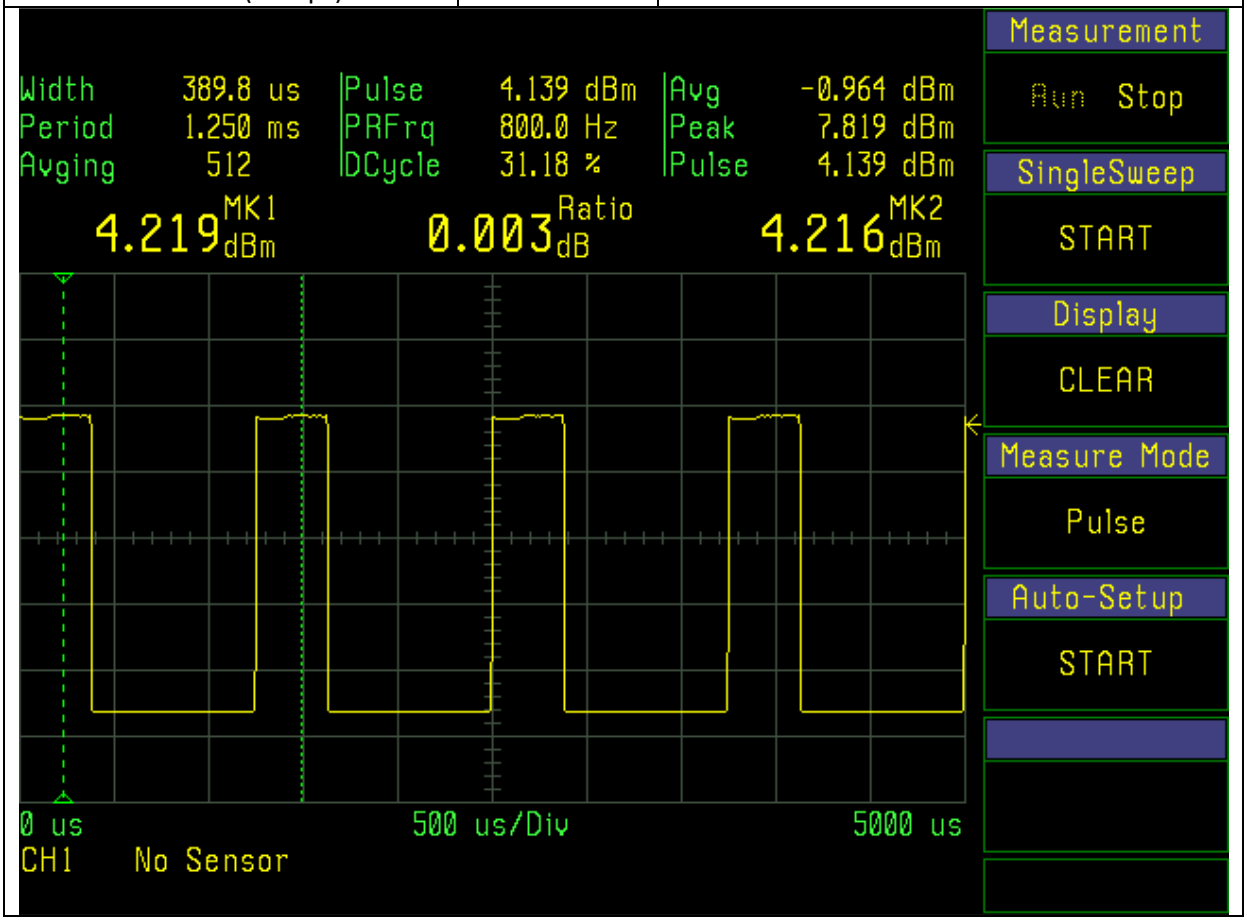
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (1Mbps)	79	7.146



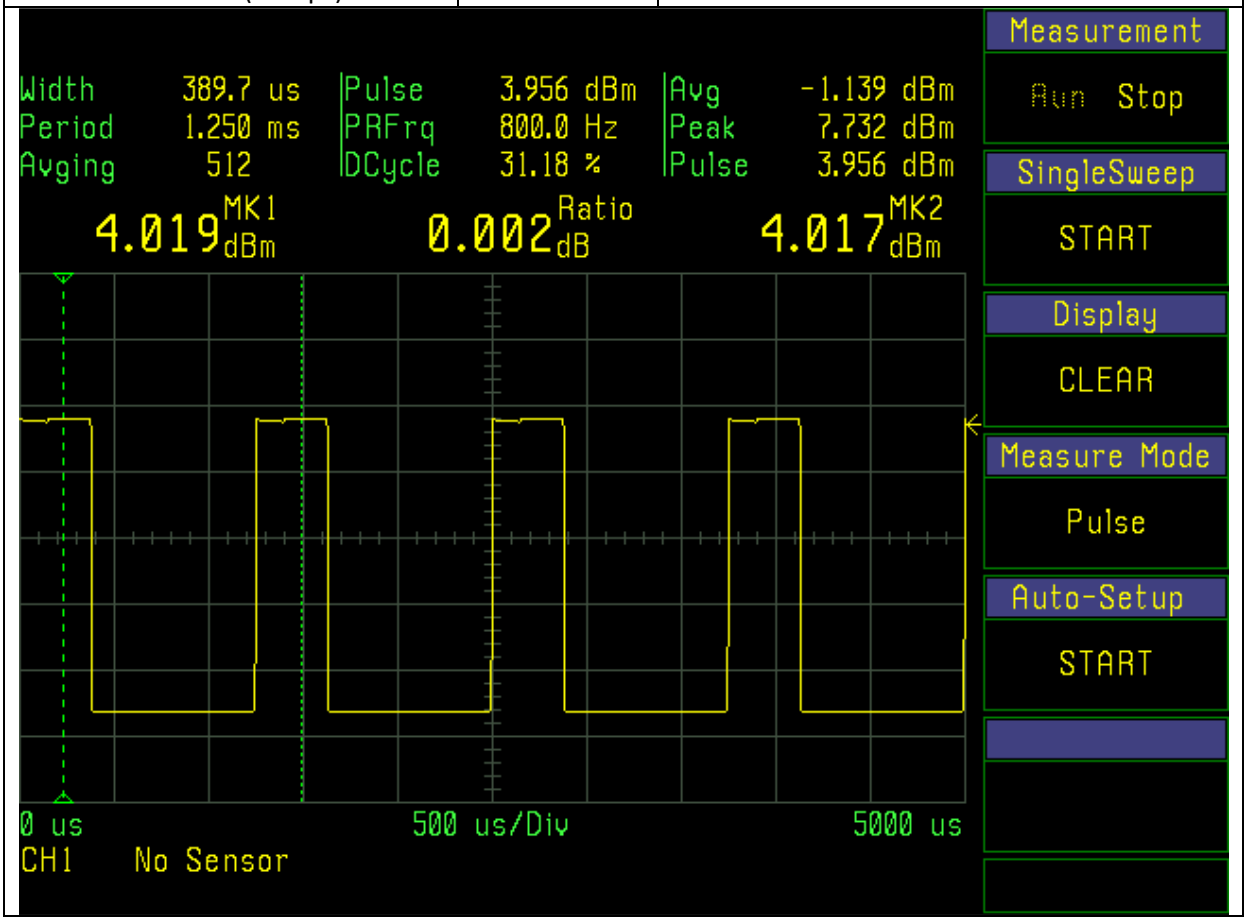
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (2Mbps)	01	4.221



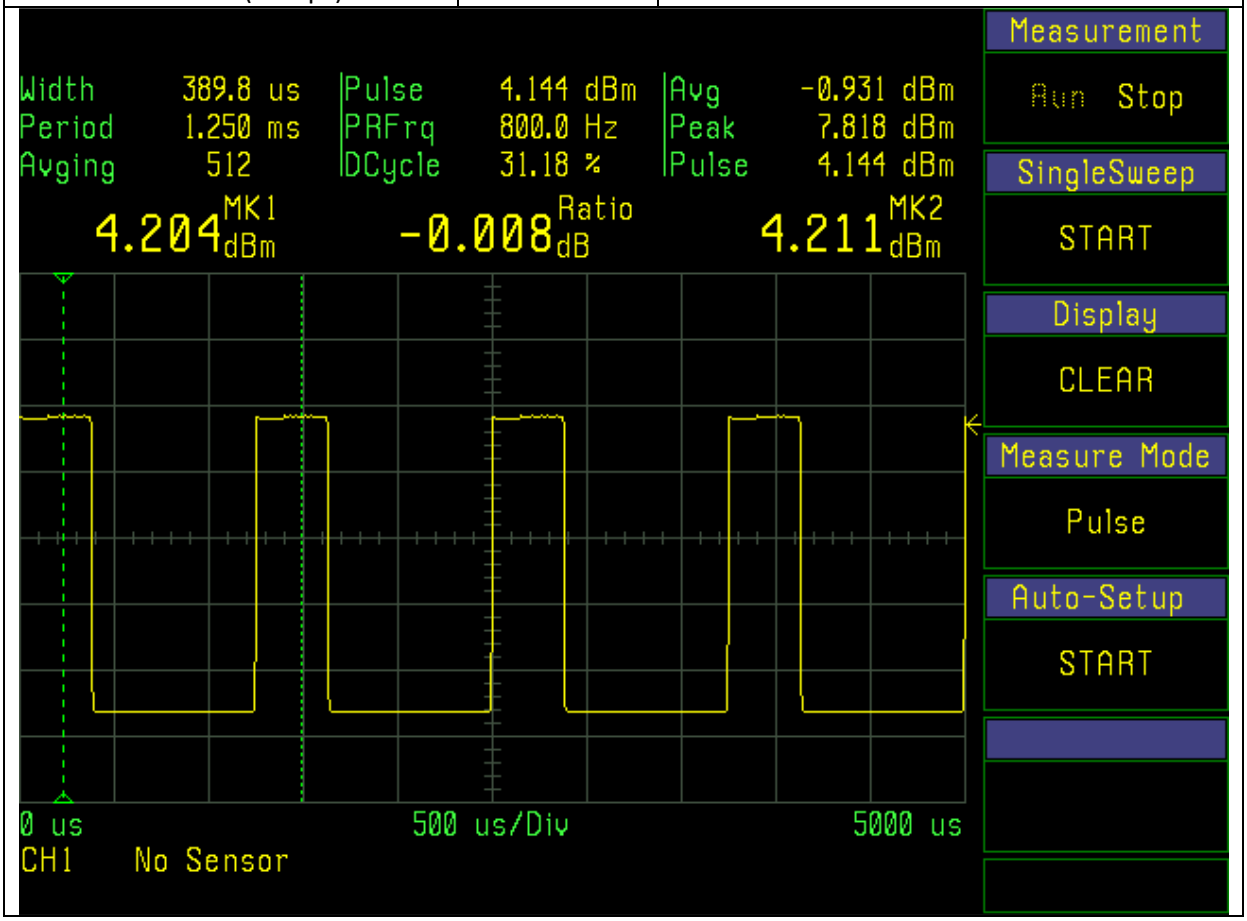
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (2Mbps)	40	4.219



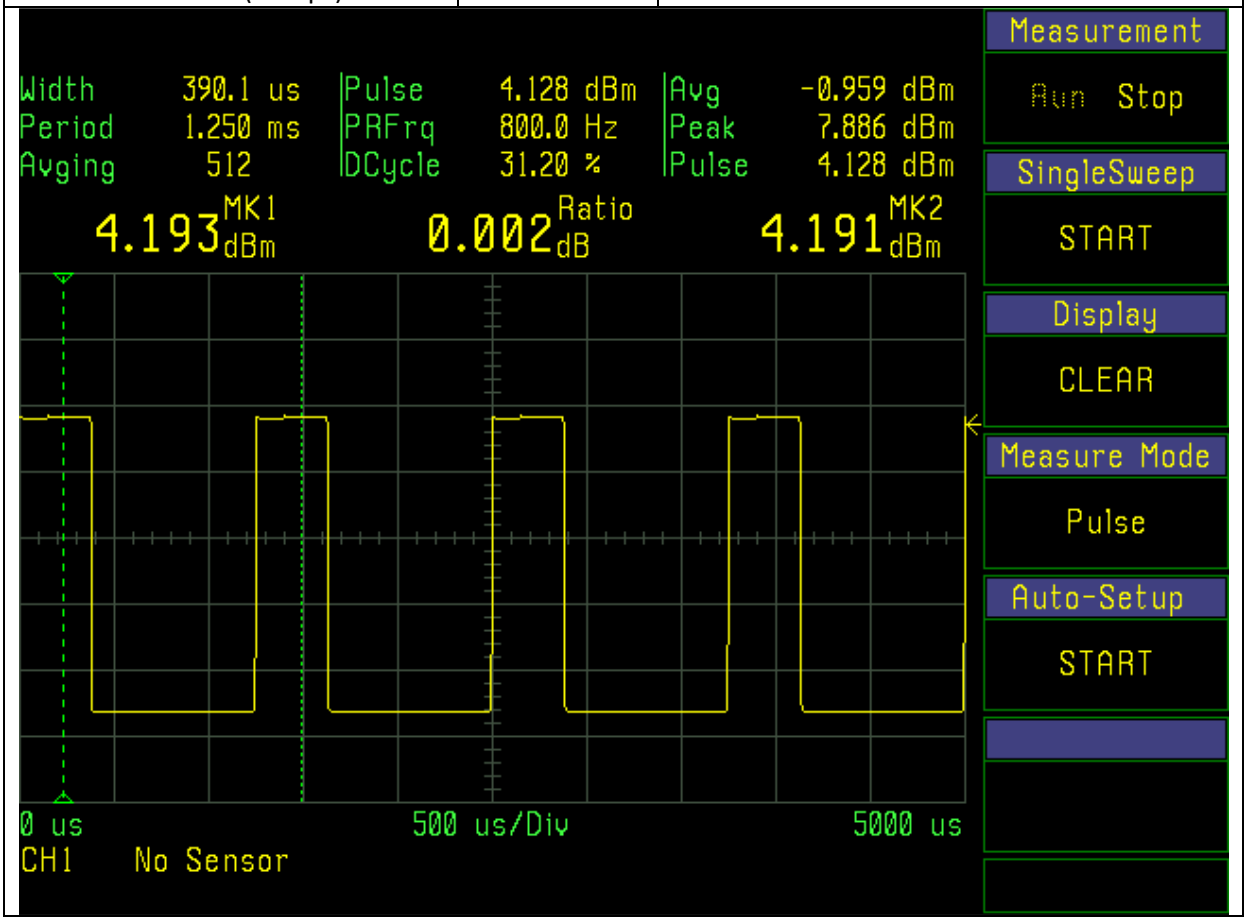
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (2Mbps)	79	4.019



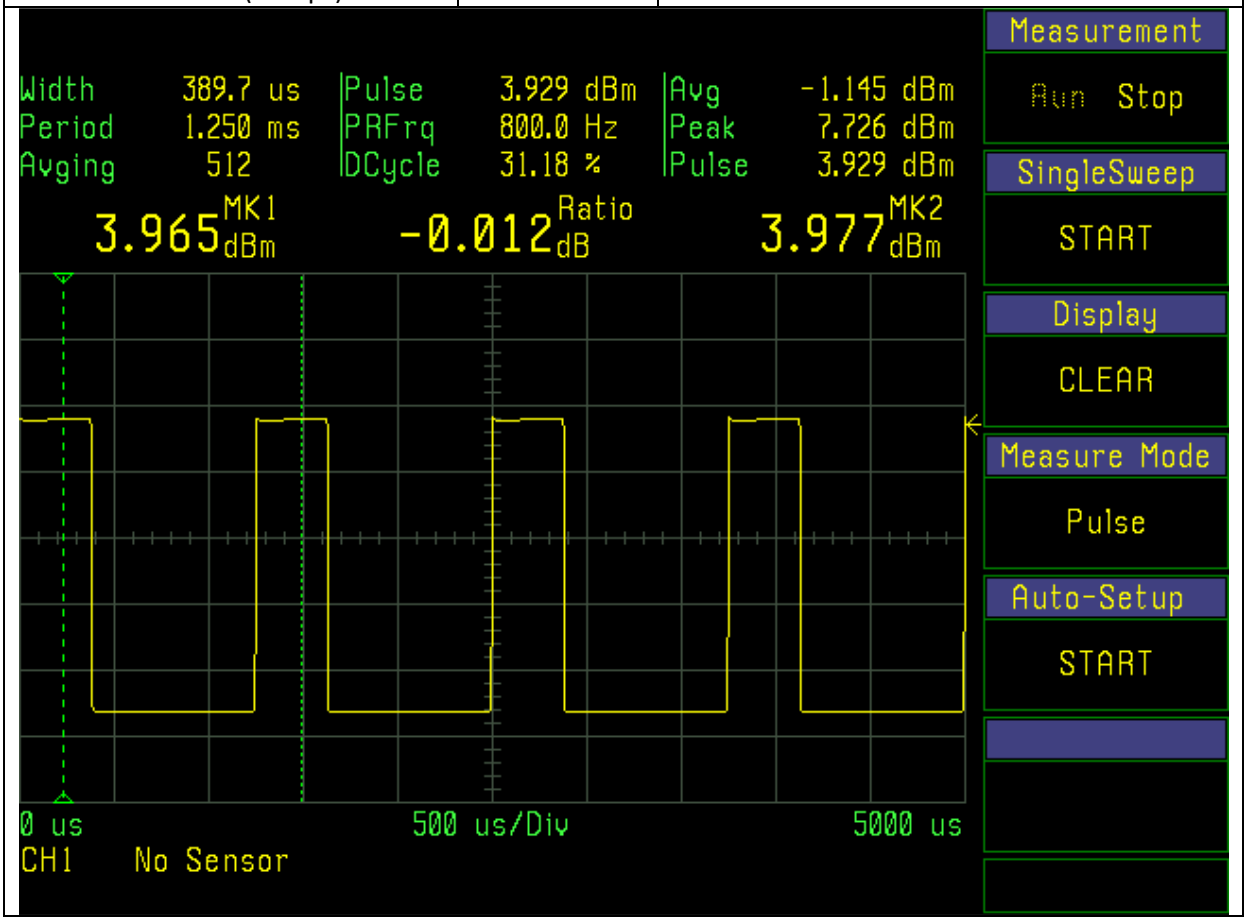
Modulation	Channel	Peak Output Power (dBm)
Bluetooth (3Mbps)	01	4.211



Modulation	Channel	Peak Output Power (dBm)
Bluetooth (3Mbps)	40	4.193



Modulation	Channel	Peak Output Power (dBm)
Bluetooth (3Mbps)	79	3.977



Comments: None.
Test Unit: 001 (Conducted)
Test Setup: B (Conducted with peak power analyser)
Tested by: D. Jamieson
Test Date/s: 22nd February 2017 and 3rd March 2017
Test Status: **PASS**

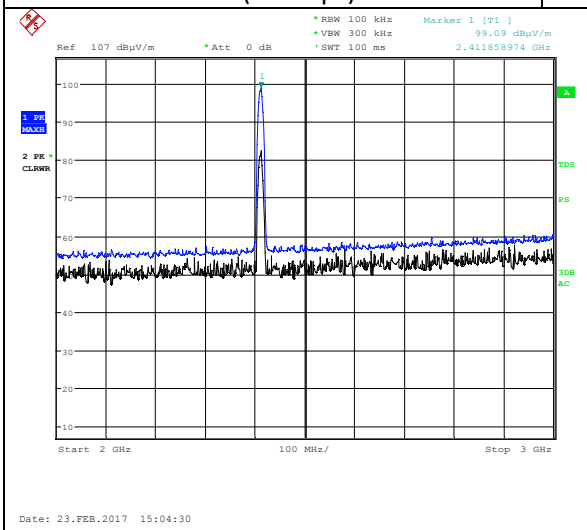
6.8 Spurious Emissions (2GHz to 26GHz)

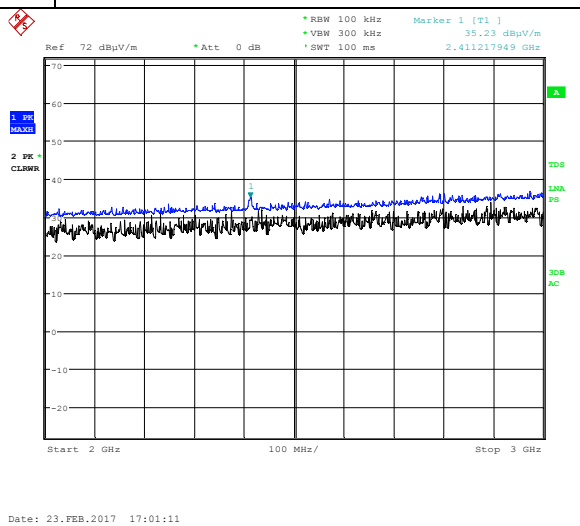
6.8.1 Spurious Emissions (2GHz to 26GHz) – Results Summary

