

Prüfbericht - Nr.: 14032767 001		Seite 1 von 15	
<i>Test Report No.:</i>		<i>Page 1 of 15</i>	
Auftraggeber: <i>Client:</i>		Bluetrek Technologies Limited 8/F., Tai Yip Building 141 Thomson Road Wanchai Hong Kong	
Gegenstand der Prüfung: <i>Test Item:</i>		Bluetooth Headset	
Bezeichnung: <i>Identification:</i>	BLUETREK Mini+	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	00130408003-002	Eingangsdatum: <i>Date of Receipt:</i>	08.04.2013
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		Test sample(s) is/are not damaged and suitable for testing.	
Prüfort: <i>Testing Location:</i>		Global United Technology Services Co., Ltd. 2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, China	
Prüfgrundlage: <i>Test Specification:</i>		FCC Part 15 Subpart C ANSI C63.4-2003 CISPR 22:2003	
Prüfergebnis: <i>Test Results:</i>		Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .	
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland Hong Kong Ltd. 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
geprüft/ tested by:		kontrolliert/ reviewed by:	
09.05.2013	Mika Chan Senior Project Engineer	09.05.2013	Sharon Li Section Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges: <i>Other Aspects</i>		FCCID: QITC45M	
Abkürzungen: <i>P(ass) = entspricht Prüfgrundlage</i> <i>F(ail) = entspricht nicht Prüfgrundlage</i> <i>N/A = nicht anwendbar</i> <i>N/T = nicht getestet</i>		Abbreviations: <i>P(ass) = passed</i> <i>F(ail) = failed</i> <i>N/A = not applicable</i> <i>N/T = not tested</i>	
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK; Pi/4 DQPSK; 8 DPSK
Number of channels	79
Channel separation	1 MHz
Type of antenna	Chip antenna
Antenna gain (dBi)	0.8
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nom} : 3.7V
Independent Operation Modes	Page scan Inquiry scan Connection state - ACL Link Connection state - SCO Link

Product function and intended use

The test item is a mono A2DP headset based on the Bluetooth technology.

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4GHz. With the introduction of the enhanced data rate (EDR) feature, the data rates can be up to 3 Mb/s.

An increase in the peak data rate beyond the basic rate of 1 Mb/s is achieved by modulating the RF carrier using phase shift keying (PSK) techniques, resulting in an increase of two to three times the number of bits per symbol. The 2 Mb/s EDR packets use a Pi/4-DQPSK modulation and the 3 Mb/s EDR packets use 8DPSK modulation.

The USB connector is for charging only, no data exchange supported.

Submitted documents

Circuit Diagram
Block Diagram
Bill of material
User Manual
Label Artwork

Remark

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases.

Special accessories and auxiliary equipment

Additional accessory used for testing

The product has been tested together with the following additional accessory:

Description	Manufacturer	Model	Serial Number
Thinkpad	IBM	2374	L3-G0686

List of Test and Measurement Instruments

Global United Technology Services Co., Ltd. (Registration number: 600491)

Radiated Emission

Equipment	Manufacturer	Type	Due Date
3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	April. 5 2015
Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	N/A
ESU EMI Test Receiver	R&S	ESU26	Jul. 06 2013
Loop Antenna	Zhinan	ZN30900A	Jul. 25 2013
Bi-log Hybrid Antenna	SCHWARZBECK	VULB9163	Mar. 17 2014
Double-ridged horn antenna	SCHWARZBECK	9120D	Mar. 17 2014
Horn Antenna	ETS-LINDGREN	3160-09	Mar. 17 2014
RF Amplifier	HP	8347A	Jul. 06 2013
RF Amplifier	HP	8349B	Jul. 06 2013
EMI Test Software	AUDIX	E3	N/A
Coaxial cable	GTS	N/A	Jul. 06 2013
Coaxial Cable	GTS	N/A	Jul. 06 2013
Thermo meter	N/A	N/A	Jul. 05 2013

Conducted Emission on AC Mains Terminals

Equipment	Manufacturer	Type	Cal Due Date
Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	Sep. 07 2013
EMI Test Receiver	R&S	ESCS30	Jul. 06 2013
Pulse Limiter	R&S	ESH3-Z2	Jul. 06 2013
Coaxial Switch	ANRITSU CORP	MP59B	Jul. 06 2013
Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	Jul. 06 2013
Coaxial Cable	GTS	N/A	Jul. 06 2013
EMI Test Software	AUDIX	E3	N/A
Thermo meter	KTJ	TA328	Jul. 26 2013

Results FCC Part 15 – Subpart C

Subclause 15.203 – Antenna Information		Pass
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	Permanent attached antenna	
Verdict:	Pass	

Subclause 15.204 – Antenna Information		Pass
Requirement:	Provide information for every antenna proposed for the use with the EUT	
Results:	a) Antenna type: Chip antenna b) Manufacturer and model no: N.A. c) Gain with reference to an isotropic radiator: 0.8 dBi	
Verdict:	Pass	

Subclause 15.207 – Disturbance Voltage on AC Mains						Pass
Test Port: AC mains input port of the computer Applied Voltage: 120VAC Adaptor Model: Please refer to page 4 Mode of operation: Charging + Music playing mode						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.202	53.09	43.09	66 - 56	56 - 46	Pass
	0.305	44.85	36.45	66 - 56	56 - 46	Pass
> 0,5 - 5	0.513	45.91	41.33	56	46	Pass
	0.697	44.92	36.70	56	46	Pass
	3.881	43.09	30.28	56	46	Pass
> 5 - 30	8.105	41.67	30.18	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.197	51.32	39.66	66 - 56	56 - 46	Pass
	0.297	43.59	34.13	66 - 56	56 - 46	Pass
> 0,5 - 5	0.529	46.12	38.35	56	46	Pass
	0.727	44.43	33.68	56	46	Pass
	1.980	39.89	29.21	56	46	Pass
> 5 - 30	15.470	40.25	30.57	60	50	Pass

Results: The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2-3.

Subclause 15.247 (a)(1) – Carrier Frequency Separation
Pass

Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

Test Specification : FCC Part 15 Subpart A – Subclause 15.31
 Mode of operation : Tx mode (hopping on), 8DPSK
 Port of testing : Temporary antenna port
 Detector : Peak
 RBW/VBW : 100 kHz / 300 kHz
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
 The centre frequencies of the hopping channels are separated by more than the $2/3 \times 20\text{dB}$ bandwidth. For test Results plots refer to Appendix 1, page 4.

Verdict: Pass

Subclause 15.247 (a)(1)(iii) – Number of hopping channels
Pass

Requirement: Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 15 hopping frequencies.

Test Specification : FCC Part 15 Subpart A – Subclause 15.31
 Mode of operation : Tx mode (hopping on), 8DPSK
 Port of testing : Temporary antenna port
 Detector : Peak
 RBW/VBW : 1 MHz / 3 MHz
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Results: The total number of hopping frequencies is more than 15. For test Results plots refer to Appendix 1, page 5.

Verdict: Pass

Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)		Pass
Requirement:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.	
Test Specification :	FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation :	Tx mode (hopping on), DH5 packet	
Port of testing :	Temporary antenna port	
Detector :	Peak	
RBW/VBW :	1 MHz / 3 MHz	
Supply voltage :	3.7VDC	
Temperature :	23°C	
Humidity :	50%	
Results:	Time period calculation = 0.4 x 79 = 31.6s Dwell time = 64 x 2.904 x 10 ⁻³ = 185.856 x 10 ⁻³ s 	

Subclause 15.247 (a) – 20 dB Bandwidth		Pass	
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.		
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31		
Mode of operation	: Tx mode (2402MHz, 2441MHz, 2480MHz)		
Port of testing	: Temporary antenna port		
Detector	: Peak		
RBW/VBW	: 30 kHz / 100 kHz		
Supply voltage	: 3.7VDC		
Temperature	: 23°C		
Humidity	: 50%		
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1, page 7-9.		
GFSK Modulation			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.462	0.474	0.936
2441	0.456	0.480	0.936
2480	0.456	0.480	0.936
8DPSK Modulation			