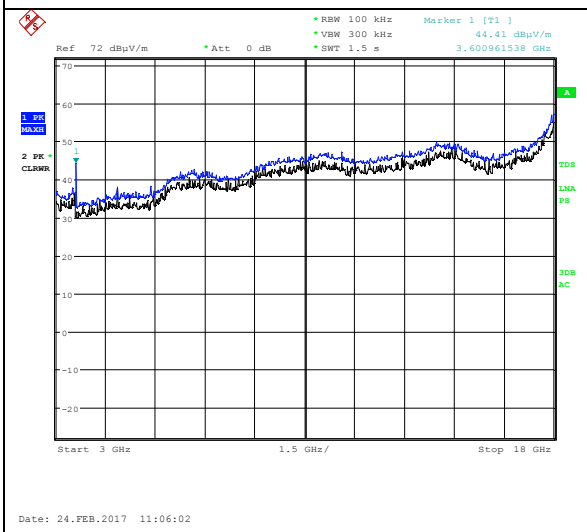
Mod.	Channel	Carrier Peak Emission (dBµV/m)	Result
11b (11Mbps)	1	99.09	Pass
	7	98.91	Pass
	11	100.55	Pass
11g (54Mbps)	1	96.19	Pass
	7	95.89	Pass
	11	96.31	Pass
11n (MCS 7)	1	95.44	Pass
	7	94.95	Pass
	11	96.48	Pass
Wi-Fi Receive	7	N/A	Pass
Bluetooth (1Mbps)	1	101.12	Pass
	40	101.52	Pass
	79	100.65	Pass
Bluetooth (2Mbps)	1	97.42	Pass
	40	97.70	Pass
	79	96.66	Pass
Bluetooth (3Mbps)	1	96.81	Pass
	40	96.61	Pass
	79	96.29	Pass
Bluetooth Receive	40	N/A	Pass

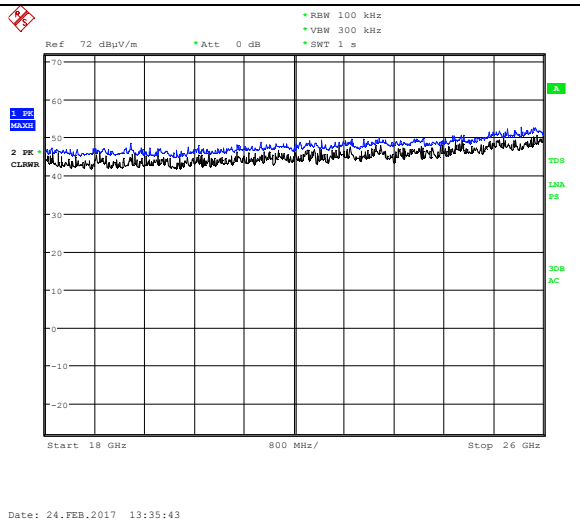
6.8.2 Spurious Emissions (2GHz to 26GHz) – Result Plots