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.648	0.648	1.296
2441	0.654	0.618	1.272
2480	0.648	0.624	1.272

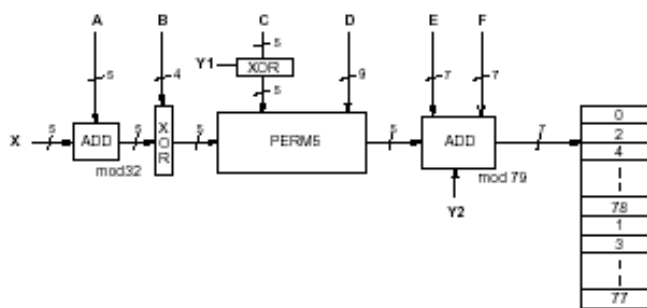
Subclause 15.247 (a) – Hopping Sequence

Pass

Requirement: The hopping sequence is generated and provided with an example.

Hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master. The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master transmission. The inputs A to D determine the ordering within the segment, the inputs E and F determine the mapping onto the hop frequencies.



Example data:

Hop sequence {k} for CONNECTION STATE:

CLK start: 0x0000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

0x0000010:	08 66	10 70	12 19	14 23	16 01	18 05	20 33	22 37
0x0000030:	24 03	26 07	28 35	30 39	32 72	34 76	36 25	38 29
0x0000050:	40 74	42 78	44 27	46 31	48 09	50 13	52 41	54 45
0x0000070:	56 11	58 15	60 43	62 47	32 17	36 19	34 49	38 51
0x0000090:	40 21	44 23	42 53	46 55	48 33	52 35	50 65	54 67
0x00000b0:	56 37	60 39	58 69	62 71	64 25	68 27	66 57	70 59
0x00000d0:	72 29	76 31	74 61	78 63	01 41	05 43	03 73	07 75
0x00000f0:	09 45	13 47	11 77	15 00	64 49	66 53	68 02	70 06
0x0000110:	01 51	03 55	05 04	07 08	72 57	74 61	76 10	78 14
0x0000130:	09 59	11 63	13 12	15 16	17 65	19 69	21 18	23 22
0x0000150:	33 67	35 71	37 20	39 24	25 73	27 77	29 26	31 30
0x0000170:	41 75	43 00	45 28	47 32	17 02	21 04	19 34	23 36
0x0000190:	33 06	37 08	35 38	39 40	25 10	29 12	27 42	31 44
0x00001b0:	41 14	45 16	43 46	47 48	49 18	53 20	51 50	55 52
0x00001d0:	65 22	69 24	67 54	71 56	57 26	61 28	59 58	63 60
0x00001f0:	73 30	77 32	75 62	00 64	49 34	51 42	57 66	59 74
0x0000210:	53 36	55 44	61 68	63 76	65 50	67 58	73 03	75 11
0x0000230:	69 52	71 60	77 05	00 13	02 38	04 46	10 70	12 78
0x0000250:	06 40	08 48	14 72	16 01	18 54	20 62	26 07	28 15
0x0000270:	22 56	24 64	30 09	32 17	02 66	06 74	10 19	14 27
0x0000290:	04 70	08 78	12 23	16 31	18 03	22 11	26 35	30 43
0x00002b0:	20 07	24 15	28 39	32 47	34 68	38 76	42 21	46 29
0x00002d0:	36 72	40 01	44 25	48 33	50 05	54 13	58 37	62 45
0x00002f0:	52 09	56 17	60 41	64 49	34 19	36 35	50 51	52 67
0x0000310:	38 21	40 37	54 53	56 69	42 27	44 43	58 59	60 75
0x0000330:	46 29	48 45	62 61	64 77	66 23	68 39	03 55	05 71
0x0000350:	70 25	72 41	07 57	09 73	74 31	76 47	11 63	13 00
0x0000370:	78 33	01 49	15 65	17 02	66 51	70 67	03 04	07 20
0x0000390:	68 55	72 71	05 08	09 24	74 59	78 75	11 12	15 28
0x00003b0:	76 63	01 00	13 16	17 32	19 53	23 69	35 06	39 22
0x00003d0:	21 57	25 73	37 10	41 26	27 61	31 77	43 14	47 30
0x00003f0:	29 65	33 02	45 18	49 34	19 04	21 08	23 20	25 24