Modulation	Channel	Peak Emission (dBµV/m)
11b (11Mbps)	01	99.09

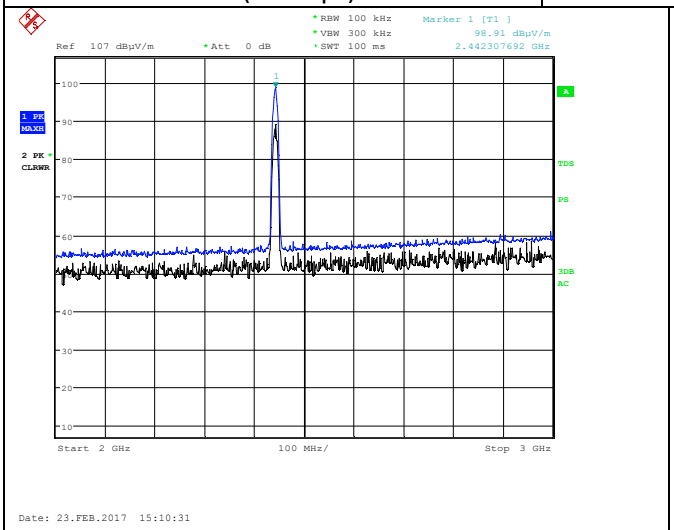


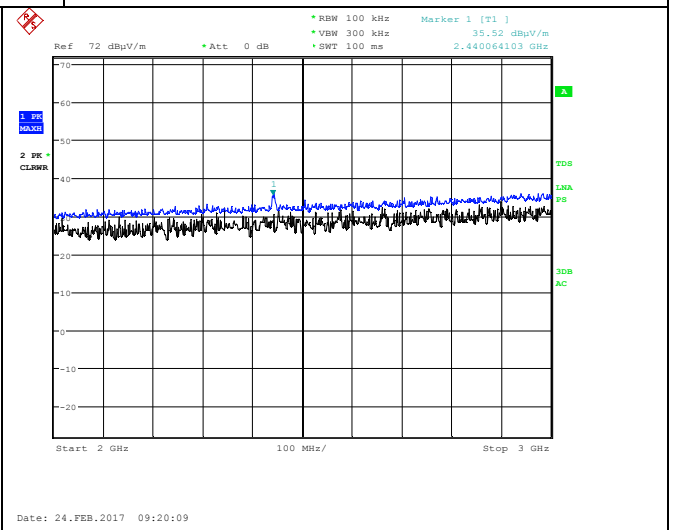


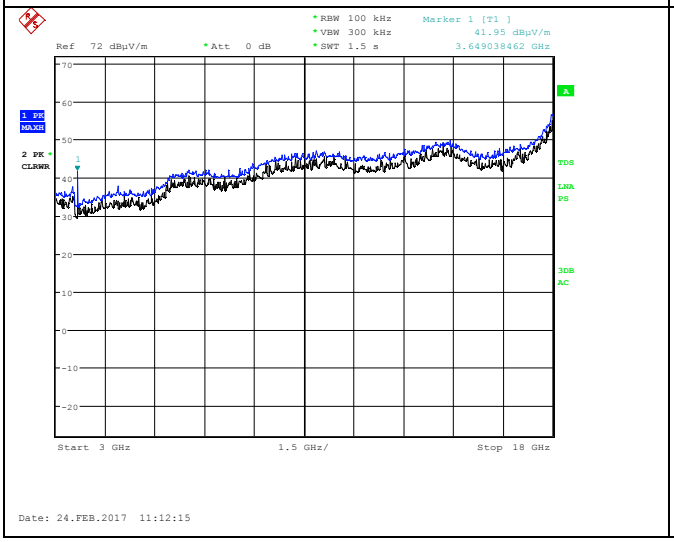


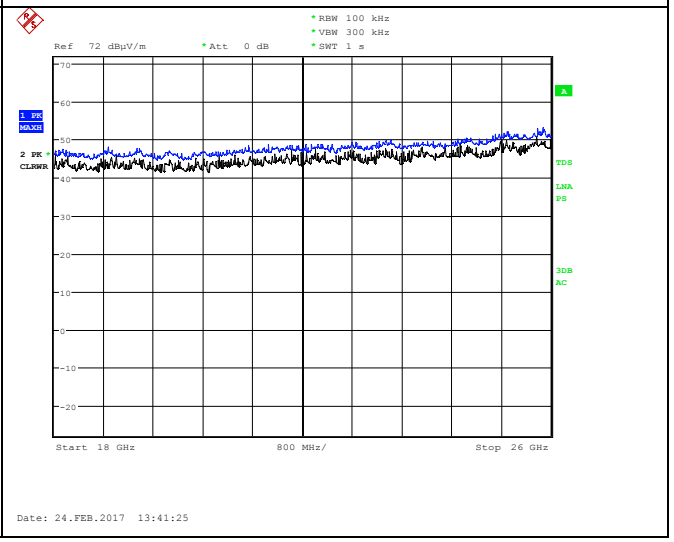


Modulation	Channel	Peak Emission (dBµV/m)
11b (11Mbps)	07	98.91

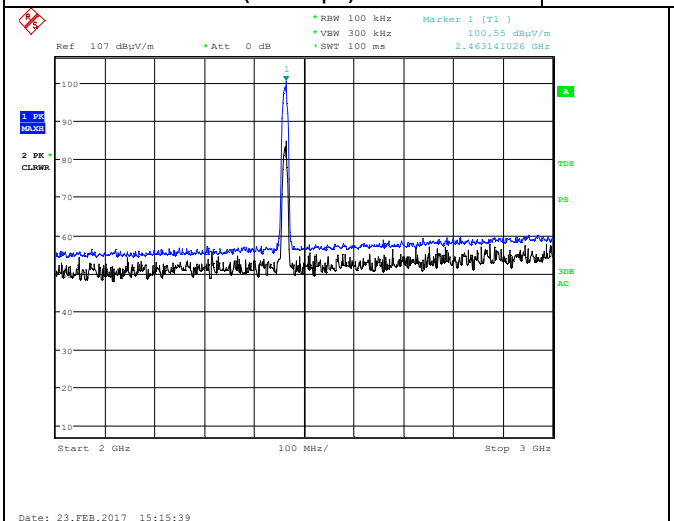


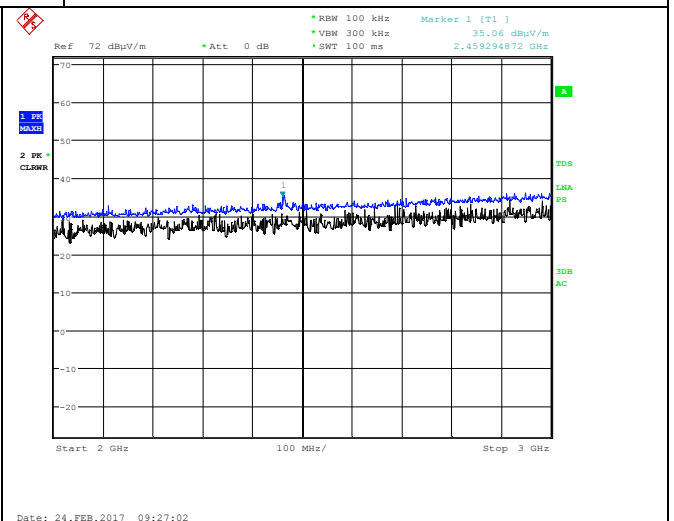


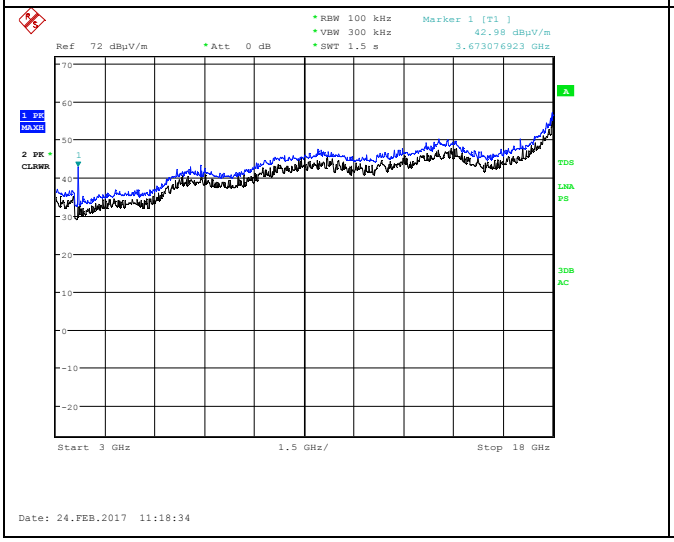


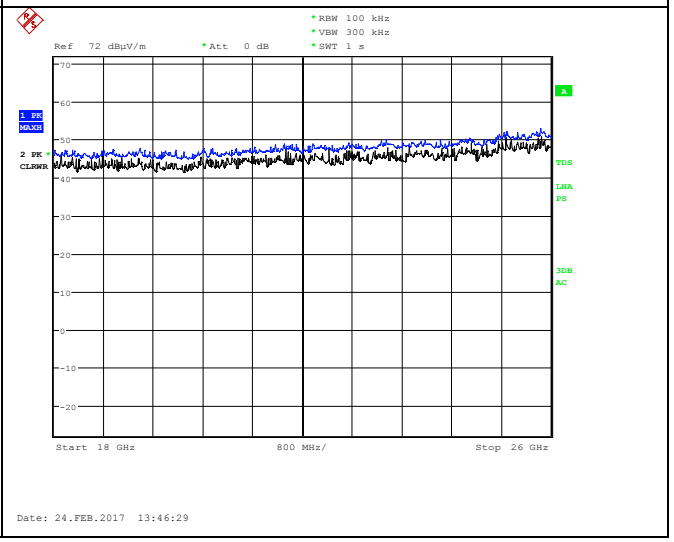


Modulation	Channel	Peak Emission (dBµV/m)
11b (11Mbps)	11	100.55

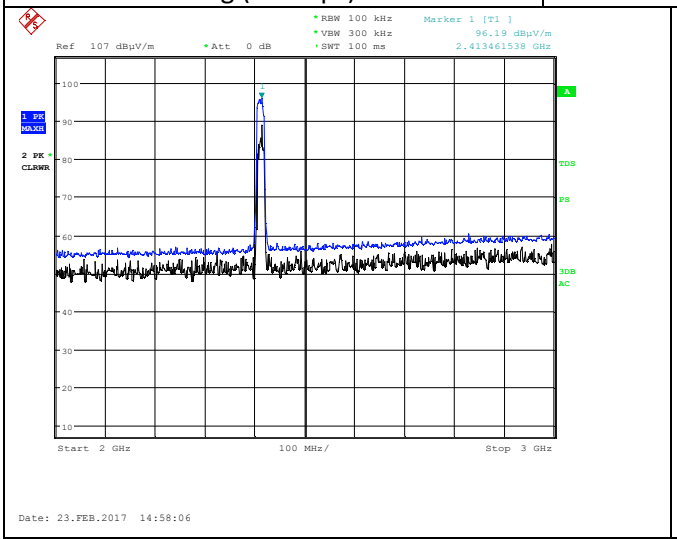


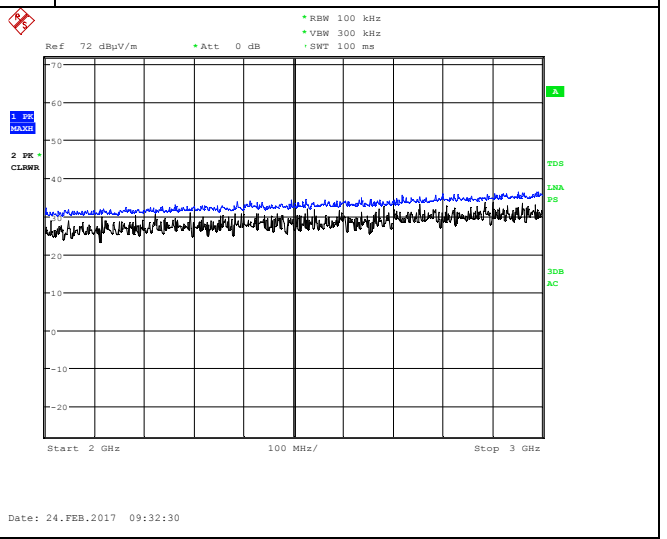


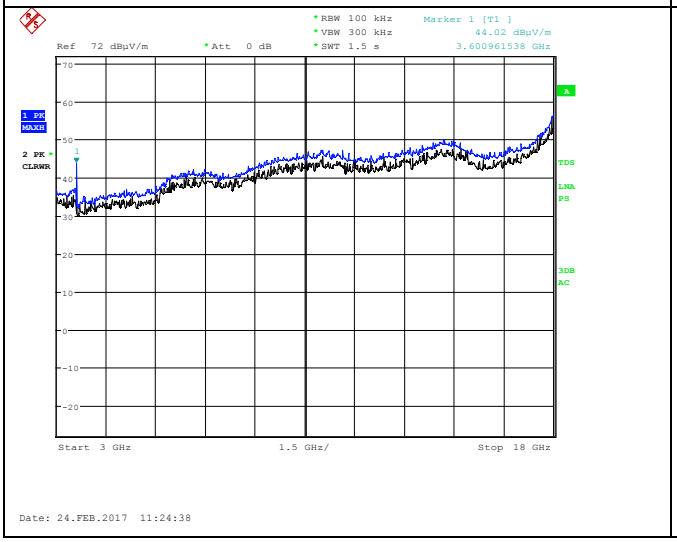


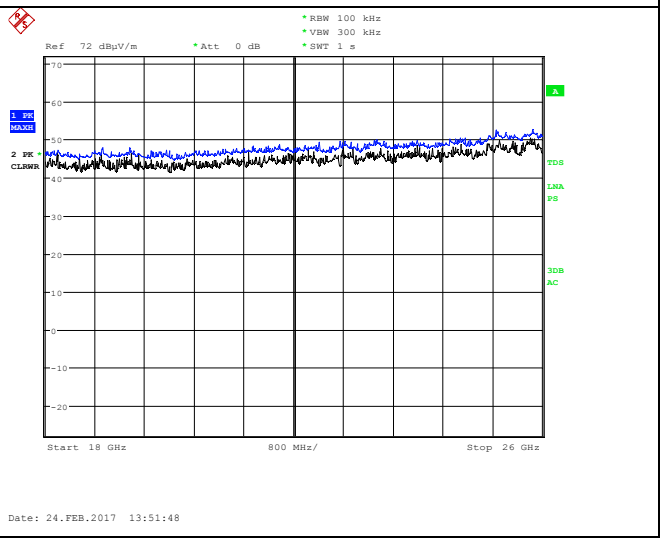


Modulation	Channel	Peak Emission (dBµV/m)
11g (54Mbps)	01	96.19

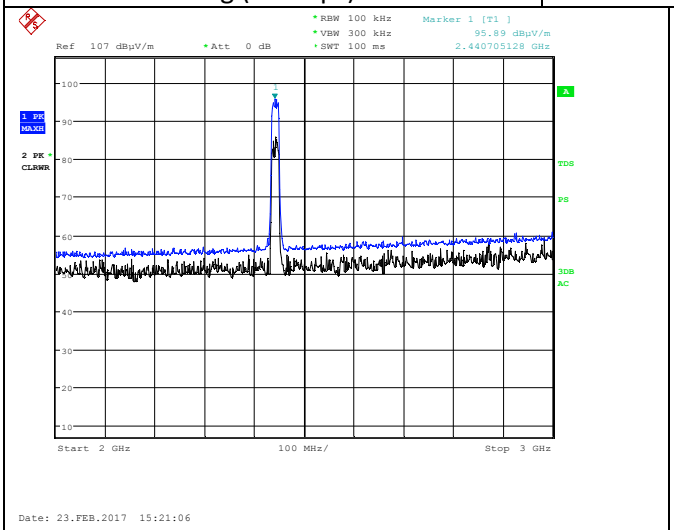


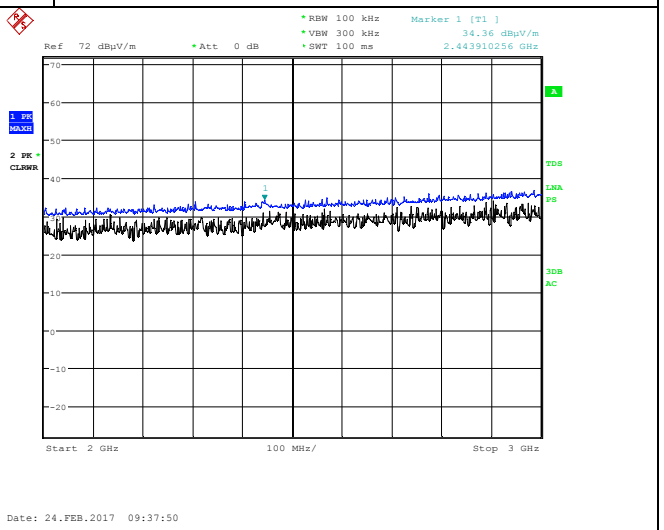


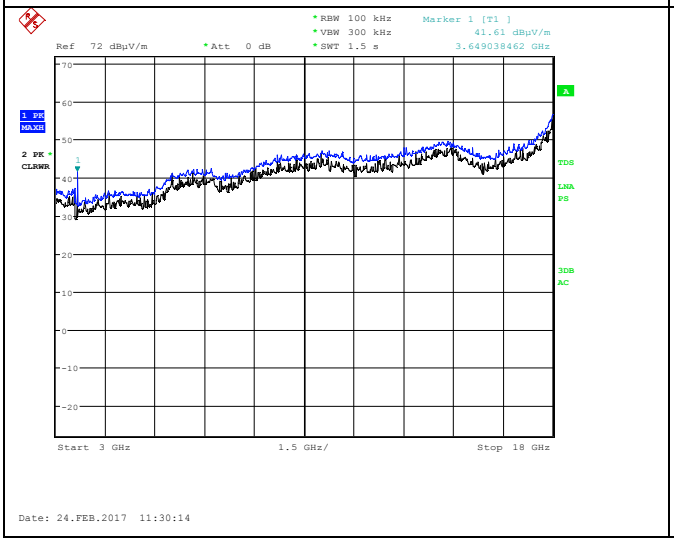


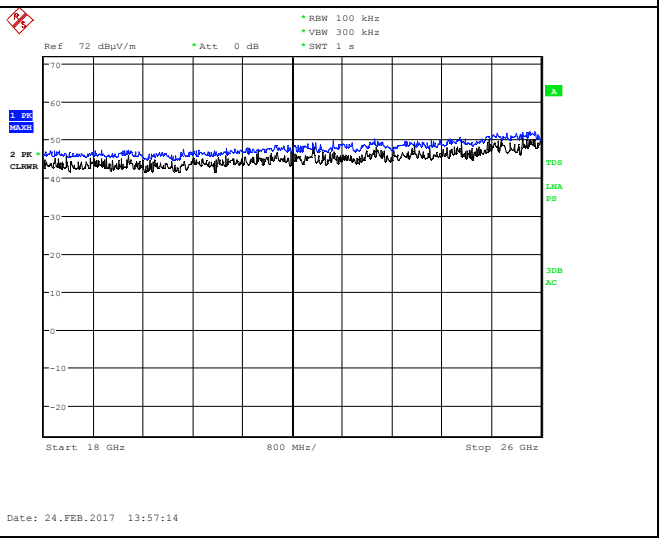


Modulation	Channel	Peak Emission (dBµV/m)
11g (54Mbps)	07	95.89

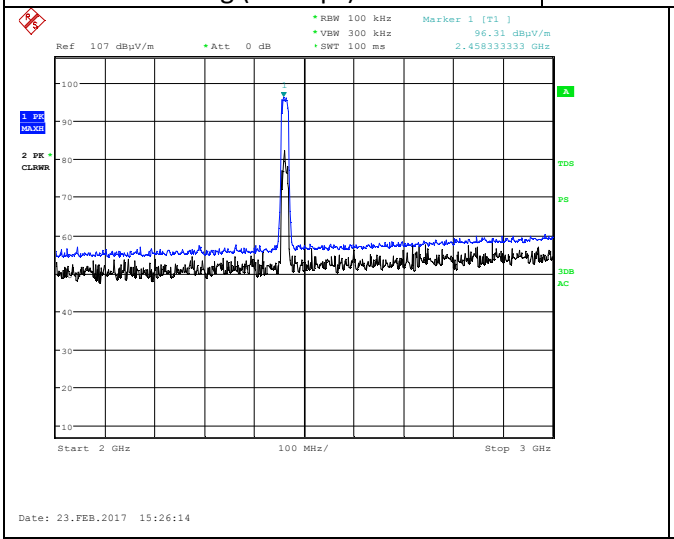


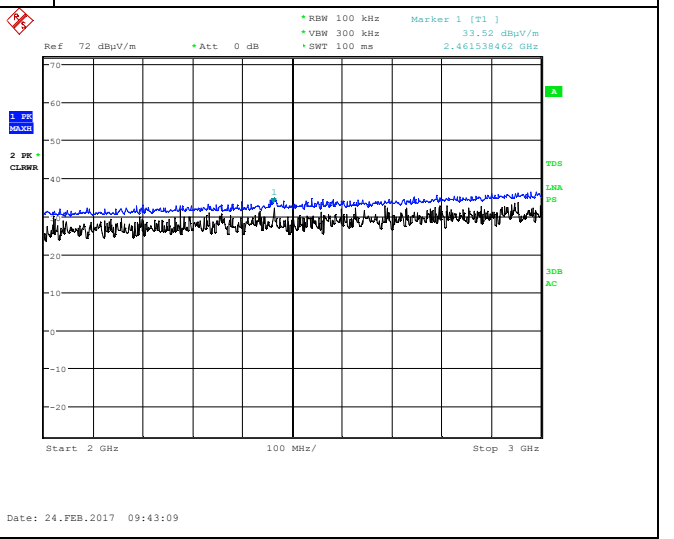


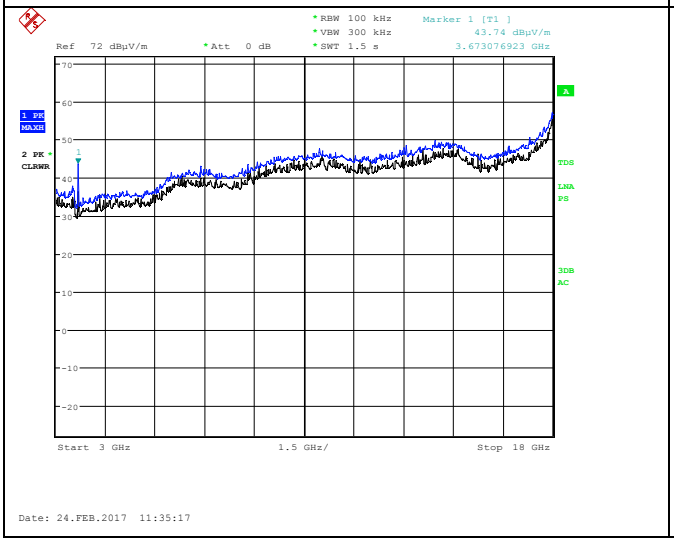


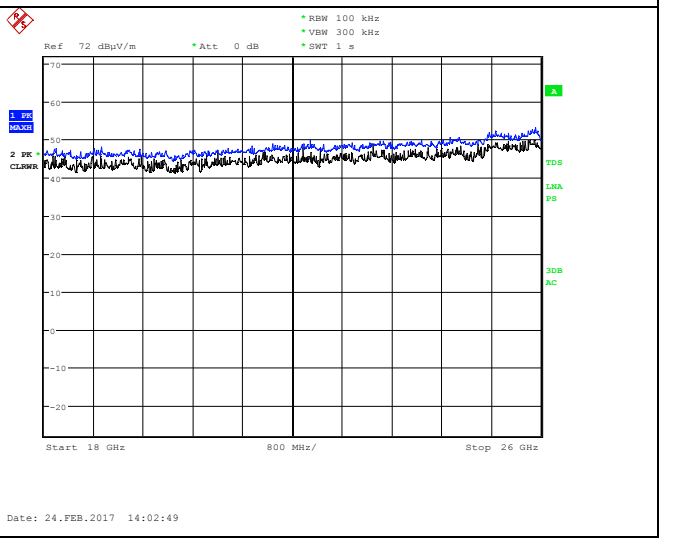


Modulation	Channel	Peak Emission (dBµV/m)
11g (54Mbps)	11	96.31

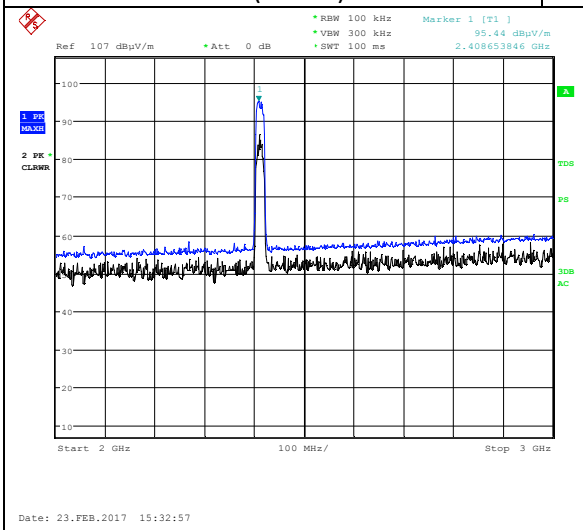


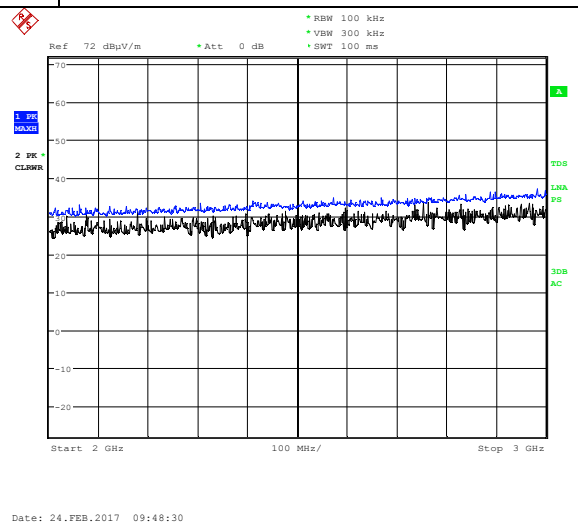


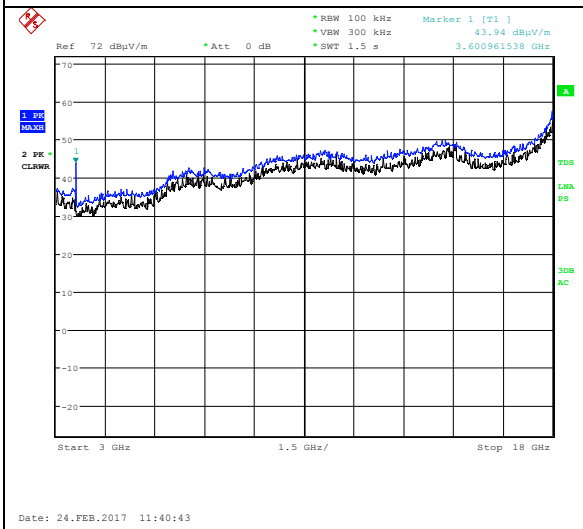


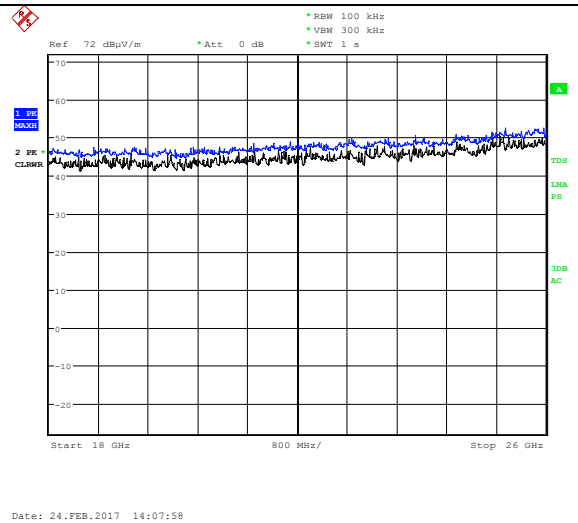


Modulation	Channel	Peak Emission (dBµV/m)
11n (MCS 7)	01	95.44

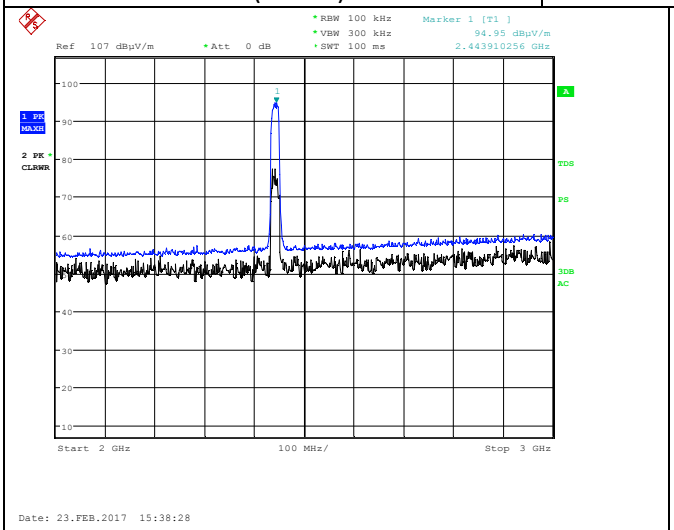


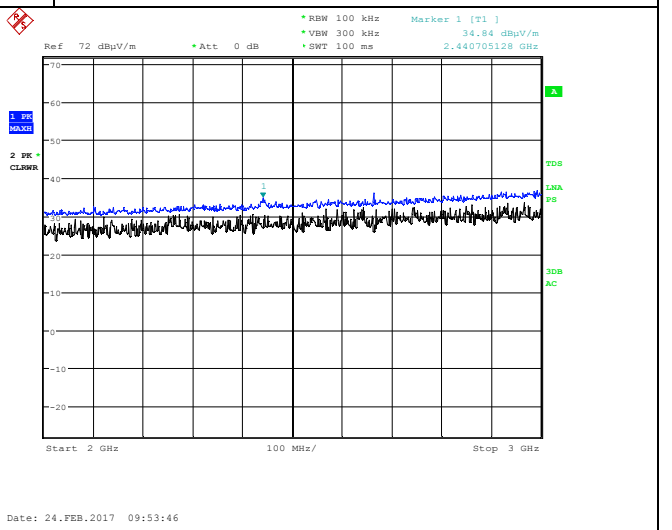


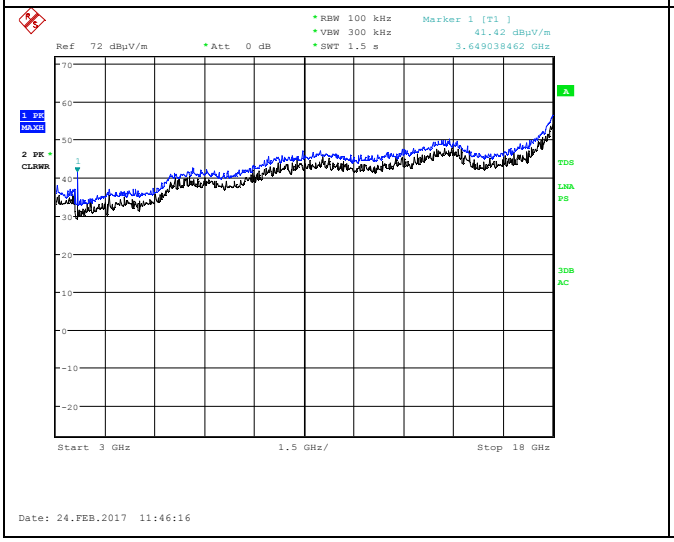


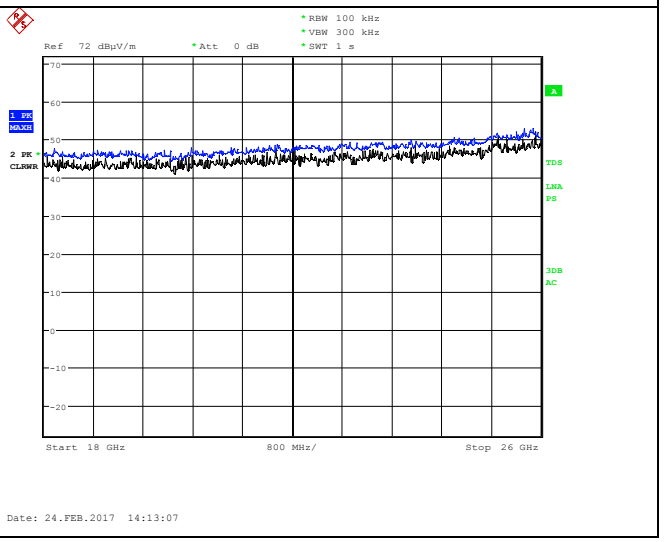


Modulation	Channel	Peak Emission (dBµV/m)
11n (MCS 7)	07	94.95

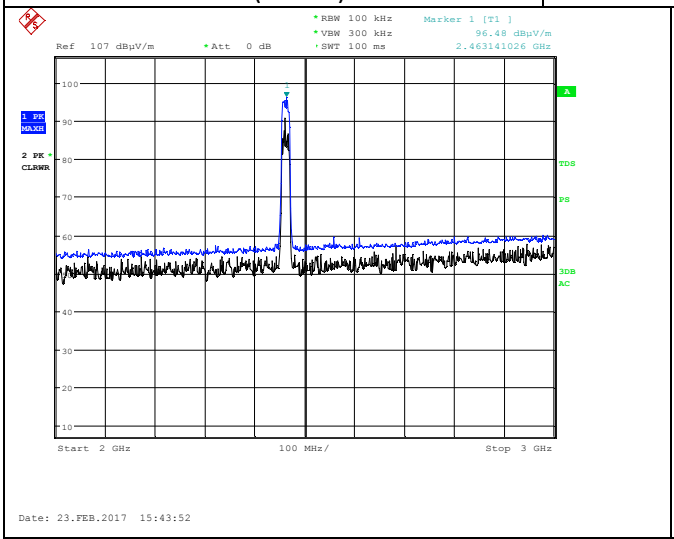


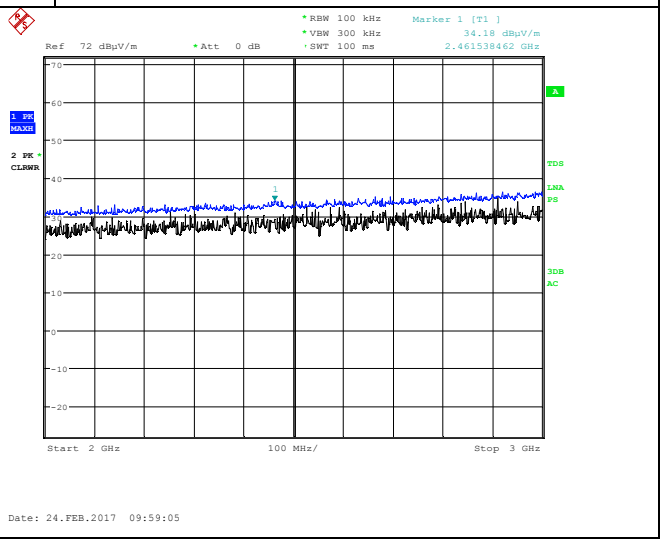


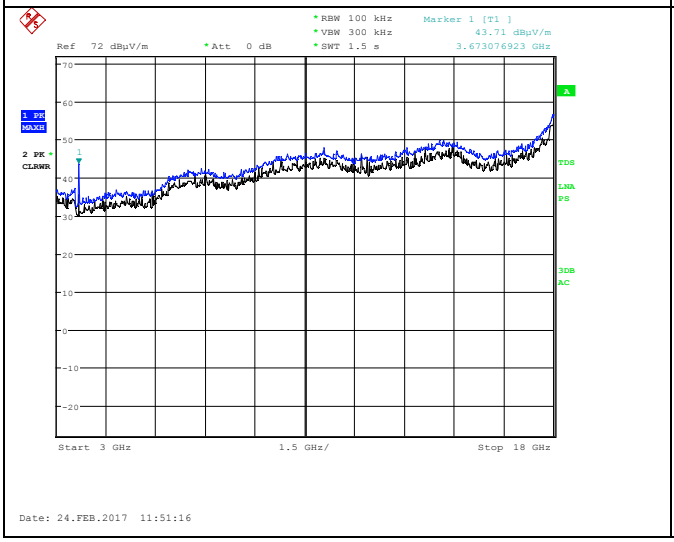


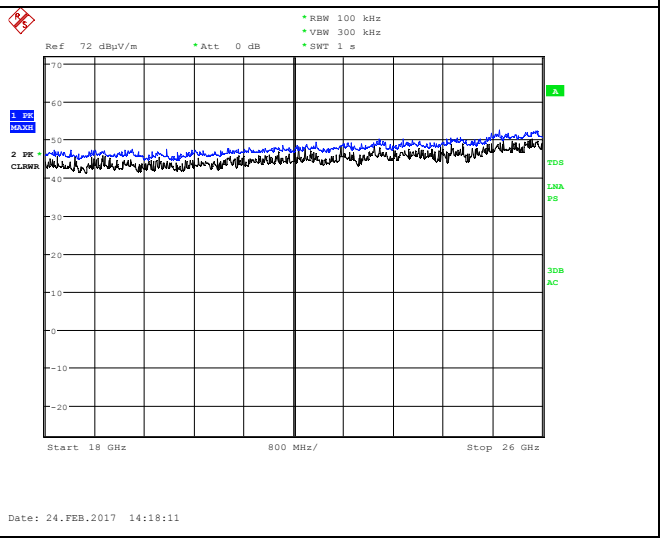


Modulation	Channel	Peak Emission (dBµV/m)
11n (MCS 7)	11	96.48

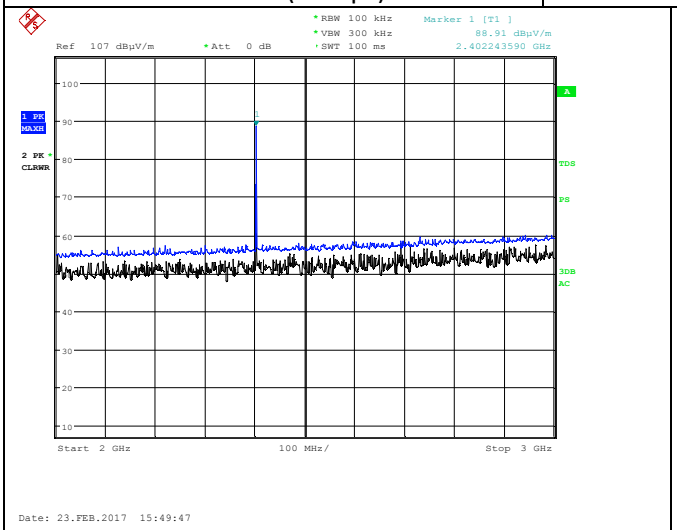


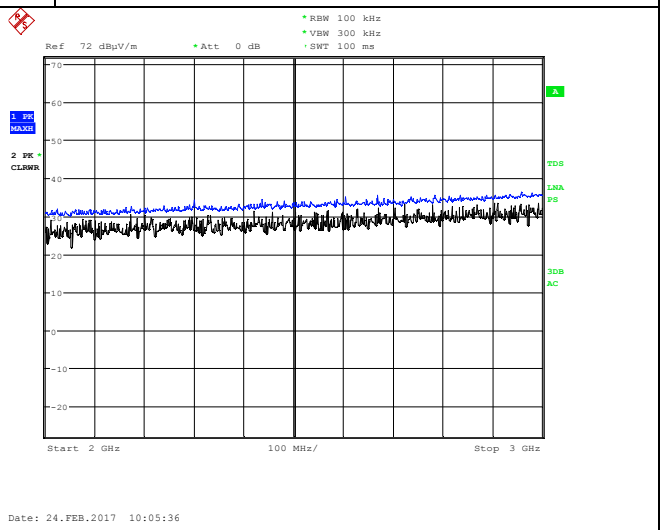


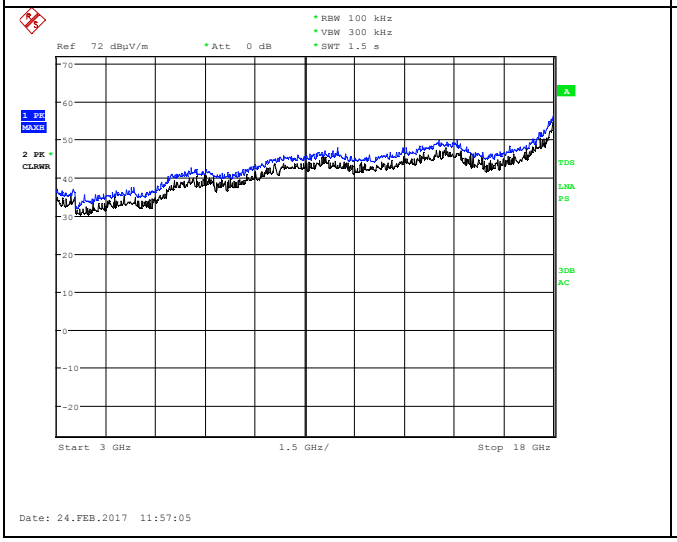


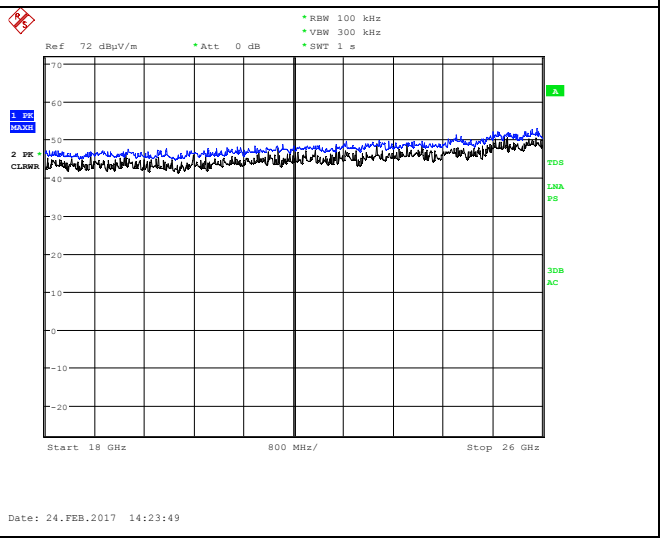


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (1Mbps)	01	101.12

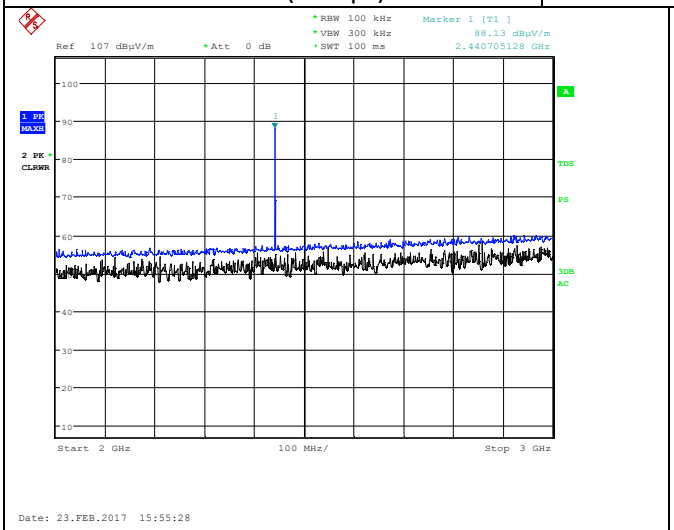


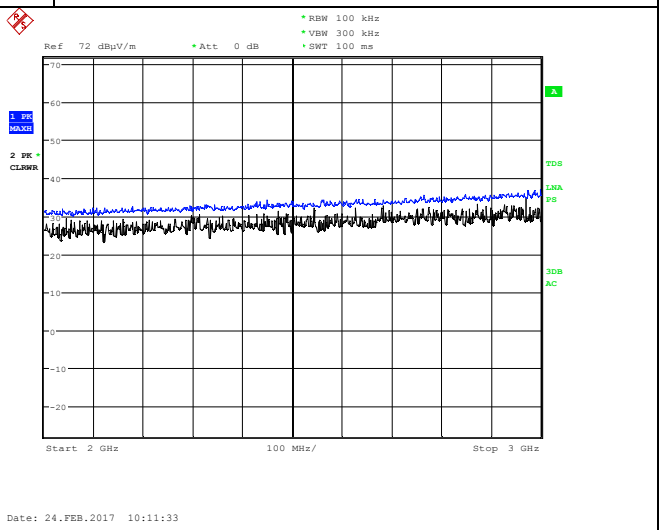


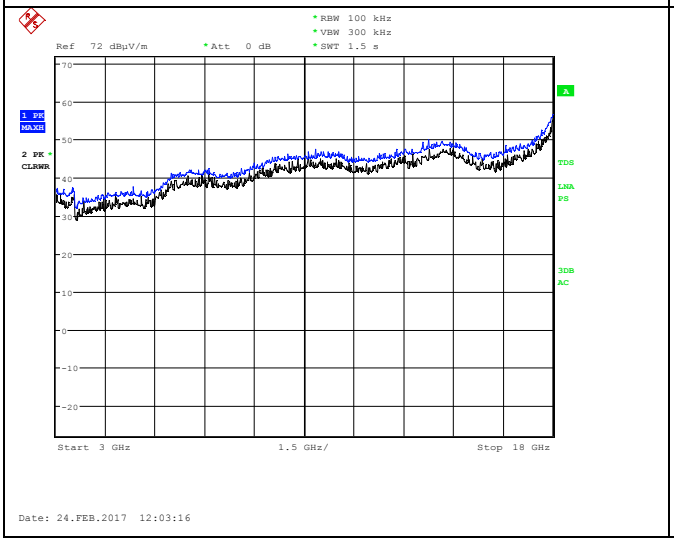


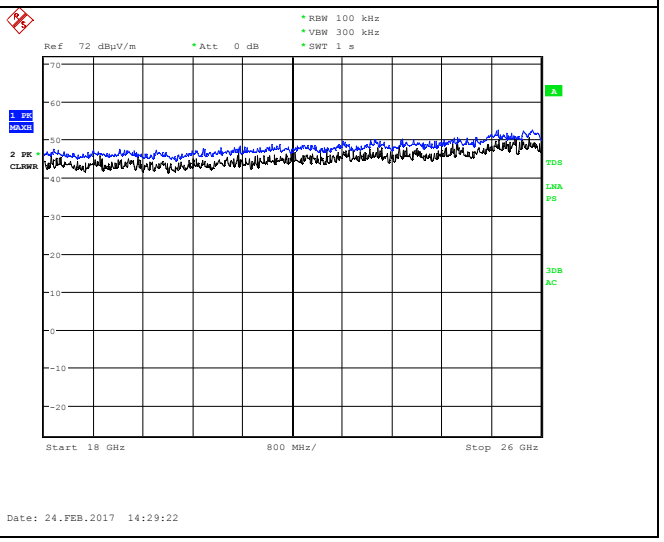


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (1Mbps)	40	101.52

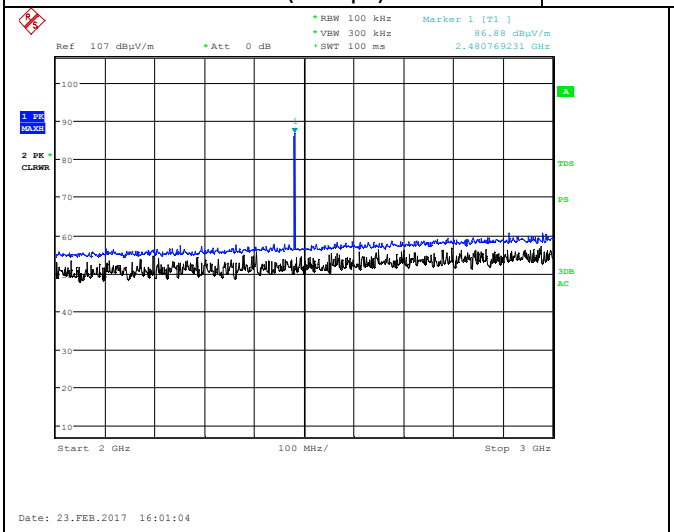


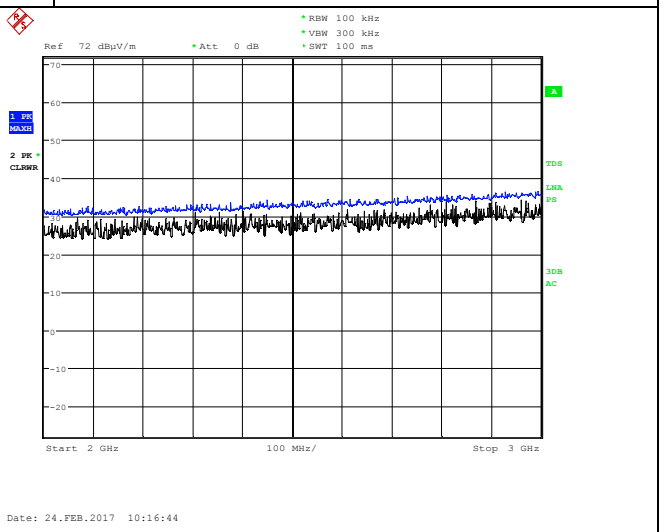


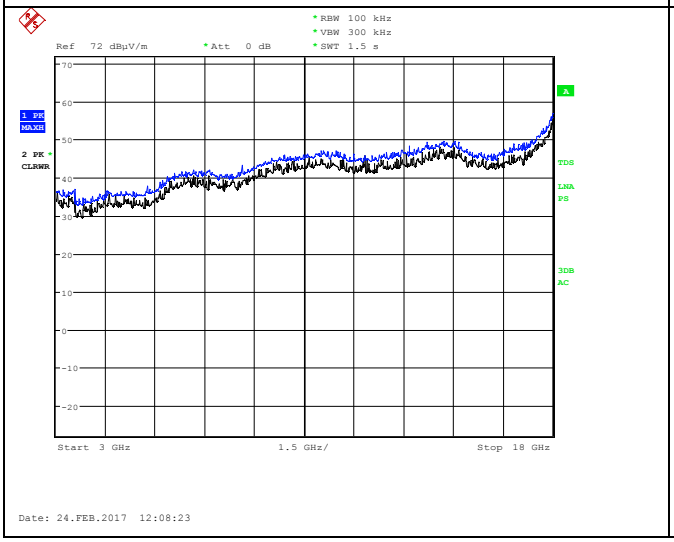


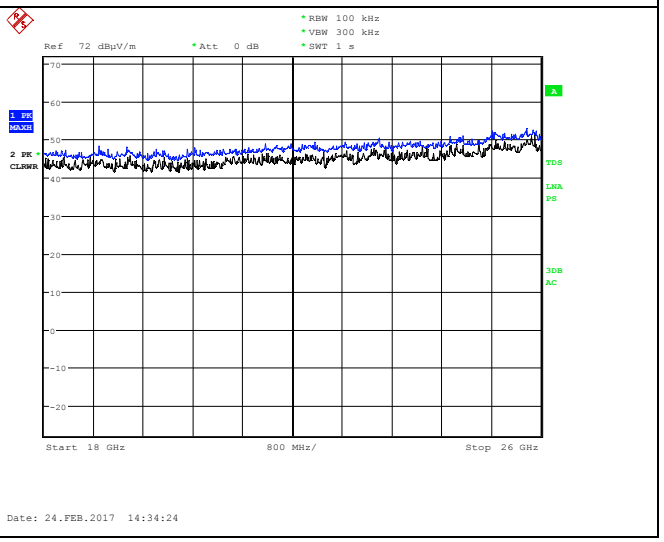


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (1Mbps)	79	100.65

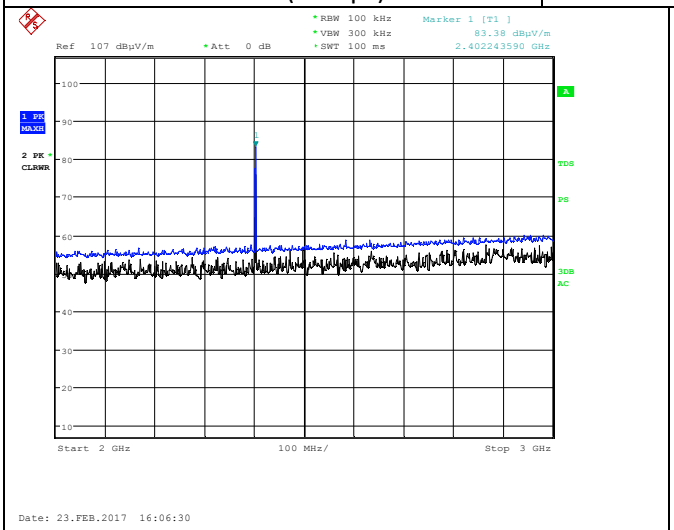


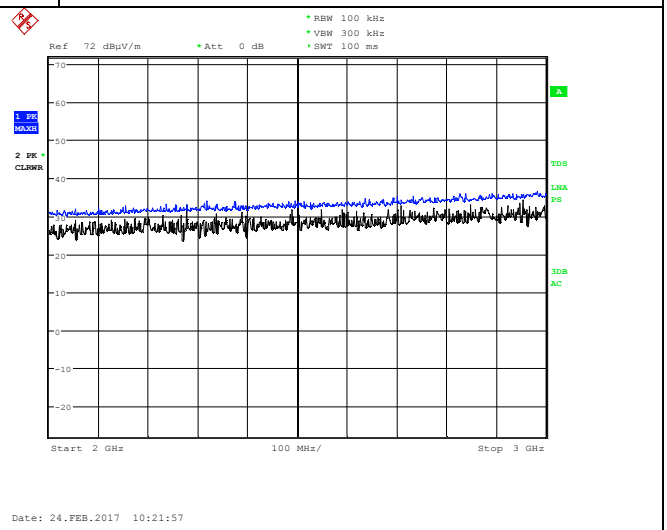