Subclause 15.247 (a) – Equal Hopping Frequency Use

Pass

Requirement: Each of the transmitter's hopping channels is used equally on average.

Equal hopping frequency use

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

Subclause 15.247 (a) – Receiver Input Bandwidth	Pass
Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
Receiver input bandwidth The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth was verified during Bluetooth RF conformance testing.	

Subclause 15.247 (a) – Receiver Hopping Capability	Pass
Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
Receiver hopping Capability The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.	

Subclause 15.247 (b)(1) – Peak Output Power					Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 3 MHz / 10 MHz Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%					
Requirement: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band: 0.125 Watts.					
Results: For test protocols please refer to Appendix 1, page 10-14.					
GFSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	3.46	0.00	3.460	1 / 30.0	Pass
2441	3.61	0.00	3.610	1 / 30.0	Pass
2480	3.64	0.00	3.640	1 / 30.0	Pass
DQPSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	3.76	0.00	3.760	1 / 30.0	Pass

2441	3.79	0.00	3.790	1 / 30.0	Pass
2480	3.61	0.00	3.610	1 / 30.0	Pass
8DPSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	3.98	0.00	3.980	1 / 30.0	Pass
2441	4.07	0.00	4.070	1 / 30.0	Pass
2480	3.89	0.00	3.890	1 / 30.0	Pass

Subclause 15.247 (d) – Band edge compliance of conducted emissions
Pass

Test Specification : FCC Part 15 Subpart A – Subclause 15.31
 Mode of operation : Tx mode (2402MHz, 2480MHz), 8DPSK
 Port of testing : Temporary antenna port
 Detector : Peak
 RBW/VBW : 100 kHz / 300 kHz
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.

 There is no peak found outside any 100 kHz bandwidth of the operating frequency band. For test protocols refer to Appendix 1, page 15-16.

Subclause 15.205 – Band edge compliance of radiated emissions
Pass

Test Specification : FCC Part 15 Subpart A – Subclause 15.31
 Mode of operation : Tx mode (2402MHz, 2480MHz), 8DPSK
 Port of testing : Temporary antenna port
 Detector : Peak
 RBW/VBW : 1 MHz / 1 MHz
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Requirement: Radiated emissions which fall in the restricted bands, as defined in 15.205 (a), must also comply with the radiated emission limits specified in 15.209(a).

Results: There is no peak found in the restricted bands. For test protocols refer to Appendix 1, page 17-24.

Subclause 15.247 (d) – Spurious Conducted Emissions					Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), 8DPSK Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7VDC Temperature : 23 °C Humidity : 50 %					
Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1, page 25-26.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	4800	-36.94	0.71	-37.65	Pass
2441	4850	-43.41	1.79	-45.20	Pass
2480	4950	-43.00	3.34	-46.34	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), 8DPSK Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%		
Requirement:	In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).	
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.	
Tx frequency 2402MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4804.000	52.87	74.0 / PK
4804.000	33.62	54.0 / AV
Tx frequency 2402MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4804.000	52.39	74.0 / PK
4804.000	33.03	54.0 / AV
Tx frequency 2441MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4882.000	51.97	74.0 / PK
4882.000	37.43	54.0 / AV
Tx frequency 2441MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4882.000	51.23	74.0 / PK
4882.000	35.02	54.0 / AV
Tx frequency 2480MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4960.000	52.04	74.0 / PK
4960.000	39.77	54.0 / AV

Tx frequency 2480MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4960.000	51.33	74.0 / PK
4960.000	38.09	54.0 / AV