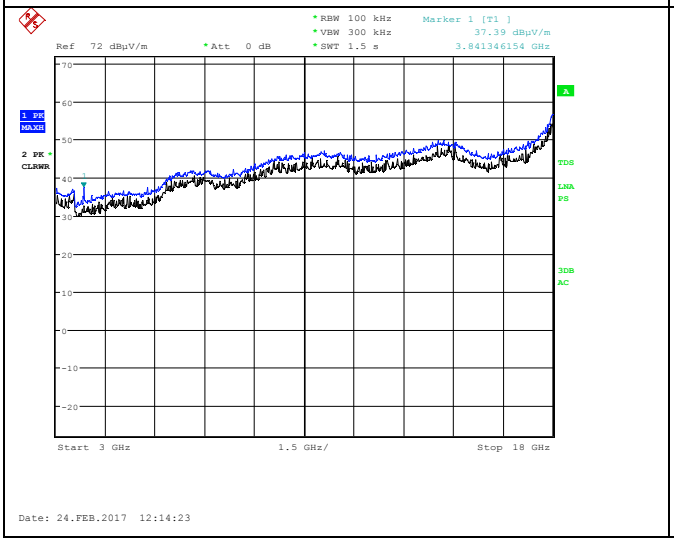


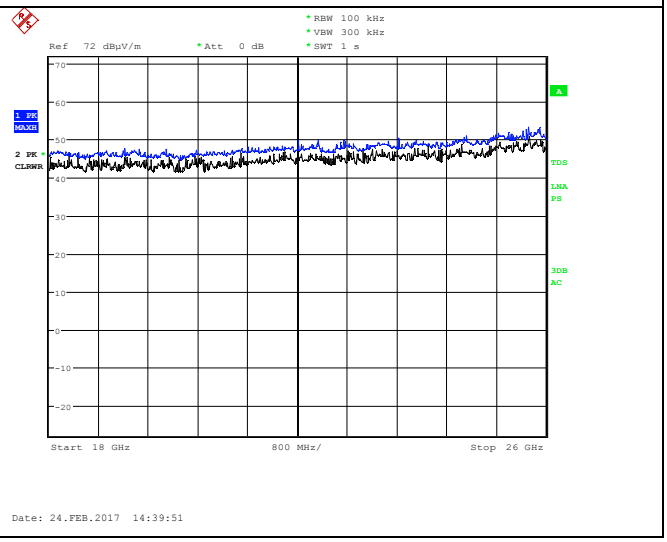


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (2Mbps)	01	97.42

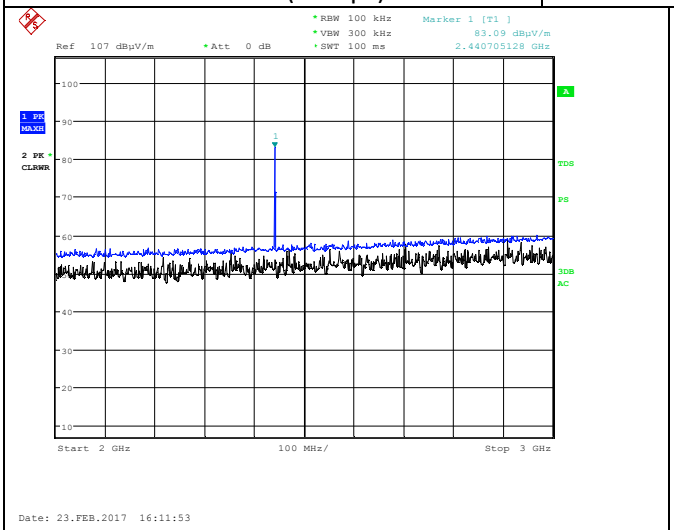


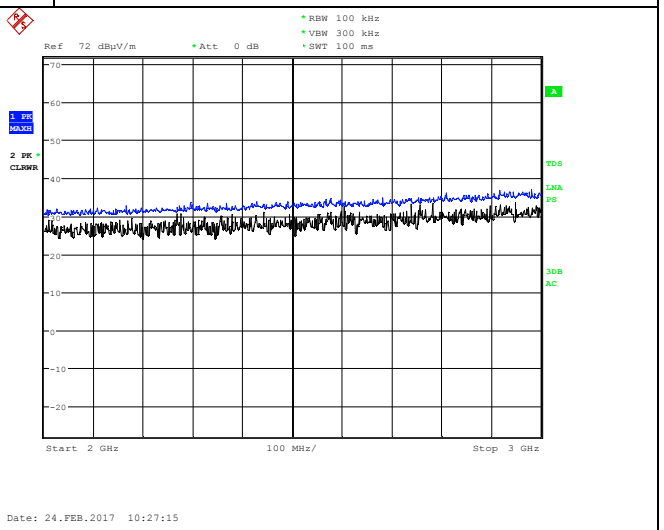


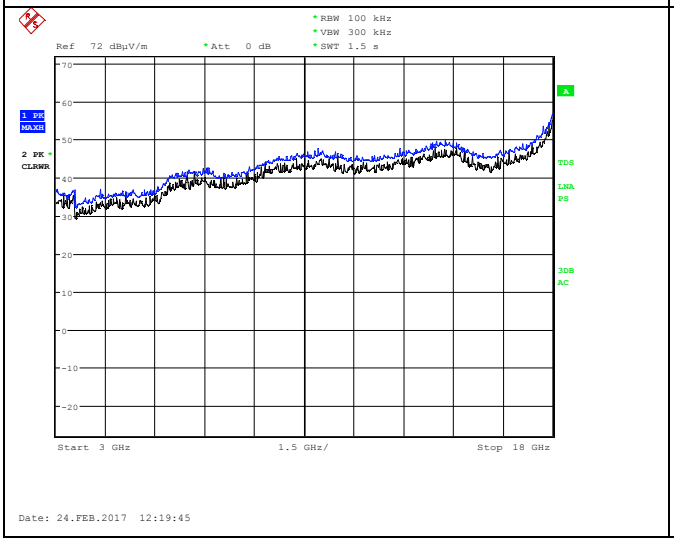


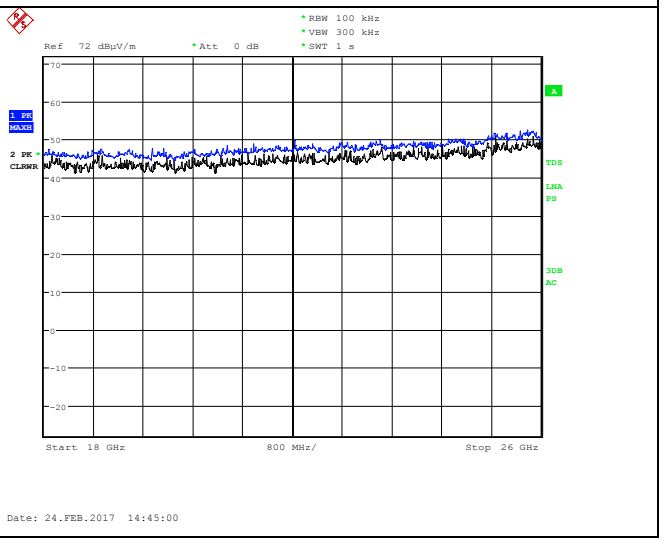


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (2Mbps)	40	97.70

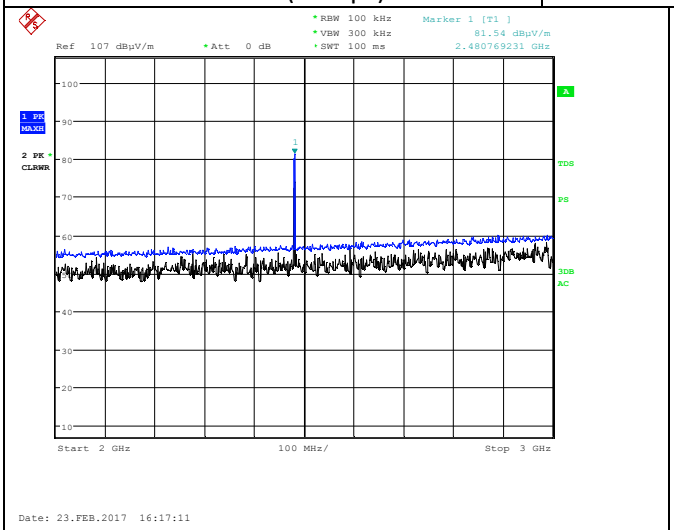


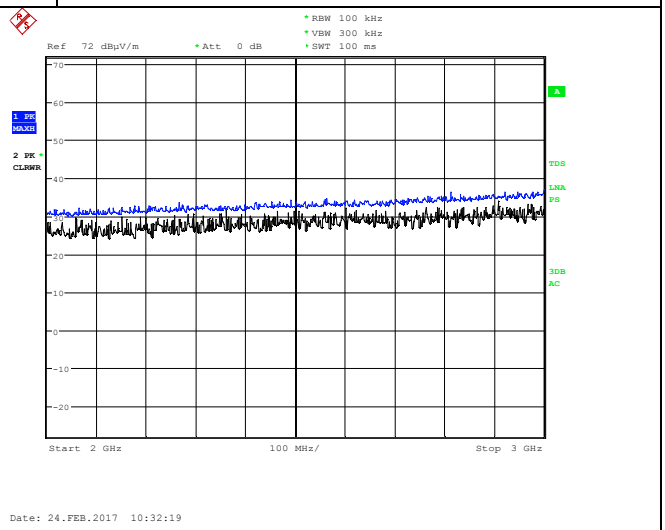


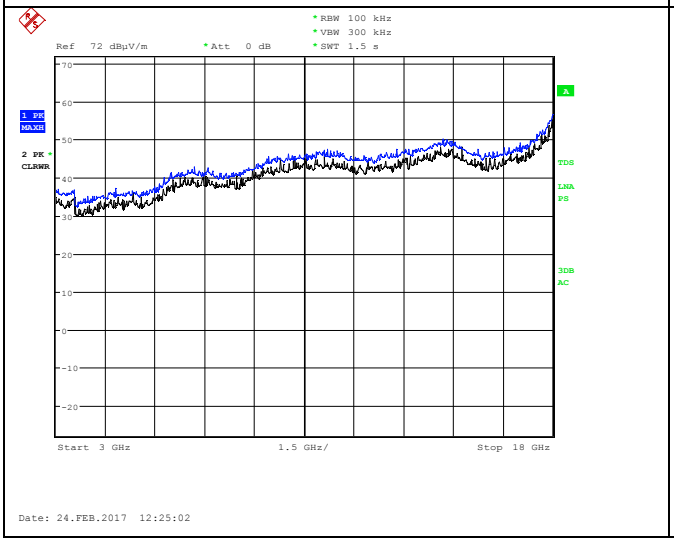


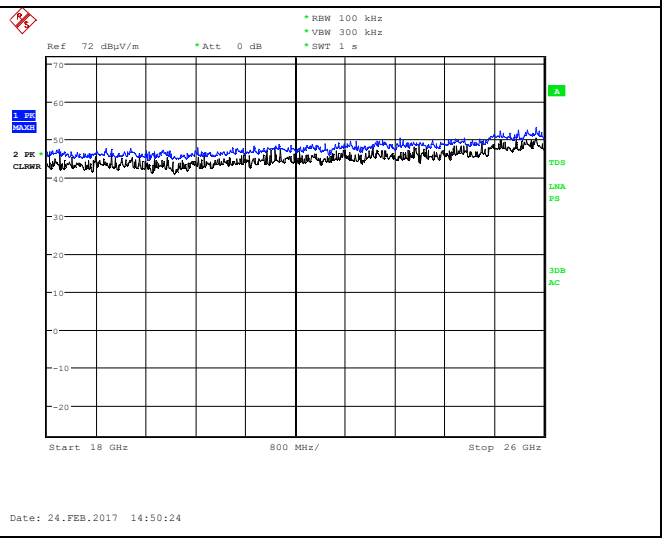


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (2Mbps)	79	96.66

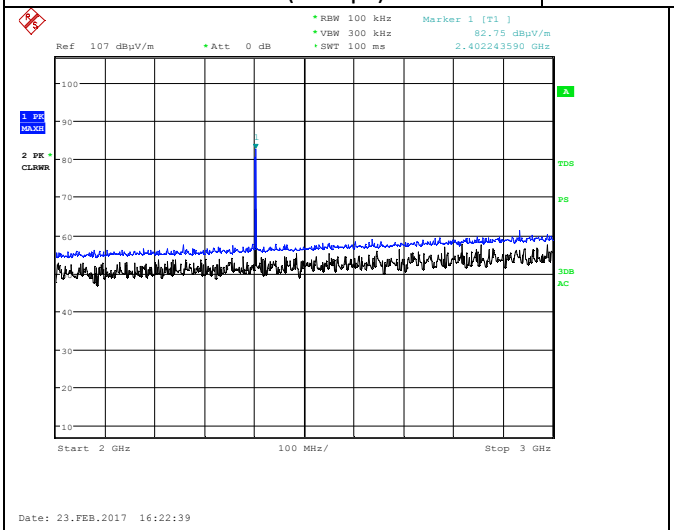


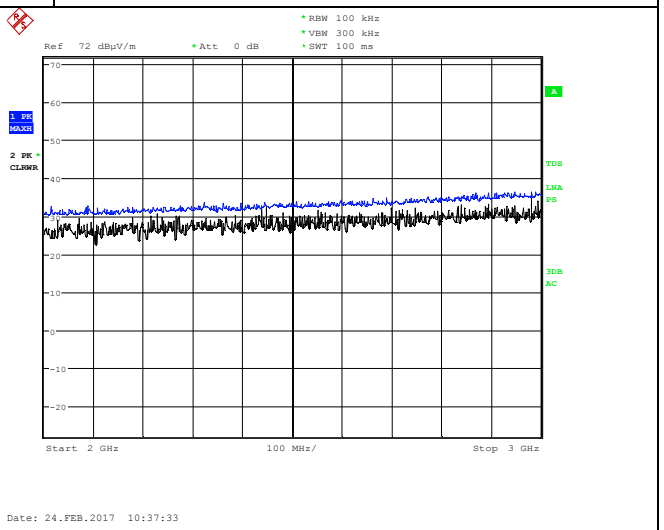


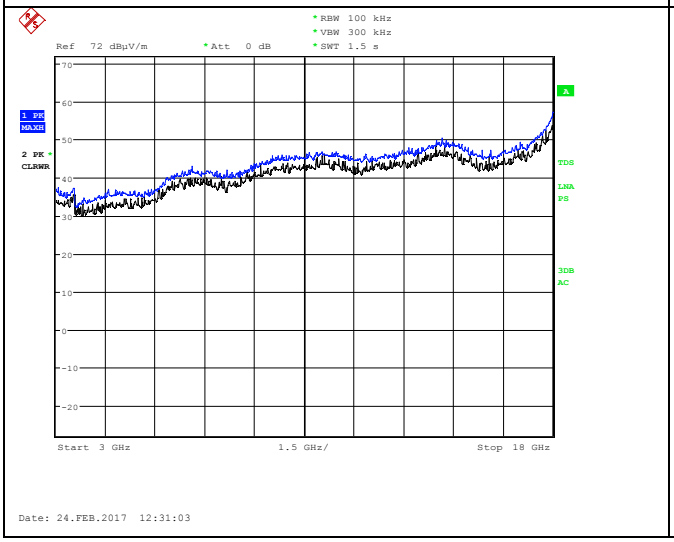


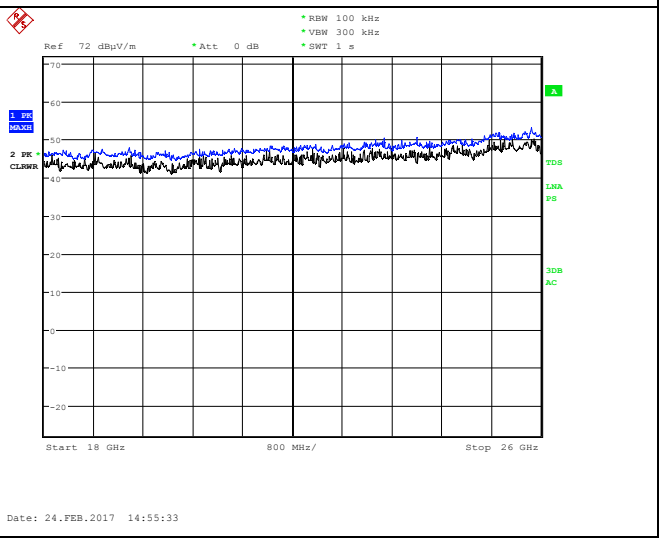


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (3Mbps)	01	96.81

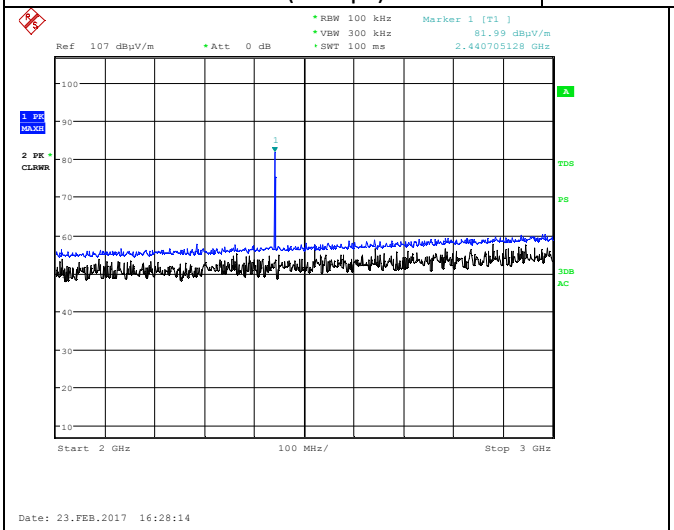


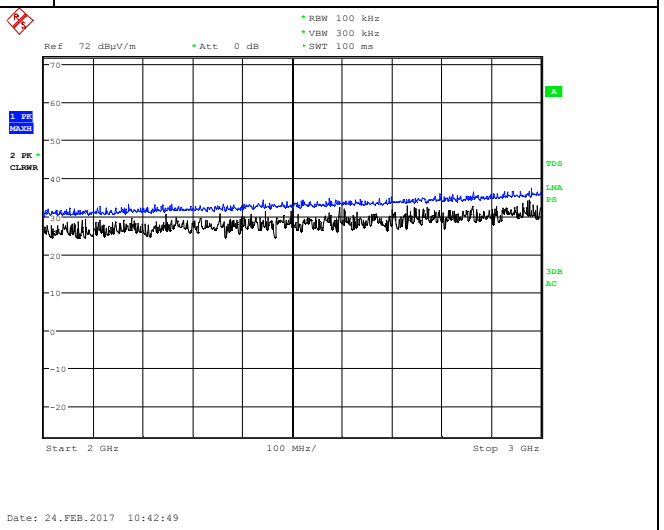


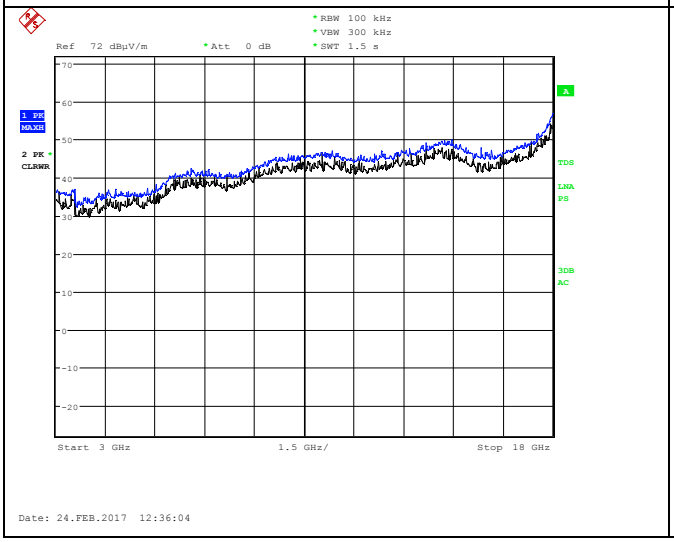


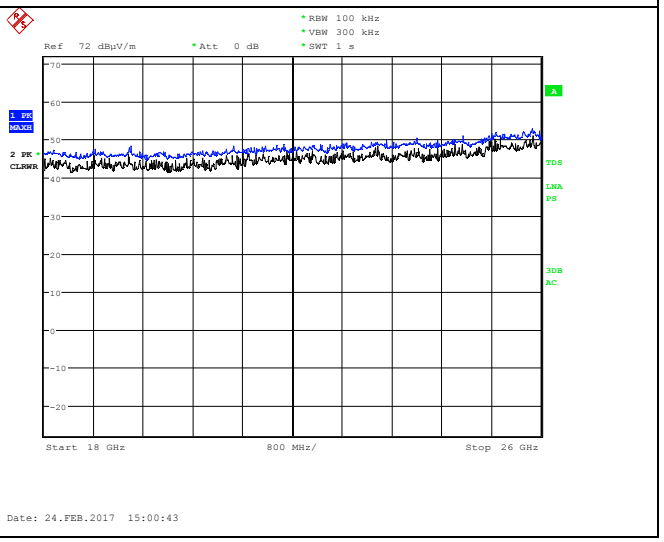


Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (3Mbps)	40	96.61

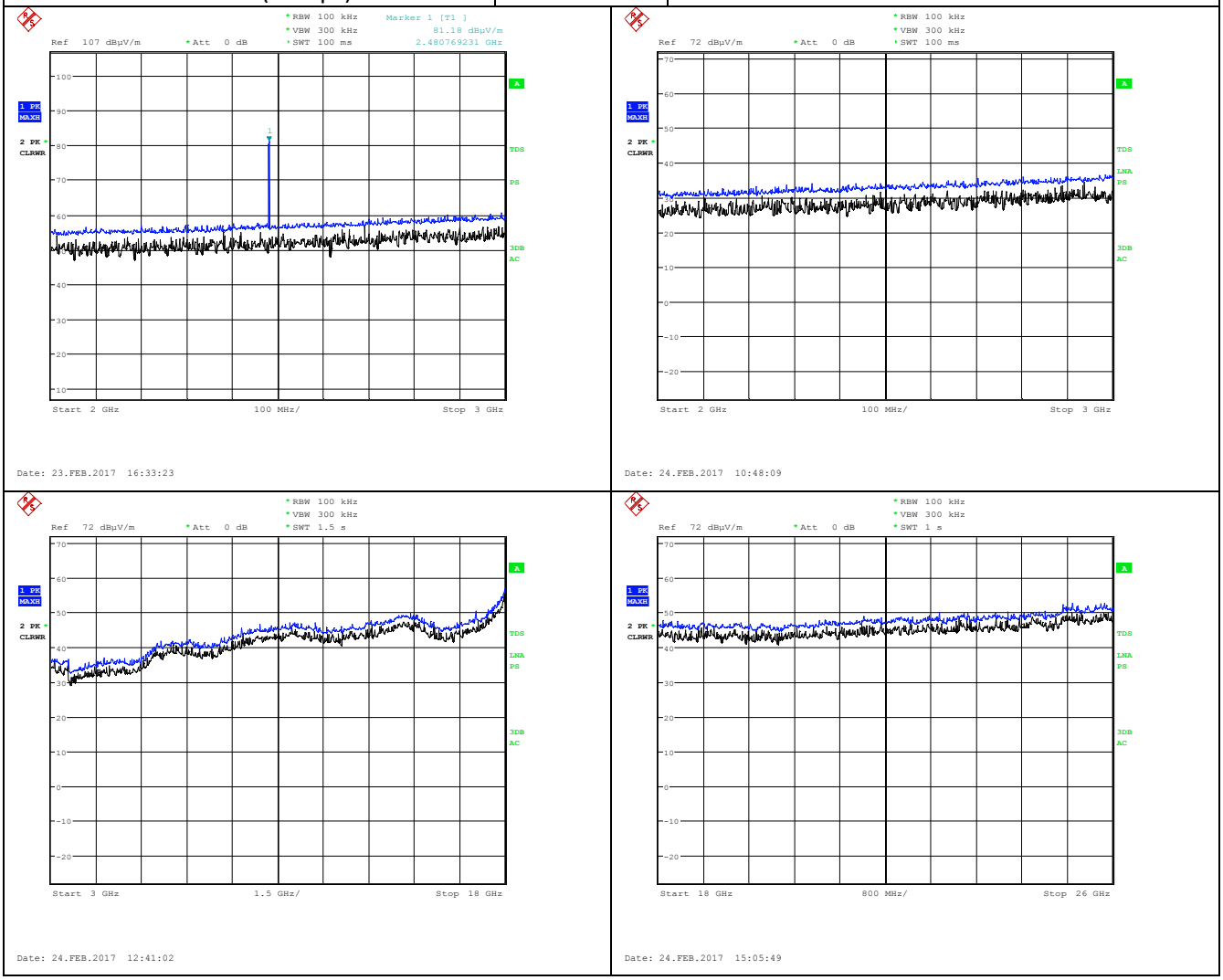








Modulation	Channel	Peak Emission (dBµV/m)
Bluetooth (3Mbps)	79	96.29



Comments: The 2GHz to 3GHz range was carried out with a 2.4GHz bandpass filter for the limits test, and without a filter for the peak emission test.

In all runs, the spectrum analyser was set to max hold, and the turntable rotated slowly from 0° to 360°, at vertical polarisation, and then 360° to 0° at horizontal polarisation.

Bluetooth peak emission levels have been corrected for after sweeps performed.

Test Unit: 002 (Radiated)
Test Setup: B (Radiated)
Tested by: D. Jamieson
Test Date/s: 23rd to 24th February 2017
Test Status: **PASS**

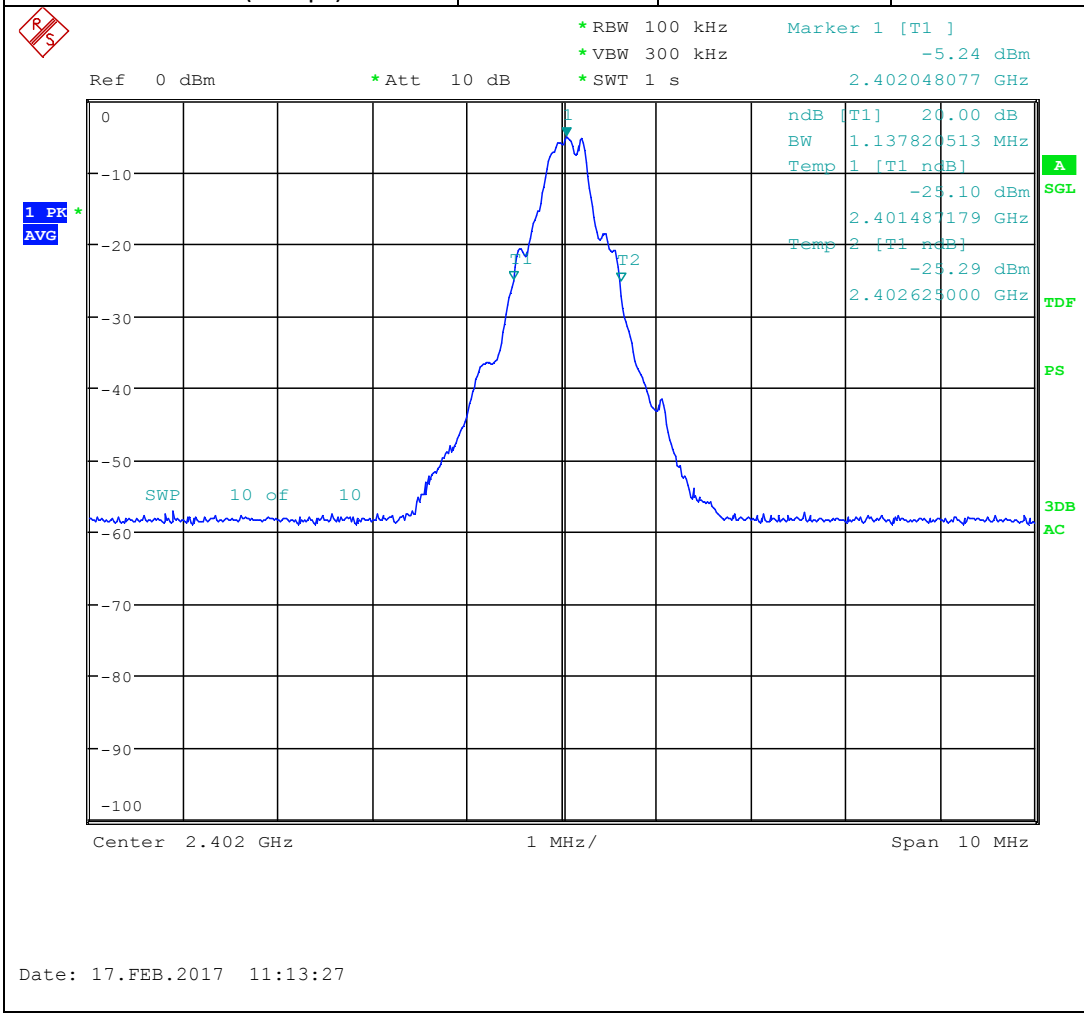
6.9 Frequency Band Edges

6.9.1 Frequency Band Edges – Results Summary

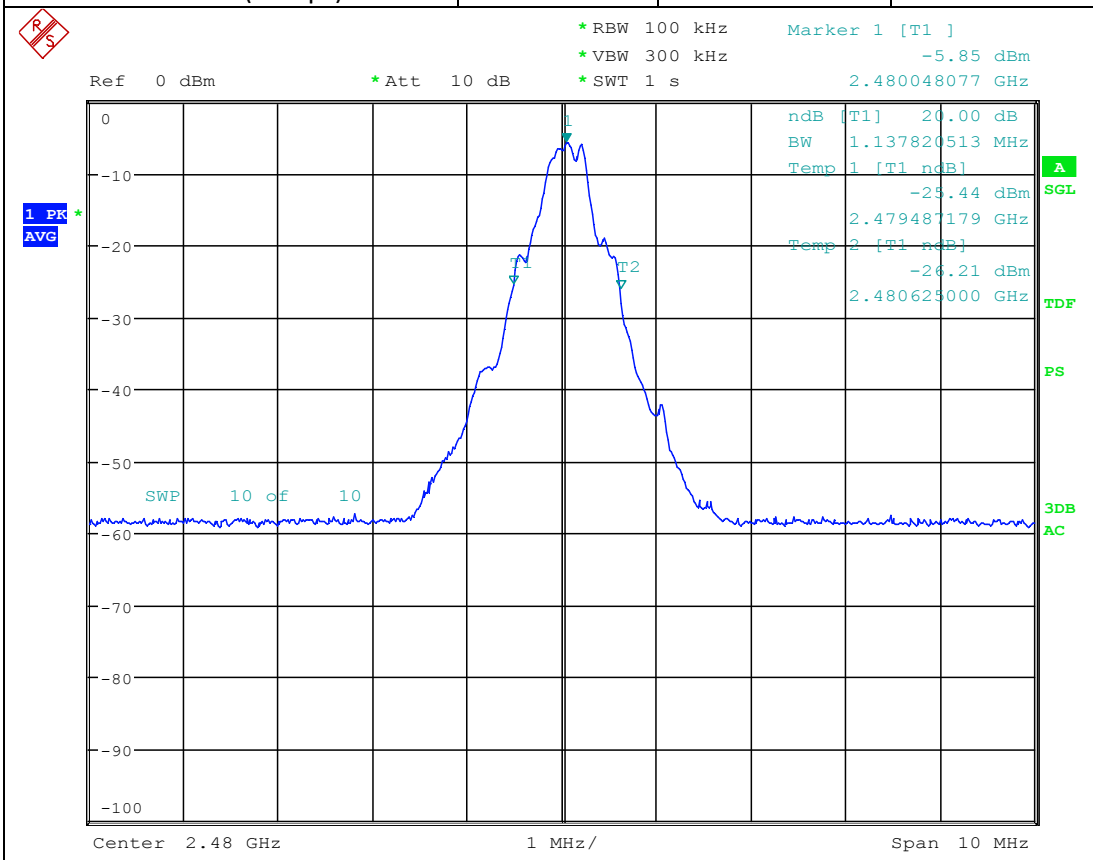
Type	Channel / Area	Frequency (GHz)	Limit (GHz)	Result
Bluetooth (1Mbps)	1 / Lower	2.401487179	2.400000000	Pass
	79 / Upper	2.480625000	2.483500000	Pass
Bluetooth (2Mbps)	1 / Lower	2.401326923	2.400000000	Pass
	79 / Upper	2.480705128	2.483500000	Pass
Bluetooth (3Mbps)	1 / Lower	2.401358974	2.400000000	Pass
	79 / Upper	2.480737179	2.483500000	Pass

6.9.2 Frequency Band Edges – Result Plots

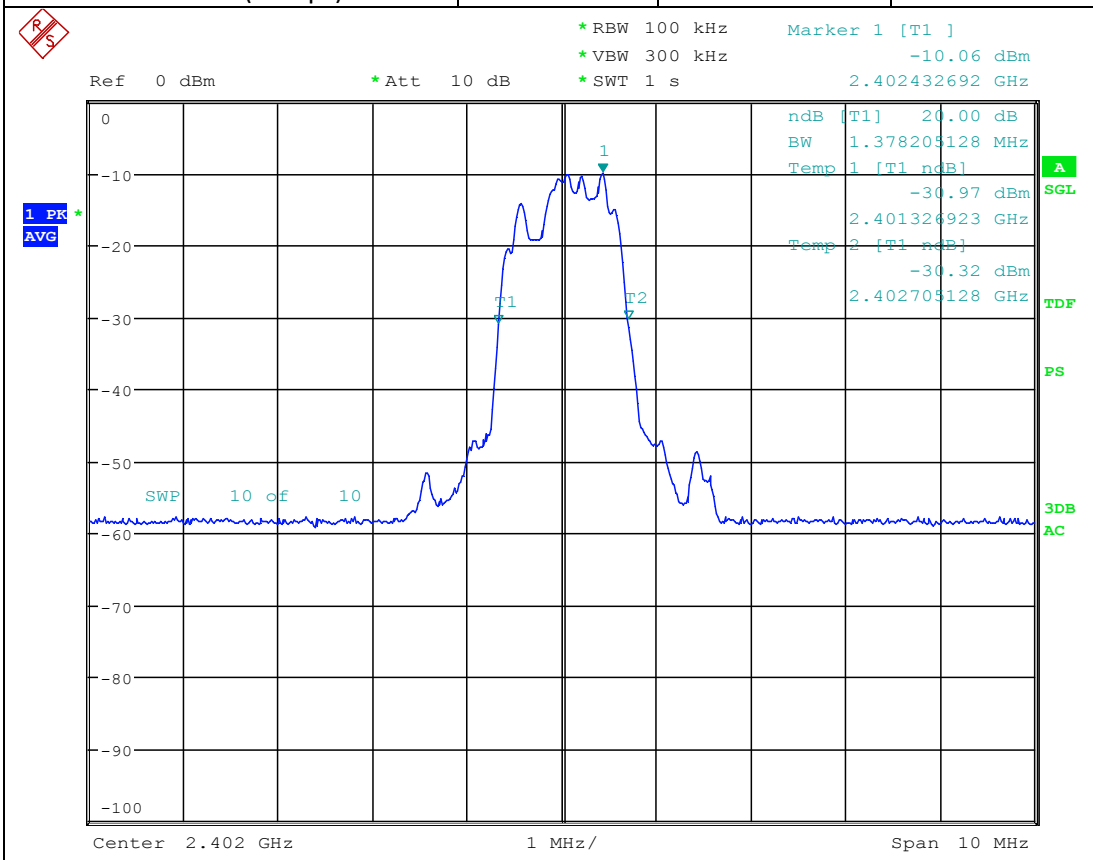
Modulation	Channel	Frequency	-20dB Lower Frequency (MHz)
Bluetooth (1Mbps)	01	2.402GHz	2.401487179



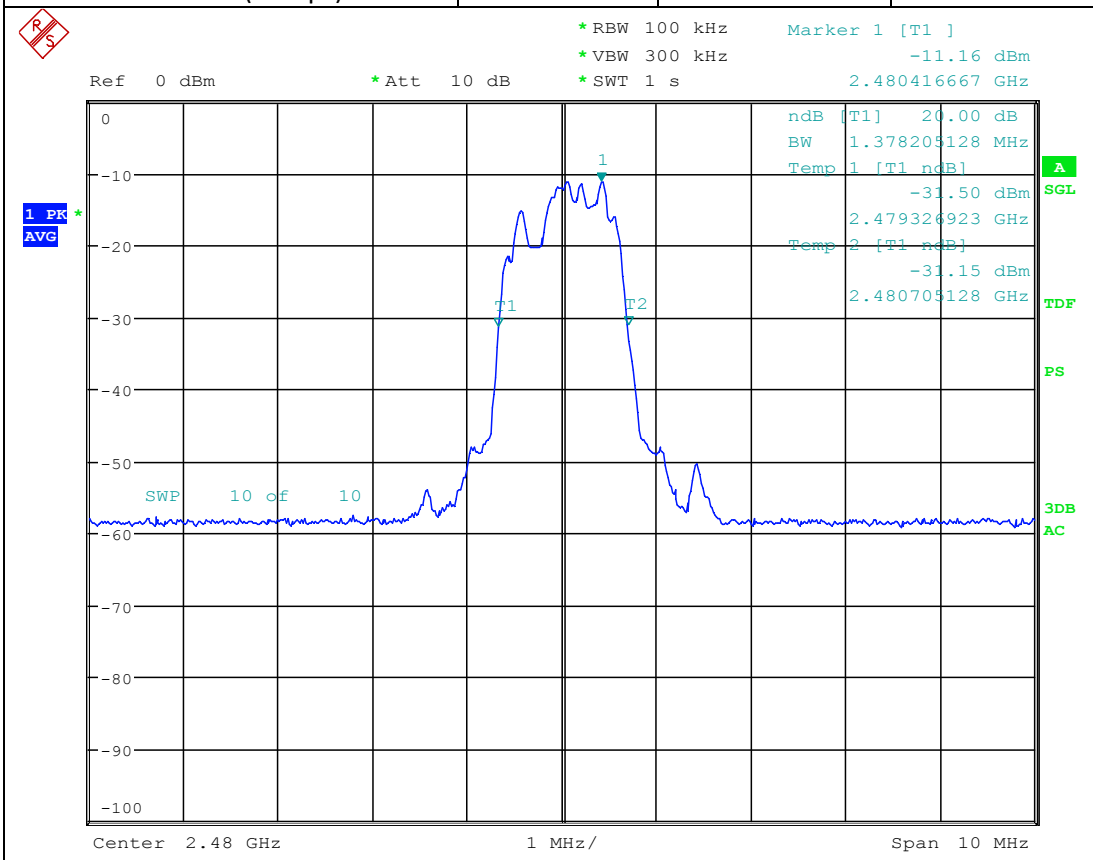
Modulation	Channel	Frequency	-20dB Upper Frequency (MHz)
Bluetooth (1Mbps)	11	2.480GHz	2.480625000



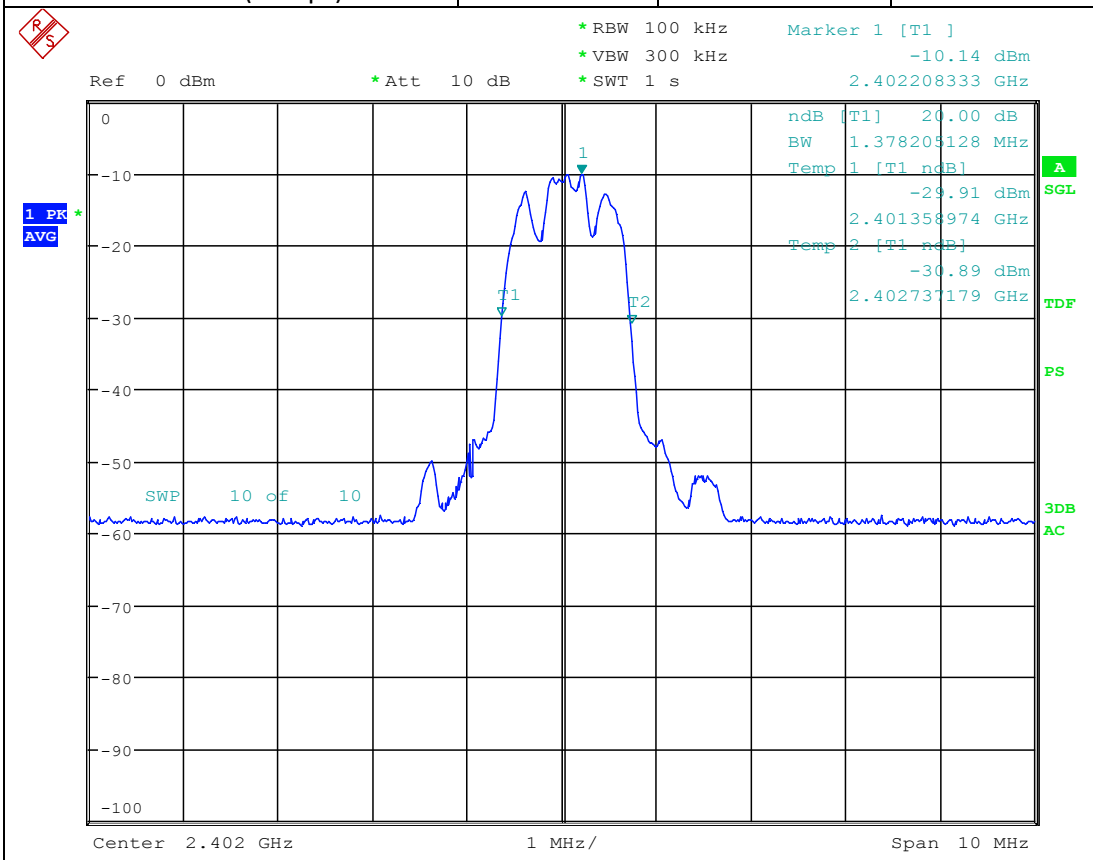
Modulation	Channel	Frequency	-20dB Lower Frequency (MHz)
Bluetooth (2Mbps)	01	2.402GHz	2.401326923



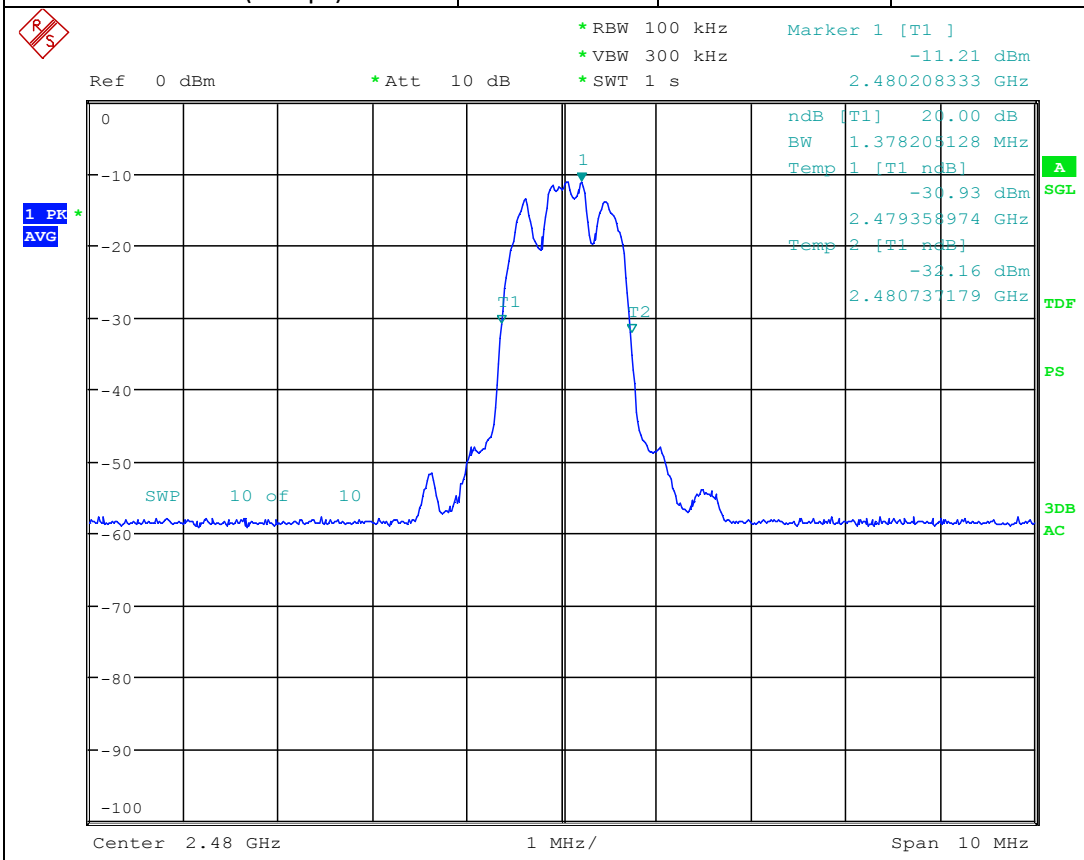
Modulation	Channel	Frequency	-20dB Upper Frequency (MHz)
Bluetooth (2Mbps)	11	2.480GHz	2.480705128



Modulation	Channel	Frequency	-20dB Lower Frequency (MHz)
Bluetooth (3Mbps)	01	2.402GHz	2.401358974



Modulation	Channel	Frequency	-20dB Upper Frequency (MHz)
Bluetooth (3Mbps)	11	2.480GHz	2.480737179



Comments: None.
Test Unit: 001 (Conducted)
Test Setup: A (Conducted)
Tested by: D. Jamieson
Test Date/s: 17th February 2017
Test Status: **PASS**

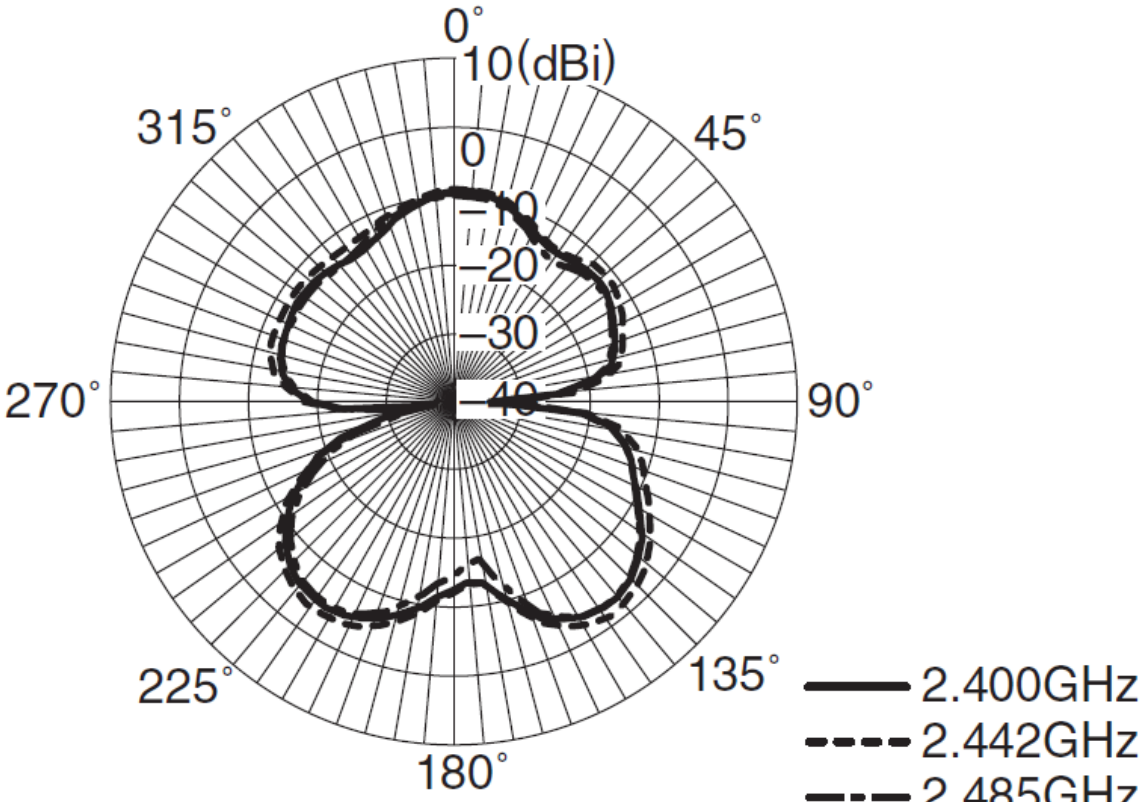
6.10 Directional Antenna with >6dBi

The TDK chip antenna design has been copied straight from the data sheet, and measurements were performed in free space. Therefore, the maximum gain as taken from their measured polar plots is 2.27dBi.

Due to the isotropic gain being less than 6dBi, this test requirement is not applicable.

6.10.1 Directional Antenna with >6dBi – Polar plots from TDK

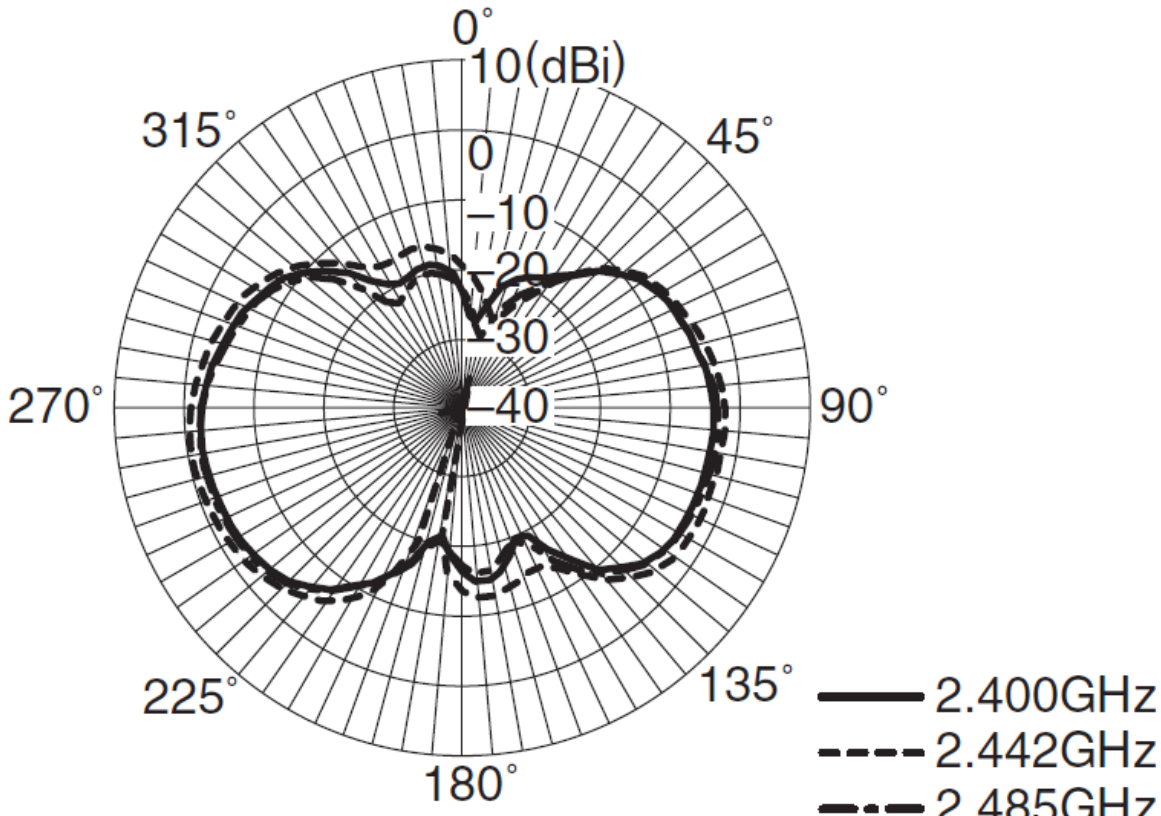
Directivity Angle	Polarisation
Y Axis	Vertical



Vertical polarization

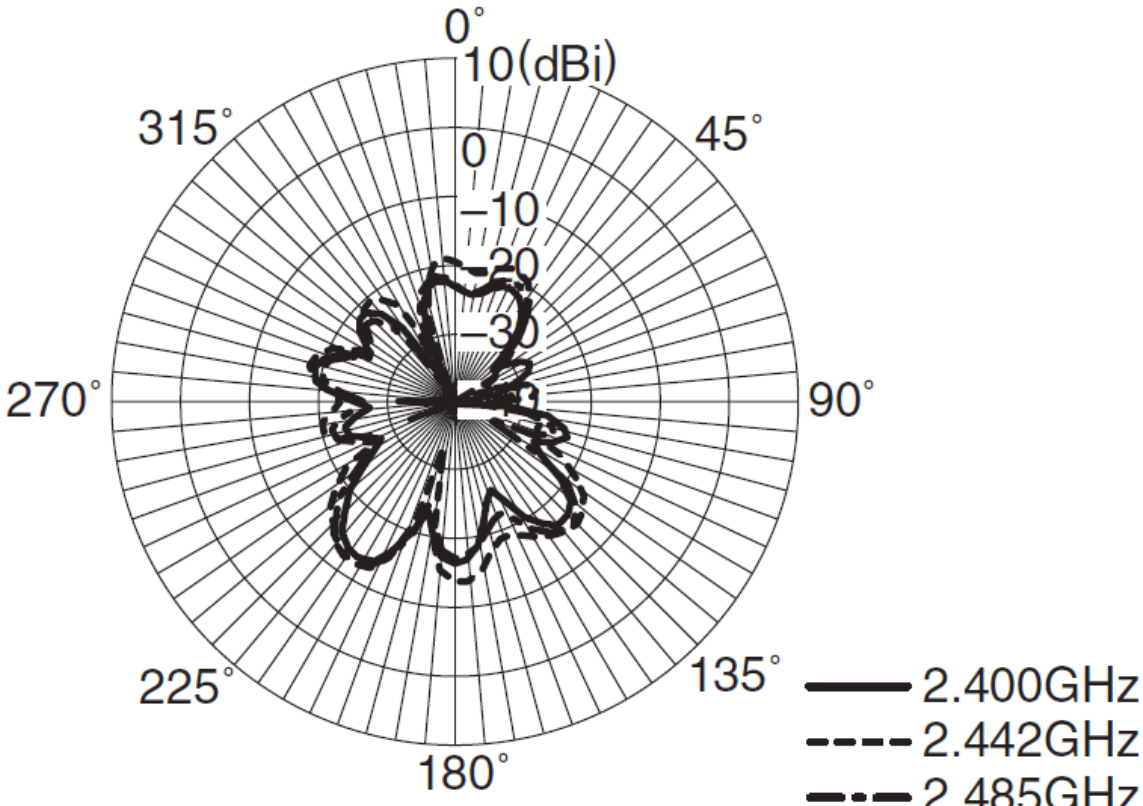
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–9.62	–8.45	–10.13
Maximum(dBi)	–2.82	–1.44	–3.02
Minimum(dBi)	–36.90	–34.11	–32.46

Directivity Angle	Polarisation
Y Axis	Horizontal



Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–7.06	–5.44	–6.82
Maximum(dBi)	–2.18	–0.48	–1.94
Minimum(dBi)	–27.38	–44.31	–29.46

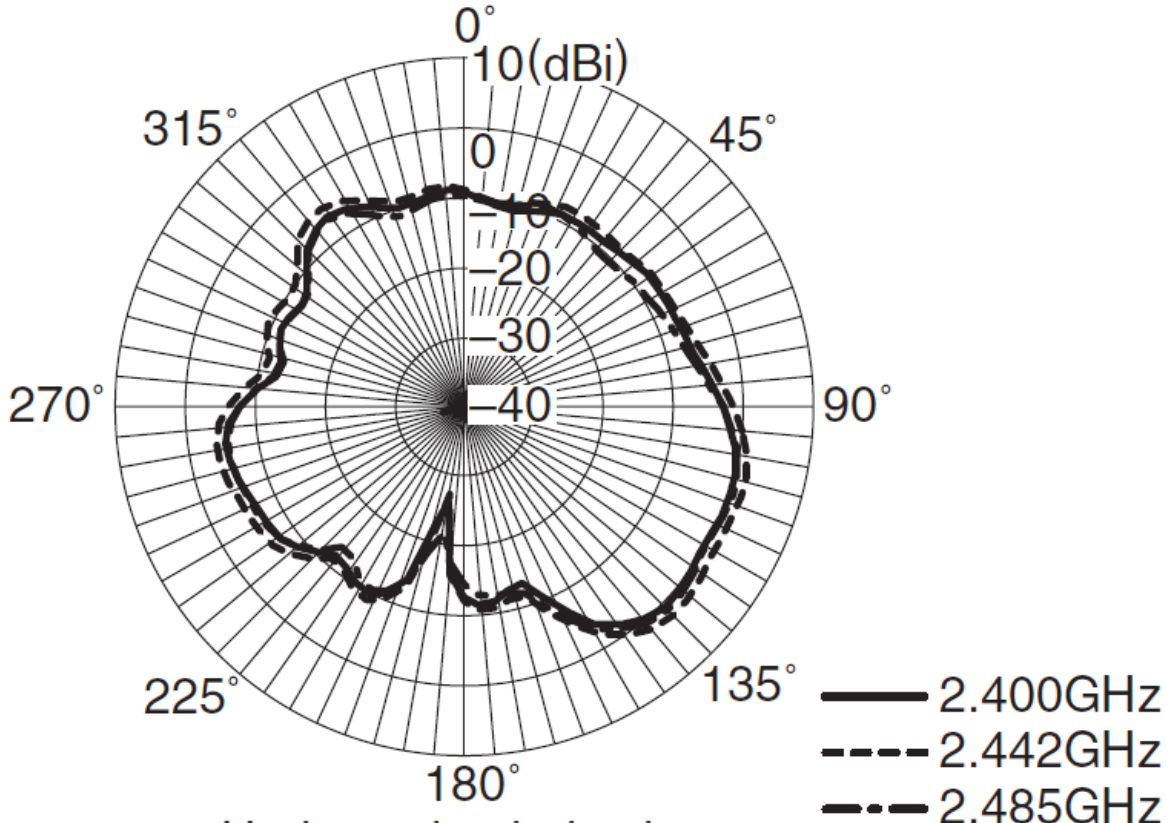
Directivity Angle	Polarisation
X Axis	Vertical



Vertical polarization

Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–21.03	–19.00	–20.43
Maximum(dBi)	–13.19	–12.04	–12.29
Minimum(dBi)	–48.22	–46.88	–40.26

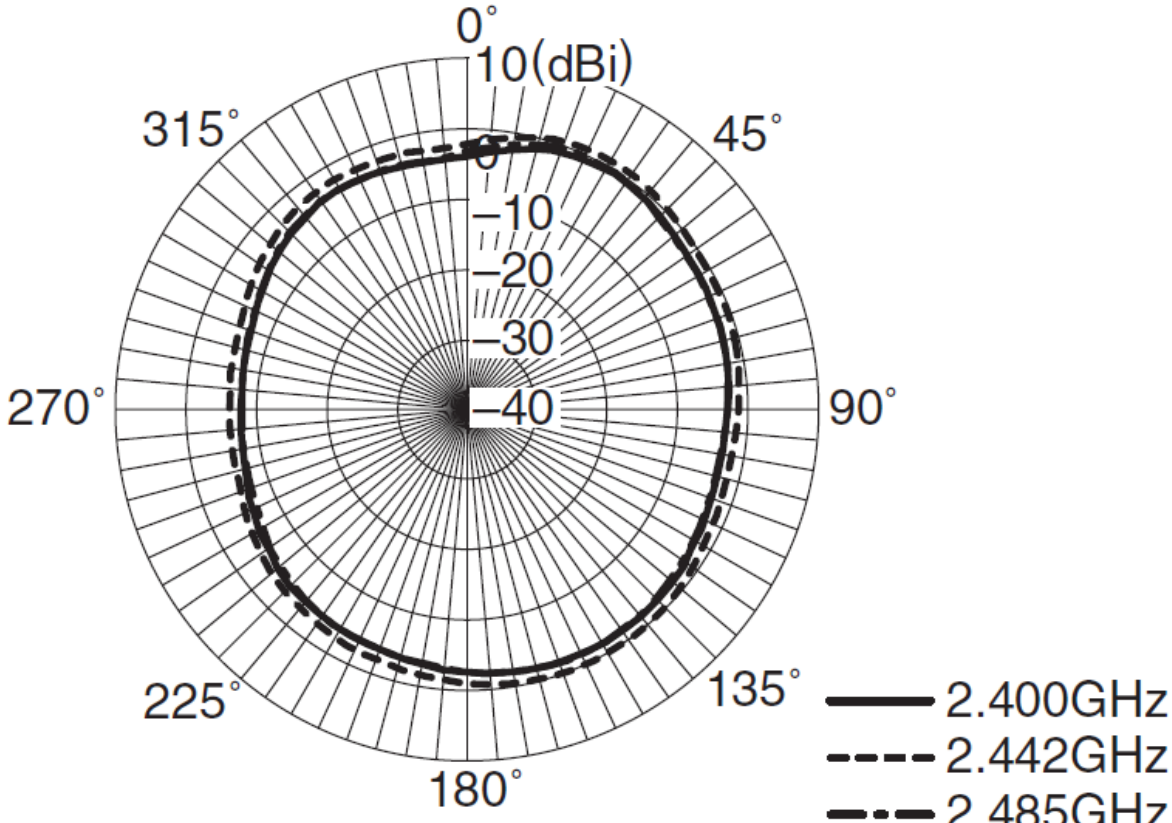
Directivity Angle	Polarisation
X Axis	Horizontal



Horizontal polarization

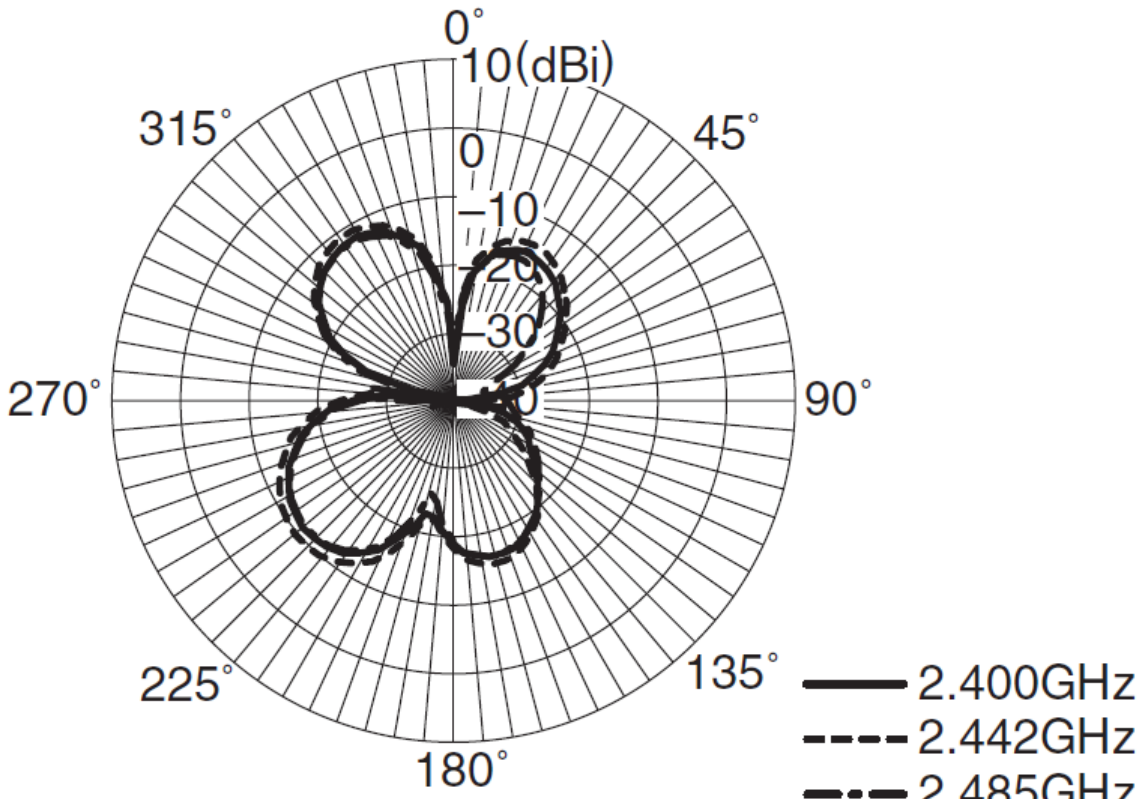
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–5.81	–4.32	–5.70
Maximum(dBi)	0.54	2.27	1.19
Minimum(dBi)	–26.20	–27.25	–22.01

Directivity Angle	Polarisation
Z Axis	Vertical



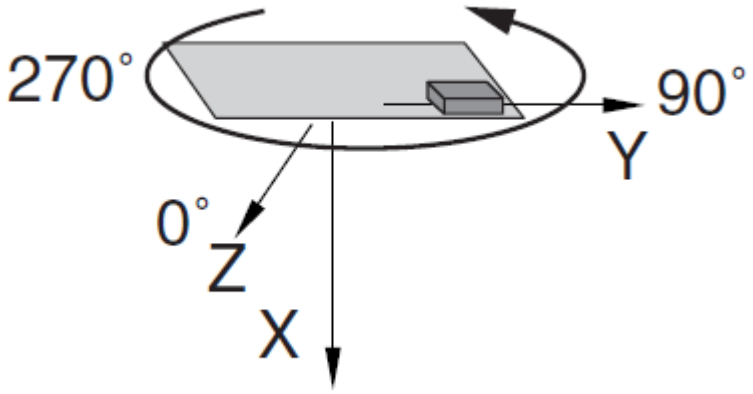
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–3.21	–1.68	–3.18
Maximum(dBi)	–0.54	0.98	–0.23
Minimum(dBi)	–7.87	–6.33	–7.97

Directivity Angle	Polarisation
Z Axis	Horizontal

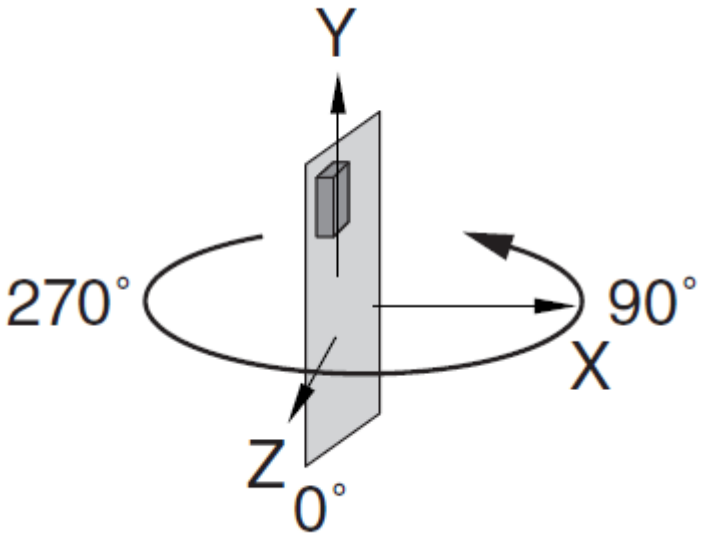


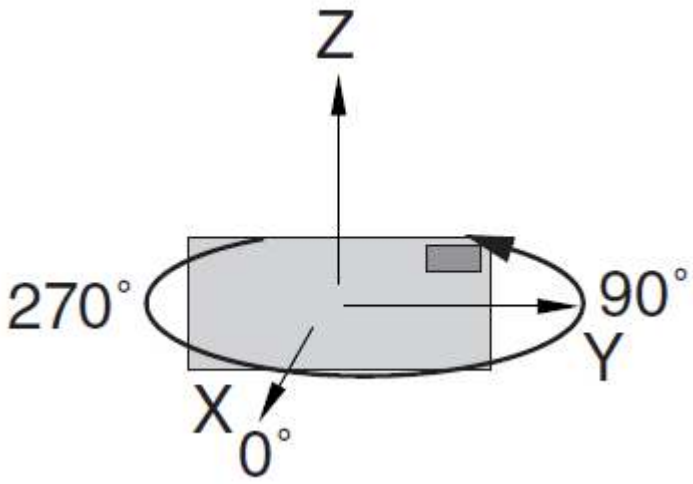
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–17.05	–15.74	–17.47
Maximum(dBi)	–11.24	–9.64	–11.46
Minimum(dBi)	–48.22	–51.80	–40.53

Directivity	
X Axis	



Directivity	
Y Axis	



Directivity	
Z Axis	
	

Comments: Results taken from TDK Report 001-01 / 20130901 / rf_ant_ant016008lcd2442ma1_en
Test Unit: N/A
Test Setup: N/A
Tested by: N/A
Test Date/s: N/A
Test Status: **N/A**

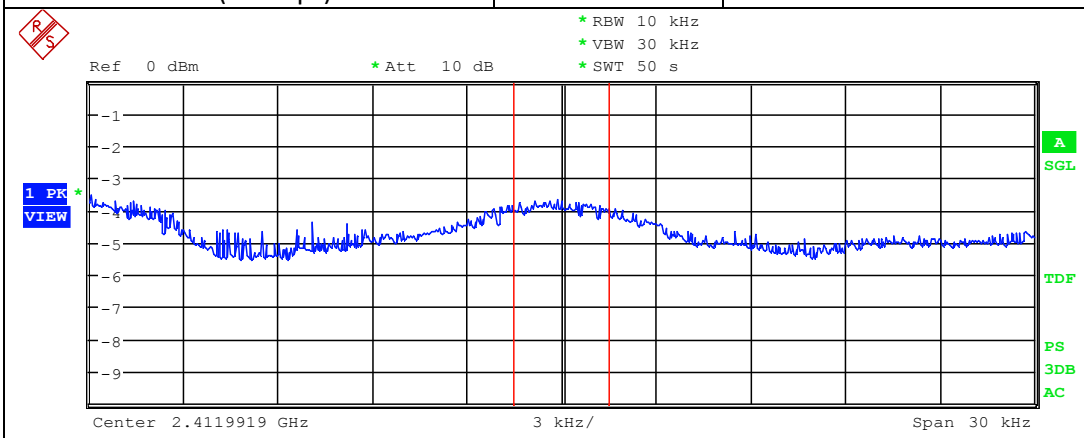
6.11 Power Spectral Density

6.11.1 Power Spectral Density – Results Summary

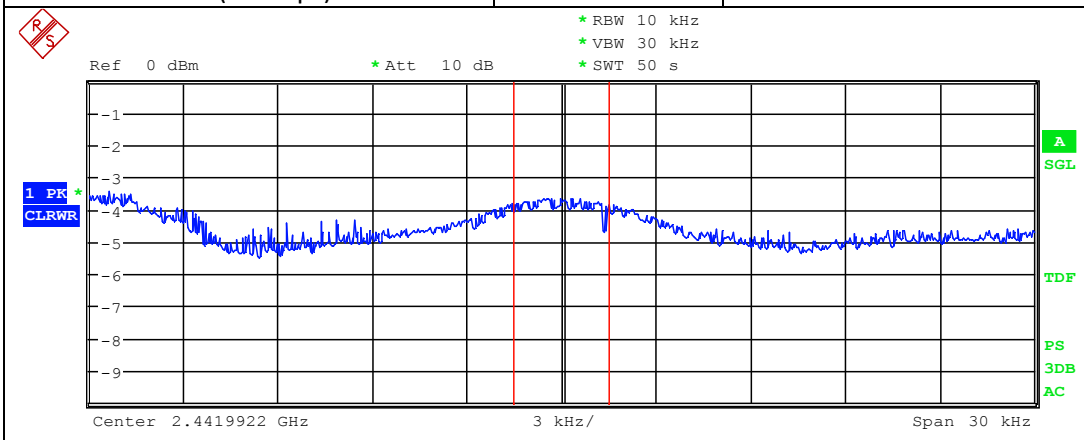
Type	Channel	PSD (dBm/3kHz)	Limit (dBm)	Result
11b (11Mbps)	1	-9.54	8	Pass
	7	-9.46	8	Pass
	11	-9.28	8	Pass
11g (54Mbps)	1	-13.30	8	Pass
	7	-13.01	8	Pass
	11	-13.02	8	Pass
11n (MCS 7)	1	-14.73	8	Pass
	7	-14.56	8	Pass
	11	-14.58	8	Pass

6.11.2 Power Spectral Density – Result Plots

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11b (11Mbps)	01	-9.54

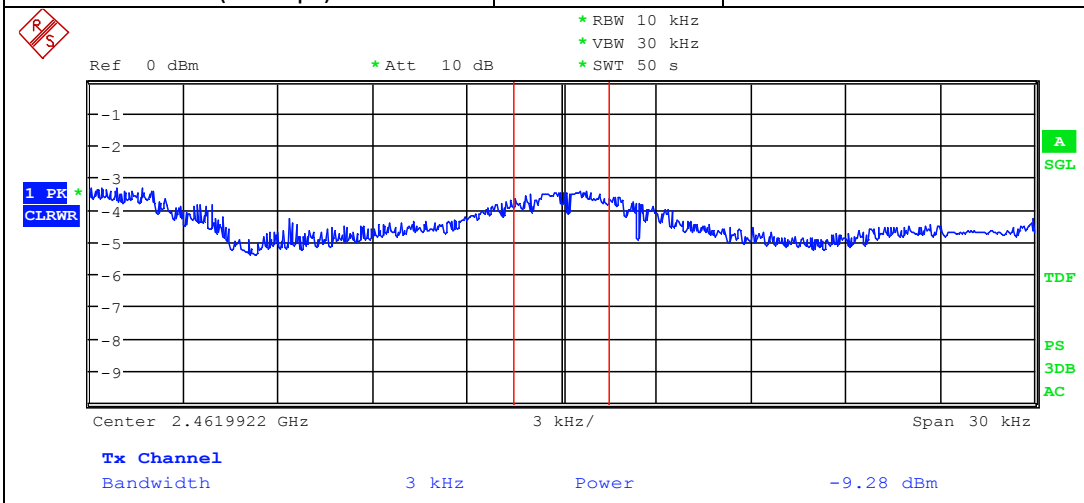


Modulation	Channel	Power Spectral Density (dBm/3kHz)
11b (11Mbps)	07	-9.46

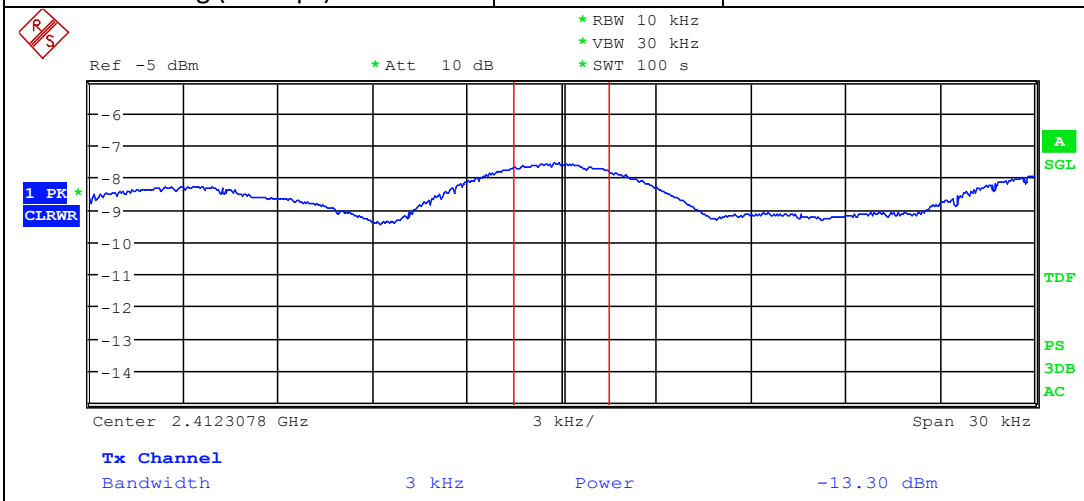


Date: 3.MAR.2017 15:33:31

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11b (11Mbps)	11	-9.28



Modulation	Channel	Power Spectral Density (dBm/3kHz)
11g (54Mbps)	01	-13.30

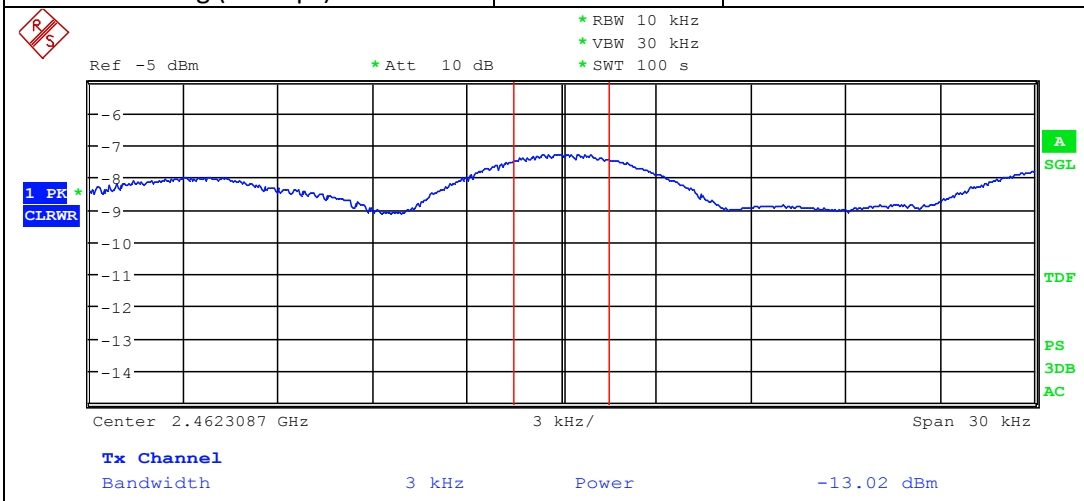


Date: 3.MAR.2017 15:44:07

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11g (54Mbps)	07	-13.01

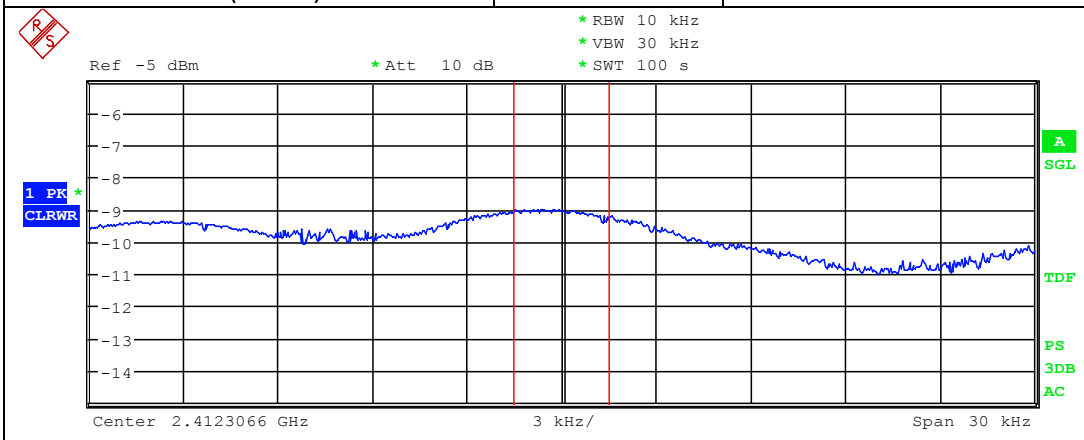
Date: 3.MAR.2017 15:46:27

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11g (54Mbps)	11	-13.02



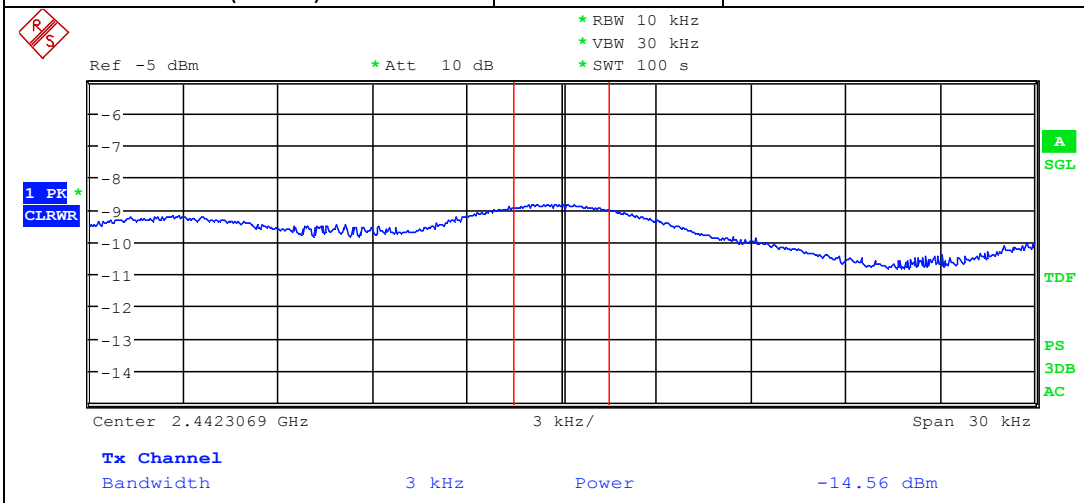
Date: 3.MAR.2017 15:49:52

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11n (MCS 7)	01	-14.73



Date: 3.MAR.2017 15:52:51

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11n (MCS 7)	07	-14.56



Date: 3.MAR.2017 15:55:22

Modulation	Channel	Power Spectral Density (dBm/3kHz)
11n (MCS 7)	11	-14.58

Comments:
Test Unit: 001 (Conducted)
Test Setup: A (Conducted)
Tested by: D. Jamieson
Test Date/s: 3rd March 2017
Test Status: **PASS**

7 List of Test Equipment

In accordance with UKAS requirements, all measuring equipment is on a calibration cycle.

7.1 Setup A – Conducted with Receiver

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
EMI Receiver 20Hz to 40GHz	Rohde & Schwarz ESU40	100017	01721	14/12/2017

7.2 Setup B – Conducted with Peak Power Analyser

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
Test Site 5	Global EMC	N/A	02932	N/A
RF Peak Power Analyser	Boonton 4500B	2061	01534	10/05/2017
Peak Power Sensor	Boonton 56318	5789	02129	10/05/2017

7.3 Setup C - Radiated Emissions

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
Semi-Anechoic Chamber, Site 1	Global EMC	GE001	02074	01/12/2017
Broadband Antenna 30MHz - 2GHz	Chase EMC CBL6141	4254	01323	25/03/2017
Active Loop Antenna 9kHz - 30MHz	Chase EMC HLA6120	29905	02475	02/10/2017
Loop Antenna PSU/Charger	Chase EMC CBP9720	n/a	02671	N/A
Antenna Horn 1GHz-18GHz	Chase BBHA9120D	9120D-578	00852	16/11/2017
Antenna Horn 18GHz-26GHz	Credowan 20-R-2843-0007	36755	00482	03/12/2017
EMI Receiver 20Hz to 26.5GHz	Rohde & Schwarz ESI26	832692/006	00886	05/12/2017
EMI Receiver 20Hz to 40GHz	Rohde & Schwarz ESU40	100017	01721	14/12/2017
Antenna Mast (4m) Site 1	Inn-co GmbH MM4000	MM4000/056/13750806/L	02075	N/A
Turntable Site 1	Inn-co GmbH DS1200S	DS1200S/175/13750806/L	02076	N/A
Mast/Turntable Controller Site 1	Inn-co GmbH CO 2000	CO/2000/359/137/50806/L	02077	N/A
Computer (Site 1)	HP Z800 Workstation	CZC0087YD3	Site1PC	N/A
Emissions Software	DARE! RadiMation v5.3.18	N/A	EMSoft01	N/A

7.4 Cable Calibration

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
Signal Generator	R & S SMR40	100164	01520	08/09/2017
EMI Receiver 20Hz to 40GHz	Rohde & Schwarz ESU40	100017	01721	14/12/2017